

MENTAL ILLNESS, CULTURE, AND SOCIETY: DEALING WITH THE COVID-19 PANDEMIC

EDITED BY: Mohammadreza Shalbafan, Renato de Filippis and
Samer El Hayek

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MENTAL ILLNESS, CULTURE, AND SOCIETY: DEALING WITH THE COVID-19 PANDEMIC

Topic Editors:

Mohammadreza Shalbafan, Iran University of Medical Sciences, Iran

Renato de Filippis, Magna Græcia University, Italy

Samer El Hayek, Erada Center for Treatment and Rehab, United Arab Emirates

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*CORRESPONDENCE
Mohammadreza Shalbafan
shalbafan.mr@iums.ac.ir

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Editorial: Mental illness, culture, and society: Dealing with the COVID-19 pandemic

Renato de Filippis ¹, Samer El Hayek ² and
Mohammadreza Shalbafan ^{3*}

¹Psychiatry Unit, Department of Health Sciences, University Magna Graecia of Catanzaro, Catanzaro, Italy, ²Medical Department, Erada Center for Treatment and Rehab, Dubai, United Arab Emirates, ³Mental Health Research Center, Psychosocial Health Research Institute, Department of Psychiatry, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

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Editorial on the Research Topic

Mental illness, culture, and society: Dealing with the COVID-19 pandemic

Since 2020, the spread of the coronavirus and its subsequent clinical manifestation, the Coronavirus Disease (COVID-19) pandemic, have represented a historic event of global significance. The pandemic has affected the quality of life and mental health status of both the general population and patients with mental health problems (1–3). In the beginning, the health and social consequences were mainly linked to the direct life-threatening risk posed by an unknown and highly fatal respiratory disease, for which no treatment or vaccine were available (4). Therefore, disease prevention, through physical distancing of the general population and isolation of cases, was considered the most effective measure to minimize the spread of the virus (5).

Lockdown and isolation measures have, therefore, characterized much of the global fight against COVID-19. These measures unfortunately had serious economic, educational, social, and mental health repercussions for individuals and societies (6). While the effects of lockdown and isolation have been extensively studied in individuals with mental health problems, less has been explored on the role of socio-cultural, environmental, and local factors in facing COVID-19 (7). Therefore, in this Research Topic, we look at the effects of the pandemic on mental health from the lens of local and sociocultural factors. We particularly look at three groups of individuals: the general population, special vulnerable populations, and health care providers.

In the first section of this editorial, we will provide an overview of the main findings of the publications in our Research Topic assessing mental health outcomes and psychological issues among the general population, amid different waves of the COVID-19 pandemic and from a various range of cultures and societies.

Post Traumatic Stress Disorder (PTSD) has been one of the most studied psychiatric disorders during the outbreak. [Shen et al.](#) reported on the prevalence of PTSD and its related factors among the Chinese population, 1 year after the start of the pandemic. The authors used the PTSD Checklist for DSM-5 (PCL-5) among a sample of 2,361 Chinese residents and found a PTSD prevalence of 9.28%. [Rajkumar](#) presented an analysis of factors contributing to PTSD amid the pandemic, by analyzing data from 35 countries. He found a positive relationship between PTSD and the COVID-19 case-fatality ratio and power distance. He also noted a trend toward a negative quadratic association between internet usage and PTSD. Lastly, he did not detect significant cross-national effects for government restrictiveness ([Rajkumar](#)).

Other mental issues such as mental wellbeing, psychological distress, and coping behaviors were topics further investigated by several studies in our Research Topic. [Wong et al.](#) looked at the impact of containment during the pandemic and coping behaviors. The authors reported that the influence of containment on individual psychological aspects was prominent, followed by impact on wellbeing and lifestyle. Furthermore, physical coping strategies and mindfulness were most commonly reported ([Wong et al.](#)). [Alghamdi et al.](#) investigated psychological distress using the Depression, Anxiety, and Stress Scale-21 (DASS-21) among 2,252 participants of the general population of Saudi Arabia. They found the DASS-21 mean score of participants to be within normal range, with the mean score of healthcare workers significantly higher than that of other participants. Age, gender, and history of contact with confirmed COVID-19 cases were significantly associated with higher DASS-21 scores ([Alghamdi et al.](#)). [Babicki et al.](#) performed a nation-wide study on 5,790 Polish individuals using the Beck Depression Inventory (BDI), the Generalized Anxiety Disorder Assessment (GAD-7), and the Manchester Short Assessment of Quality of Life (MANSA) in the first three waves of the pandemic. The authors concluded that, as the COVID-19 pandemic progressed, depressive and anxiety symptoms increased. In addition, women, single individuals, and those with prior psychiatric treatment were the most vulnerable ([Babicki et al.](#)). In another study, [Hu et al.](#) investigated COVID-19 related stress and mental health outcomes among 771 Chinese individuals using an online survey. They reported that resilience mediates the effects of COVID-19 related stress on depression and post-traumatic growth. On the other hand, social support mediates the impacts of COVID-19 related stress on post-traumatic growth, depression, and anxiety ([Hu et al.](#)). [Menculini et al.](#) performed a two-year observational study on youths in Umbria, central Italy, to assess psychopathological distress amid the pandemic. The authors found anxiety disorders to be the most prevalent. The most frequently used treatment approach was digital mental health services, and psychopharmacological treatment was more commonly provided among the general population

([Menculini et al.](#)). In addition, [Yong and Zhang](#) used the 12-item General Health Questionnaire (GHQ-12) to evaluate COVID-19 worry and mental health among 1,584 economically active Chinese participants. Almost half (42%) of participants reported being “very worried” or “extremely worried” about the pandemic. This worry was associated with male gender, young age (16–45 years), being unemployed, and having mental health problems ([Yong and Zhang](#)). [Jang et al.](#) also investigated the relationship between economic loss and anxiety among 911 Korean individuals at two times: during the early months of the pandemic and 6 months later. The authors concluded that, in the early stages of the pandemic, gratitude and perceived stress had moderating effects on this relationship. However, after 6 months, only perceived stress had a significant moderating effect ([Jang et al.](#)). [Schabus et al.](#) investigated psychosocial burden, risk-perception, and attitudes among 3,848 Austrian individuals from the general population. They found that isolation from family and friends, homeschooling, and economic consequences were perceived as the most stressful factors. They also noted that, compared to non-regular users, regular public media users significantly overestimated hospitalization risk secondary to COVID-19 ([Schabus et al.](#)). [Sadeh-Zadeh et al.](#) assessed the effects of the pandemic on components of social and mental health using machine learning among a general sample from the United States. They concluded that individuals with previous diagnosis of any psychiatric disorders were most affected by the constraints implemented during the pandemic ([Sadeh-Zadeh et al.](#)).

One of the included papers in our Research Topic assessed the correlation between COVID-19 and schizophrenia. In this case-control study conducted in Indonesia, [Amin et al.](#) found that the coronavirus infection was more frequent in the schizophrenia group, particularly among older adults.

A few papers investigated social concepts amid the pandemic. In their Ecuador-United States based study, [Franklin et al.](#) analyzed overconsumption behaviors during the pandemic. The authors concluded that health consciousness is responsible for stimulating overconsumption behaviors ([Franklin et al.](#)). [Pratt and Carr](#) published an opinion piece about the effects of the pandemic on the Japanese society, more specifically tackling the postponement of the Olympic games. Last but not the least, in a qualitative study among school-based professionals in Appalachia, [Haliwa et al.](#) reported about the overall positive attitude of participants toward mindfulness training.

To summarize, this first part of our Research Topic highlights and emphasizes the importance of mental health among the general population during the COVID-19 pandemic. The included papers suggest different practical approaches to improve the mental wellbeing of societies, through the help of policymakers and national governments.

In the second section of this editorial, we will discuss studies in our Research Topic that looked at how the COVID-19 pandemic affected the mental health of special populations. In

particular, the studies focused on students, veterans, teachers, pregnant women, immigrants, older adults, and patients with severe medical comorbidities, providing data otherwise largely missing in current literature panorama (8). This part of our Research Topic encompassed a total of 19 papers: 13 original research articles, three reviews, one brief research report, one perspective paper, and one opinion piece, thus offering a wide panorama of study designs and formats covering most aspects related to the implications of COVID-19 on the mental wellbeing of vulnerable populations.

The large percentage of articles with original data demonstrates the flourishing and recent international scientific production around COVID-19, with data often collected through surveys or telemedicine, which have been adapted due to the impossibility of physical contact during lockdown measures (9).

The paper by Cerami et al. defined the clinical framework of reference when talking about fragile subjects at greater risk of developing serious consequences secondary to COVID-19. Through an online survey distributed among 1,258 residents during the first pandemic wave and the consequent first general lockdown in Italy, the authors highlighted the importance of social vulnerability to environmental stressors, such as social distancing, isolation, and loneliness, to explain the individual perception of the impact of COVID-19 emergency on health, beyond physical frailty (Cerami et al.). The authors concluded that the early identification of individuals most exposed to the social consequences of COVID-19 could direct governments to allocate more resources and plan strategies to contain consequences, and, in the case of this Research Topic, to phenotype these vulnerable categories to better focus research on them.

Following the same path, Kumar et al. conducted a rapid review to investigate the trends in psychological impacts, coping ways, and public support during the COVID-19 pandemic in the United States. They reported results from 35 included studies, mainly involving vulnerable individuals, suggesting that women, children, elderly, and racial minorities have been affected by a lack of adequate support for psychological wellbeing during the crisis.

Alternatively, hospitalization, quarantine, and social isolation were negative prognostic factors for the mental health of patients testing positive for COVID-19 (10). In the cross-sectional survey conducted by Ouanes et al., the authors evaluated the physical and psychological wellbeing of 141 inpatients with COVID-19, 99 quarantined patients, and 285 healthy controls. They found better psychological growth and enhanced resilience in patients with social support from family and friends, and easy access to mental health screening and care, highlighting the importance of the socio-cultural context for the support of the most fragile patients.

Women's health was also severely affected by the coronavirus outbreak, including the menstrual cycle, pregnancy, and

peripartum period (11). Three papers included in this Research Topic dealt with pregnancy and peripartum conditions. Arzamani et al. conducted a review exploring psychological problems (e.g., fear, anxiety, depression) experienced by pregnant women during the outbreak. Their findings pinpoint that mental health issues linked to the pandemic may reduce compliance to effective preventive behaviors in pregnant women, provide unhealthy coping mechanisms, cause inadequate care during childbirth, and have negative effects on the prognosis of pregnancy and fetal development. Similar results were found in the study carried out in Italy by Orsolini et al., regarding perinatal depression caused by fear and anxiety related to COVID-19. This study was among the first to investigate, in detail, which COVID-19-related psychopathological determinants may predispose to perinatal depression. The authors concluded that isolation, quarantine, lockdown, and deprivation of normal social support led a total sample of 184 perinatal outpatients to have increased levels of anxiety, fear, and psychological distress, independently of their previous psychiatric history (Orsolini et al.). Finally, the study conducted by Ma et al. confirmed previous results as it assessed the psychological impact of the COVID-19 pandemic among pregnant women in mainland China. This study, carried out as a cross-sectional survey enrolling a large sample of 1,078 participants, stated that despite increased family and social support, more than half of enrolled pregnant women reported increased feelings of being horrified, apprehensive, and helpless secondary to the pandemic.

Similar results can be found among children and elderly, who are considered as the two age groups at greatest risk of suffering from social and relational restrictions. Therefore, in her *wake-up call*, Solerdelcoll outlined the current global interest in the impact of the COVID-19 pandemic on children's mental health, mainly based on speculation, media coverage, and academic studies. In this opinion piece, she pointed out the attention about the need to deepen knowledge and raise awareness of the key cultural and contextual factors affecting children, sketching out the main points on which to act immediately. Similarly, older adults are considered vulnerable individuals who should be protected from the direct and indirect effects of COVID-19 on the general and psychological health. In contrast to many literature results, the group led by López has shown how psychological wellbeing, structured on personal growth and purpose in life, acted as a strong protective factor for 192 people over 60 years old during all the pandemic phases in Spain.

Several articles delved into the effects of the pandemic on school and education. During the early stages of the pandemic, one study carried out among college students in China investigated the effect of perceived threat avoidability of COVID-19 on coping strategies and anxiety (Wu et al.). The authors found that the perceived threat of coronavirus infection exacerbated anxiety symptoms in students. These

symptoms were only partially mitigated by coping strategies. These findings were confirmed by a rapid review of the literature examining the COVID-19 influence on five aspects of mental health: emotional features, personality, interpersonal relationships, learning behavior, and employment options among undergraduate students (Shi et al.). Teachers also suffered from the lockdown measures which tremendously affected school systems and educational problems (12). In an original study settled in Bangladesh, Hossain et al. found a high prevalence of depression, anxiety, and stress during the second wave of the COVID-19 pandemic among teachers, especially those who were males and older.

Another large population considered at risk for the consequences of COVID-19 are patients with severe physical comorbidities. In this context, we collected three articles that respectively evaluated patients living with type 2 diabetes mellitus (T2DM) (Sayed Ahmed et al.), dementia (Mohammadian et al.), and immunocompromised health (Heesen et al.). The high prevalence of both T2DM and coronavirus infection around the world makes the overlap between these two diseases not only very likely but also extremely common (13). Therefore, it does not come as a surprise that living with T2DM during the COVID-19 pandemic was linked with increased distress, depression, and anxiety symptoms in Egypt (Sayed Ahmed et al.). Similarly, dementia and cognitive decline seem to be negative prognostic factors in individuals infected with COVID-19. In this regard, Mohammadian et al. found a direct relationship between cognitive decline and the psychological impact of COVID-19 in both patients and their caregivers in Iran. Lastly, the reduction of the immune defenses of the body represents an important risk factor for the development of infectious diseases, including COVID-19. In this sense, Heesen et al. studied the participation of immunocompromised patients in Germany in social activities, before and after completing the vaccination cycle. He concluded that vaccination returns to special populations a good level of social interaction that was lost with physical isolation (Heesen et al.).

The study by Kilic et al. evaluated infection risk and vaccine status in patients with attention deficit and hyperactivity disorder (ADHD). The authors found that the COVID-19 vaccine is acceptable and receiving the vaccine is typically endorsed by patients with ADHD. In addition, being diagnosed with ADHD did not provoke any kind of mental disturbance in the sense of perception of danger from COVID-19 (Kilic et al.). However, despite the growing evidence on the effectiveness of vaccines, vaccination hesitancy remains a widespread phenomenon around the world. In some areas, including Latin America and the Caribbean, this phenomenon appears particularly marked; we have therefore included a perspective article in our Research Topic that particularly tackles this subject (Faria et al.).

Lastly, this section of our Research Topic included two articles assessing the impact of the pandemic on two other vulnerable populations: veterans and immigrants. Veterans are already at a high risk to develop anxiety, sleep disorders, depression, and PTSD (14). Therefore, assessing how the COVID-19 pandemic might have impacted their mental health is critical. According to Stellman et al., previous military experiences affected coping with COVID-19 both positively and negatively, and may have helped instill useful personal health behaviors in veterans. When it comes to immigrants, we included an illustrative work on how migrants coped with the COVID-19 pandemic, with a peculiar study about the experience of Afghan immigrants in Iran (Mohammadsadeghi et al.). COVID-19 and the subsequent lockdown and isolation measures caused further trauma, adding to the effects of previous experiences of war and migration, with the consequent appearance of fear of losing control, being overwhelmed, and inability to cope (Mohammadsadeghi et al.).

Lastly, one important aspect to evaluate is the effect of working place infection control practices on workers' psychological distress. In this line of thought, Kodama et al. found that some infection control practices reduced workers' distress while others worsen it. Therefore, employers need to consider, not only infection control practices, but also the worsening mental state of employees following a decrease in income caused by such measures (Kodama et al.).

One notable aspect of the current impact of the COVID-19 pandemic on mental health was how the pandemic affected individuals working within the medical field, while particularly noting the intertwining roles of culture and society (15).

Accumulating evidence indicates that the COVID-19 pandemic and associated public health crises have had a disproportionately negative impact on healthcare workers (HCWs) (16). Due to the high levels of psychological stress, this group has been experiencing worsening mental health outcomes. These psychological problems, affecting physicians, nurses, and other HCWs, include depression, anxiety, insomnia, and PTSD (17, 18). Therefore, this last section of the editorial is particularly dedicated to studies in our Research Topic looking at the impact of COVID-19 on healthcare professionals (HCPs).

Several articles assessed the prevalence of mental health symptoms and disorders among HCWs. The article by Almalki et al. looked at the prevalence of depression, anxiety, and stress among physicians, pharmacists, nurses, and other HCWs in Saudi Arabia using the DASS-21. Among 501 HCWs, the estimated prevalence rates of depression, anxiety, and stress were 54.69%, 60.88%, and 41.92%, respectively. HCWs with chronic diseases, nurses, and HCWs from the southern region of the country were more likely to suffer from depression and stress. Further, individuals with positive COVID-19 test results showed a greater proportion of depressive symptoms compared to others. In addition, knowing someone who died due to

COVID-19 and having a chronic illness were predisposing factors for anxiety (Almalki et al.).

Along the same lines, Hajebi et al. looked at the mental health of HCWs in Iran, albeit using the Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder-7 (GAD-7), and Copenhagen Burnout Inventory, and found comparable results. Half of the participants (53%) either had a generalized anxiety disorder or major depressive disorder or both disorders. Moderate and high levels of burnout were seen among 48.9% of the study participants. The prevalence of mental disorders and burnout was significantly higher among females and those working in hospitals compared to primary healthcare centers. Predictors of mental disorder and burnout were “worry about children and old members of the family,” “family worries for my health condition”, and “lack of specific effective treatment for COVID-19” (Hajebi et al.).

The influence of COVID-19 among occupational and physical therapists in Kuwait was particularly assessed in the paper by Alnaser et al. This cross-sectional study included 98 participants and examined self-reported anxiety (via the GAD-7) and somatic symptoms (via the modified PHQ, mPHQ-15). The authors found that 14%, 38%, and 21% of participants had mild, moderate, and severe anxiety, respectively. In terms of somatic symptoms, 20%, 38%, and 29% of participants reported mild, moderate, and severe symptoms, respectively. GAD-7 and mPHQ-15 scores were moderately positively correlated. The therapists perceived that the quality (76%) and effectiveness (20%) of their rehabilitation services were negatively affected by the pandemic (Alnaser et al.).

In their qualitative study, Rouhbakhsh et al. looked at themes about the perception of stress among HCPs during the pandemic. Twenty HCPs were recruited from a teaching hospital in Iran and included physicians, nurses, and other paramedics. Participants reported a wide range of psychological reactions including anxiety, feelings of guilt, depression, and anger. Uncertainty accompanied by the pandemic and shortcomings in preparation for crisis management were recognized as the two main sources of stress (Rouhbakhsh et al.). Nohesara et al. also carried out qualitative research to study the grief experiences of 12 intensive care unit staff members who experienced the loss of a family member during the pandemic in Iran. The authors found five common themes in the experiences of participants: complex grieving process, new experiences for coping with loss, more empathy for patients, change in the meaning of death, and the need for support in workplaces (Nohesara et al.).

Shifting perspectives, Chen et al. looked at anxiety and depression states among 428 dry eye patients in China. Patients were tested with the Ocular Surface Disease Index, Short Healthy Anxiety Inventory, Hospital Anxiety and Depression Scale, and Pittsburgh Sleep Quality Index. The incidence rates of depression and anxiety were 26.87 and 27.34%, respectively. One-quarter of participants (24.30%) had comorbid anxiety and depression. Higher education levels, a shorter course of the disease, lower health anxiety levels, and better subjective sleep

quality were significantly associated with reduced depressive and anxiety symptoms among patients (Chen et al.). The study by Lan et al. also evaluated sleep disorders related to COVID-19. The authors suggested that an individual's perceived COVID-19 crisis strength indirectly affects their life satisfaction and sleep quality, via their perceived risk of being infected (Lan et al.).

Besides the above clinical reports, Zhou et al. and validated a machine learning-based model to predict depression symptoms among HCWs during the pandemic. The model was created using survey data collected from 2,574 HCWs in hospitals designated to care for COVID-19 patients in China. The machine learning models highly consistently identified and ranked risk predictors for depression. Self-perceived health status factors always occupied the top five most important predictors. Other top predictors were worries about infection, working on the frontline, a very high level of uncertainty, and having COVID-19-like symptoms. The authors concluded that the application of such machine learning models could support decision-making on the implementation of mental health interventions to support HCWs (Zhou et al.).

The last paper by Halms et al. presents a scoping review and evaluation of guidelines and recommendations published for the support of HCWs during the pandemic. The study included 41 articles published between April 2020 and May 2021. The authors clustered the retrieved guidelines and recommendations into four main categories: social/structural support, work environment, communication/information, and mental health support. Although there was substantial agreement across the recommendations, empirical evidence on their effectiveness was lacking. More importantly, most recommendations were developed without involving HCWs or related stakeholders (Halms et al.).

Taken together, this section covers the effects of COVID-19 on HCPs and updates readers on the latest research in this field. We hope that this work will encourage researchers to further explore the relationship between the COVID-19 pandemic, mental health, and HCPs. We also hope that it will provide insights into how to support HCWs appropriately and effectively during this era.

In conclusion, all papers included in the Research Topic and described in this Editorial piece focus on the mental health status of the general population, vulnerable populations, and HCPs during several phases of the COVID-19 pandemic. Considering the novelty and paucity of evidence available about the consequences of lockdown measures and physical distancing on various groups and within different sociocultural backgrounds, the articles collected in this Research Topic shed some light on the mental health implications of the pandemic throughout a wide range of settings.

Although research on COVID-19 and mental health has already produced a large amount of data on many aspects, we believe that the clinical framework offered in these articles provides a different and original point of view that could lead

to more targeted and specific use of forces and resources, which may interest clinicians and researchers all over the world.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

that could be construed as a potential conflict of interest.

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Identifying Frail Populations for Disease Risk Prediction and Intervention Planning in the Covid-19 Era: A Focus on Social Isolation and Vulnerability

Chiara Cerami^{1,2}, Marco Canevelli^{3,4}, Gaia Chiara Santi¹, Caterina Galandra⁵, Alessandra Dodich⁶, Stefano F. Cappa^{1,7}, Tomaso Vecchi^{8,9} and Chiara Crespi^{2,8*}

¹ Scuola Universitaria Superiore IUSS Pavia, Pavia, Italy, ² Cognitive Computational Neuroscience Center, IRCCS Mondino Foundation, Pavia, Italy, ³ Department of Human Neuroscience, Sapienza University of Rome, Rome, Italy, ⁴ National Center for Disease Prevention and Health Promotion, Italian National Institute of Health, Rome, Italy, ⁵ Neurogenetic Research Center, IRCCS Mondino Foundation, Pavia, Italy, ⁶ Center for Neurocognitive Rehabilitation - CIMeC, University of Trento, Rovereto, Italy, ⁷ Dementia Research Center, IRCCS Mondino Foundation, Pavia, Italy, ⁸ Department of Brain and Behavioral Sciences, University of Pavia, Pavia, Italy, ⁹ Cognitive Psychology Center, IRCCS Mondino Foundation, Pavia, Italy

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Charlotte R. Blease,
Beth Israel Deaconess Medical Center
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Ellen E. Lee,
University of California, San Diego,
United States

*Correspondence:

Chiara Crespi
chiara.crespi@unipv.it

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The early identification of fragile populations in the Covid-19 era would help governments to allocate resources and plan strategies to contain consequences of the pandemic. Beyond frailty, social vulnerability to environmental stressors, such as the social distancing enforced to reduce the SARS-CoV2 contagion, can modify long-term disease risk and induce health status changes in the general population. We assessed frailty and social vulnerability indices in 1,258 Italian residents during the first lockdown phase via an on-line survey. We compared indices taking into account age categories and gender. While frailty showed a linear increase with age and was greater in females than in males, social vulnerability was higher in young adults and elders compared to middle aged and older adults, and in males than females. Both frailty and social vulnerability contributed in explaining the individual perception of the impact of Covid-19 emergency on health, which was further influenced by proactive attitudes/behaviors and social isolation. Social isolation and loneliness following the Covid-19 outbreak may exert dramatic psychosocial effects in the general population. The early detection of vulnerable categories, at risk to become ill and develop long-lasting health status changes, would help to prevent consequences on general well-being by allocating resources to targeted interventions managing psychosocial distress and increasing young adults and elderly resilience toward the post-Covid-19 crisis.

Keywords: COVID-19, frailty, social vulnerability, psychosocial variables, social isolation

INTRODUCTION

After more than a year from the discovery of the first infected cases in China, the new coronavirus (SARS-CoV-2) is continuing to claim victims all around the world. Beyond the world health emergency, the coronavirus disease 19 (Covid-19) pandemic is bringing down the global economy and threatening the stability of social systems. As the outbreak increased in each country, forced

measures of social distancing and isolation were progressively adopted by national governments. In Italy, the abrupt wave of infected cases recorded in Northern regions on February 2020 imposed extreme containment measures and social distancing for 3 months. All Italian resident inhabitants were bordered within their houses. The massive lockdown imposed by the Italian government (DCPM #iorestocasa—I stay at home—March 9, 2020) forced thus millions of people to change work habits, daily routines, and lifestyles. This large-scale catastrophic event occurring within a very short amount of time hit thousands of singles and families and dramatically decreased the psychosocial well-being of the population.

The rapid diffusion of the SARS-CoV-2 contagion among the population required to reallocate available healthcare resources (e.g., intensive care unit and emergency dedicated personnel) and plan strategies to sustain difficult medical and ethical choices (e.g., guidance for the use of mechanical ventilation, triage systems). In this perspective, yet in the first phases of the pandemic the screening of frailty has been suggested as possible key tool to assist clinicians in decision-making (<https://www.nice.org.uk/guidance/ng159/resources/covid19-rapid-guideline-critical-care-in-adults-pdf-66141848681413>, accessed on 27 March 2020).

People above 65 years of age actually represent the population with higher risk of poor outcomes in case of SARS-CoV-2 contagion (1). They account for more than 80% of Covid-19 related deaths (2). However, the characterization of risk profiles and the provision of care in the case of older people cannot be properly based on mono-dimensional criteria (e.g., chronological age) that are poorly informative of the overall health status and needs of the aging individual. According to a recent meta-analysis on clinical characteristics of Covid-19 patients, age, male gender, hypertension and diabetes are significantly associated with increased mortality (3). In this regard, the adoption of the frailty construct may allow to target choices and interventions to the clinical and biological complexity of the individual, in the premise of a person-centered approach (4).

Frailty is a condition characterized by reduced homeostatic reserves and increased vulnerability to stressors exposing the individual to negative outcomes (5). It is a widely used clinical measure, both in geriatrics and other medical specialties, resulting from combining different age-related biological determinants leading to decreased functional reserve capacities (6). It is growingly recognized as a valid proxy of the individual risk profile toward adverse health outcomes (e.g., disability and/or mortality) (7). Frailty measures have become crucial instruments for planning and delivering services and are recommended by scientific society guidelines to quickly and reliably screen populations for clinical vulnerability and to orient the triage procedures (<https://www.nice.org.uk/guidance/ng191>, published on 23 March 2021, updated on 8 April 2021). The Clinical Frailty Scale (CFS) has proven to provide more informative data than single measures of cognition, function or comorbidity in assessing medium-term risk of death for Covid-19 infection [(8); NICE <https://www.nice.org.uk/guidance/ng159/resources/covid19-rapid-guideline-critical-care-in-adults-pdf-66141848681413> published on 20 March 2020, updated on 12

February 2021]. Moreover, the use of a Frailty Index at patient hospital admission during the first weeks of Covid-19 pandemic in Italy helped the clinical decision-making process, predicting mortality and ICU admission (9). However, the individual's risk of negative health-related outcomes is not influenced only by his/her biological asset and complexity. A significant role is also played by diverse social circumstances and psychological determinants that are not captured by biologically-oriented definitions of frailty (10).

Frailty and social vulnerability can be both summarized by using a deficit accumulation approach, i.e., arithmetically counting the biological and psychosocial negative attributes presented by the individual. Based on this model, the more deficits an individual has the more he/she will be vulnerable to stressors and at risk for unfavorable outcomes (11). Previous studies have shown that the indexes resulting from this approach (i.e., frailty index and social vulnerability index) predict a range of health outcomes (12–14). A person-centered approach assessing different dimensions that may influence health status—considered as biological, psychological and social well-being—should therefore be promoted in order to assess more thoroughly the risk of short- and long-term adversities and the outcome of pharmacological and non-pharmacological interventions.

In the present study, we evaluated how frailty and social vulnerability, both operationally defined using a cumulative approach, influence the psycho-socio-emotional dimensions and the individual perception of Covid-19 impact on health. Moreover, we assessed the impact of age and sex on these two constructs. We predicted that, in line with current literature, frailty would increase with age and females would result frailer than males (15–17). We expected that, in the light of the social distancing imposed during the lockdown phase, social categories whose significant relationships were held outside the family (e.g., young adults) or away from their living context (e.g., elders) would result vulnerable compared to people who have active and strong social ties within their home (e.g., middle aged and older adults living with their children). Moreover, we hypothesized that the frailty and social vulnerability may interact with the psychological and emotional asset of the individual in influencing his/her perception of the pandemic.

PARTICIPANTS AND METHODS

Participants

Immediately after the lockdown phase imposed by Italian government on March 9, 2020 (DCPM #iorestocasa—I stay at home), we launched the PsyCOVID study (<https://wprn.org/item/428452>), aiming at evaluating changes in habits, routines and psychosocial dimensions in the Italian population during the social distancing period [see baseline findings at Cerami et al. (18)].

As we reported earlier (18), we conducted an anonymous on-line survey among Italian residents between March 14 and 31, 2020. We used convenience sampling, selecting participants based on their accessibility and proximity to the research group. We created the survey using Google Forms and distributed it through a freely accessible link (<https://forms.gle/>

5f3yH3aTNJYEuJ7B9). We distributed the survey link *via* written invitations through e-mails, WhatsApp and social networks. We then asked initial participants to diffuse the questionnaire through their social networks. Eligibility criteria were age (18 years of age or older) and place of residence (Italy). The PsyCovid Study was approved by the IUSS-University of Pavia Ethics Committee and performed in accordance with relevant guidelines/regulations. All study participants provided their informed consent to the experimental procedure and they did not receive any incentive to take part in the study.

The response rate was 98% and was calculated as the ratio of the number of complete responses to the total number of potential participants who had the chance to access the first page of the survey (18). Non-responders were persons who did not provide their informed consent to participate or who declared an age <18 years old.

A total of 1,258 adult Italian residents completed the survey (71.5% females; mean age: 43 ± 13.5 ; age range: 18–81). **Table 1** provides details about the socio-demographic characteristics of the sample.

Measures

Frailty

Frailty was measured by computing a Frailty Index (FI) following a standard procedure (19, 20). A total of 30 variables, representing symptoms, clinical signs, comorbidities, and impaired functions, were considered. For each item, we assigned a score 0 in the absence and 1 in the presence of the deficit. The FI score was then calculated by dividing the sum of the deficits presented by each participant by the total number of variables measured (i.e., 30). The variables incorporated in the FI are listed in Appendix A in **Supplementary Material**.

Social Vulnerability

Social vulnerability was operationalized analogously to frailty, by calculating a cumulative social vulnerability index (SVI). Thirty self-reported variables pertaining to social and psychological factors were considered. Each item was scored as 0 (absent) or 1 (present). The total number of deficits presented by the subject was then divided by the total number of deficits considered, yielding a continuous SVI score ranging from 0 to 1. The variables incorporated in the SVI are reported in Appendix B in **Supplementary Material**.

Of note, the FI and SVI were mutually exclusive, with no deficit overlap between the two instruments.

Psycho-Socio-Emotional Dimensions

In addition to data on socio-demographic characteristics, the questionnaire recorded information about different psycho-socio-emotional dimensions, relevant for emergency settings and post-traumatic situations (i.e., loneliness, empathic skills, coping strategies, alexithymia) (21–25). To collect information about these psycho-socio-emotional dimensions we used a battery of validated questionnaires in Italian language. Loneliness was assessed with the Italian Loneliness Scale (ILS) (26), including the three sub-scales (General Loneliness, Emotional Loneliness, Social Support). We used the Empathic Concern

TABLE 1 | Sample description.

Characteristics	No. (and %) of respondents
Sex	
Male	359 (28.5)
Female	899 (71.5)
Age	
Young adults (18–34 y)	405 (32.2)
Middle adults (35–49 y)	472 (37.5)
Old adults (50–64 y)	269 (21.4)
Elders (>65 y)	112 (8.9)
Education	
Elementary school (5 y)	2 (0.2)
Secondary school (8 y)	30 (2.4)
High school (13 y)	352 (28.0)
Graduate school (16–18 y)	580 (46.1)
Postgraduate school (>18 y)	293 (23.3)
Occupation	
Student	88 (7.0)
Housemaker	33 (2.6)
Unemployed	53 (4.2)
Employee	576 (45.8)
Manager	105 (8.3)
Freelance	230 (18.3)
Professor or researcher	37 (2.9)
Retired	117 (9.3)
Job field	
Industry	114 (9.1)
Financial and economy	118 (9.4)
Communication industry	60 (4.8)
Art and manufacturing	59 (4.7)
Humanities	199 (15.8)
Non-profit	99 (7.9)
Construction	25 (2.0)
Trade	65 (5.2)
Healthcare	185 (14.7)
Education and university	61 (4.8)
Public services	62 (4.9)
Others	205 (16.3)
Geographic area (place of residence)	
Northern Italy	832 (66.1)
Center Italy	115 (9.1)
Southern Italy	311 (24.7)

The table reports demographic features of the sample (n = 1,258).

(EC) and Perspective Taking (PT) sub-scales of the Interpersonal Reactivity Index (IRI) (27) to capture emotional and cognitive facets of empathic abilities, respectively. Coping strategies were investigated with the short version of the Coping Orientation to the Problems Experienced (COPE-NVI-25) scale (28), measuring different coping behaviors or styles toward problems and stressful events, reflected in 5 sub-scores (Positive attitude, Problem orientation, Transcendence orientation, Social support, Avoidance strategies). Finally, we recorded information about individuals' ability to identify and describe emotions experienced

by one's self or others with the Toronto Alexithymia Scale (TAS-20) (29).

Perceived Impact of Covid-19 Outbreak on Health

We assessed the perceived impact of Covid-19 outbreak on health with a 4-item scale (*average interitem covariance* = 0.34; *Cronbach's alpha* or α = 0.74) [see (18)]. This scale required participants to rate the perceived severity of Covid-19 outbreak for health at the local (item 1: city or town), regional (item 2), and global (item 3: national; item 4: international) levels, on a 5-point Likert scale (0 = not serious at all; 4 = extremely serious). The individual global score results by summing up the item ratings (range 0–16).

Statistical Analysis

We performed statistical analyses using SPSS (<https://www.spss.it/>) and STATA (<https://www.stata.com/>).

Since a small percentage of data were missing in any analysis (<2% of cases), we dropped cases with missing values *via* list-wise deletion. We set statistical significance at $p < 0.05$ for all statistical tests. We calculated descriptive statistics including frequencies and percentages for categorical variables, and mean and standard deviation for pseudo-continuous variables. We estimated interindividual differences in FI and SVI with a two-way MANOVA, considering sex and age categories (young adults: 18–34 y.o., middle aged adults: 35–49 y.o., old adults: 50–64 y.o., elders: >64 y.o.) as fixed factors.

Then, in order to reduce dataset complexity and optimize interpretability of results, we applied a Principal Component Analysis (PCA) on variables reflecting psycho-socio-emotional dimensions. In particular, after assessing the suitability of the correlation matrix (Keiser-Meyer-Olkin Measure of Sampling Adequacy = 0.702; Bartlett's test of sphericity <0.001), we performed a PCA on the scores of 11 variables, including the three ILS sub-scores, EC and PT sub-scores from the IRI, the five COPE-NVI-25 sub-scores and TAS-20 global score. Both the scree plot and the Kaiser-Guttman criterion (i.e., components with eigenvalue >1) converged in determining the number of components to be retained (=3). We used an orthogonal rotation (Varimax) to facilitate the interpretation of the resulting components (30). Loading factors of the three components obtained were then used in the subsequent correlation and mediation analyses. Correlation analysis (Pearson's r coefficient) was carried out to evaluate the relationship linking FI and SVI with PCA components (C1: *Proactivity*; C2: *Isolation*; C3: *Inactivity*) and the perceived impact of Covid-19 outbreak on health.

Finally, in the light of the correlation results, we assessed two different mediation paths *via* the *sgmediation* package in STATA. The first (*Social Vulnerability Model*) tested the indirect effect of C1 (*Proactivity*) on the relationship between SVI and perceived impact of Covid-19 outbreak on health. The second mediation path (*Frailty Model*) assessed the indirect effect of C2 (*Isolation*) on the relationship linking FI and perceived impact of Covid-19 outbreak on health.

RESULTS

Sample Distribution of FI and SVI

Descriptive statistics are illustrated in Table 2 and Figure 1.

Age and Gender Effects on FI and SVI

The two-way MANOVA showed a significant multivariate effect of gender [Λ = 0.984; $F_{(2, 1249)} = 10.036$, $p < 0.001$] and age categories [Λ = 0.957; $F_{(6, 2498)} = 9.253$, $p < 0.001$] on both FI and SVI. However, the interaction between gender and age categories was not significant [Λ = 0.999; $F_{(6, 2498)} = 0.127$, $p = 0.993$]. Univariate results confirmed gender and age categories effects on both FI [*sex*: $F_{(1, 1250)} = 5.951$, $p = 0.015$, with a greater FI in females than males; *age categories*: $F_{(3, 1250)} = 9.211$, $p < 0.001$], and SVI [*sex*: $F_{(1, 1250)} = 14.040$, $p < 0.001$, with a greater SVI in males than females; *age categories*: $F_{(3, 1250)} = 9.309$, $p < 0.001$]. *Post-hoc* analysis (Bonferroni *post-hoc* test) of univariate results taking into account between-group differences in age categories showed that while FI was significantly higher in old adults (50–64 y.o.) and elders (>64 y.o.) compared to young (18–34 y.o.) and middle aged adults (35–49 y.o.) (Figure 1), SVI was significantly higher in young adults and elders compared to middle aged and old adults (Figure 1).

Relationship Between FI and SVI, Psycho-Socio-Emotional Variables, and Perceived Impact of Covid-19 on Health

The PCA reduced the original 11 psycho-socio-emotional variables into 3 non-collinear components, explaining the 61% of the overall variance (Supplementary Table 1). Component 1 (C1: *Proactivity*) included variables related to empathy, social support, active and positive coping strategies, denoting an internal locus of control. Component 2 (C2: *Isolation*) included two loneliness variables. Finally, Component 3 (C3: *Inactivity*) encompassed variables related to alexithymia, transcendent or avoidance coping styles, indicating an external locus of control.

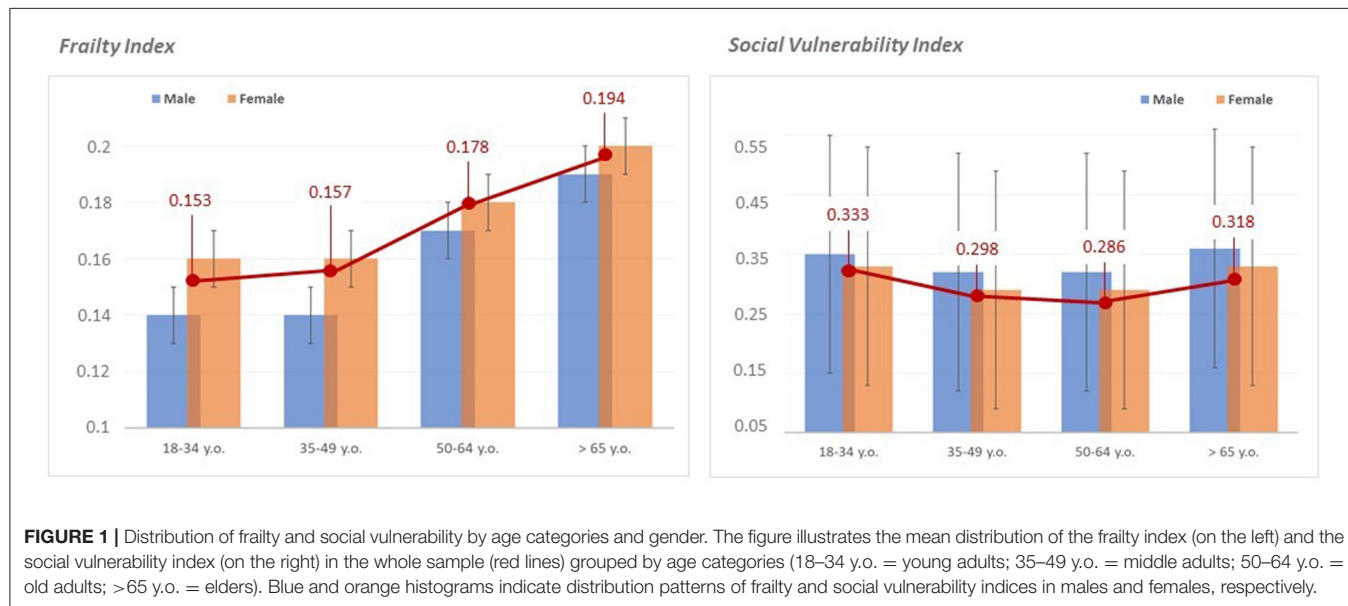
Correlation analyses assessing the relationship between FI, SVI, the three psycho-socio-emotional components (C1, C2, C3) and the perceived impact of Covid-19 on health are reported in Supplementary Table 2. In particular, we observed that both FI ($p < 0.05$) and SVI ($p < 0.01$) were significantly correlated with the perceived impact of Covid-19 on health. Based on the correlation patterns emerged, we selected a definite set of variables and tested two mediation paths in one model, with the perceived impact of Covid-19 outbreak on health as dependent variable.

In the *Frailty* path (Figure 2, blue color) we assessed the presence of a mediation effect of C2 (*Isolation*), which was negatively correlated to the perceived impact of Covid-19 outbreak for health (dependent variable) and positively with FI (independent variable), on the positive relationship linking FI and the perceived impact of Covid-19 outbreak for health. We found a significant indirect effect of C2 (Sobel test $p < 0.001$), which mediates ~86% of the total effect of FI on the perceived impact of Covid-19 outbreak for health. Here, direct effect and indirect effect showed opposite signs (direct effect = 3.3, $Z = 3.7$, $p < 0.001$; indirect effect = -1.5, $Z = -3.92$, p

TABLE 2 | Descriptive statistics of frailty and social vulnerability indices.

		Frailty index						Social vulnerability index					
		Males			Females			Males			Females		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Age	18–34	0.14	0.07	0.03–0.37	0.16	0.08	0.03–0.43	0.35	0.1	0.10–0.60	0.33	0.1	0.07–0.70
	35–49	0.14	0.07	0.03–0.37	0.16	0.1	0.03–0.83	0.32	0.11	0.03–0.60	0.29	0.1	0.03–0.60
	50–64	0.17	0.09	0.03–0.40	0.18	0.11	0.00–0.63	0.32	0.12	0.03–0.63	0.29	0.11	0.03–0.67
	>65	0.19	0.1	0.03–0.37	0.2	0.11	0.07–0.53	0.36	0.11	0.17–0.57	0.33	0.12	0.13–0.67

The table reports mean, standard deviation (SD) and score range of both indices in the sample ($n = 1,258$), grouped by age categories and gender.



< 0.001), suggesting that C2 exerted a suppression effect on the relationship between frailty and the perceived impact of Covid-19 on health (31).

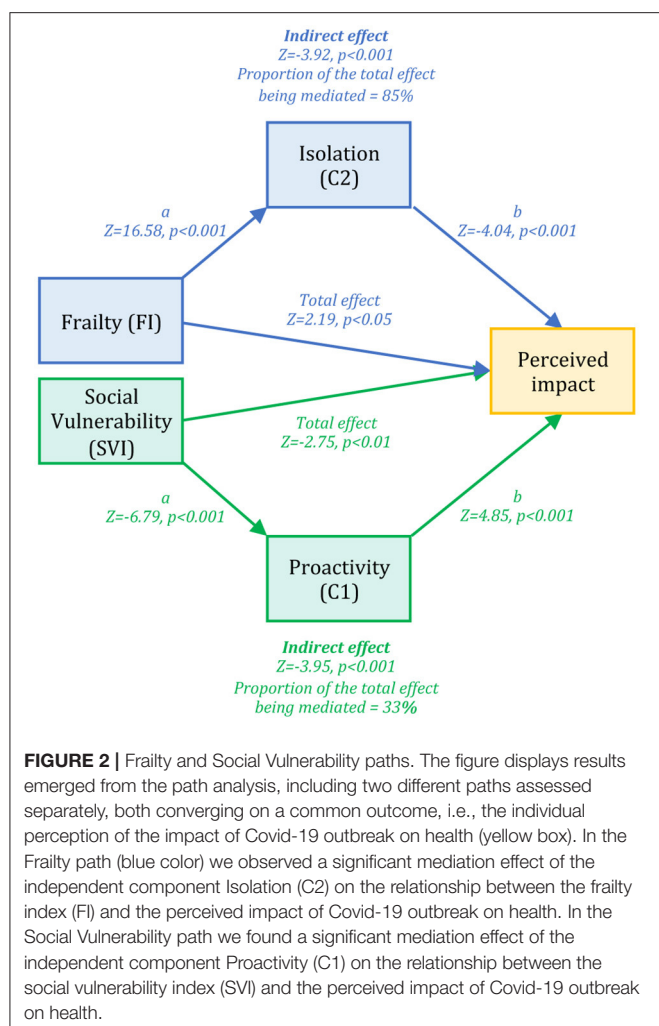
In the *Social Vulnerability* path (Figure 2, green color) we assessed the presence of a mediation effect of C1 (*Proactivity*), which was positively correlated with the perceived impact of Covid-19 outbreak for health (dependent variable) and negatively correlated with SVI (independent variable), on the negative relationship linking SVI and the perceived impact of Covid-19 outbreak for health. Here we observed a significant indirect effect of problem-oriented coping (Sobel test $p < 0.001$), which mediates ~33% of the total effect of SVI on perceived impact of Covid-19 outbreak for health.

DISCUSSION

Social distancing measures and indoor space isolation have been applied as effective actions to contain SARS-CoV-2 contagion. Though differently adopted by governments, these measures entered everyday life for millions of people in a few days. Digital solutions to communicate with others and limited physical

contacts will characterize our future for a while. It is however not negligible that this may have detrimental effects on the individual psychophysical health status and the well-being of the society. Humans live in a social contextual world and need social interactions to enhance the equilibrium of mind and brain, especially in case of vulnerable individuals.

In line with previous literature, frailty showed a significant increase with age. However, as expected, social vulnerability showed a different pattern. Indeed, younger people and elders appear the most vulnerable age categories. Women and people between 35 and 64 y.o. represented the less socially vulnerable categories in our sample. This evidence may suggest that the social distancing period during the lockdown phase was critical for those people whose significant relationships are held with contacts outside the family network (e.g., friends, colleagues, or mates for young adults, as well as relatives and next of kin for elders living alone). At the same time, individuals less engaged with indoor childcare or caregiving duties (i.e., men) may have suffered the most. This finding diverged from classical studies about social vulnerability [e.g., see Andrew et al. (32)], which reported that both frailty and social vulnerability correlate each other and have a linear increase with age, with women showing



higher index values than men. However, the extraordinary and unprecedented observation time of this study, together with the fact that we computed FI and SVI on a sample covering all adult ages, and not only elderly, may account for differences with these classical studies.

Both FI and SVI can be considered as predictors of the perceived impact of Covid-19 outbreak on health. However, while FI was directly related to the perceived severity of the Covid-19 impact on health—people having a higher FI perceiving the Covid-19 outbreak as more severe than individuals with lower FI—we observed a negative relationship between SVI and the perceived impact of Covid-19 outbreak for health, indicating that the subjects with higher social vulnerability were perceiving the impact of the Covid-19 outbreak as less severe than people displaying lower SVI. In particular, this latter result is confirming a previous suggestion (33). The lack of social contacts and loneliness made individuals less aware of the impact of the Covid-19 outbreak for health. Conversely, it is straightforward to understand the reason why people with high FI perceived the Covid-19 outbreak impact as more severe. Indeed, we believe that the presence of physical symptoms and/or preexistent diseases may possibly enhance the perceived feeling of being in

danger during the Covid-19 pandemic, as it represents a life-threatening acute event that may alter preexistent psycho-physical integrity. Testing two possible indirect effects through which FI and SVI might relate to the perceived impact of the Covid-19 outbreak for health, we found that both frailty and social vulnerability paths showed significant mediation effects. In line with our previous work (18), the *Frailty* path revealed that the *Isolation* component (C2, including two different loneliness measures) had a suppression effect (31) on the relationship linking FI with the perceived impact of Covid-19 outbreak for health, possibly making those individuals experiencing a greater degree of loneliness less aware of the impact of the Covid-19 outbreak for health. Again, the presence of a larger social network increases the probability to have friends, relatives or colleagues who have been infected and thus to judge the impact of the outbreak as more severe. The *Social Vulnerability* path highlighted the mediation effect of *Proactivity* (C1, including variables related to empathy, social support, active and positive coping strategies) to the negative relationship linking SVI to the perceived seriousness of Covid-19 outbreak impact for health. This might indicate that, in a condition of social vulnerability and lack of connectedness, the presence of empathic skills and proactive coping strategies can reduce the detrimental effect of SVI, increasing people awareness about the health impact of Covid-19.

Finally, there are some limitations to the present work mainly related to the cross-sectional nature of the study that prevents us to generalize results and draw inference on possible changes over time. Data collection based on a convenience-based sampling and relying on self-report questionnaires may hinder the generalization of our findings to the general population. Thus, only future replication studies on larger samples and including younger (<18 y.o.) and older (>65 y.o.) individuals, can confirm the reliability of present results and overcome limitations of our study design.

CONCLUSION

Our findings underline the dangers of social isolation in general population, as well as the importance of empathic skills and active coping strategies in promoting the individuals' psychosocial adaptation to a threatening event, like the Covid-19 pandemic. Frailty and social vulnerability, which contributed in explaining the individual perception of the perceived impact of Covid-19 emergency on health, were indeed influenced by proactive attitudes/behaviors and social isolation.

Measure as frailty and social vulnerability indices, coupled with information on personal psychological and emotional attitudes, may thus be helpful to monitor vulnerable populations, acting early to prevent social distancing from becoming social isolation. Social isolation in students and elderly has been linked to increased risk of mental illness as well as of cognitive decline and immune dysregulation (33–35). Moreover, it reduces resilience factors such as self-worth, sense of purpose, and feeling valued (36). These effects may lead to adverse health outcomes and increase susceptibility to infections. Health care systems and society communities must thus consider without further delay the psychosocial burden

of social distancing, finding shared support strategies to keep individual engaged and motivated and screening for mental and physical symptoms.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article are available at the following doi: 10.5281/zenodo.5082071.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by IUSS-University of Pavia Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CCe, MC, GS, and CCr conceptualized the work and designed the analysis. CCe, GS, CG, AD, and CCr performed data collection

and analysis. CCe, MC, AD, SC, TV, and CCr interpreted the results. CCe and CCr wrote the main manuscript text. All authors reviewed and approved the final version of the work.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2021.626682/full#supplementary-material>

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Post-traumatic Stress Disorder and Associated Factors 1 Year After the Beginning of the COVID-19 Pandemic Among Chinese Residents

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Edited by:

Mohammadreza Shalbafan,
Iran University of Medical
Sciences, Iran

Reviewed by:

Wanderson Moreira,
University of São Paulo, Brazil
Jamal Shams,
Shahid Beheshti University of Medical
Sciences, Iran
Masoud Ahmadzadeh,
University of Toronto, Canada
Seyyed Taha Yahyavi,
Tehran University of Medical
Sciences, Iran

*Correspondence:

Yong Gan
scswj2008@163.com
Chuanzhu Lv
lvchuanzhu677@126.com
Xiaotong Han
hanxiaotong2021@163.com

†These authors have contributed
equally to this work

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Xin Shen^{1†}, Shijiao Yan^{2,3†}, Heng Jiang^{4,5}, Hui Cao⁶, Rowan Dowling⁴, Jing Feng¹,
Zihui Lei¹, Jingru Li⁷, Xiaotong Han^{8*}, Chuanzhu Lv^{9,10*} and Yong Gan^{1*}

¹ Department of Social Medicine and Health Management, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, ² School of Public Health, Hainan Medical University, Haikou, China, ³ Key Laboratory of Emergency and Trauma of Ministry of Education, Hainan Medical University, Haikou, China, ⁴ Centre for Alcohol Policy Research, School of Psychology and Public Health, La Trobe University, Melbourne, VIC, Australia, ⁵ Melbourne School of Population and Global Health, University of Melbourne, Melbourne, VIC, Australia, ⁶ Department of Labor Economics and Management, Beijing Vocational College of Labour and Social Security, Beijing, China, ⁷ Department of Psychology, School of Education and Human Development, Hong Kong Education University, Hong Kong, China, ⁸ Department of Emergency Medicine, Hunan Provincial Institute of Emergency Medicine, Hunan Provincial Key Laboratory of Emergency and Critical Care Metabolomics, Hunan Provincial People's Hospital/The First Affiliated Hospital, Hunan Normal University, Changsha, China, ⁹ Emergency Medicine Centre, Sichuan Provincial People's Hospital, University of Electronic Science and Technology of China, Chengdu, China, ¹⁰ Research Unit of Island Emergency Medicine, Chinese Academy of Medical Sciences, Hainan Medical University, Haikou, China

Background: By investigating the incidence of post-traumatic stress disorder (PTSD) among residents during a period of low transmission, this study reflects the long-term impact of coronavirus disease 2019 (COVID-19) and identify which categories of residents are more likely to develop PTSD due to an acute infectious disease crisis, facilitating the development of targeted strategies to protect mental health after outbreaks of similar acute infectious diseases in the future.

Methods: A cross-sectional survey was conducted in China from 4 to 26 February 2021. A convenience sampling strategy was adopted to recruit participants. Participants were asked to complete the PTSD Checklist for DSM-5 (PCL-5). A multivariable linear stepwise regression analysis model was used to identify which factors were associated with PTSD in residents of China.

Results: A total of 2,361 Chinese residents completed the questionnaire. The mean PCL-5 score for the respondents was 13.65 (SD = 8.66), with 219 (9.28%) patients having probable PTSD symptoms. Respondents who were female ($\beta = 0.038$), had a relative or friend who had contracted COVID-19 ($\beta = 0.041$), and had poor health ($\beta = 0.184$) had higher PCL-5 scores, while the population aged over 60 years ($\beta = -0.063$), who agreed that COVID-19 information was released in a timely manner ($\beta = -0.347$), who had experienced a relatively limited impact of COVID-19 on their life ($\beta = -0.069$), and who agreed that the local prevention initiatives were sophisticated ($\beta = -0.165$) had lower PTSD scores.

Conclusions: Outbreaks of acute infectious diseases can have long-term psychological health effects in the general population. In addition, health policy makers need to be concerned about and implement measures to support the mental health of vulnerable groups.

Keywords: PTSD, acute infectious diseases, long-term impact, COVID-19, low transmission period

BACKGROUND

Post-traumatic stress disorder (PTSD) can develop after traumatic events outside the range of common human experience, such as violent physical assaults, torture, accidents, rape or natural disasters, and is characterized by a typical pattern of symptoms involving intrusive thoughts, the persistence of the trauma, the avoidance of relevant stimuli, emotional numbness and physiological hyperarousal (1). The coronavirus disease 2019 (COVID-19) epidemic in China was first identified in late December 2019, when clusters of cases of pneumonia of unknown etiology were observed (2). The Chinese Lunar New Year holiday, the start of which coincided with the emergence of COVID-19, is the most celebratory time of the year in China, and mass panic was triggered by the declaration that the virus could be transmitted among humans (3). Since the start of the outbreak, the Chinese government has been swift to respond, and 3 weeks after the start of the epidemic, on 23 January, Wuhan was put into a lockdown in an unprecedented attempt to slow the spread of the virus, and travel into and out of the area was restricted. Within days, the lockdown was extended to additional provinces and cities, affecting more than 50 million people in total. Many people stayed at home and socially isolated themselves to avoid being infected, leading to a “desperate plea” (4). There have also been reports of shortages of masks and health care equipment. The ongoing emerging infectious disease crisis has induced fear (5).

Several studies have explored the psychological effects of epidemics, such as those involving severe acute respiratory syndrome (SARS) and H1N1 influenza. Mak et al. (6) and Lam et al. (7) both reported that more than 40% of SARS survivors had experienced PTSD at some time during the outbreak. Meanwhile, those respondents who had been isolated, worked in high-risk workplaces such as SARS wards, or had friends or close relatives who contracted SARS were two to three times more likely to develop high levels of PTSD than those who were not exposed to the disease (8). Consequently, PTSD should be given more attention during the outbreak of COVID-19.

During the COVID-19 outbreak, researchers in the United States (9), Italy (10), and Spain (11) performed studies on the prevalence of PTSD in the residents of their countries and found that the occurrence of PTSD was significantly related to demographic characteristics, risk perception and other factors (12). Chinese researchers have also investigated PTSD in different groups. For example, Tang et al. investigated the level of PTSD among college students (13), and Bo et al. surveyed the prevalence of PTSD among COVID-19 patients (14). However, unlike individual-level traumatic events, the COVID-19 outbreak has been a continuing crisis experienced by every member of

society. There is a wide range of profound psychosocial impacts at the individual, community, and international levels during outbreaks of emerging infectious diseases. However, no studies have been conducted to investigate whether PTSD continues to affect the population after the achievement of control over the spread of COVID-19.

Currently, although the epidemic in China has entered a period of low transmission, the prevalence of PTSD in the population affected by this acute infectious disease is not clear. By investigating the prevalence of PTSD among Chinese residents during a period of low transmission, this study can reflect the long-term impact of COVID-19 and identify which subgroups of residents are more likely to develop PTSD due to an acute infectious disease crisis, facilitating the implementation of targeted strategies to protect mental health after outbreaks of similar acute infectious diseases in the future. As an increasing number of countries enter periods of low transmission, it becomes important to investigate the prevalence of and risk factors for PTSD in the population at this stage of the infectious disease outbreak. In 2021, the Chinese New Year fell on 4–26 February. This study explored the prevalence of PTSD due to the acute infectious disease crisis in the Chinese population 1 year after the start of the COVID-19 outbreak and the long-term psychological impact of the COVID-19 epidemic on the population, thereby filling in the gaps in available research. The results can serve as a reference for physical and mental health care policy makers.

METHODS

Ethics Statement

The protocol for this study was approved by the institutional review board of Tongji Medical College of Huazhong University of Science and Technology, Wuhan, China. All methods were performed in accordance with the relevant guidelines and regulations. Respondents were informed that their participation was voluntary, and consent was implied by the completion of the questionnaire.

Study Participants and Survey Design

A cross-sectional survey was conducted in China from 4 to 26 February 2021. A convenience sampling strategy was adopted to recruit participants; the research team used WeChat (the most popular social media platform in China) to advertise the study and circulate the survey link to their network members. Network members were asked to distribute the survey invitation to all their contacts. We collect information on respondents through Questionstar, a popular survey distribution and collection

site. The site will automatically identify and eliminate non-responders. Respondents were stratified according to the regions of China as follows: East (Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan), Central (Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan) and Western (Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Inner Mongolia, and Guangxi). Participants were informed that their participation was voluntary, and their consent was implied by their completion of the questionnaire. The inclusion criteria were as follows: 1) Chinese citizens who were at least 18 years old and 2) able to comprehend and read Chinese.

In our study, a 95% confidence level and $\pm 5\%$ precision are assumed for the Equation.

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size, and e is the level of precision. Thus, the conservative total sample size for this questionnaire is 1,200.

Instruments

The survey consisted of questions that assessed the following: 1) the participants' demographic background; 2) the participants' perception of their personal risk during the COVID-19 pandemic (measuring exposure level is essential to understanding the implications of the prevalence of PTSD; this study measured "perceived exposure" based on whether the respondent had contracted COVID-19, whether they had lost relatives or acquaintances, the duration of lockdown, etc.); and 3) the PTSD Checklist for DSM-5 (PCL-5). Demographic information, including sex, age, marital status, place of residence, highest education level attained, region, and employment status, was collected. The assessment of the participants' personal risk perception during the COVID-19 pandemic gathered information on participants' experiences during, perceptions of, and attitudes toward the COVID-19 pandemic.

PTSD was assessed with the PCL-5 (15), which was compiled by Bragesjö et al. (16) and translated into Chinese and revised by Zhou et al. (17). A total of 20 items rated on a five-point scale ranging from 0 (never) to four (severe) were used to assess the frequency of symptoms after being diagnosed with COVID-19. The participants were asked to report their symptoms in the last month. The PCL-5 is composed of four dimensions: intrusion, emotion alteration, avoidance, and hyperarousal. A total score is computed for each dimension, with higher scores indicating a higher degree of PTSD symptoms. Based on the clinical criteria (18), scores >33 indicate PTSD symptoms. The psychometric properties of Chinese version of the original PCL-5 have recently been validated, and it has been widely used in trauma-related research and practice (19). In the current Chinese study, Cronbach's alpha for the scale was 0.962 (20).

China was the first country to be affected by the COVID-19 outbreak and was ultimately severely affected, resulting in a high risk of infection among the residents. According to the

Life Events Checklist for DSM-5 (LEC-5), which is part of the PCL-5, this type of experience constitutes a traumatic event (21). Thus, in the present study, residents of different regions of China were selected and instructed to rate how much they were affected by the outbreak of COVID-19 in the last month by completing the PCL-5. The PCL-5 not only reflects the degree of PTSD symptoms experienced by an individual but can also be used to measure the prevalence of PTSD in a population based on a cut-off score. Even in a population of residents not clinically diagnosed with PTSD, there are significant differences in PCL-5 scores. Therefore, this study used this scale to identify which groups were more likely to have PTSD. Using the PCL-5 score as the dependent variable enables the exploration of the subtle differences among various groups of people, facilitating the identification of the groups at risk for poor mental health who need targeted support.

Statistical Methods

Descriptive analysis included the calculation of the means and standard deviations of continuous variables and the numbers and percentages of categorical variables. *T*-tests and ANOVA were used to compare factors affecting PTSD between residents in different regions. No clustering was observed in the respondents (correlation = 0.03, $P < 0.001$). Therefore, a multivariable linear stepwise regression analysis model was used to identify the factors associated with PTSD in the respondents (inclusion and exclusion criteria were $P = 0.05$ and $P = 0.01$, respectively). For each comparison, the P values were corrected for multiple comparisons to control the false discovery rate. We used a variance inflation factor to assess multicollinearity. All analyses were performed using STATA 12.0, and all differences were tested with two-tailed tests. A $P < 0.05$ was considered statistically significant.

RESULTS

Descriptive Statistics

A total of 2,453 residents received the questionnaire. The response rate was 96.24%, with 21 participants who did not respond and 71 questionnaires that were not completed. The remaining 2,361 complete questionnaires were used in our analysis. **Table 1** reports the socio-demographic characteristics of the 2,361 respondents. The mean age was 29.72 years (18–77, $SD = 6.94$), and the majority of respondents were female (60.10%). Among the respondents, 421 (17.83%), 1,470 (62.26%), and 470 (19.91%) were from East, Central, and Western China, respectively. Most respondents (89.24%) reported having attained a bachelor's degree or higher. More than half of the participants were unemployed (57.05%), unmarried (66.07%) and lived in urban areas (58.11%).

The mean score on the PCL-5 was 13.65 ($SD = 8.66$). Using a cut-off score of 33, 219 (9.28%) patients had probable PTSD symptoms. **Table 1** shows the mean scores in different subpopulations. There were significant differences in PCL-5 scores based on age, marital status, place of residence, highest education level attained, presence of relatives or friends with COVID-19, agreement that information about COVID-19 has

TABLE 1 | Statistical description of study samples.

Variables	N (%)	PCL-5 Scores M (SD)	F/t	P-value
Total	2,361 (100)	19.65 (12.66)	NA	NA
Gender				
Male	942 (39.90)	20.16 (13.00)	2.60	0.11
Female	1,419 (61.10)	19.30 (12.41)		
Age group, y				
18–44	1,845 (78.14)	20.36 (12.81)	18.75	<0.001
45–59	369 (15.63)	18.18 (12.23)		
>60	111 (4.70)	14.32 (9.93)		
Marital status				
Unmarried	1,560 (66.07)	20.24 (12.94)	10.261	0.001
Married	801 (33.93)	18.48 (11.99)		
Place of residence				
Urban	1,372 (58.11)	18.91 (12.21)	11.282	0.001
Rural	989 (41.89)	20.67 (13.18)		
Highest educational level attained				
Primary school or below	68 (2.88)	21.87 (13.85)	3.014	0.049
middle school	186 (7.88)	21.33 (12.09)		
College degree or above	2,107 (89.24)	19.43 (12.65)		
Region				
Eastern China	421 (17.83)	19.32 (12.55)	1.498	0.224
Central China	1,470 (62.26)	19.45 (12.76)		
Western China	470 (19.91)	20.54 (12.41)		
Employment status				
Employed	1,014 (42.95)	19.33 (12.70)	1.129	0.288
Unemployed	1,347 (57.05)	19.89 (12.62)		
Relative or friend has experienced COVID-19				
Yes	206 (8.73)	19.46 (12.52)	5.161	0.023
No	2,155 (91.27)	21.56 (13.90)		
Consent COVID-19 information has been released timely				
Yes	657 (27.83)	27.06 (12.05)	360.395	<0.001
No	1,704 (72.17)	16.79 (11.69)		
COVID-19 have a low impact on your life				
Strongly disagree	620 (26.26)	21.13 (12.99)	4.328	0.002
Disagree	964 (40.83)	19.70 (12.66)		
Not sure	562 (23.80)	18.10 (11.97)		
Agree	124 (5.25)	17.26 (11.10)		
Strongly agree	91 (3.85)	18.64 (12.51)		
Individual health is currently poor				
Strongly disagree	65 (2.75)	20.40 (12.61)	0.728	0.572
Disagree	67 (2.84)	21.48 (12.70)		
Not sure	436 (18.47)	18.98 (12.69)		
Agree	955 (40.45)	19.74 (12.61)		
Strongly agree	838 (35.49)	19.68 (12.70)		
Keeping concerning health information				
Strongly disagree	74 (3.13)	21.36 (13.63)	3.488	0.008
Disagree	179 (7.58)	21.17 (13.10)		
Not sure	752 (31.85)	20.51 (13.01)		
Agree	815 (34.52)	19.20 (12.38)		
Strongly agree	541 (22.91)	18.38 (12.16)		

(Continued)

TABLE 1 | Continued

Variables	N (%)	PCL-5 Scores M (SD)	F/t	P-value
The local prevention initiatives are sophisticated				
Strongly disagree	66 (2.80)	22.03 (14.03)	1.175	0.320
Disagree	136 (5.76)	19.80 (13.33)		
Not sure	691 (29.27)	20.13 (12.66)		
Agree	890 (37.30)	19.43 (12.31)		
Strongly agree	578 (24.48)	19.10 (12.84)		

been released in a timely manner, agreement that COVID-19 has had a limited impact on their lives, and “keeping concerning health information”.

Table 2 lists the results of the multivariable linear stepwise regression analysis of the factors associated with PTSD. Female sex ($\beta = 0.038$), relative or friend with COVID-19 ($\beta = 0.041$), and poor health ($\beta = 0.184$) were associated with higher PCL-5 scores, while age > 60 years ($\beta = -0.063$), agreement that information about COVID-19 has been released in a timely manner ($\beta = -0.347$), perception that COVID-19 had a limited impact on their life ($\beta = -0.069$), and agreement that the local prevention initiatives were sophisticated ($\beta = -0.165$) were associated with lower PCL-5 scores.

Table 3 reports the stratified results of the multivariable linear regression of the predictions regarding PTSD by region. There were differences in the predicted results regarding psychological resilience among regions. In East China, residents who agreed that information about COVID-19 had been released in a timely manner ($\beta = -0.409$) had lower PCL-5 scores. In Central China, sex ($\beta = 0.062$), agreement that information about COVID-19 had been released in a timely manner ($\beta = -0.317$) and perception that COVID-19 had a limited impact on their life ($\beta = -0.074$) were significantly associated with the PCL-5 scores. In Western China, age > 60 years ($\beta = -0.096$) and agreement that information about COVID-19 had been released in a timely manner ($\beta = -0.333$) were associated with lower PCL-5 scores.

DISCUSSION

We firstly evaluate the consequences of the COVID-19 outbreak with regard to PTSD ~ 1 year after the start of the outbreak in China and identify the related risk factors. The mean psychological resilience score of the respondents was 13.65 (SD = 8.66), and 219 (9.28%) participants had higher PCL-5 scores. Sex, age, relative or friend with COVID-19, poor health, agreement that information about COVID-19 had been released in a timely manner, perception that COVID-19 had a limited impact on their life and agreement that local prevention initiatives were sophisticated were the main factors associated with the residents' PCL-5 scores.

The COVID-19 pandemic is a significant source of psychological stress and has had tremendous impacts on all facets of individuals' lives and organizations' operations in

TABLE 2 | Stepwise regression analysis of associated factors for PTSD among respondents.

Variables	Unstandardized coefficients		Standardized coefficients	<i>t</i>	<i>p</i> -value	95%CI
	β	<i>SE</i>	β			
Total	19.37	2.38	NA	8.138	<0.001	14.963 ~ 24.272
Gender (Ref: male)						
Female	0.99	0.497	0.038	1.994	0.046	0.006 ~ 1.947
Age group, y (Ref: 18–44)						
45–59	–1.08	0.677	–0.031	–1.596	0.111	–2.446 ~ 0.200
>60	–3.30	1.031	–0.063	–3.199	0.001	–5.278 ~ –1.245
Marital status (Ref: unmarried)						
Married	–2.58	0.701	–0.097	–3.685	<0.001	–3.955 ~ –1.209
Place of residence (Ref: urban)						
Rural	–0.636	0.548	–0.025	–1.161	0.246	–1.710 ~ 0.438
Highest educational level attained (Ref: primary school or below)						
Middle school	0.687	1.699	0.015	0.404	0.686	–2.644 ~ 4.018
College degree or above	–0.545	1.495	–0.013	–0.365	0.715	–3.475 ~ 2.385
Region (Ref: Eastern China)						
Central China	0.706	0.669	0.027	1.054	0.292	–0.606 ~ 2.018
Western China	0.951	0.792	0.03	1.202	0.230	–0.600 ~ 2.503
Employment status (Ref: employed)						
Unemployed	0.897	0.687	0.035	1.306	0.192	–0.449 ~ 2.243
Relative or friend has experienced COVID-19 (Ref: no)						
Yes	1.825	0.869	0.041	2.1	0.036	0.122 ~ 3.528
Consent COVID-19 information has been released timely (Ref: no)						
Yes	–9.803	0.556	–0.347	–17.625	<0.001	–10.893 ~ –8.713
COVID-19 have a low impact on your life (Ref: strongly disagree)						
Disagree	–1.104	0.606	–0.043	–1.821	0.069	–2.292 ~ 0.084
Not sure	–1.91	1.158	–0.034	–1.649	0.099	–4.181 ~ 0.360
Agree	–2.259	1.319	–0.034	–1.713	0.087	–4.843 ~ 0.326
Strongly agree	–2.053	0.684	–0.069	–3.000	0.003	–3.394 ~ –0.712
Individual health is currently poor (Ref: strongly disagree)						
Disagree	3.954	2.562	0.052	1.543	0.123	–1.068 ~ 8.975
Not sure	2.644	2.309	0.081	1.145	0.252	–1.881 ~ 7.169
Agree	3.903	2.275	0.151	1.715	0.086	–0.557 ~ 8.362
Strongly agree	4.867	2.29	0.184	2.125	0.034	0.379 ~ 9.354
Keeping concerning health information (Ref: strongly disagree)						
Disagree	0.44	1.877	0.009	0.234	0.815	–3.240 ~ 4.119
Not sure	0.022	1.718	0.001	0.013	0.99	–3.346 ~ 3.389
Agree	–0.984	1.716	–0.037	–0.574	0.566	–4.347 ~ 2.379
Strongly agree	–1.639	1.743	–0.054	–0.94	0.347	–5.056 ~ 1.778
The local prevention initiatives are sophisticated (Ref: strongly disagree)						
Disagree	–4.104	2.475	–0.076	–1.658	0.097	–8.956 ~ 0.748
Not sure	–3.979	2.353	–0.143	–1.691	0.091	–8.590 ~ 0.632
Agree	–4.567	2.343	–0.175	–1.949	0.051	–9.160 ~ 0.026
Strongly agree	–4.851	2.389	–0.165	–2.03	0.042	–9.533 ~ –0.168

virtually every social and economic sector worldwide. Fear of illness and uncertainty about the future can lead to the development of anxiety- and stress-related disorders. Fear of illness, fear of death, and uncertainty regarding the future are significant psychological stressors, and social isolation resulting from the loss of structured education and work activities

also threatens to worsen public mental health. The world has been affected by an unprecedented pandemic remains poorly understood. Previous studies on COVID-19 have reported a prevalence of PTSD-related symptoms of ~ 5% in Wuhan, the first area in China affected by the COVID-19 epidemic. This result was observed by administering the PCL-5 and by using

TABLE 3 | Stratified stepwise regression of predictors of psychological resilience by region.

Variables	Unstandardized coefficients		Standardized coefficients	<i>t</i>	<i>p</i> -value	95%CI
	β	SE	β			
Total	19.37	2.38	–	8.138	<0.001	14.963 ~ 24.272
Eastern China						
Consent COVID-19 information has been released timely (Ref: no)						
Yes	–10.804	1.243	–0.409	–8.692	<0.001	–13.240 ~ –8.368
Central China						
Gender (Ref: male)						
Female	1.618	0.650	0.062	2.488	0.013	0.344 ~ 2.893
Consent COVID-19 information has been released timely (Ref: no)						
Yes	–9.520	0.752	–0.317	–12.658	<0.001	–10.994 ~ –8.046
COVID-19 have a low impact on your life (Ref: strongly disagree)						
Strongly agree	–2.228	0.892	–0.074	–2.498	0.013	–3.976 ~ –0.480
Western China						
Age group, y (Ref: 18–44)						
>60	–3.957	1.913	–0.096	–2.069	0.039	–7.705 ~ –0.208
Consent COVID-19 information has been released timely (Ref: no)						
Yes	–8.628	1.229	–0.333	–7.022	<0.001	–11.037 ~ –6.220

a cut-off score of 33 points (22). Our study found that many people were still have higher PCL-5 scores nationwide even a year after the start of the pandemic.

Female respondents were found to have more intrusive thoughts than males. This result is consistent with previous studies, which showed that after traumatic events, acute psychological disorders characterized by intrusive memories are more prevalent in women than men (23, 24). Some evidence suggests that fluctuations in ovarian hormone levels are responsible for differences in sensitivity to emotional stimuli during certain phases in the menstrual cycle, during which intrusive flashbacks are enhanced, possibly explaining the increased vulnerability of women to psychological disorders (25). Similarly, age and marital status were important factors affecting PCL-5 scores. Several studies have suggested that demographic characteristics are critical factors affecting the predisposition to PTSD (10, 10, 13, 26). Our study also shows that older adults are more likely to get higher PCL-5 scores.

During one influenza outbreak, ~ 10–30% of the general public was very or fairly worried about the possibility of contracting the virus (27). With the closure of schools and business, the negative emotions experienced by individuals can be compounded (27). During the SARS outbreak, many studies investigated the psychological impact on the uninfected community and showed that there were significant psychiatric morbidity associated with younger age and increased self-blame (28). In our study, residents who had relatives or friends who contracted COVID-19, had poor health, and experienced a large impact due to COVID-19 had higher PCL-5 scores, indicating that vulnerable groups are more likely to have psychological problems. Residents who agreed that information about COVID-19 information had been released in a timely manner and that local prevention initiatives were sophisticated had lower PCL-5

scores, which showed that government policies have significant impacts on the mental health of residents. Therefore, efforts need to be made to support residents and break the vicious circle of fear and panic related to COVID-19. A combination of strategies is required at both the public and individual levels, which could include public engagement, support for individual self-adjustment through participation in stress-releasing activities, familial support, and even psychiatric help (29).

Addressing PTSD requires a multifaceted approach. Individuals should assess the COVID-19 situation objectively, determine the risk they face in different situations, and take scientific protective measures to reduce their fears and inappropriate protective behaviors. They should also recognize and overcome their PTSD emotions. When individuals are unable to cope with PTSD, seek help from health care agencies or the government. The government should take the initiative to understand the mental health and PTSD status of the population, identify high-risk groups in a timely manner, and avoid suicide, impulsive behavior and extreme events. Medical institutions shall carry out publicity and education and provide mental health services.

Strengths and Limitations

This is the first study to measure PTSD in the population during a period of low transmission, showing the long-term psychological damage caused by the COVID-19 outbreak in the general population. Meanwhile, we investigated the major factors influencing the psychological health of residents 1 year after the start of the COVID-19 outbreak and identified vulnerable populations in need of mental health support. We involved a nationwide sample of the Chinese population, and the results could be useful to countries entering a period of low transmission.

However, this study has some limitations. First, we used social media as the main method of disseminating the survey. Participants without access to the internet were probably not included. In the absence of data regarding epidemiological variables (e.g., age, education, employment etc.) for the participants, it is difficult to determine the representativeness of the sample. Second, the distribution of the study participants was imbalanced across regions (421: 1,470: 470); therefore, the sample might not be representative of the national population. In addition, under convenience sampling, more female, younger age, and educated participants were also brought. Future studies need to be more detailed, based on population and geography. Third, we could not determine how many participants viewed the online poster or survey but decided not to complete the survey; thus, the presence of non-response bias could not be assessed. Finally, as the behaviors were self-reported, reporting bias was possible. Overall, generalization of the results should be performed with caution.

CONCLUSIONS

In a period of low transmission of COVID-19, the mean PCL-5 score among Chinese respondents was 13.65 (SD = 8.66), and 219 (9.28%) participants had probable PTSD symptoms. This means that outbreaks of acute infectious diseases can have long-term psychological health effects in the general population. In addition, health care policy makers need to be concerned about and support the mental health of vulnerable groups.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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ETHICS STATEMENT

All individuals provided written informed consent. This study was performed in line with the principles of the Declaration of Helsinki. The protocol strictly abided by the Chinese Statistical Law to ensure that participants' personal information was kept confidential. This study protocol was approved by the institutional review board of Tongji Medical College of Huazhong University of Science and Technology, Wuhan, China ([2021]S088).

AUTHOR CONTRIBUTIONS

XS, SY, and YG: conceived and designed the study. JF and ZL: participated in the acquisition of data. HC and HJ: analyzed the data. RD and JL: gave advice on methodology. XS and SY: drafted the manuscript. XH, CL, and YG: revised the manuscript. YG is the guarantor of this work and had full access to all the data in the study and takes responsibility for its integrity and the accuracy of the data analysis. All authors have read and approved the final manuscript.

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Physical and Psychosocial Well-Being of Hospitalized and Non-Hospitalized Patients With COVID-19 Compared to the General Population in Qatar

Sami Ouane¹, Hassen Al-Amin², Nurrunnazha Binti Hussein¹, Faisal Khan¹, Ahmad Al Shahrani¹, Premalatha David¹, Amel Baker Wali¹, Maliha Thapur³, Mustafa Abdul Karim¹, Muna Al Maslamani³, Zainab Al-Ansari⁴ and Suhaila Ghuloum^{1*}

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Sciences, Iran

*Correspondence:

Suhaila Ghuloum
sghuloum@hamad.qa

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¹ Department of Psychiatry, Hamad Medical Corporation, Doha, Qatar, ² Weill Cornell Medicine, Psychiatry Department, Doha, Qatar, ³ Communicable Disease Center, Hamad Medical Corporation, Doha, Qatar, ⁴ Weill Cornell Medicine, Medical Education, Doha, Qatar

Background: Many studies have shown a high prevalence of depression, anxiety, and stress symptoms in COVID-19 patients and the general population. However, very few studies directly examined the potential impact on the health-related quality of life (HRQoL), and none compared HRQoL in COVID-19 patients to the general population amid the pandemic.

Methods: We carried out a cross-sectional study comparing HRQoL (as measured using the RAND Short Form 36 or SF-36 Health Survey) in randomly selected individuals from three different groups: hospitalized COVID-19 patients, quarantined COVID-19 patients, and controls from the general population in Qatar. We constructed a multivariate analysis of covariance (MANCOVA) to compare the SF-36 scores between the three groups and control for various covariates.

Results: Our sample consisted of 141 COVID-19 inpatients, 99 COVID-19 quarantined patients, and 285 healthy controls. Surprisingly, we found that HRQoL was higher in COVID-19 hospitalized than in COVID-19 non-hospitalized patients than in controls. The main components where COVID-patients scored higher than controls were physical functioning and role limitations due to emotional problems. In COVID-19 patients, the female gender, older age, and past psychiatric history were associated with lower HRQoL.

Conclusions: It seems that COVID-19 patient's HRQoL might be better than expected. Our results can be explained by social support from family and friends, easy access to mental health screening and care, and a possible change of perspectives after recovery from COVID-19, resulting in psychological growth and enhanced resilience.

Keywords: COVID-19, functioning, quality of life, hospitalized, quarantined, general population

INTRODUCTION

Amidst the Coronavirus disease (COVID-19) pandemic, more reports showed an increase in the prevalence of depressive, stress, and anxiety symptoms in the general population. Indeed, a meta-analysis of the global prevalence of mental health problems among the general population during the COVID-19 pandemic found a prevalence of 28.0% (95% CI = 25.0–31.2%) for depression, 26.9% (95% CI = 24.0–30.0%) for anxiety, and 36.5% (95% CI 30.0–43.3%) for stress symptoms (1).

A meta-analysis of the prevalence of depression, anxiety, and insomnia symptoms in patients with COVID-19 found a pooled prevalence of 38% (95% CI = 25–51%) for depression, 38% (95% CI = 24–52%) for anxiety, and 48% (95% CI = 11–85%) for insomnia (2). Similarly, a systematic review of psychiatric sequelae of COVID-19 highlighted high rates of depressive (10.0 and 68.5%), anxiety (5.0 and 55.2%), and acute stress reaction (10.0 to 28.0%) symptoms, as well as high rates of insomnia (26.0 to 52.2%). Even months after recovery, 7.0 to 36.4% of patients endorsed symptoms suggestive of post-traumatic stress disorder (PTSD), and 40.0 to 69.0% reported persistent fatigue 2 to 3 months after discharge, with a significant impact on their activities of daily living and quality of life (3). All of these symptoms can affect individual's physical and psychosocial well-being.

However, in stark contrast with the very large number of studies examining depressive, anxiety, and stress symptoms in COVID-19 patients, only a few studies directly examined the health-related quality of life (HRQoL). Some studies reported that HRQoL is low in COVID-19 patients 1–3 months after discharge (4, 5); others reported that COVID-19 patients were scoring lower than norms on certain components of the HRQoL (6, 7).

One fundamental limitation of these studies is the lack of a control arm, and most simply used previously established norms to interpret COVID-19 patient's HRQoL scores (8). Thus, it is better to have a control group to discern the direct effects of COVID-19 infection on HRQoL from the overall impact of the pandemic on the whole population. Indeed, some studies reported high rates of depression, anxiety, and stress in the general population (1), and others found low HRQoL (9, 10) in the general population amidst the pandemic.

This study aimed to address some of the shortcomings of the previous studies by (i) directly examining the HRQoL amid the pandemic rather than assuming that depressive, anxiety, and stress symptoms translate into poorer HRQoL; (ii) comparing the HRQoL in COVID-19 patients to a sample from the general population group; (iii) comparing two different groups of COVID-19 patients (hospitalized vs. quarantined).

METHODS

We conducted this cross-sectional study in July–September 2020 in the State of Qatar to examine HRQoL in COVID-19 patients compared to a sample from the general population. We used hospitalization vs. non-hospitalization as a proxy for COVID-19 severity.

We included three groups:

- A group of individuals diagnosed with COVID-19 and admitted to hospital (inpatient group)
- A group of individuals diagnosed with COVID-19 but not requiring hospital admission (quarantine group)
- A general population sample (control group)

We enrolled participants through phone interviews or an anonymous online version of the same questionnaire through Survey Monkey. We used phone interviews for cases tested positive for COVID-19, hospitalized or quarantined. For the general population sample, we sent a link to the online version by phone.

Participants

The inclusion criteria for the three groups were the following: adults aged 18–65 years who could speak Arabic or English. For the inpatient group, we excluded patients at the intensive care unit at the time of the study.

For COVID-19 groups (both inpatient and quarantine), we used the national records of COVID-19 hospitalized or quarantined patients to select the participants randomly. Then, we contacted every 10th name inviting them to participate until we reached the required number.

For the three groups, we chose *not* to exclude subjects with past history of psychiatric disorders, because: (i) this would allow us to examine the HRQoL in this subpopulation as well, and to examine the effect of past psychiatric history as a potential predictor for the HRQoL in COVID-19 patients vs. controls (ii) using MANCOVA, we can control for the effect of the presence of past history of psychiatric disorders in the comparison between groups.

We allocated the randomly chosen cases to members of the research team, who then contacted the patients by phone. The interviewers were blinded to whether the patients were hospitalized or quarantined to avoid potential bias.

The research team member explained the purpose of the phone call and invited the patient to participate in the study. After granting the consent, we offered participants to conduct the interview either over the phone or using a web-based survey.

We sent text messages through a mobile service operator to 10,000 subjects, randomly selected English and Arabic speakers to recruit the general public group. The text messages contained a brief explanation of the study and a link to the anonymous online survey.

Sample Size Calculation

We calculated the sample size using the one-way ANOVA to compare three means (scores of SF-36 for each group) followed by pairwise comparisons with two-sided equality. Thus, we had three groups (i.e., three pairwise comparisons). In addition, we wanted a significant difference of 33% for each comparison, with a standard deviation of 10, a power of 80%, and a type one error of 5% (significance level). Based on these parameters, the calculated sample size was 83 subjects for each group. Further, we elected to recruit at least 100 subjects for each group to account for 20% of dropouts or incomplete data.

Measurements

The survey consisted of questions about basic sociodemographic information and sleep and an assessment of the HRQoL using the RAND Short Form 36 (SF-36) Health Survey in English or Arabic (depending on the participant's preferred language).

The RAND SF-36 questionnaire is a widely used 36-item questionnaire to evaluate HRQoL. It covers eight domains of physical and mental well-being: physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health (11).

We interpreted and analyzed the SF-36 scale results using the scoring rules detailed on the RAND corporation Website (RAND Corporation, 12). For each scale, the score ranges from 0 to 100, with 100 indicating the best health. These eight concepts have also been summarized into two scales: a physical component score and a mental component score (13). The questionnaire was constructed for self-administration and by telephone interview (14). The English version of the SF-36 has demonstrated excellent reliability (Cronbach's alpha for the eight scales ranging from 0.85 to 0.94) and discriminant validity (15). The Arabic version was previously validated and showed good reliability (median Cronbach's alphas exceeded 0.70 for every scale except for general health, which had an alpha value of 0.6), high correlations with the English version (ranging from 0.73 to 0.92), as well as good test-retest reliability (16). Previous studies used the Arabic SF-36 in different Arab countries, including Saudi Arabia (16), Jordan (17), Egypt (18), Tunisia (19), Lebanon (20), and Qatar (21).

Ethical Considerations

Hamad Medical Corporation Institutional Review Board (MRC-05-045) approved this study.

Informed consent was obtained from all participants. All the research team members were bilingual (Arabic and English) and received similar training to standardize the consent process. Participants were offered a consultation with mental health services if needed.

Statistical Analysis

Data were analyzed using SPSS for Windows, version 26.

Descriptive Statistics

We determined absolute and relative frequencies for categorical variables and the mean and standard deviation (SD) for the continuous ones.

Analytical Statistics

To compare categorical variables between groups (inpatient group, quarantine group, and controls), we used Pearson's Chi-square and, in case of non-validity (cells with an expected count < 5), Fischer's exact test. To compare continuous variables between groups (pairwise), we used the *t*-test for independent samples.

We chose to use the APA style in the table reporting chi-square and *t*-test results because the high number of comparisons would otherwise make the table too complex, and difficult to read.

We used a one-way analysis of variance to examine the associations between the SF-36 physical and mental component scores and the categorical variables. For the variables that did not follow a normal distribution (as per the Shapiro-Wilk test), we used non-parametric correlations to examine the associations between the SF-36 physical and mental component scores and the continuous sociodemographic and clinical variables.

To compare the SF-36 scale scores between the three groups (inpatient, quarantine, and controls), we constructed a multivariate analysis of covariance (MANCOVA): the SF-36 scores (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, general health) as dependent variables; and the group (inpatient vs. quarantine vs. controls) as a fixed factor, with gender, age, nationality group (dichotomized as belonging to the most represented group among COVID-19 patients, i.e., Indian Subcontinent vs. others), education (dichotomized as higher education vs. others), occupation (dichotomized as belonging to the most represented group among COVID-19 patients, i.e., craft and manual workers vs. others), and previous psychiatric history as covariables. We chose to conduct a MANOVA rather than a multiple regression analysis because the SF-36 has eight components that cannot be summarized into one total score (12). Preliminary assumptions for MANCOVA (including normality, linearity, univariate and multivariate outliers, covariance matrices, and multicollinearity) were tested. Pillai's trace test was used because the SF-36 scores violated the normality assumption. The effect size was assessed using the partial eta squared. The alpha value was set at 0.05. Finally, we adjusted *p* values for multiple comparisons using Bonferroni's method.

RESULTS

Sociodemographic and Clinical Characteristics

Our sample consisted of 141 inpatients, 99 quarantined individuals with COVID-19, and 285 controls (subjects from the general population who were neither infected nor quarantined) (Table 1).

The proportion of males was significantly higher in inpatients than in the quarantine sample than in controls. Mean age was also higher in inpatients than in quarantined individuals or controls. More craft and manual workers in the inpatient group than in quarantine than in controls. The inpatient group also had lower education levels than both other groups.

The percentage of participants who reported positive psychiatric history (anxiety, depression, or both) was comparable between groups (ranging between 3 and 4.6%). The number of sleep h was comparable across groups, with a mean of 7.1–7.2 h, and an SD of 1.3–1.4.

When comparing SF-36 scale scores, we found no significant differences between the inpatient and quarantine groups. However, controls reported lower physical functioning scores than inpatients and quarantined individuals. Similarly, controls

TABLE 1 | Sociodemographic and clinical features of COVID-19 inpatients vs. COVID-19 infected quarantined individuals vs. controls.

		A: Inpatient <i>n</i> = 141	B: Quarantine <i>n</i> = 99	C: Controls <i>n</i> = 285
Gender, Male, <i>n</i> (%)		121 (85.8%) _a	69 (69.7%) _b	122 (42.8%) _c
Age, in years, <i>m</i> ± <i>SD</i>		44.0 ± 10.5 _a	36.8 ± 10.4 _b	38.6 ± 10.2 _b
Nationality Group, <i>n</i> (%)	Qatar	21 (14.9%) _a	3 (3.0%) _b	30 (10.5%) _{a,b}
	Arab countries other than Qatar	16 (11.3%) _a	32 (32.3%) _b	37 (13.0%) _a
	Indian Subcontinent	90 (63.8%) _a	58 (58.6%) _a	6 (2.1%) _b
	Southeast Asia	8 (5.7%) _a	4 (4.0%) _a	127 (44.6%) _b
	Other	6 (4.3%) _a	2 (2.0%) _a	85 (29.8%) _b
Occupation, <i>n</i> (%)	Unemployed	1 (0.7%) _a	3 (3.0%) _{a,b}	17 (6.0%) _b
	Housewife	6 (4.3%) _a	12 (12.1%) _a	32 (11.2%) _a
	Craft and Manual Worker	83 (58.9%) _a	26 (26.3%) _b	8 (2.8%) _c
	Professional	45 (31.9%) _a	53 (53.5%) _b	210 (73.7%) _c
	Student	3 (2.1%) _a	5 (5.1%) _a	17 (6.0%) _a
	Retired	3 (2.1%) _a	0 (0.0%)	1 (0.4%) _a
Education, <i>n</i> (%)	Primary or Middle School	54 (38.3%) _a	14 (14.1%) _b	4 (1.4%) _c
	Secondary School	49 (34.8%) _a	31 (31.3%) _a	46 (16.1%) _b
	Higher education	38 (27.0%) _a	54 (54.5%) _b	235 (82.5%) _c
Past psychiatric history, yes, <i>n</i> (%)		5 (3.5%) _a	3 (3.0%) _a	13 (4.6%) _a
Number of hours of sleep, <i>m</i> ± <i>SD</i>		7.1 ± 1.4 _a	7.2 ± 1.4 _a	7.1 ± 1.3 _a
SF-36 scale scores, <i>m</i> ± <i>SD</i>	Physical functioning	91.0 ± 15.1 _a	91.2 ± 14.7 _a	79.6 ± 25.3 _b
	Role limitations due to physical health	79.4 ± 35.9 _a	76.3 ± 38.4 _a	78.4 ± 32.3 _a
	Role limitations due to emotional problems	83.9 ± 34.9 _a	80.1 ± 36.2 _a	68.0 ± 39.5 _b
	Energy/fatigue	64.3 ± 21.8 _a	58.6 ± 22.7 _a	60.7 ± 20.5 _a
	Emotional well-being	77.7 ± 16.8 _a	75.2 ± 18.9 _{a,b}	71.0 ± 20.9 _b
	Social functioning	74.5 ± 26.6 _a	72.3 ± 28.9 _{a,b}	67.6 ± 26.8 _b
	Pain	83.9 ± 22.3 _a	83.1 ± 23.5 _a	83.2 ± 20.0 _a
	General health	77.6 ± 18.7 _a	78.9 ± 17.0 _a	74.9 ± 17.0 _a
SF-36 component scores, <i>m</i> ± <i>SD</i>	Physical component score	58.1 ± 6.6 _a	58.2 ± 6.3 _a	57.2 ± 7.0 _a
	Mental component score	51.2 ± 8.3 _a	49.5 ± 8.7 _{a,b}	47.9 ± 10.4 _b

M, mean; *SD*, standard deviation; *SF-36*, 36-Item Short Form Health Survey. Comparisons are displayed using the APA style: values in the same row and subtable not sharing the same subscript (corresponding to each group in the first row) are significantly different at $p < 0.05$. Bonferroni correction was applied to multiple comparisons.

scored worse on role limitations due to emotional problems than the inpatients or the quarantined groups. In emotional well-being and social functioning, controls scored lower than inpatients, but their scores did not significantly differ from quarantined subjects. In other subdomains (role limitations due to physical health, energy/fatigue, pain, and general health), controls did not differ significantly from either of the other groups.

The SF-36 physical component score did not differ between the three groups. Nevertheless, the mental component score was significantly lower in the control group than in the inpatient group. On the other hand, the mental component score in the quarantine group did not differ significantly from either of the other groups.

Factors Associated With SF-36 Component Scores in Patients With COVID-19 (Either Inpatient or Quarantined)

The SF-36 physical component score was significantly lower in females, and was significantly associated with the nationality group and the occupation, but did not with education level or

with past psychiatric history. We also did not find any correlation between the physical component score and age or the reported number of sleep hours (Table 2).

The SF-36 mental component score was significantly lower in participants with past psychiatric history and was positively correlated with the reported number of sleep hours ($Rho = 0.138$, $p = 0.033$). However, we did not find any association between the SF-36 mental component score and gender, age, nationality group, or education level.

Further, the physical and the mental component scores were not significantly correlated ($Rho = 0.062$, $p = 0.342$).

Multivariate Analysis

We used the MANCOVA analysis to compare the SF-36 scores in the three groups controlling for gender, age, past psychiatric history, education, nationality, and occupation. The results (Table 3) showed significant small effects of gender, age, and group (inpatient, quarantine, or controls). Past psychiatric history displayed significant effects on SF-36 scores, whereas education, nationality, and occupation did not show any significant effects.

TABLE 2 | Factors associated with SF-36 component scores in patients with COVID-19 (either inpatient or quarantined).

		Mental component score	F	p-value	Physical component score	F	p-value
Gender	Female	48.6 ± 9.2	3.128	0.078	55.6 ± 9.1	10.263	0.002
	Male	51.0 ± 8.2			58.8 ± 5.4		
Nationality Group	Qatar	48.8 ± 11.8	0.557	0.694	53.5 ± 10.1	3.914	0.004
	Arab countries other than Qatar	49.9 ± 8.0			58.6 ± 5.1		
	Indian subcontinent	50.7 ± 8.3			58.7 ± 6.1		
	Southeast Asia	52.4 ± 5.8			57.6 ± 4.8		
	Other	52.3 ± 7.4			60.6 ± 3.3		
Occupation	Unemployed	50.7 ± 8.8	1.386	0.230	56.8 ± 7.1	4.725	0.000
	Housewife	48.8 ± 10.1			59.2 ± 6.9		
	Craft and Manual worker	51.1 ± 7.9			58.4 ± 6.6		
	Professional	50.3 ± 8.2			58.0 ± 5.9		
	Student	53.3 ± 9.8			58.6 ± 6.2		
Education	Primary or Middle School	49.8 ± 9.4	0.415	0.661	58.0 ± 7.0	0.090	0.914
	Secondary school	51.1 ± 7.9			58.4 ± 6.6		
	Higher education	50.5 ± 8.3			58.0 ± 6.4		
Past psychiatric history	No	50.8 ± 8.5	6.479	0.012	58.3 ± 6.4	1.617	0.205
	Yes	43.1 ± 5.2			55.3 ± 5.9		

SF-36, 36-Item Short Form Health Survey. SF-36 component scores are shown as mean ± standard deviation.

TABLE 3 | Multivariate covariance analysis comparing SF-36 scale scores between COVID-19 inpatients vs. COVID-19 infected quarantined individuals vs. controls controlling for sociodemographic and clinical variables.

Effect	Pillai's Trace	F	p-value	Partial Eta squared
Gender	0.053	3.567	0.000	0.053
Age	0.031	2.045	0.040	0.031
Past psychiatric history	0.079	5.448	0.000	0.079
Education	0.021	1.355	0.214	0.021
Nationality	0.018	1.142	0.333	0.018
Occupation	0.011	0.736	0.659	0.011
Group	0.094	3.160	0.000	0.047

SF-36, 36-Item Short Form Health Survey. Bold values indicate statistically significant results.

Univariate tests of between-subjects' effects (Table 4) showed that group had a small effect on physical functioning and role limitations due to emotional problems. Age showed a significant small effect on physical functioning, whereas past psychiatric history had small effects on all SF-36 scale scores except physical functioning. Gender showed small effects on the following scale scores: role limitations due to emotional problems, energy/fatigue, emotional well-being, pain, and general health (Figure 1).

DISCUSSION

In this cross-sectional study, we examined the physical and psychosocial well-being (or HRQoL as measured by the SF-36) of hospitalized and non-hospitalized patients with COVID-19 compared to the general population in Qatar. Surprisingly, we found that HRQoL was higher in COVID-19 hospitalized than in

COVID-19 non-hospitalized patients. The latter also had higher HRQoL than controls. In COVID-19 (both hospitalized and non-hospitalized) patients, the main functioning components that were better than controls consisted of physical functioning and role limitations due to emotional problems. Among COVID-19 patients, female participants scored lower in role limitations due to emotional issues, energy/fatigue, pain, and emotional well-being. In COVID-19 patients, older age was associated with lower physical functioning, and past psychiatric history was linked to poorer functioning in all SF-36 domains except physical functioning.

Physical and Psychosocial Well-Being of the General Public Amid the COVID-19 Pandemic

When compared to the normative data of the Arabic version of SF-36, the general population group had SF-36 scores between one standard deviation below the mean and the mean (17). Most of the previous studies that examined the impact of the pandemic on the general population did not directly assess the HRQoL but rather "assumed" that the HRQoL was affected because they found a high prevalence of depressive, anxiety, and stress symptoms (22, 23). For example, one Chilean study that directly assessed the HRQoL in the general population found the HRQoL to be affected in 1,082 adults, between 18 and 60 years old, who were quarantined by the COVID-19 health alert but who were neither confirmed nor suspected cases of COVID-19 (9). Similarly, in a group of Italian non-infected women aged between 28 and 50, SF-36 scores were significantly decreased (10). However, a Dutch study did not find the level of mental well-being during the peak of COVID-19 to be lower than in 2018 (24). This discrepancy could be due to the differences in

TABLE 4 | Univariate tests of between-subject's effects with SF-36 scale scores as dependent variables, group (inpatients vs. COVID-19 infected quarantined individuals vs. controls) as a fixed factor, and sociodemographic and clinical characteristics as covariables.

	Dependent Variable	Type III Sum of Squares	Mean Square	F	p-value	Partial Eta Squared
Gender	Physical functioning	419.757	419.757	0.945	0.331	0.002
	Role limitations due to physical health	741.223	741.223	0.634	0.426	0.001
	Role limitations due to emotional problems	17599.406	17599.406	13.018	0.000	0.025
	Energy/fatigue	7243.418	7243.418	17.260	0.000	0.032
	Emotional well-being	2715.770	2715.770	7.646	0.006	0.015
	Social functioning	2437.598	2437.598	3.380	0.067	0.007
	Pain	3887.007	3887.007	8.857	0.003	0.017
	General health	2536.761	2536.761	9.059	0.003	0.017
Age	Physical functioning	3129.109	3129.109	7.046	0.008	0.013
	Role limitations due to physical health	1958.734	1958.734	1.674	0.196	0.003
	Role limitations due to emotional problems	4557.089	4557.089	3.371	0.067	0.006
	Energy/fatigue	782.612	782.612	1.865	0.173	0.004
	Emotional well-being	122.332	122.332	0.344	0.558	0.001
	Social functioning	1.251	1.251	0.002	0.967	0.000
	Pain	258.653	258.653	0.589	0.443	0.001
	General health	14.175	14.175	0.051	0.822	0.000
Past psychiatric history	Physical functioning	1314.742	1314.742	2.961	0.086	0.006
	Role limitations due to physical health	6587.292	6587.292	5.630	0.018	0.011
	Role limitations due to emotional problems	14181.776	14181.776	10.490	0.001	0.020
	Energy/fatigue	7656.771	7656.771	18.244	0.000	0.034
	Emotional well-being	11106.885	11106.885	31.272	0.000	0.057
	Social functioning	8673.863	8673.863	12.028	0.001	0.023
	Pain	2205.210	2205.210	5.025	0.025	0.010
	General health	7609.925	7609.925	27.176	0.000	0.050
Education	Physical functioning	1012.351	1012.351	2.280	0.132	0.004
	Role limitations due to physical health	259.209	259.209	0.222	0.638	0.000
	Role limitations due to emotional problems	25.336	25.336	0.019	0.891	0.000
	Energy/fatigue	143.529	143.529	0.342	0.559	0.001
	Emotional well-being	0.024	0.024	0.000	0.993	0.000
	Social functioning	287.095	287.095	0.398	0.528	0.001
	Pain	642.052	642.052	1.463	0.227	0.003
	General health	943.465	943.465	3.369	0.067	0.006
Nationality group	Physical functioning	43.374	43.374	0.098	0.755	0.000
	Role limitations due to physical health	2621.681	2621.681	2.241	0.135	0.004
	Role limitations due to emotional problems	2098.261	2098.261	1.552	0.213	0.003
	Energy/fatigue	65.496	65.496	0.156	0.693	0.000
	Emotional well-being	163.234	163.234	0.460	0.498	0.001
	Social functioning	303.236	303.236	0.421	0.517	0.001
	Pain	5.768	5.768	0.013	0.909	0.000
	General health	1027.364	1027.364	3.669	0.056	0.007
Occupation	Physical functioning	354.009	354.009	0.797	0.372	0.002
	Role limitations due to physical health	1189.128	1189.128	1.016	0.314	0.002
	Role limitations due to emotional problems	1434.500	1434.500	1.061	0.303	0.002
	Energy/fatigue	11.276	11.276	0.027	0.870	0.000
	Emotional well-being	100.268	100.268	0.282	0.595	0.001
	Social functioning	1057.067	1057.067	1.466	0.227	0.003
	Pain	209.782	209.782	0.478	0.490	0.001
	General health	104.485	104.485	0.373	0.542	0.001
Group	Physical functioning	7829.189	3914.595	8.815	0.000	0.033
	Role limitations due to physical health	2339.098	1169.549	1.000	0.369	0.004
	Role limitations due to emotional problems	13550.684	6775.342	5.012	0.007	0.019
	Energy/fatigue	1638.254	819.127	1.952	0.143	0.008
	Emotional well-being	646.024	323.012	0.909	0.403	0.004
	Social functioning	1078.017	539.008	0.747	0.474	0.003
	Pain	1527.752	763.876	1.741	0.176	0.007
	General health	195.708	97.854	0.349	0.705	0.001

Bold values indicate statistically significant results.

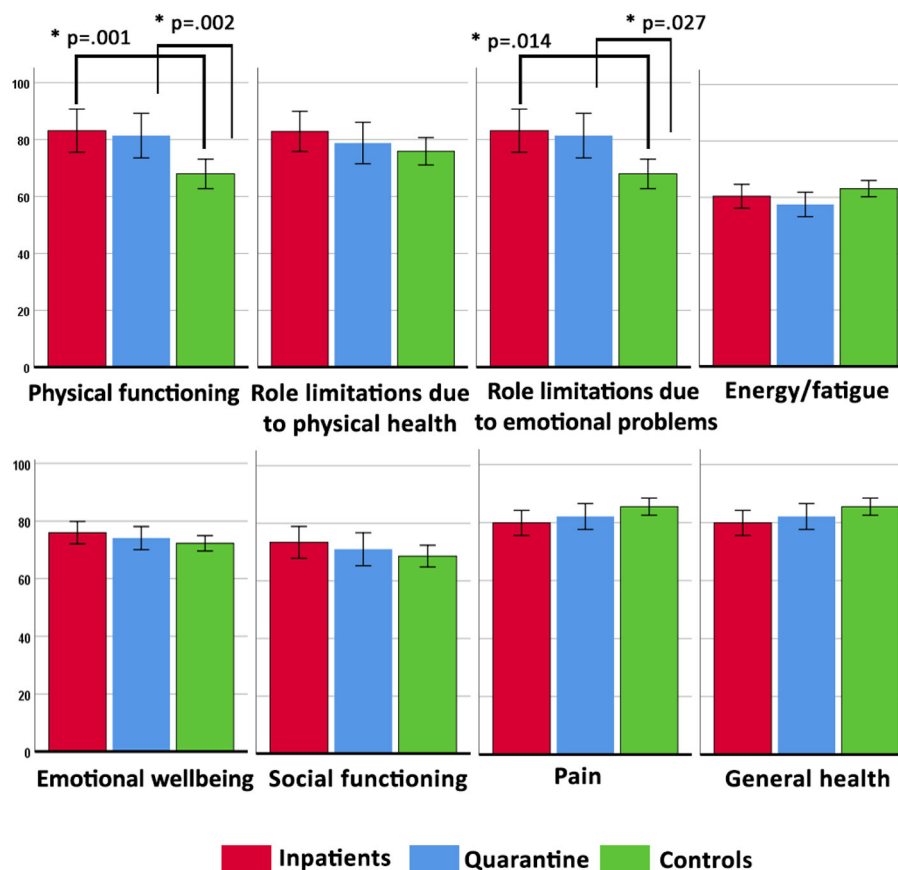


FIGURE 1 | Estimated marginal means (with their 95% error bars) of the SF-36 scores in the inpatient, quarantine, and control groups, controlling for gender, age, past psychiatric history, education, nationality, and occupation. All *p* values were adjusted for multiple comparisons using the Bonferroni method.

participant selection criteria, the times the studies took place regarding the pandemic course, and the variations in COVID-19-related restrictions from country to country throughout the pandemic. Overall, there seems to be a paucity of data regarding the potential impact of the pandemic on the general population's HRQoL, even though most of the available indirect evidence suggests a likely negative impact (1, 23).

Physical and Psychosocial Well-Being of Patients With COVID-19

The results of our study showing that COVID-19 patients might not have a poorer HRQoL than controls might be unexpected. Indeed, a growing number of studies showed a high prevalence of depression, anxiety, stress, and insomnia symptoms in patients with COVID-19 (2, 3). Based on these findings, it is often “assumed” that COVID-19 infection negatively affects physical and psychosocial well-being. However, most of these studies lacked a control group, and only a few directly examined the impact of the disease on the patient's quality of life and functioning. Thus, one can argue that while the prevalence of depressive, anxiety, and stress symptoms are high in COVID-19 patients, these can also increase in the general population amid the pandemic (1, 25). In addition, studies directly comparing

infected to non-infected individuals found that infected ones had more pronounced depressive and anxiety symptoms (26), including one study from Qatar (27), but this was not the case for other studies (23).

Moreover, recent studies suggested that the prevalence of depressive and anxiety symptoms in COVID-19 patients is overestimated due to possible overlaps between these symptoms and certain features of the COVID-19 infection, including fatigue, loss of appetite, sleep disturbance, pain, and palpitations (28). In this regard, studies using the Hospital Anxiety and Depression Scale (HADS) (29), designed to identify emotional symptoms of depression in patients with concurrent somatic illness, reported a lower prevalence of depression than those using the Patient Health Questionnaire (PHQ-9), designed to cover all bodily and emotional features (2). Thus, it seems likely that the high prevalence of depression, anxiety, and stress has affected the population as a whole, rather than COVID-19 infected patients in particular.

It is hypothesized that COVID-19 infected patients might have depressive and anxiety symptoms due to the virus's potential neurotropic effects, the immune response, and the isolation due to hospitalization or quarantine (2, 30). However, the biological effects of the virus on the brain are not possibly of

clinical significance in most patients. Previous studies, including a meta-analysis of longitudinal studies and natural quarantine experiments, have not found that quarantine had any major impact on mental health (31, 32). It is also possible that infected individuals have benefited from more support from their families, friends, and frequent mental health screening or interventions (23).

In addition, our samples had diverse sociocultural backgrounds, and the distribution of nationalities among the groups was different. Such cultural variation might have impacted the SF-36 scores since the expression of emotions and tendency toward somatization can greatly differ from culture to culture (33).

The mean SF-36 scores for physical and emotional components in our study were comparable to the scores reported in other studies (4–7). Out of these four studies, two interpreted the HRQoL in COVID-19 as being “low.” However, the patients’ Warwick-Edinburgh Mental Well-being Scales (WEMWBS) did not differ from the population norms (6). Chen et al. (7) findings were even closer to ours: they found that one month after discharge, COVID-19 patients scored lower than the Chinese population norm only in certain HRQoL domains (social functioning and role limitations due to physical and emotional problems). However, they scored higher on other domains (mental health, bodily pain, vitality, general health) with no difference for physical functioning compared to population norms (7).

These findings, including ours, suggest that while the HRQoL in COVID-19 patients is probably affected, it is not necessarily more so than the general population amid the pandemic. In this context, the HRQoL was found to be less affected in COVID-19 patients than in their family members (34). Furthermore, the anticipation of the infection might cause more psychological distress than the infection itself since worrying about a negative event is often more anxiogenic than the occurrence of the event itself (35).

Even though most assume that hospitalized COVID-19 patients may experience higher rates of depression, anxiety, and stress, than non-hospitalized patients, other findings did confirm this. Indeed, previous studies reported the prevalence of depressive, anxiety, and PTSD symptoms in never-hospitalized COVID patients to be similar or even higher than in hospitalized patients (De (3, 36–39)). It is possible that being hospitalized in a protective environment helped to reassure the patients. COVID-19 inpatients reported medical staff care as the main supportive factor as it gave them “a sense of security” (40). Hospitalized COVID-19 patients may also have been more commonly screened for mental health issues and benefited from mental health services during their stay (39). In addition, going through the experience of a potentially severe illness and recovering from it can make people cherish the good aspects of their life, resulting in a positively biased perception of their HRQoL. Such an initial “euphoria” has been reported in patients who survived critical medical conditions (41) and in Ebola survivors (42). In a study examining the psychological experience of COVID-19 patients during a hospital stay, most patients endorsed how the thought that their lives could have suddenly

ended made them realize how valuable their life, their families, and their friends are. In a sense, surviving COVID-19 can change perspectives and enhance psychological growth (40).

Factors Associated With Poorer Physical and Psychosocial Well-Being in Patients With COVID-19

Our results suggested that female COVID-19 patients may have poorer HRQoL than males, particularly in role limitations due to emotional problems, fatigue, pain, and emotional well-being. These findings align with previous studies among COVID-19 patients showing that the prevalence of depression, anxiety, stress, and insomnia symptoms were higher in women than men (2, 3). Similarly, Chen et al. reported that the female gender was associated with poorer physical functioning, bodily pain, and role limitations due to emotional problems (2, 3). Furthermore, a similar gender difference is reported at the general population level in most studies using the SF-36 in different countries (43–45), including Arab countries (19, 46, 47).

We also found that older age in infected patients was associated with lower physical functioning. This association was also reported previously (7). It was attributed to the poor prognosis of COVID-19 in the elderly (48) and the physiological decline of physical functioning with age in the general population (44, 45). In our study, we did not find age to be associated with mental health-related HRQoL. Associations between older age and mental health in COVID-19 patients have been inconsistent, with some studies reporting better (49) and others reporting worse outcomes in the elderly (3).

In the present study, past psychiatric history in COVID-19 patients was linked to poorer functioning in all SF-36 domains except physical functioning. This link is expected given that COVID-19 patients with prior psychiatric history have been reported to experience higher levels of anxiety, depression, stress, and sleep disturbance than patients with no psychiatric history (3). In addition, patients with mental illness showed an increased risk of contracting COVID-19 and higher hospitalization rates and death compared to individuals with no history of mental illness (50).

Strengths and Limitations

The present study is one of the few studies to focus on mental health outcomes in patients with COVID-19 infection. Furthermore, contrary to most other studies about mental health consequences of the COVID-19 disease, which merely examined the prevalence of anxiety, depression, and stress symptoms, the present study scrutinized different domains of psychosocial and physical well-being (3, 25).

However, some limitations need to be acknowledged. For example, although we used MANCOVA to control the differences in certain sociodemographic characteristics between the three groups, these variations could still bias the proper comparisons. Moreover, mental health issues or the poor perceived HRQoL may have affected the decision to participate in the survey, especially among controls. This bias might have caused controls

to score poorer than expected. Social-desirability bias might also have influenced certain participant's answers (51). Besides, we could not capture certain variables that may have affected HR-QoL (severity of COVID-19 beyond the mere need for hospitalization, duration of hospitalization, and the exact time elapsed between discharge and filling the questionnaire). In addition, like most previous studies, the cross-sectional design of the present study does not allow to distinguish between short-term and long-term effects on well-being in COVID-19 patients. A prospective design could have helped disentangle the acute consequences of the infection from any potential long-term sequelae (2, 3).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available upon request from the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by IRB of Hamad Medical Corporation. Written informed consent for participation was not required for this

study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

SG, HA-A, and NH formalized the research concept and proposal. ZA-A supported with literature review, administrative aspects of the research, randomized, and distributed subjects. NH, FK, AA, PD, ABW, MT, and MK conducted the survey and entered the data. SO did the statistical analysis and wrote the manuscript. SG and HA-A reviewed and edited the manuscript. SG was responsible for the overall project and supervised all steps associated with the study as the lead principal investigator. MAM supported the project by providing data on patients admitted to either hospital or quarantine facilities. All authors contributed to the article and approved the submitted version.

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Impact of the COVID-19 Pandemic on Mental Well-Being. A Nationwide Online Survey Covering Three Pandemic Waves in Poland

Mateusz Babicki^{1*}, Krzysztof Kowalski², Bogna Bogudzińska³ and Agnieszka Mastalerz-Migas¹

¹ Department of Family Medicine, Wrocław Medical University, Wrocław, Poland, ² Department and Clinic of Psychiatry, Wrocław Medical University, Wrocław, Poland, ³ Students' Scientific Group at the Faculty of Psychiatry, Wrocław Medical University, Wrocław, Poland

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*Correspondence:

Mateusz Babicki
ma.babicki@gmail.com

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The COVID-19 pandemic has a significant impact on human life. This study aims to assess the prevalence of depressive and anxiety symptoms, and the assessment of the quality of life in different stages of the COVID-19 pandemic based on an online nationwide survey. The study was based on a voluntary, anonymous, and authors' own questionnaire. The first section assesses sociodemographic status. Then, standardized psychometric tools were used such as the Beck Depression Inventory (BDI), the Generalized Anxiety Disorder Assessment (GAD-7), and the Manchester Short Assessment of Quality of Life (MANSA). The study was conducted in three stages corresponding to the waves of the COVID-19 pandemic in Poland. The survey involved 5,790 respondents; 2,457, 1,626, and 1,707 for the first, second, and third pandemic wave, respectively. It was found that anxiety and depressive symptoms increased as the pandemic progressed. There was no significant effect on the subjective quality-of-life assessment. Moreover, there was a gradual decrease in anxiety about being infected with COVID-19 as well as reduced adherence to the Minister of Health's recommendations. As the COVID-19 pandemic progressed, depressive and anxiety symptoms increased among Poles. Women, singles, and people with prior psychiatric treatment are more likely to develop the aforementioned symptoms.

Keywords: COVID-19, anxiety, depression, quality of life, mental health

INTRODUCTION

A few months after the first viral pneumonia of SARS-CoV-2 etiology was diagnosed and due to the rapid spread of SARS-CoV-2 around the world, the WHO declared a pandemic (1–3). Although safe and effective vaccines against COVID-19 were invented, their worldwide availability and, in some countries, the degree of their public acceptance is too low to stop the pandemic at this stage (4). Therefore, keeping a safe distance from others is still part of the fight against the pandemic. As the pandemic continued, the Polish government—as many other governments around the world—made decisions to limit, and sometimes even completely close many sectors of the economy. Furthermore, schools, and kindergartens were closed (5). The introduced restrictions evoked many emotions and controversy about their validity and effectiveness, while significantly

changing and complicating daily professional, and social functioning (5, 6). Prolonged feelings of fear and uncertainty about the future as well as separation from loved ones have contributed to a significant increase in the prevalence of anxiety, and depressive disorders in the population (7). Scientific reports clearly indicate that the increase of these symptoms is concurrent with the pandemic progression and they are more prevalent in women and singles (8). Moreover, these scientific reports imply that the psychological stress associated with COVID-19 is not a short-term condition and it may contribute to chronic mental health disorders that are similar to those described in post-traumatic stress disorder (8). UK observations revealed that the rise of the third wave of the pandemic led to an increase in the incidence of suicidal thoughts—especially in young people. People with lower socioeconomic status and prior psychiatric treatment also suffer from poorer mental health. Losing your job and the resulting worse financial situation lead to an increased sense of helplessness (9). Although effective vaccines are available in developed countries, it is still uncertain when the pandemic will end and the associated problems will disappear (10). The prolonged and variable course of the pandemic, successive pandemic waves and emergence of new SARS-CoV-2 variants point to a high likelihood of further public mood volatility, as well as an increase in mental disorders associated with chronic stress (8). This study aims to assess the prevalence of depressive and anxiety symptoms, and the subjective assessment of the quality of life in different stages of the COVID-19 pandemic based on an online nationwide survey. Based on previous knowledge, the following research hypotheses were posed: (1) The ongoing epidemic situation has a negative impact on mental health. (2) Women and singles have poorer mental health. (3) Economic instability significantly worsens the mental condition.

MATERIALS AND METHODS

Methodology

The study was based on the authors' own questionnaire distributed online through a social networking site. Participation in the study was fully anonymous and voluntary. The questionnaire was addressed to all persons living in Poland, aged 18 or older, with access to the Internet. Before the respondents took part in the study, they were informed about the nature of the study, its methodology and objectives. Informed consent was then obtained from those willing to participate. The participants were free to withdraw from the study at any stage without giving any reason. The study consisted of three consecutive stages of survey distribution. The first stage covered the early days of the pandemic in Poland—from 17 to 26 April 2020, i.e., less than a month after the first confirmed case of COVID-19 in Poland. That was the period when 263 to 460 cases of COVID-19 were diagnosed in Poland per day and the number of deaths fluctuated between 18 and 40 (11). To inhibit the spread of SARS-CoV-2, the Polish government decided to implement several restrictions that covered many areas of daily life, including closing schools, shops except for grocery shops, theaters, cinemas, swimming pools, gyms, restaurants (only take-out food), hairdressing salons, and

hotels (12). The second stage of the study was conducted during the period of the next increase in SARS-CoV-2 cases in Poland, referred to as the “second wave of the pandemic”; the questionnaire was distributed from 1 to 30 December 2020. During that time, the number of COVID-19 cases fluctuated between 2,921–14,835 cases and between 29–620 deaths per day (11). Restrictions used in the first wave of the pandemic were reimplemented with the exception of the closure of shopping malls, hairdressing salons, and beauty salons (13). The third stage of the study covered the period of the highest incidence and death rates in Poland due to COVID-19. Data were collected from 20 March 2021 to 30 April 2021 when the daily incidence rate ranged from 6,802 to 35,246 COVID-19 cases, with daily deaths ranging from 428 to 954 (11). Faced with dramatic rates, the Polish government decided to implement a series of restrictions that were much more restrictive than those implemented in previous stages. Those restrictions included the closure of shopping malls, DIY shops, excluding i.e., grocery shops, pharmacies, beauty supply shops, newsagent's shops, bookshops. Hairdressing salons and beauty salons, sports facilities, including gyms and fitness centers, were closed, and only professional sports activities could take place—without any visitors present. Schools, nurseries and kindergartens were closed—the last two remaining open only for children of healthcare professionals. Art galleries, museums, and theaters were also closed. There was a strong emphasis on doing remote work wherever possible (14).

The study was approved by the Bioethics Committee of the Wrocław Medical University and was conducted in accordance with the Declaration of Helsinki.

The questionnaire designed for this study and prepared by the authors consisted of several sections. The first section included the sociodemographic status of the respondents including age, sex, place of residence, level of education, marital status, and being a healthcare professional. Moreover, past medical history of mental disorders and COVID-19 infection, as well as its suspicion, was assessed. To assess the level of anxiety about contracting COVID-19 infection, the authors used their own set of questions based on a 10-point Likert scale (1—no anxiety, 10—extreme anxiety) concerning both subjective anxiety about being infected with SARS-CoV-2 and the level of anxiety about neighbors in quarantine or neighbors being infected with COVID-19. The subjective assessment of adherence to the Ministry of Health recommendations regarding COVID-19 prevention.

Another section consisted of standardized psychometric tools such as the Beck Depression Inventory (BDI), the Generalized Anxiety Disorder Assessment (GAD-7), and the Manchester Short Assessment of Quality of Life (MANSA).

- (1) *The Beck Depression Inventory (BDI)* is one of the most commonly used psycho-metric tools consisting of 21 questions, in which the respondent makes a subjective assessment of the severity of a particular mental state on a scale from 0 to 3. To interpret the results, the following cut-off points were applied: 0–11—no depression, 12–26 points—mild depression; 27–49—moderate depression; 50–63—severe depression (15).

- (2) *The Generalized Anxiety Disorder Assessment (GAD-7)* is a 7-item tool based on a 4-point Likert scale. Respondents assess the frequency of occurrence of a particular mental state during the last 14 days (0—not at all, 1—a few days, 2—more than half the time, 3—almost always). The maximum number of available points to score was 21. The analysis of the tool is based on 3 cut-off points: 5, 10, and 15 points that indicate the presence of mild, moderate, and severe anxiety, respectively. A score of at least 10 points indicated a high probability of generalized anxiety disorder (16).
- (3) *The Manchester Short Assessment of Quality of Life (MANSA)* is a tool derived from the Lancashire Quality of Life Profile (LQLP) while keeping its parametric values. It is used for the subjective assessment of the quality of life by rating 16 aspects of life on a 7-point Likert scale (1—could not be worse, 7—could not be better). The analysis of the tool is based on the total score—the higher the score, the higher the quality of life. The analysis of the tool can also be done at the level of individual questions (17, 18).

Statistical Analysis

The statistical analysis was performed using R 4.1.0 and Statistica 14.0.0.15.

Variables were of qualitative and quantitative nature. Basic descriptive statistics methods were used for the quantitative variables. Furthermore, the Lilliefors test was used for assessing the normality of the distribution and the Brown-Forsythe test was used for assessing the variance. When the assumption of equality of variance across subgroups for quantitative variables was not met, the Welch ANOVA was performed. Subsequently, the *post-hoc* analysis was performed using the Games-Howell test. The Pearson's chi-squared test with Bonferroni correction was used for comparing qualitative variables. Linear models were used for the assessment of the relationship between sociodemographic variables and final scale scores. The Spearman's correlation analysis was used for assessing the correlation between different scales.

Statistical significance level was established at $p < 0.05$ for each case.

RESULTS

Characteristics of the Study Group

A detailed profile of the study group is shown in **Table 1**. The study included 5,790 participants. At each stage, the overwhelming majority of respondents were women and those living in a city with a population of over 250,000. In the first, second and third stage of the study, the mean age of the respondents was 32.2 ± 10.72 , 24.6 ± 7.06 , and 27.83 ± 9.55 years, respectively. As the study progressed, the percentage of both individuals and their relatives who were COVID-19 convalescents increased. Also, as the pandemic progressed, there was a downward trend in COVID-19-related information retrieval and daily tracking of death and hospitalization statistics.

R Analysis of BDI, GAD-7, and MANSA for Each Wave of the COVID-19 Pandemic

The mean GAD-7 score increases in successive waves of the COVID-19 pandemic; however, there are no significant differences between the first and second wave or between the second and third wave. There is a statistically significant difference between the first and third wave ($p = 0.001$). The mean BDI score increases in successive waves of the COVID-19 pandemic; however, there is a significantly greater increase between the first and second wave than between the second and third wave. Stated differently, respondents revealed a lower sense of depression and anxiety in the first wave than in successive waves. The mean MANSA score does not have either increasing or decreasing trend. The analysis of individual questions included in the MANSA scale showed that as the COVID-19 pandemic continued, a significant decrease in satisfaction with one's mental condition, financial condition, and one's additional activities (hobbies) was observed. However, some aspects have improved, mainly relationships with family and roommates. A detailed breakdown of the MANSA scores is presented in **Supplementary Table 1**.

The results are summarized in **Tables 2, 3**.

The BDI interpretation revealed a statistically significant difference between individual pandemic waves ($p < 0.0001$), as did GAD-7 ($p = 0.004$). The comparison of individual waves of the COVID-19 pandemic revealed a significant difference in terms of the distribution of BDI interpretations between the first and second wave and between the first and third wave. GAD-7 revealed the difference between COVID-19 pandemic waves only when comparing the first wave and third wave.

As the pandemic continues, there is an increasing trend in the percentage of individuals whose BDI score indicates the presence of depressive disorders. Moreover, there is an increase in the percentage of individuals with moderate and severe depression. There is no statistically significant difference between adjacent interpretations (no depression—mild depression, mild depression—moderate depression, moderate depression—severe depression); however, there is a statistically significant difference for the pairs such as no depression—moderate depression, no depression—severe depression, and mild depression—severe depression. This may be indicative of systematically progressive unidirectional changes. The results are shown in **Table 4**. The exact distribution of BDI interpretations is shown in **Figure 1**.

There is no statistically significant difference between adjacent interpretations (no anxiety—mild anxiety, mild anxiety—moderate anxiety, moderate anxiety—severe anxiety), as well as between pairs such as no anxiety—moderate anxiety, mild anxiety—severe anxiety, while there is a statistically significant difference in terms of the distribution of COVID-19 pandemic waves for the pair no anxiety—severe anxiety. The results are shown in **Table 5**. Extreme GAD-7 scores changed significantly during the pandemic (**Figure 2**).

TABLE 1 | Characteristics of the study group by study stage.

Variable		Stage 1 (n = 2,467) M ± SD*/N (%)	Stage 2 (n = 1,627) M ± SD*/N (%)	Stage 3 (n = 1,696) M ± SD*/N (%)	p
Age*		32.2 ± 10.72	24.6 ± 7.06	27.83 ± 9.55	<0.001
Sex	Female	2,037 (82.5)	1,295 (79.6)	1,394 (82.2)	0.0229
	Male	430 (17.5)	332 (20.4)	302 (17.8)	
Place of residence	Rural area	461 (18.7)	287 (17.6)	326 (19.2)	0.0749
	Town of up to 50,000 inhabitants	377 (15.3)	233 (14.4)	268 (15.8)	
	City of 50,000–250,000 inhabitants	449 (18.2)	303 (18.6)	353 (20.8)	
	City of over 250,000 inhabitants	1,180 (47.8)	804 (49.4)	744 (44.2)	
Level of education	Higher (university degree)	1,481 (60.0)	513 (31.5)	654 (38.6)	<0.001
	Incomplete higher	514 (20.8)	646 (39.6)	543 (32.1)	
	Secondary	429 (17.4)	437 (26.9)	445 (26.4)	
	Vocational	26 (1.0)	8 (0.5)	9 (0.5)	
	Lower secondary	13 (0.6)	19 (1.2)	24 (1.4)	
	Primary	4 (0.2)	4 (0.3)	9 (0.5)	
Marital status	Married	867 (35.1)	163 (10.0)	323 (19.0)	<0.001
	Partnership	556 (22.6)	446 (27.5)	475 (28.0)	
	Widowed	30 (1.2)	7 (0.4)	14 (0.8)	
	Divorced	108 (4.4)	25 (1.5)	50 (3.0)	
	Single	905 (36.7)	986 (60.6)	834 (49.2)	
Healthcare professional	Yes	632 (25.6)	203 (12.5)	245 (14.5)	<0.001
	No	1,835 (74.4)	1,424 (87.5)	1,451 (85.5)	
Prior psychiatric treatment	Yes	516 (20.9)	333 (20.5)	340 (20.1)	0.7899
	No	1,951 (79.1)	1,294 (79.5)	1,356 (79.9)	
Psychiatric drug treatment	Yes	443 (18.0)	268 (16.5)	283 (16.7)	0.3846
	No	2,024 (82.0)	1,359 (83.5)	1,413 (83.3)	
COVID-19 infection suspected	Yes	78 (3.2)	323 (19.9)	352 (20.8)	<0.001
	No	2,389 (96.8)	1,304 (80.1)	1,344 (79.2)	
Forced quarantine	Yes, I am under home isolation	23 (0.9)	29 (1.8)	31 (1.8)	<0.001
	Yes, I was under home isolation	59 (2.4)	243 (14.9)	314 (18.5)	
	No	2,385 (95.7)	1,355 (82.3)	1,351 (79.7)	
Diagnosed with COVID-19	In the course of the disease	189 (7.9)	33 (2.0)	39 (2.3)	<0.001
	Yes, I was infected with COVID-19 in the past	143 (6.0)	248 (15.2)	298 (17.6)	
	No	2,056 (86.1)	1,346 (82.8)	1,359 (80.1)	
COVID-19 diagnosed in loved ones	Yes	117 (4.7)	1,036 (63.7)	1,122 (66.2)	<0.001
	No	2,350 (95.3)	591 (36.3)	574 (33.8)	
Information retrieval	Yes	1,530 (62.0)	776 (47.7)	767 (45.22)	<0.001
	No	937 (38.0)	851 (52.3)	929 (54.8)	
Tracking statistics on COVID-19	Yes	1,562 (63.3)	781 (48.0)	710 (41.9)	<0.001
	No	905 (36.7)	846 (52.0)	986 (58.1)	
Loss of income opportunities	Yes	610 (24.7)	340 (20.9)	359 (21.2)	0.0039
	No	1,857 (75.3)	1,287 (79.1)	1,337 (78.8)	

Anxiety About Being Infected With COVID-19 and Adherence to the Ministry of Health Recommendations Regarding COVID-19 Prevention

The authors' own set of questions based on a 10-point Likert scale regarding anxiety about being infected with SARS-CoV-2 infection, as well as anxiety about neighbors in

quarantine or neighbors being infected with COVID-19, were used for the assessment of the subjective sense of anxiety about contracting COVID-19 disease. The analysis of the subjective assessment of anxiety about contracting COVID-19 disease reveals a significantly statistical level of anxiety reduction as the COVID-19 pandemic continued ($p < 0.0001$). When comparing individual waves of the pandemic, the strongest anxiety reduction was observed between stage 1

TABLE 2 | Comparison of BDI, GAD-7, and MANSA scores according to different stages of the study.

BDI Wave	Wave	Difference in means	Lower end of the range for differences confidence intervals	Upper end of the range for differences	P*
1	2	0.0971677	0.0617	0.133	0.000
1	3	0.1384415	0.102	0.175	0.000
2	3	0.0412738	0.0002	0.082	0.048
GAD-7					
1	2	0.0559536	−0.009	0.121	0.109
1	3	0.1006945	0.034	0.166	<0.001
2	3	0.0447409	−0.026	0.116	0.306
MANSA					
1	2	0.0574767	−0.002	0.117	0.060
1	3	−0.0271350	−0.087	0.033	0.536
2	3	−0.0846117	−0.150	−0.019	0.007

**(Welch's) ANOVA univariate. Significant effects (<0.05) are marked in bold.*

TABLE 3 | Comparison of individual COVID-19 pandemic waves between BDI and GAD-7 interpretations.

Stage of the study	Stage of the study	P*
BDI		
First wave	Second wave	<0.0001
First wave	Third wave	<0.0001
Second wave	Third wave	0.125
GAD-7		
First wave	Second wave	0.376
First wave	Third wave	0.001
Second wave	Third wave	0.812

**Pearson's chi-squared test with Bonferroni correction. Significant effects (<0.05) are marked in bold.*

TABLE 4 | Pairwise comparison of BDI interpretations between individual waves of the COVID-19 pandemic.

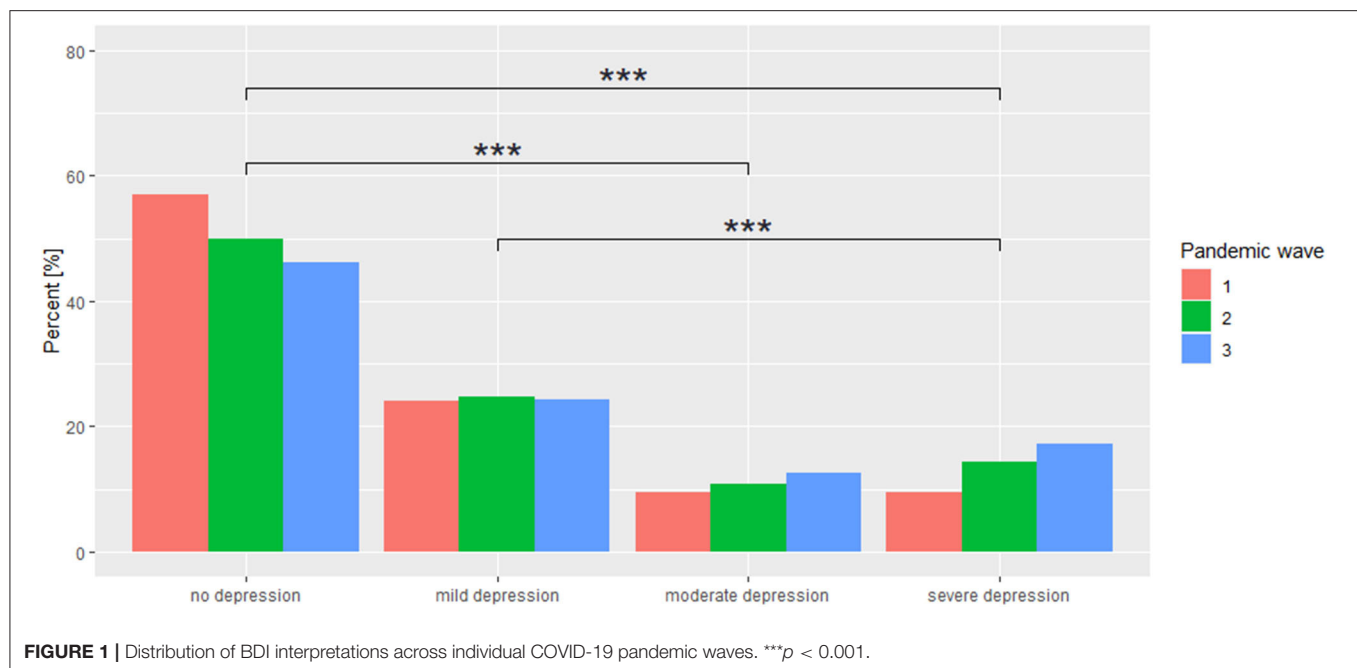
Interpretation		P*
No depression	Mild depression	0.0874
No depression	Moderate depression	0.0001
No depression	Severe depression	<0.0001
Mild depression	Moderate depression	0.3272
Mild depression	Severe depression	<0.0001
Moderate depression	Severe depression	0.1443

**Pearson's chi-squared test with Bonferroni correction. Significant effects (<0.05) are marked in bold.*

and 2 of the study ($p < 0.0001$). That relationship was not observed when comparing stage 2 and 3 of the study. Similar relationships were observed when assessing the anxiety about neighbors in quarantine or neighbors being infected with COVID-19. There is a statistically significant difference between individual stages of the study ($p < 0.0001$) when assessing anxiety about contracting COVID-19 infection compared to other afflictions. Over time, the percentage of those who are concerned about SARS-CoV-2 infection more strongly than about other afflictions or to the same extent decreased, while the percentage of those who are not concerned about COVID-19 infection increased. The comparison of response rates across COVID-19 pandemic waves is shown in **Figure 3**. The assessment of the adherence to the Ministry of Health recommendations regarding COVID-19 prevention reveals its gradual reduction as the pandemic progressed. With each subsequent COVID-19 pandemic wave, the level of this adherence was significantly lower. A detailed comparison is summarized in **Table 6**.

Assessment of the Effect of Sociodemographic Factors on the Mean Scores of BDI, GAD-7, and MANSA

The effect of sociodemographic variables on the mean scores of BDI, GAD-7, and MANSA is summarized in detail in **Table 7**. There was a statistically significant relationship between the age of the respondent and the mean score of BDI and GAD-7—the higher the age, the lower the score of both scales. Men and individuals with a university degree obtained significantly lower scores on BDI and GAD-7 scales, with no difference in terms of pandemic waves. The reduction in income opportunities due to the pandemic significantly affected the final scores of each scale used. The BDI analysis revealed that the increase was significantly greater during the second wave of the COVID-19 pandemic (value 2.193; SD 0.766; $t = 2.86$; $p = 0.004$), similarly to the GAD-7 questionnaire (value 1.180; SD 0.469; $t = 2.51$; $p = 0.012$). It was observed that healthcare professionals had significantly lower BDI questionnaire scores and the score increased more slowly from wave to wave compared to non-healthcare workers (second wave: value −1.747; SD 0.887;



$t = -1.97$; $p = 0.049$; third wave: value -2.182 ; SD 0.836; $t = -2.61$; $p = 0.009$).

Correlations Between BDI, GAD-7, and MANSA Scores

Each stage of the pandemic reveals a positive correlation between GAD-7 and BDI (stage I: $r = 0.7$, $p < 0.001$; stage II: $r = 0.73$, $p < 0.001$; stage III: $r = 0.75$, $p < 0.001$). However, both GAD-7 and BDI reveal an inverse correlation compared to MANSA at each stage of the study (GAD-7: stage I: $r = -0.51$, $p < 0.001$; stage II: $r = -0.59$, $p < 0.001$; stage III: $r = -0.632$, $p < 0.001$; BDI: stage I: $r = -0.63$; $p < 0.001$; stage II: $r = -0.712$, $p < 0.001$; stage III: $r = -0.74$, $p < 0.001$).

DISCUSSION

The unanticipated pandemic outbreak in March 2020 changed the lives of many people in a significant way. Its dynamics and multifaceted nature have led some re-searchers to consider it a phenomenon of collective trauma (19). A pandemic state is associated with tremendous life instability, and it is characterized by an uneven course. This is due to the surge nature of infections and associated numerous restrictions imposed by the government to inhibit the transmission of the virus. When it comes to negative emotions recognized in society during the pandemic, such as sadness, fear and grief, uncertainty was prevalent emotion. This factor, resulting from a completely new stressor for Polish society—the pandemic situation, extremely negatively affects the human psyche (20). It is still impossible to assess the long-term social, and health impacts of the pandemic (6). Therefore, this study mainly aims to assess the mental state

TABLE 5 | Pairwise comparison of GAD-7 interpretations between individual waves of the COVID-19 pandemic.

Interpretation		P^*
No anxiety	Mild anxiety	1
No anxiety	Moderate anxiety	0.129
No anxiety	Severe anxiety	0.003
Mild anxiety	Moderate anxiety	1
Mild anxiety	Severe anxiety	0.058
Moderate anxiety	Severe anxiety	1

*Pearson's chi-squared test with Bonferroni correction. Significant effects (<0.05) are marked in bold.

of the Polish people during the COVID-19 pandemic across its waves.

The study was conducted in three stages for each pandemic wave, respectively. Its results indicate a gradual increase in the frequency of depressive, and anxiety symptoms in the Polish population as the pandemic progressed. It should be noted that those changes were not uniform. Although restrictions regarding COVID-19 prevention were greatest, and longest during the third wave of the pandemic, there was a greater difference between the first and second wave than between the second, and third wave (14). On the one hand, it is obvious that due to the significant increase in infection and death rates, fear, and concern for one's own life arose in society. On the other hand, the slight difference between the second, and third wave points to a progressive partial adaptation to the pandemic situation (3). Psychological research implies that despite the much pandemic-related annoyance, some people observed also positive aspects of the pandemic state in their life, e.g., solidarity among local communities in support of the healthcare system, more leisure time, improved relationships

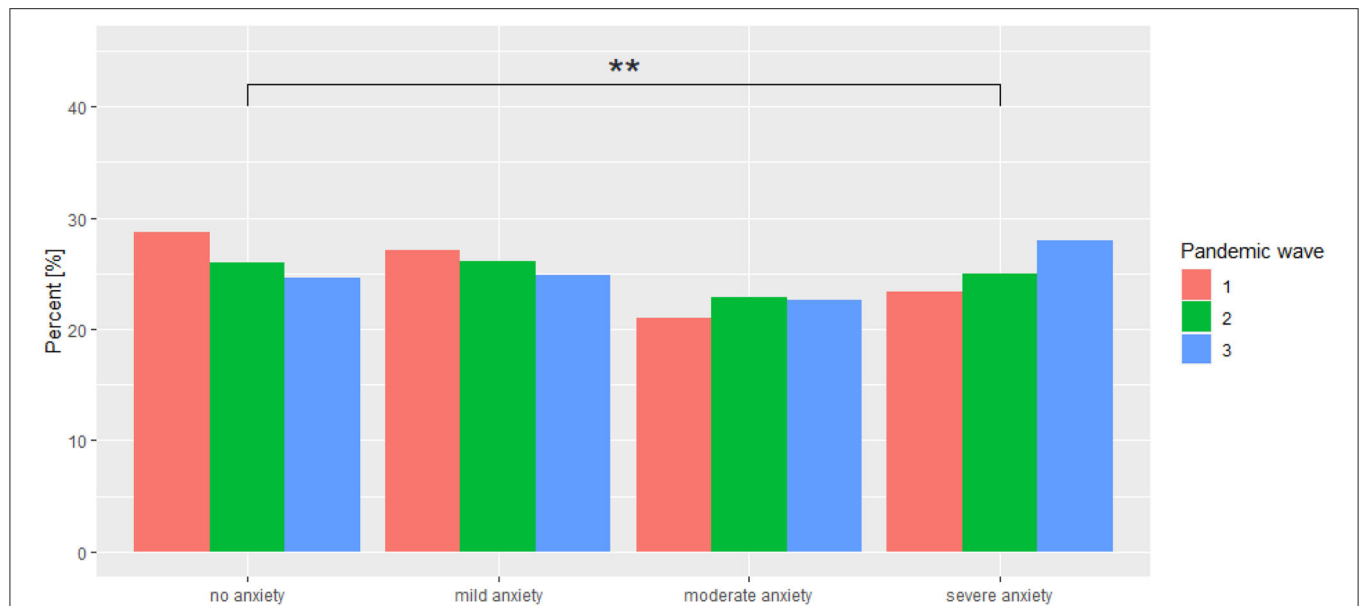


FIGURE 2 | Distribution of GAD-7 interpretations across individual COVID-19 pandemic waves. $**p < 0.01$.

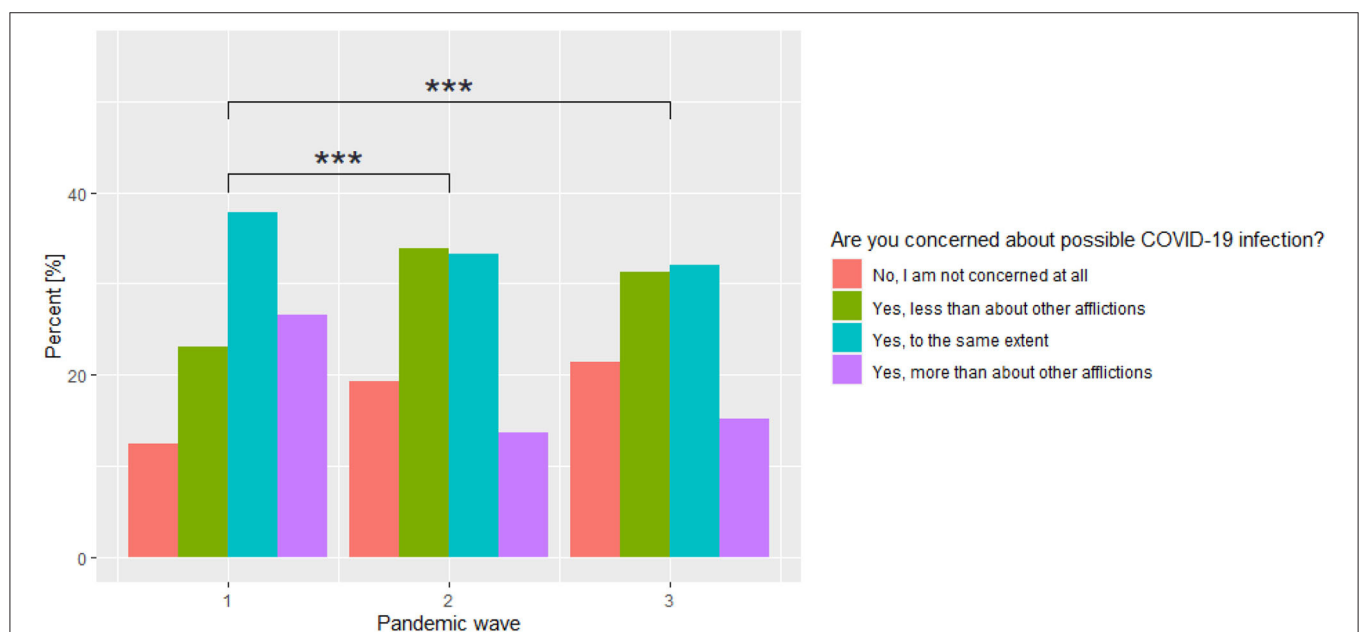


FIGURE 3 | Comparison of the percentage of individuals who are concerned about COVID-19 infection across the three waves of the COVID-19 pandemic. $***p < 0.001$.

with other people, increased sensitivity to their own mental, and physical health or hygiene (21).

Moreover, in the BDI analysis regardless of the stage of the survey, more than one third of the respondents obtained a score indicating the occurrence of at least mild depression. It should be noted that there were unidirectional changes in symptom severity, including an increase in the percentage of individuals whose scale score indicated the presence of depressive disorders, as well as a gradual increase in the

percentage of individuals with moderate and severe depression as the pandemic progressed. Similar scores were found in the interpretation of GAD-7, where the number of people showing severe anxiety increased between the first, and third wave of the COVID-19 pandemic by nearly 5%. In addition to that, the observed anxiety, and depressive symptoms were significantly higher than those found in epidemiological studies conducted in Poland before the pandemic (22). An interesting relationship was found in a longitudinal study on the Spanish,

TABLE 6 | Comparison of mean scores of anxiety about being infected with SARS-CoV-2 and about neighbors in quarantine or neighbors being infected with COVID-19.

	First wave	Second wave	Third wave	P*
Anxiety about being infected with COVID-19 disease				
Mean	5.51	4.86	4.92	<0.0001
Comparison of individual COVID-19 pandemic waves			x	<0.0001
		x		<0.0001
	x			0.9799
Anxiety about neighbors being infected with COVID-19				
Mean	5.73	3.63	3.59	<0.0001
Comparison of individual COVID-19 pandemic waves			x	<0.0001
		x		<0.0001
	x			0.1829
Anxiety about neighbors in quarantine				
Mean	4.64	3.03	2.93	<0.0001
Comparison of individual COVID-19 pandemic waves			x	<0.0001
		x		<0.0001
	x			0.256
Adherence to the Ministry of Health recommendations regarding SARS-CoV-2 prevention				
Mean	8.67	7.63	7.10	<0.0001
Comparison of individual COVID-19 pandemic waves			x	<0.0001
		x		<0.0001
	x			<0.0001

*Type-II ANOVA. The assessment of the adherence to the Ministry of Health recommendations regarding SARS-CoV-2 prevention. Significant effects (<0.05) are marked in bold.

and Chinese populations, where there was also an increase in depressive symptoms as the time of the restrictions regarding COVID-19 prevention prolonged. In contrast to the results of this study, anxiety symptoms remained on a high level since the beginning of the pandemic (23, 24). In a British longitudinal study, anxiety symptoms even decreased during successive stages of the pandemic despite persistently high levels of depressive symptoms and increased suicidal tendencies (9). This was justified by the fact that the unexpected global situation generated extremely strong anxiety, while deepening financial instability and social isolation had a greater impact on mood decline, which also seems to be reflected in this study (23).

Furthermore, it was also found that as the pandemic progressed, the respondents had significantly lower scores for anxiety about their own or their neighbors' possible COVID-19 infection, as well as they revealed less rigorous adherence to the Minister of Health's recommendations to reduce the virus transmission. The longitudinal study on Chinese, and American populations also revealed a gradual decrease in anxiety about virus infection. This was thought to be related to the fact that mortality turned out to be lower than initially anticipated and safeguards were implemented to reduce the risk of virus transmission (25). On the contrary, the population of Israel revealed greater willingness to adhere to public health recommendations as the pandemic progressed (26). The trend present in the Polish population may be due to low trust of the Polish people in media coverage of the pandemic situation, and also due to the fact that between the second, and third wave of the COVID-19 pandemic, a vaccination programme was

implemented in Poland, which gave some people a greater sense of security (27).

At the same time, there was no unidirectional shift in quality-of-life scores on the MANSA scale. According to the European Foundation for the Improvement of Living, and Working Conditions, the EU inhabitants assessed their quality of life significantly lower only during the third wave of the COVID-19 pandemic as their economic situation worsened (28). In a German study of families, the statistically significant deterioration in quality of life was obtained as early as the second wave of the pandemic, and the strength of the effect was dependent on the quality of family relationships (29). Quality of life is undoubtedly a complex and difficult parameter to assess, which is affected by many factors. Some of the variables that could affect the outcome of the assessment improved (e.g., anxiety about developing COVID-19 disease) and others, such as economic situation, worsened, which may explain the balanced results obtained in subsequent stages of this study. The correlation analysis between the scales clearly reveals a decrease in the quality-of-life assessment as depressive and anxiety symptoms increase. Moreover, unlike BDI and GAD-7, age, and sex did not differentiate MANSA scores.

When analyzing the collected data, the significant influence of socio-economic parameters on the scores obtained by the respondents should be noted. Significantly worse mental health status was obtained by women and young people on all three scales. According to research reports, young age and female sex increase the risk of increasing depressive and anxiety symptoms. This may be due to older people's greater mental resilience, greater life experience, habitual solitude, and better emotion

regulation (30, 31). Singles, individuals with prior psychiatric treatment and those whose in-come opportunities were reduced during the pandemic showed a similar negative trend. Based on previous economic crises, it was observed that job loss, higher work-loads or pay reductions increase the frequency of depressive and anxiety disorders and suicides (32, 33). In another study conducted during the pandemic, it was found that ruminating and worrying accompanying loneliness had a greater effect on depressive symptoms than anxiety symptoms, which is also observed in this study when taking into consideration the strength of the effect (34). At the same time, numerous studies have revealed that individuals with mental illness, compared to the general population, showed increased susceptibility to stress during a crisis already before the pandemic and they frequently had exacerbated psychopathology (35).

The scores indicating lower intensity of psychological problems were obtained by healthcare professionals; however, in another Polish study using GHQ-28, medical professionals working in direct exposure to COVID-19 obtained higher scores on this scale compared to the general population. Therefore, it should be emphasized that this is a heterogeneous group and the obtained scores may differ significantly in terms of individual occupational subgroups (36). This has also been confirmed in many other world studies (37, 38). Economic stability seems to be an important element for medical professionals. In the era of the pandemic, healthcare professionals were not exposed, like other professions, to reduction or even complete freezing of earnings due to government restrictions—as known from previous reports, economic stability is one of the strongest predictors of psychological well-being (32, 33). Moreover, as the pandemic continued, working conditions improved, access to personal protective equipment in-creased and the management of a person suspected or infected with SARS-CoV-2 was more clearly defined. Furthermore, individuals with a university degree were more resilient to depressive and anxiety disorders, and a similar pattern was also found in a study concerning the Chinese population (39). On the other hand, as a pandemic continues, and hence a significant workload, the mental condition of medical workers may deteriorate. According to WHO, the condition of medical workers is an important aspect of the fight against the COVID-19 pandemic and the need for support for psychiatric care is high (40, 41). Therefore, it is necessary to implement appropriate psychological support strategies as well as to ensure safe working conditions in order to maintain the psychological comfort of employees (38, 42–44). Failure to do so may lead to a deterioration of mental health, which may result in a reduction in the quality of services provided, and even professional burnout.

The authors are aware of the strengths and weaknesses of this study. According to the available data, this is one of the first cross-sectional studies concerning the psychological well-being of the Polish people that includes data obtained from all three waves of the COVID-19 pandemic, which demonstrates its strength and innovation. However, the limitation of this review is undoubtedly the lack of representativeness of the study group with respect to Polish society. The overwhelming predominance of women and the low mean age of respondents may influence the final result of the observation. Another methodological limitation

TABLE 7 | Effects of sociodemographic variables on scores of individual scales.

	BDI				GAD-7				MANSA				
	Value	SD	t	p	Value	SD	t	p	Value	SD	t	p	
Sex	Age	-0.097	0.018	-5.19	0.000	-0.035	0.011	-3.11	0.001	-0.002	0.024	-0.11	0.914
	Male	-1.629	0.345	-4.72	0.000	-1.974	0.208	-9.48	0.000	-0.195	0.436	-0.45	0.653
Place of residence	Rural area	0.267	0.365	0.73	0.463	0.103	0.222	0.47	0.641	-0.315	0.461	-0.68	0.494
	Town of up to 50,000 inhabitants	0.332	0.393	0.84	0.398	-0.037	0.239	-0.16	0.875	-0.755	0.496	-1.52	0.128
Level of education	City of 50,000-250,000 inhabitants	-0.106	0.361	-0.29	0.769	-0.259	0.219	-1.18	0.238	0.294	0.456	0.65	0.518
	Higher (university degree)	-9.820	1.350	-7.27	0.000	-3.476	0.831	-4.18	0.000	8.717	1.720	5.07	0.000
	Incomplete higher	-6.949	1.355	-5.13	0.000	-2.861	0.834	-3.43	0.000	6.547	1.726	3.79	0.000
	Secondary	-6.320	1.362	-4.64	0.000	-2.605	0.838	-3.11	0.001	5.429	1.734	3.13	0.001
Marital status	Vocational	-4.363	1.895	-2.30	0.021	-1.657	1.167	-1.42	0.155	3.253	2.414	1.35	0.177
	Primary	0.636	2.763	0.23	0.817	-2.958	1.701	-1.74	0.082	6.887	3.519	1.96	0.050
	Married	-2.838	0.461	-6.15	0.000	-0.528	0.292	-1.81	0.070	3.015	0.602	5.01	0.000
Medical professionals	Partnership	-1.407	0.527	-2.67	0.007	-0.168	0.331	-0.51	0.610	2.869	0.683	4.20	0.000
	Yes	-1.939	0.464	-4.17	0.000	-0.037	0.283	-0.13	0.894	2.404	0.436	5.51	0.000
Earnings reduction	Yes	3.249	0.465	6.98	0.000	1.267	0.285	4.44	0.000	-4.757	0.586	-8.11	0.000
Psychiatric treatment	Yes	5.771	0.487	11.83	0.000	2.965	0.196	15.09	0.000	-5.819	0.409	-14.22	0.000

Significant effects (<0.05) are marked in bold.

is the data collection method in the form of an anonymous survey distributed through a social networking site. As a result, the authors have no way of verifying the number of people who started but did not complete the survey or the number of people who knew about the survey. On the other hand, due to the prevailing sanitary and epidemiological restrictions, that was the only way to safely conduct a study on this scale. Furthermore, non-lockdown periods were not taken into consideration although this might have contributed to obtaining more robust conclusions, as longitudinal studies from other countries revealed gradual improvements in psychological well-being as prevailing restrictions regarding COVID-19 prevention were loosened. Due to the nature of the study (full anonymity and the way the questionnaire was distributed), the authors of this report could not provide psychological support to respondents. One can hope that participation in this study prompted the participants to take a closer look at their own mental health and, if necessary, seek medical assistance.

The authors intend to continue to conduct observations, and the obtained results will provide a more precise way to determine progressive changes in the severity of mental disorders in the population, which will help better understand the complexity of the impact of the pandemic on mental health. Another study is also necessary due to the likely fourth pandemic wave associated with the Delta variant of coronavirus (45). To this end, it would be worthwhile to consider extending the authors' own questionnaire to include newly developed tools designed for assessing psychological well-being in relation to the ongoing COVID-19 pandemic, e.g., the Coronavirus Anxiety Scale (46).

In summary, the COVID-19 pandemic is an unexpected and unique experience. Its numerous implications affect people's mental health. Therefore, there is a need for constant monitoring of this phenomenon and searching for systemic solutions that can significantly reduce the destructive impact of the pandemic on mental health. The example of such a solution could be the use of workplaces and schools for providing training in mental health hygiene, including stress management techniques (47).

CONCLUSIONS

The COVID-19 pandemic has a significant impact on the mental health of the Polish people. This effect is not uniform and the

severity of depressive and anxiety symptoms varies from wave to wave. As the pandemic continues, there is a unidirectional shift toward increased anxiety and depressive disorders. The impact of the COVID-19 pandemic on a subjective sense of quality of life is not uniform, with particular components worsening and others improving as the pandemic continues. Women, younger people, singles, and those treated psychiatrically in the past have significantly more severe psychotic symptoms. There is a need to continue to monitor the impact of the ongoing global epidemic situation on mental well-being to assess the long-term effects of the pandemic on mental health.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Bioethics Committee of the Wroclaw Medical University. The Ethics Committee waived the requirement of written informed consent for participation.

AUTHOR CONTRIBUTIONS

MB, KK, BB, and AM-M: conceptualization, methodology, writing—original draft, and writing—review and editing. KK: formal analysis. MB: funding acquisition and visualization. MB, BB, and AM-M: investigation and supervision. All authors contributed to the article and approved the submitted version.

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The Psychological Impact of COVID-19 on Healthcare Workers in Saudi Arabia: A Year Later Into the Pandemic

Atiah H. Almalki^{1,2*}, Mohammad S. Alzahrani^{3†}, Fahad S. Alshehri⁴, Adnan Alharbi⁵, Samirah F. Alkhudaydi⁶, Rawan S. Alshahrani⁶, Aseel H. Alzaidi⁶, Majed A. Algarni³, Hashem O. Alsaab⁷, Yasser Alatawi⁸, Yusuf S. Althobaiti^{2,9}, Ahmed K. Bamaga¹⁰ and Abdullah A. Alhifany⁵

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Tehran University of Medical
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Yong Gan,

Huazhong University of Science and
Technology, China

*Correspondence:

Atiah H. Almalki
ahalmalki@tu.edu.sa

[†]These authors have contributed
equally to this work

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¹ Department of Pharmaceutical Chemistry, College of Pharmacy, Taif University, Taif, Saudi Arabia, ² Addiction and Neuroscience Research Unit, Health Science Campus, Taif University, Taif, Saudi Arabia, ³ Department of Clinical Pharmacy, College of Pharmacy, Taif University, Taif, Saudi Arabia, ⁴ Department of Pharmacology and Toxicology, College of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia, ⁵ Department of Clinical Pharmacy, College of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia, ⁶ College of Pharmacy, Taif University, Taif, Saudi Arabia, ⁷ Department of Pharmaceutics and Pharmaceutical Technology, Taif University, Taif, Saudi Arabia, ⁸ Department of Pharmacy Practice, Faculty of Pharmacy, University of Tabuk, Tabuk, Saudi Arabia, ⁹ Department of Pharmacology and Toxicology, College of Pharmacy, Taif University, Taif, Saudi Arabia, ¹⁰ Neurology Division, Pediatric Department, Faculty of Medicine, King Abdulaziz University Hospital, King Abdulaziz University, Jeddah, Saudi Arabia

Objective: The COVID-19 pandemic poses unprecedented challenges to healthcare workers worldwide. This study sought to estimate the prevalence of depression, anxiety, and stress among healthcare workers in Saudi Arabia, and to identify the factors associated with these psychological disorders.

Methods: A cross-sectional questionnaire-based study was conducted from January 21 to March 2, 2021. Physicians, pharmacists, nurses, and other healthcare workers from different parts of Saudi Arabia were recruited through snowball sampling. Psychological outcomes were measured using the Depression, Anxiety, and Stress Scale (DASS-21). Pearson's chi-square test was used to explore the bivariate association between diverse characteristics and each outcome. Multiple logistic regression analyses were performed to identify factors associated with depression, anxiety, and stress.

Results: A total of 501 healthcare workers completed the survey, of whom 60% were female and nearly half were pharmacists. The majority (76.25%) of respondents reported that a family member, friend, or colleague had contracted COVID-19, and more than one-third (36%) knew someone who died due to COVID-19. Overall, the estimated prevalence rates of depression, anxiety, and stress were 54.69, 60.88, and 41.92%, respectively. The multivariate analysis revealed that healthcare workers with chronic diseases, nurses, and healthcare workers from the southern region were more likely to suffer from depression and stress. Further, individuals with positive COVID-19 test results showed a greater proportion of depressive symptoms compared to others. In addition, knowing someone who died due to COVID-19 and having a chronic illness were predisposing factors for anxiety.

Conclusion: After more than a year, the prevalence of depression, anxiety, and stress remains substantial among healthcare workers in Saudi Arabia. The findings can help guide efforts to mitigate the psychological impact of the pandemic.

Keywords: mental health, Saudi Arabia (KSA), COVID-19, health care workers (HCW), depression, anxiety, stress

INTRODUCTION

The novel coronavirus (SARS-CoV-2) was first reported by the Chinese government in December 2019 in the city of Wuhan (1), and declared a pandemic by the World Health Organization (WHO) on March 7, 2020 (2). SARS-CoV-2 has caused a similar pathogenesis as previous coronaviruses, such as Middle East Respiratory Syndrome (MERS) in 2012 (3). Pandemics and natural disasters often have a psychological impact on infected people and those in direct contact, such as healthcare workers (HCWs). About 30% of the general population in China has complained of moderate to severe anxiety (4). A study conducted among students found that anxiety and stress were highly associated with academic delays and low quality of life during the corona pandemic (5). Moreover, many medical doctors and nurses in Wuhan reported mental disturbances and anxiety disorders, and indicated that mental health support provided relief and alleviated symptoms (6, 7). In China, the incidence of psychological stress and anxiety in medical staff was higher compared to college students, possibly explained by the student's limited contact with confirmed positive COVID-19 cases in comparison to practicing healthcare providers (8).

Unlike prior outbreaks, the COVID-19 pandemic could have a potentially long-term psychological impact on both the general public and HCWs. One year following the start of the pandemic, few studies have been conducted to assess the psychological impact among HCWs using the Depression, Anxiety, and Stress Scale (DASS-21) questionnaire (9–15). Also, few longitudinal studies have been conducted to evaluate the long-term impact of the pandemic on health care providers (16–22). A recent Chinese study reported that some residents were still suffering from depression and anxiety during the low transmission period one year after the start of the pandemic (23). As Saudi Arabia also enters the low transmission phase, a timely psychological assessment is needed to identify vulnerable populations.

To date, few studies have evaluated the long-term impact of COVID-19 on the Saudi population, and none have tackled the long-term impact on HCWs in Saudi Arabia (3, 24, 25). The HCWs were on the front line of the crisis in Saudi Arabia, whether in hospitals or community pharmacies. Few studies have assessed the psychological impact of the COVID-19 pandemic among HCWs in Saudi Arabia in the past year (11, 26, 27), and no study has examined pharmacists working on the front line of this crisis, whether in hospitals or community pharmacies, or while delivering patient medications. The present study, therefore, aimed to investigate the long-term impact of COVID-19 among pharmacists and other HCWs one year following the start of the pandemic.

METHODS

Study Design and Setting

A cross-sectional questionnaire-based study was conducted from January 21 through March 2, 2021. HCWs residing in Saudi Arabia and working at the Saudi MOH, local community pharmacy chains, and other government or private hospitals were eligible to participate in the study. Exclusion criteria included those under 18 years of age, non-Arabic speakers, and non-HCWs. The study participants were recruited using a snowball sampling technique, where a link to the online survey was promoted and shared via WhatsApp, Twitter, and internal emails. The web-based survey was designed to ensure that every participant could take part only once. All participants were informed of the study purpose and were assured of the confidentiality of their responses. The study was approved by the Scientific Research Ethics Committee at Taif University (42-0068) and the Institutional Review Board of MOH (472).

A priori sample size was calculated according to the formula suggested by Lwanga and Lemeshow (28). We assumed that the prevalence of psychological distress during the COVID-19 pandemic in Saudi Arabia was 23.6%, as reported in a recent study (29). The required sample size was calculated using OpenEpi (Version 3.01, Atlanta, USA). The minimum sample size required for 80% power was 416, with a 95% confidence level, 5% confidence limit, and 1.5 design effect.

Data Collection

Data were collected via a standardized, self-administered questionnaire. We adopted the Depression, Anxiety, and Stress Scale–21 (DASS–21), a reliable and valid self-administered instrument to screen for these psychological disorders (30). This survey tool has 21 items, each of which is scored on a scale from 0 (“does not apply to me at all”) to 3 (“applies to me most of the time”). Scores for each subscale are determined by summing the scores of relevant items and then multiplying by a factor of 2. Each subscale was categorized into normal, mild/moderate, and severe/extremely severe based on the recommended cut-off values (30). The survey tool was translated to Arabic according to the forward and backward translation technique, which is known as a cross-cultural adaptation of research instruments (31). The process included two steps: (1) the forward translation from English to Arabic by two translators fluent in Arabic and English; and (2) the backward translation from Arabic to English by two different translators also fluent in both languages. Afterward, two faculty members with knowledge of the subject assessed the face validity of the Arabic version of the questionnaire.

We gathered demographic and occupational characteristics from the questionnaire, including data on age, gender, nationality

TABLE 1 | Sociodemographic characteristics of study participants.

Characteristic	Job category				Total (N = 501)
	Physicians (N = 63)	Pharmacists (N = 244)	Nurses (N = 54)	Others (N = 140)	
Female, %	68.25	44.67	79.63	78.57	60.88
Age, %					
18–24	38.10	30.33	55.56	59.29	42.12
25–34	38.10	56.97	33.33	28.57	44.11
35 or older	23.81	12.70	11.11	12.14	13.77
Nationality, %					
Saudi	61.90	92.21	83.33	85	85.43
Non-Saudi	38.10	7.79	16.67	15	14.57
Marital status, %					
Married	30.16	35.80	24.07	18.57	29.00
Single/widowed/divorced	69.84	64.20	75.93	81.43	71.00
Region, %					
Central Region	41.27	25.82	35.85	30.94	30.26
Eastern Region	17.46	11.07	32.08	15.11	15.23
Northern Region	9.52	7.79	7.55	10.79	8.82
Southern Region	11.11	13.52	9.43	12.23	12.42
Western Region	20.63	41.80	15.09	30.94	33.27
Healthcare setting, %					
Inpatient Hospital Setting	41.27	26.64	51.85	31.16	32.46
Outpatient Hospital Setting	12.70	15.16	5.56	10.87	12.63
Primary Health Care Centre	25.40	6.15	16.67	19.57	13.43
Community Pharmacy	-	22.95	1.85	-	11.42
Other	20.63	29.10	24.07	38.41	30.06
Have chronic illness, %	28.57	13.52	22.22	19.29	17.96
Tested positive for COVID-19, %	31.75	15.16	24.07	17.14	18.76
Family member, friend, or colleague tested positive for COVID-19, %	74.60	79.51	66.67	75.00	76.25
Family member, friend, or colleague died due to COVID-19, %	44.44	36.07	32.08	33.57	36.00

(Saudi or non-Saudi), marital status (married or unmarried), and geographic region (central, eastern, western, northern, or southern region). Job occupation was categorized into physician, pharmacist, nurse, and others, which included various occupations such as dentist, laboratory worker, radiology technician, and medical intern. In addition, we collected data on whether the participants had a chronic illness, whether they had tested positive for COVID-19, and whether someone they knew had tested positive for COVID-19 or had died due to COVID-19.

Statistical Analysis

Univariate, bivariate, and multivariate statistical analyses were conducted. Frequency and percentages were used to describe characteristics and estimate prevalence rates of depression, anxiety, and stress among participants. A bivariate analysis was conducted using Pearson's chi-square test to explore the association between sociodemographic traits and each DASS subscale. Variables that were significantly associated with the outcomes were further analyzed by entering the adjusted multivariate model. Age, gender, and job category were predetermined to enter into the adjusted model, regardless of their bivariate association with each outcome. A multivariate logistic regression analysis determined the factors associated with

each outcome (i.e., depression, anxiety, and stress). Adjusted odds ratios with 95% confidence intervals (CIs) and *p*-values were calculated to determine the strength and significance of the association. All statistical analyses were performed using SAS software (version 9.2, SAS Institute Inc., Cary, NC, USA).

RESULTS

A total of 501 HCWs completed the survey, nearly half of whom were pharmacists ($n = 244$). The response rate was 97.8%. The majority of participants were Saudis, one-third were from the Western region, and about 60% were female (**Table 1**). While only 18.76% of the participants had tested positive for COVID-19, the majority (76.25%) reported that a family member, friend, or colleague had tested positive for COVID-19. In addition, about 44% of physicians reported that a family member, friend, or colleague had died due to COVID-19, compared to 36.07 and 32.08% of pharmacists and nurses, respectively.

Based on the DASS subscale scores, the estimated prevalence rates of depression, anxiety, and stress among participants were 54.69, 60.88, and 41.92%, respectively. In terms of severity, one-third (33.13%) of the participants suffered from severe or extremely severe anxiety, 23.95% suffered from severe or



FIGURE 1 | Severity levels of psychological disorders among HCWs.

extremely severe depression, and 15.17% suffered from severe or extremely severe stress. Stratified by occupation, nurses had the highest severity rates across all DASS subscales (**Figure 1**). The prevalence rate of stress, ranging from mild to extremely severe, was higher among pharmacists (40.16%) compared to physicians (33.33%), but less than that of nurses (61.11%) (**Table 2**). The prevalence of depression was significantly higher among participants with chronic diseases and those who had tested positive ($p < 0.001$ and $p = 0.004$, respectively). Chronic illness was also significantly associated with anxiety and stress. The younger age group (18–24 years) had a significantly higher

percentage of anxiety and depression than the older age groups. HCWs who were not married had significantly higher rates of depression, anxiety, and stress. Compared to other regions, the southern region of Saudi Arabia had the highest prevalence rates of depression, anxiety, and stress among HCWs.

The multivariate analysis of depression showed that nurses had more than two times the odds of suffering from depression compared to physicians (OR = 2.37, 95% CI: 1.03–5.47) (**Table 3**). In addition, HCWs in the southern region were twice as likely to suffer from depression than their counterparts working in the western region (OR = 2.32, 95% CI: 1.21–4.47).

TABLE 2 | Bivariable analysis of depression, anxiety, and stress.

Characteristic	Depression [†] , %	P-value*	Anxiety [‡] , %	P-value*	Stress [§] , %	P-value*
Gender		0.06		0.12		0.13
Male	49.49		56.63		37.76	
Female	58.03		63.61		44.59	
Age		<0.001		0.001		0.05
18–24	65.40		70.62		47.39	
25–34	47.51		54.30		39.82	
35 or older	44.93		52.17		31.88	
Married		0.001		0.002		0.02
Yes	43.45		50.34		33.79	
No	59.15		65.07		45.07	
Nationality		0.13		0.25		0.36
Saudi	56.07		61.92		42.76	
Non-Saudi	46.58		54.79		36.99	
Job category		0.04		0.19		0.02
Physician	53.97		61.90		33.33	
Pharmacist	50.41		56.97		40.16	
Nurse	72.22		72.22		61.11	
Others	55.71		62.86		41.43	
Region		0.007		0.16		0.009
Central Region	60.26		64.24		47.02	
Eastern Region	47.37		56.58		34.21	
Northern Region	43.18		59.09		40.91	
Southern Region	70.97		72.58		58.06	
Western Region	50.00		56.02		34.94	
Healthcare setting		0.88		0.98		0.79
Inpatient Hospital Setting	51.85		61.73		40.74	
Outpatient Hospital Setting	57.14		57.14		38.10	
PHC	53.73		61.19		41.79	
Community Pharmacy	52.63		59.65		49.12	
Other	57.33		61.33		42.00	
Chronic illness		<0.001		<0.001		<0.001
Yes	75.56		81.11		63.33	
No	50.12		56.45		37.23	
Tested positive for COVID-19		0.004		0.11		0.40
Yes	68.09		68.09		45.74	
No	51.60		59.21		41.03	
Family member, friend, or colleague tested positive for COVID-19		0.66		0.33		0.009
Yes	56.11		59.69		38.74	
No	54.06		64.71		52.10	
Family member, friend, or colleague died due to COVID-19		0.09		0.02		0.79
Yes	52.62		67.78		42.78	
No	61.34		57.19		41.56	

[†] Depression was defined as DASS-21 depression subscale score ≥ 10 . [‡] Anxiety was defined as DASS-21 anxiety subscale score ≥ 8 . [§] Stress was defined as DASS-21 stress subscale score ≥ 15 . *P-values produced using Pearson's Chi square test.

Having a chronic illness and testing positive for COVID-19 were significant predictors of depression. The multivariate analysis of anxiety revealed that the youngest age group (18–24 years old) had greater odds of having anxiety than the oldest age group (35 years or older) (Table 3). The adjusted model indicated that having a chronic illness and knowing someone who died due to COVID-19 were significant predictors of anxiety. Finally, the multivariate analysis of stress suggested that nurses, HCWs in the southern region, and participants with chronic illnesses had significantly greater odds of suffering from stress (Table 3).

DISCUSSION

The present study examines the mental health toll of the COVID-19 pandemic on HCWs in Saudi Arabia. According to Saudi Commission For Health Specialties (SCFHS) report in 2020, ~500,000 HCWs were registered in the country (32). To our knowledge, this study is among the first to determine the prevalence and associated factors of depression, anxiety, and stress among HCWs in all regions of Saudi Arabia. Our findings indicate a considerably high prevalence rate of psychological disorders among physicians, pharmacists, nurses,

TABLE 3 | Multivariable logistic regression analysis of depression, anxiety, and stress.

Characteristic	Depression		Anxiety		Stress	
	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Gender						
Male	Ref		Ref		Ref	
Female	1.15 (0.74–1.78)	0.53	0.95 (0.62–1.46)	0.81	1.18 (0.77–1.83)	0.45
Age						
35 or older	Ref		Ref		Ref	
25–34	1.07 (0.56–2.02)	0.34	1.16 (0.62–2.16)	0.42	1.33 (0.67–2.61)	0.59
18–24	1.71 (0.83–3.52)	0.06	1.88 (0.92–3.87)	0.03	1.38 (0.65–2.93)	0.49
Married						
No	Ref		Ref		Ref	
Yes	0.79 (0.47–1.35)	0.39	0.72 (0.43–1.21)	0.21	0.83 (0.48–1.43)	0.50
Job category						
Physician	Ref		Ref		Ref	
Pharmacist	1.14 (0.61–2.12)	0.38	0.95 (0.51–1.76)	0.30	1.78 (0.94–3.38)	0.98
Nurse	2.37 (1.03–5.47)	0.02	1.71 (0.74–3.94)	0.11	3.49 (1.55–7.90)	0.005
Others	1.11 (0.58–2.13)	0.34	0.99 (0.51–1.89)	0.46	1.58 (0.81–3.09)	0.52
Region						
Western Region	Ref		—	—	Ref	
Central Region	1.24 (0.77–1.99)	0.52			1.43 (0.89–2.32)	0.53
Eastern Region	0.72 (0.39–1.30)	0.06			0.85 (0.46–1.57)	0.07
Northern Region	0.81 (0.39–1.65)	0.25			1.27 (0.62–2.60)	0.95
Southern Region	2.32 (1.21–4.47)	0.003			2.29 (1.23–4.29)	0.01
Chronic illness						
No	Ref		Ref		Ref	
Yes	2.62 (1.52–4.52)	<0.001	2.93 (1.64–5.24)	<0.001	2.90 (1.76–4.79)	<0.001
Tested positive						
No	Ref		—	—	—	—
Yes	1.79 (1.07–2.99)	0.03				
Family member, friend, or colleague died due to COVID-19						
No	—	—	Ref		Ref	
Yes			1.60 (1.07–2.39)	0.02	0.69 (0.44–1.07)	0.09

and other HCWs during the pandemic. The overall prevalence of depression, anxiety, and stress was 54.69, 60.88, and 41.92%, respectively. The prevalence rates of psychological disorders found in this study were greater than those of the general public in Saudi Arabia revealed in a previous study (29). Several factors can increase the risk of mental health conditions among HCWs, including fear of infection, high workload, and recurrent isolation from family members (33). Findings from this study underscore the importance of mental health interventions for HCWs. Mental health policy makers at health institutions should implement training in coping strategies and stress management skills for their HCWs. In addition, mental health programs and initiatives in Saudi Arabia should promote and expand their mental health counseling services.

The unprecedented pandemic has likely had an inevitable and enduring impact on the psychological well-being of HCWs. In terms of severity, we found that one-third of the HCWs had severe or extremely severe anxiety. This rate was higher compared to previous studies conducted during the early stages of the pandemic among HCWs in Saudi Arabia and other countries (11, 34–36). Our study was conducted in early 2021, a period when the number of cases in Saudi Arabia had

reached more than 360,000, and deaths due to COVID-19 had surpassed 6,000 (37). In our sample, more than one-third (36%) of HCWs knew someone who had died due to COVID-19. Our findings suggest that the psychological impact of the pandemic has persisted among HCWs, even though many restrictions in Saudi Arabia have been eased. This is in line with findings observed in a systematic review of previous infectious disease epidemics, such as MERS, suggesting long-lasting effects (38). Longitudinal studies are better suited to investigate the long-term psychological impact of the COVID-19 pandemic. One year later, few studies have been conducted to assess the psychological impact among HCWs using the DASS-21 questionnaire (9–15), and few cohort studies have evaluated the impact of the pandemic on health care providers (16–22). For instance, one study conducted over 3 months showed that improving workplace support might protect HCWs from adverse psychological consequences (39). A study conducted in Singapore among Medical residents found that HCWs were at high risk of psychological sequelae (40). Another study measured the long-term psychological impact of COVID-19 on frontline doctors in the UK over three periods of time (41).

As expected, we found that nurses were most affected by the COVID-19 crisis. Our findings indicate that nurses have a higher prevalence of moderate to severe psychological disorders than other healthcare professionals. Additionally, multivariate analyses revealed that nurses were more likely to suffer from depression and anxiety. This is not surprising because the literature has shown that, even prior to the COVID-19 pandemic, nurses and HCWs in direct contact with patients have a higher risk of depression, anxiety, and sleep disorders (42–44). During the COVID-19 crisis, several studies reported that nurses were more vulnerable to psychological disorders than other HCWs (11, 34, 45). Compared to other professionals, nurses may be at greater risk of contracting COVID-19 because of their regular and close contact with patients.

In this study, we explored the association between various demographic traits and psychological disorders. Female respondents had higher prevalence rates of anxiety than males (63.61 vs. 56.63%). The multivariate analysis did not show that females were more likely to develop anxiety. This finding is in contrast to a previous study performed in Saudi Arabia, which demonstrated that female HCWs were at greater risk of anxiety (46). However, we used a different screening tool and found that the younger age group had significantly higher prevalence rates of depression and anxiety than the older age group. A similar finding was observed in a Chinese study, which suggested that age is negatively associated with depression, anxiety, and insomnia, indicating that older age is a protective factor (47). In the bivariate analysis, we observed that married participants had lower rates of depression, anxiety, and stress. However, after adjusting for other factors, marital status was not associated with psychological disorders. A study of frontline HCWs in China found that the stress level was higher among married participants, likely due to the fear of transmitting the infection to one's spouse (48).

Our results indicated that geographic region was associated with depression and stress. Interestingly, the multivariate analysis shows that HCWs from the southern region were more likely to develop depression and stress. A previous study of HCWs in Saudi Arabia found that respondents from the central region had higher scores of depression and anxiety than those from other regions (34), but the study sample consisted of respondents from only three regions and did not include HCWs from the southern region. The findings of a Chinese study suggested that HCWs in Wuhan, the epicenter of the pandemic, were more likely to experience distress than those working outside Wuhan (49). Surely, it is expected that HCWs in locations with COVID-19 outbreaks would experience a greater psychological impact. However, the southern region of Saudi Arabia had fewer new and cumulative COVID-19 cases compared to the central or western regions. While it is unclear why HCWs from the southern region were more likely to suffer from depression and stress, this finding highlights the need to promote mental health and provide support services across the kingdom. Future research is warranted to address the variability in the psychological impact on HCWs from different geographic regions.

The findings revealed that HCWs with chronic illnesses had significantly higher prevalence rates of psychological disorders.

In the multivariate analysis, we found that chronic disease was the strongest predictor of depression, anxiety, and stress. This finding corresponds with the literature, which suggests that people with chronic ailments are more prone to suffer from depression, anxiety, and stress (33, 35, 50, 51). This could be explained by the fact, established early in the pandemic, that people with chronic diseases are at greater risk of severe and potentially fatal COVID-19 disease (52). The results have also shown that knowing someone who died due to COVID-19 was a significant predictor of anxiety. Special attention should be paid to providing adequate personal protective supplies to HCWs with chronic illnesses.

Some limitations need to be considered when interpreting the findings. First, as this was a cross-sectional study, the causal relationship between various factors and psychological disorders could not be established, and we were unable to identify whether participants had pre-existing mental health issues that could have influenced the results. Second, we did not collect data on potential confounders, such as workload or social and organizational support, or whether participants were involved in the direct care of COVID-19 patients. Third, we used a non-probability sampling technique, which may have led to selection bias and limited generalizability of the findings. Nonetheless, our sample included HCWs from all regions of Saudi Arabia. Finally, the use of self-administered surveys could potentially increase response bias. Despite these limitations, our study provides valuable insight into decision-makers in healthcare institutions regarding how the COVID-19 crisis has affected HCWs.

CONCLUSION

Physicians, pharmacists, and nurses alike have been deeply impacted by the COVID-19 crisis. The estimated prevalence rates of depression, anxiety, and stress among HCWs in Saudi Arabia were considerably high. This study identified certain populations who are at a greater risk of psychological disorders. Generally, factors associated with psychological disorders include having a chronic illness, being a nurse, knowing someone who died due to COVID-19, and being a healthcare worker from the southern region. Our study underscores the need to provide and promote support services for HCWs to mitigate the psychological impact of this pandemic.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

ETHICS STATEMENT

The study was approved by the Scientific Research Ethics Committee at Taif University (42-0068) and the Institutional Review Board of MOH (472). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AHA, MSA, FA, and AAA contributed to conception and design of the study. FA, AAlha, SFA, RA, and AAlz collected and organized the database. MSA, FA, and YA performed and validated the statistical analysis and wrote the statistical section. AHA, MSA, MAA, and AAA wrote the first draft of the manuscript. AB, HA, and YSA revised and edited the manuscript. All authors contributed to revising the manuscript and read and approved the submitted version.

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Assessment of Impact of Containment During the COVID-19 Epidemic and Coping Behaviours Using Newly Developed Assessment Tools

Li Ping Wong^{1,2*}, Haridah Alias¹, Mahmoud Danaee¹, Hai Yen Lee², Kit Mun Tan³, Peter Seah Keng Tok^{1,4}, Mustakiza Muslimin⁵, Sazaly AbuBakar^{2,6}, Yulan Lin^{2*} and Zhijian Hu^{2*}

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Mohammadreza Shalbafan,
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Vahid Rashedi,
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Sciences, Iran
Hassan Rafiey,
University of Social Welfare and
Rehabilitation Sciences, Iran

*Correspondence:

Zhijian Hu
huzhijian@fjmu.edu.cn
Yulan Lin
yulanlin@fjmu.edu.cn
Li Ping Wong
wonglp@ummc.edu.my

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¹ Faculty of Medicine, Department of Social and Preventive Medicine, Centre for Epidemiology and Evidence-Based Practice, University of Malaya, Kuala Lumpur, Malaysia, ² Department of Epidemiology and Health Statistics, School of Public Health, Fujian Medical University, Fuzhou, China, ³ Faculty of Medicine, Department of Medicine, Centre for Epidemiology and Evidence-Based Practice, University of Malaya, Kuala Lumpur, Malaysia, ⁴ Institute for Clinical Research, National Institutes of Health (NIH), Ministry of Health Malaysia, Shah Alam, Malaysia, ⁵ Faculty of Health Sciences, Department of Medical Science & Technology, PICOMS International University College, Kuala Lumpur, Malaysia, ⁶ Faculty of Medicine, Department of Medical Microbiology, University of Malaya, Kuala Lumpur, Malaysia

Background: The confinement measures during COVID-19 had a massive effect on physical and psychological health in public. This study assessed the impact of containment and coping behaviour among the Malaysia public during the COVID-19 pandemic. Questions assessing the impact of containment and coping behaviours were developed and psychometrically tested.

Methods: Exploratory factor analysis (EFA) was conducted with the items using principal component analysis extraction and Varimax rotation. Partial least squares structural equation modelling was used to determine the relationship between coping and impact.

Results: The 13-item of impact and 10-item coping instruments were developed with three dimensions identified through EFA. Both scales demonstrated excellent composite reliability and good convergent validity. The survey findings revealed that the impact on individual psychological aspects was prominent, followed by well-being and lifestyle. Mindfulness and physical coping strategies were most commonly reported. Coping through seeking help from health professionals and hotlines had a positive direct effect on well-being and lifestyle ($b = 0.231, p < 0.001$), psychological ($B = 0.132, p < 0.001$), and employment-related ($0.194, p < 0.001$) impacts. Coping through mindfulness practise had a negative effect on well-being and lifestyle-related impact ($B = -0.180, p < 0.001$) and employment-related impact ($B = -0.096, p = 0.008$).

Conclusions: Despite some limitation, the scales for measuring impact and coping behaviours have the potential to be used as a measurement tool in future studies. Findings highlight the enormous impact of the pandemic on psychological

well-being and lifestyles. Health authorities should support individual coping as it was found to be an important resilience-related factor to mitigate the impacts of containment during the pandemic.

Keywords: psychological, confinement measures, COVID-19, partial least squares, exploratory factor analysis

INTRODUCTION

The 2019 coronavirus disease (COVID-19) outbreak, which began in Wuhan, China, in December, has become a global health challenge and resulted in significant morbidity and mortality. Worldwide SARS-CoV-2 infections topped 20 million as of mid-August 2020 (1). The rapid increase in COVID-19 cases has prompted many governments around the world to introduce confinement measures to contain the epidemic. These measures have led to many businesses being shut down temporarily and a reduced workforce across all economic sectors. Along with its high infectivity and fatality rates, containment during the COVID-19 pandemic has imposed a universal economic burden and financial losses. The confinement measures have also had a massive effect on physical and psychological health (2, 3). People have become suddenly inactive and adopted sedentary behaviours, resulting in an unprecedented health crisis as self-isolation and living in confinement for several weeks to months represents a physiological challenge with significant health risks, especially in people with chronic diseases (4, 5). With respect to psychological health, the high contagiousness and fatality rates provoke fear, anxiety, and depression in the public, which results in increased mental issues in society (6, 7). Further stigma and discrimination are other aspects of the outbreak of the pandemic that add to the psychological health burden (8).

As in many countries around the world, Malaysia, a country in Southeast Asia, is also significantly impacted by the COVID-19 pandemic. Malaysia announced the first three cases of COVID-19 on 25 January 2020. Subsequently, the country implemented a nationwide movement control order (MCO) to curb the outbreak on 18 March 2020. The MCO order included the closure of schools and higher education institutions, “non-essential” businesses, as well as a general prohibition of mass movements and gatherings across the country including religious, sports, social, and cultural activities. The public has been asked to engage in social distancing, self-isolation and in-home confinement. During the MCO, only one person was allowed to represent a household to perform necessary tasks and errands. Over the MCO period, the public was concerned with the uncertainty over how long the COVID-19 pandemic will persist. Malaysia has gone through four MCO phases, each phase lasting 2 weeks. A Conditional Movement Control Order (CMCO) was implemented from 13 May to 9 June, and a Recovery Movement Control Order (RMCO) took effect from 10 June and will last until 31 August with more lenient restrictions.

Currently, the coronavirus pandemic is far from over in Malaysia, as well as many other countries in Asia and worldwide, and the pandemic continues to evolve rapidly. In the context of the present evolving COVID-19 pandemic, there is a need to investigate the impact as well as the coping behaviours of the

public in order to help design interventions to better support the general public, should there be the resurgence of the outbreak and the re-enforcement of movement restrictions. To date, there are some knowledge gaps in the current literature with regard to the impact on and coping strategies of the Malaysian public during the MCO. An earlier study found that the level of anxiety, as well as the financial and employment impact among the Malaysian public, increased along with the duration of movement confinement (9). Nonetheless, other health and general well-being consequences of movement confinement remain unclear and have never been comprehensively reported in Malaysia. Previous international studies have shown that quarantine or confinement to contain the COVID-19 outbreak have profoundly affected the general well-being, health, and employment of the community (3, 10). The implication of such an unprecedented disruption to Malaysian society needs to be assessed empirically so that support can be provided to mitigate stressors and promote healthy behaviours.

Coping responses are expected during a pandemic and understanding individualised ways of coping in such a situation is of paramount importance (11). It is an immediate research priority to understand how the public can be supported to optimise coping strategies to mitigate their impact, and subsequently facilitate the implementation of preventive interventions in the future. During the COVID-19 pandemic, it is crucial that the public is well-supported during in-home containment, with minimal consequences on health, well-being, and economic aspects. Hence, there is also a need to investigate the resilience of the public during the pandemic period to identify coping behaviours that can effectively reduce their impact.

For these reasons, this study aimed to determine the impact on and coping behaviours of the public during the MCO period of the COVID-19 pandemic in Malaysia. To date, no standard tools are available to measure impact and coping during the COVID-19 pandemic. Thus, a questionnaire on impact and coping was developed by the research team. The psychometric testing of the impact and coping items were conducted. Secondly, the study explored the use of various coping behaviours on its implication on different components of impact.

METHODS

Measurement Development

Questions measuring impact and coping behaviours were developed in English and then translated into Bahasa Malaysia, the national language of Malaysia. Forward and backward translation was carried out to maintain the equivalence of the questionnaire in both languages. Questions were presented in both English and Bahasa Malaysia in the survey link. Questions were first developed by the research team members. Panel experts

that consist of academicians and researchers were invited to performed face and qualitative content validation of the items. The authors met to discuss the evaluations and comments from the expert panel members, including the expert panel members' suggestions for improvements. Subsequently, pilot testing was performed on 30 participants to assess the clarity of the items. Minor revisions were made and the questionnaire was further pre-tested before field administration.

The developed questions measuring impact and coping behaviours are shown in **Appendix 1**. The impact of COVID-19 was measured using a 13-item questionnaire that queried participants of various impacts including general well-being, lifestyle, mental, and employment aspects. The response options were scored on a three-point Likert scale: 2, *extremely*; 1, *moderately*; 0, *never*. The possible impact score ranged from 0 to 26, with higher scores representing higher levels of impact. Coping behaviours were measured using a 10-item questionnaire assessing physical and psychological coping as well as help-seeking. The response options were scored on a three-point Likert scale: 2, *most of the time*; 1, *sometimes*; 0, *never*. The possible total coping behaviour score ranged from 0 to 20, with higher scores representing greater coping difficulty.

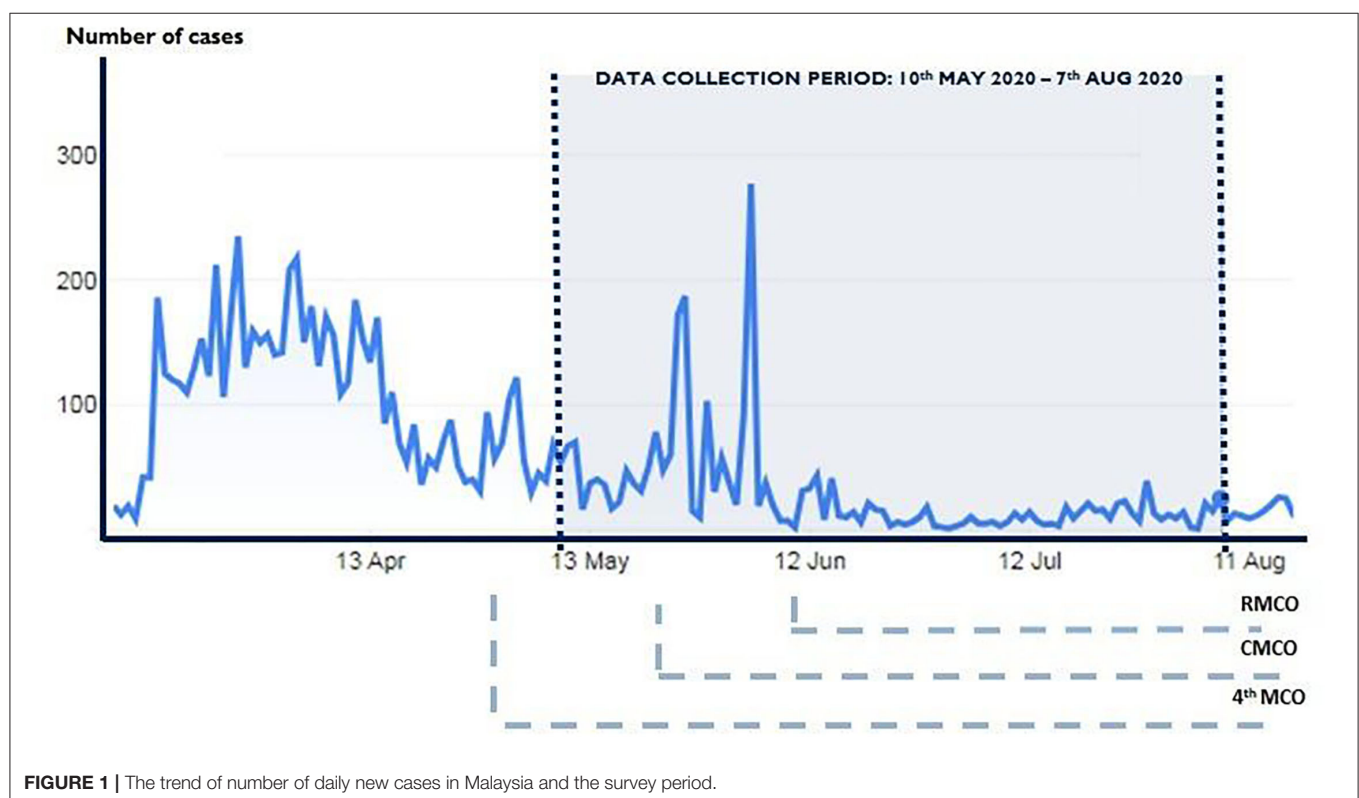
Survey Administration

The developed measurements were administered on a diverse national sample across Malaysia. An anonymous Internet-based, cross-sectional survey was conducted between 10 May and 7 July 2020. **Figure 1** shows the trend of the number of daily new cases in Malaysia from the beginning of the COVID-19 outbreak

and the survey period. Snowball and convenience sampling were used to recruit the participants. The researchers used social network platforms (WhatsApp, Facebook, and Instagram) to disseminate and advertise the survey link. Respondents who completed the survey received a note to encourage them to disseminate the survey link to all their contacts. All respondents were informed that their participation was voluntary and consent was implied through their completion of the questionnaire. The survey also gathered demographic background, experience with COVID-19, and the health status of the participants. Personal details, including age, gender, ethnicity, religion, marital status, occupation, and average monthly household income were collected. The participants were also asked if they had existing chronic diseases and to rate their overall perceived health status. Overall perceived health is a subjective, individualised self-assessment of the current overall state of personal health and was measured by a single question asking for a rating of current general health status using five-item choices ("very good," "good," "fair," "poor," or "very poor"). COVID-19 experience asked participants if they knew of friends, neighbours, or colleagues who had been infected with COVID-19.

Statistical Analysis

Descriptive statistical analyses were performed using the Statistical Package for the Social Sciences, version 25.0 (IBM Corp., Armonk, NY, USA). The significance level was set at $\alpha < 0.05$, and all tests were two-tailed. The categorical data were presented as numbers and percentages. The scores for impact and coping were not normally distributed, hence are



presented as medians and interquartile ranges (IQRs). The non-parametric Kruskal-Wallis and Mann-Whitney *U* tests were applied to compare the impact and coping scores between two or more groups.

The reliability of the impact and coping measurements were tested for Cronbach's alpha reliability coefficient and composite reliability. Convergent and discriminant validity was evaluated using average variance extracted (AVE) and heterotrait-monotrait (HTMT) ratio of correlations method, respectively. The Kaiser-Meyer Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used to examine the appropriateness of factor analysis. Exploratory factor analysis was performed using the principal components method with Varimax rotation to determine the factor structure of the 13-item impact and 10-item coping scales. Varimax rotation maximises within-factor variance of the loadings of the factors extracted (12) and hence is preferred. Partial least squares structural equation modelling (PLS-SEM) was used to explore the association between impact and coping. This technique assesses the reliability of the dataset and the statistical significance of the coefficients and the error of the estimated path coefficients (13). The bootstrapped significance calculation was performed in SmartPLS software version 3.2.8 (SmartPLS GmbH) (14).

Ethical Considerations

All respondents were informed that their participation was voluntary and provided consent online. This research was approved by the University of Malaya Research Ethics Committee (UM.TNC2/UMREC - 922). This study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

Psychometric Testing of the Impact Questionnaire

Bartlett's test of sphericity yielded a significant chi-square statistic, indicating that a relationship exists between at least some of the subscales [$\chi^2_{(78)} = 3465.51, p < 0.05$]. The analysis also produced a Kaiser Meyer Olkin (KMO) value of 0.842, indicating satisfactory sample adequacy. The communality values of the 13 items were above 0.5. Factor loading for all items was also above 0.5. Factor analysis extracted three components with an eigenvalue greater than one. The first component (6 items) explained 20.79% of the variance. The second component (4 items) and third component (3 items) explained 16.40 and 15.69% of the variance, respectively (Table 1). The three impact components were found to fit together conceptually and were named (1) lifestyle, (2) psychological, and (3) employment-related impacts.

Psychometric Testing of Coping Questionnaire

Bartlett's test of sphericity also yielded a significant chi-square statistic, indicating that a relationship exists between at least some of the subscales [$\chi^2_{(45)} = 3308.167, p < 0.05$]. The KMO value was 0.085. The communality values of the 10

TABLE 1 | Factor loadings based principal component analysis with Varimax rotation for items related to impact and coping scales.

Impact items	Component 1	Component 2	Component 3
	Well-being and lifestyle	Psychological psychological	Employment-related
D8	0.717		
D5	0.702		
D6	0.690		
D4	0.626		
D10	0.577		
D9	0.407		
D12		0.793	
D11		0.730	
D13		0.708	
D7		0.459	
D2			0.882
D1			0.835
D3			0.528
Eigenvalues	2.703	2.132	2.039
% of variance	20.795	16.404	15.688

Coping item	Component 1	Component 2	Component 3
	Mindfulness practice	Physical coping	Help seeking
E3	0.796		
E1	0.735		
E4	0.726		
E2	0.71		
E7		0.802	
E6		0.738	
E5		0.623	
E8		0.581	
E10			0.93
E9			0.918
Eigenvalues	2.483	2.095	1.821
% of variance	24.825	20.949	18.207

items and factor loading were also above 0.5. Likewise, factor analysis extracted three components with an eigenvalue greater than one. The first component (4 items) explained 28.83% of the variance. The second component (4 items) and third component (2 items) explained 20.95 and 18.21% of the variance, respectively (Table 1). Similarly, the three coping behaviour components were found to fit together conceptually and were named (1) mindfulness practise, (2) psychological, and (3) help-seeking coping.

Participant Demographics

A total of 1,052 complete responses were received. The demographic characteristics of the study participants are shown in the first and second columns of Table 2. The majority of the study participants were between the ages of 18 and 30 years old (52.9%). The proportion of female (73.1%) participants

TABLE 2 | Demographic characteristic of study participants, COVID-19 coping and impact scores ($N = 1,052$).

Covariates	N (%)	Impact score median (IQR)	P-value	Coping score median (IQR)	P-value
Socio demography					
Age group (years)					
18–30	557 (52.9)	8.0 (5.0–12.0)	0.009 ^k	12.0 (9.0–15.0)	0.020 ^k
31–40	272 (25.9)	7.0 (5.0–11.0)		12.0 (9.0–15.0)	
>40	223 (21.2)	7.0 (4.0–11.0)		13.0 (10.0–15.0)	
Gender					
Male	283 (26.9)	8.0 (5.0–12.0)	0.22 ^m	12.0 (9.0–15.0)	0.67 ^m
Female	769 (73.1)	8.0 (5.0–11.0)		12.0 (10.0–15.0)	
Marital status					
Single	649 (61.7)	8.0 (5.0–12.0)	0.015 ^m	12.0 (10.0–15.0)	0.053 ^m
Married	403 (38.3)	7.0 (4.0–11.0)		13.0 (10.0–15.5)	
Ethnicity					
Malay	601 (57.1)	8.0 (5.0–12.0)	0.19 ^k	13.0 (10.0–16.0)	0.001 ^k
Chinese	330 (31.4)	7.0 (4.0–11.0)		12.0 (9.0–14.0)	
Indian	63 (6.0)	9.0 (5.0–11.0)		13.0 (9.5–16.0)	
Indigenous Sabah/Sarawak/Others	58 (5.5)	7.5 (5.0–12.0)		12.0 (10.0–15.0)	
Highest education level					
Secondary and below	88 (8.4)	9.0 (5.0–14.0)	0.033 ^m	12.0 (9.0–15.5)	0.99 ^m
Tertiary [†]	964 (91.6)	8.0 (5.0–11.0)		12.0 (10.0–15.0)	
Occupation type					
Professional and managerial	490 (46.6)	7.0 (4.0–11.0)	<i>p</i> < 0.001 ^k	13.0 (10.0–15.0)	0.089 ^k
General worker	145 (13.8)	10.0 (6.0–13.0)		12.0 (9.0–15.0)	
Student	297 (28.2)	8.0 (5.0–12.0)		12.0 (10.0–15.0)	
Retired/Unemployed/Housewife	120 (11.4)	9.0 (5.0–13.0)		12.0 (10.0–15.0)	
Average monthly household income (MYR) ^{††}					
3,000 and below	401 (38.1)	9.0 (6.0–13.0)	<i>p</i> < 0.001 ^k	12.0 (10.0–15.0)	0.28 ^k
3,001–6,000	306 (29.1)	8.0 (5.0–11.0)		12.0 (10.0–15.0)	
6,001 and above	345 (32.8)	6.0 (4.0–10.0)		12.0 (9.0–15.0)	
Locality					
Urban	695 (66.1)	8.0 (5.0–11.0)	0.21 ^k	12.0 (10.0–15.0)	0.73 ^k
Sub-urban	245 (23.3)	7.0 (5.0–11.0)		12.0 (10.0–15.0)	
Rural	112 (10.6)	9.0 (5.0–13.0)		13.0 (10.0–15.0)	
Region					
Northern	147 (14.0)	8.0 (5.0–13.0)	0.74 ^k	12.0 (9.0–15.0)	0.002 ^k
Southern	163 (15.5)	8.0 (5.0–11.0)		12.0 (9.0–15.0)	
East coast	100 (9.5)	7.0 (4.5–11.0)		14.0 (11.5–16.0)	
Central	589 (56.0)	8.0 (5.0–11.0)		12.0 (9.0–15.0)	
Borneo island	53 (5.0)	8.0 (6.0–10.0)		12.0 (11.0–15.0)	
Experience with COVID-19					
Had close family members infected by COVID-19					
Yes	17 (1.6)	9.0 (4.0–10.0)	0.95 ^m	11.0 (10.0–15.0)	0.87 ^m
No	1,035 (98.4)	8.0 (5.0–12.0)		12.0 (10.0–15.0)	
Known any friends, neighbor or colleagues infected by COVID-19					
Yes	168 (16.0)	8.0 (5.0–11.0)	0.97 ^m	12.0 (10.0–15.0)	0.61 ^m
No	884 (84.0)	8.0 (5.0–12.0)		12.0 (10.0–15.0)	
Health status					
Have an existing chronic disease					
Yes	77 (7.3)	8.0 (5.0–12.0)	0.59 ^m	12.0 (10.0–15.0)	0.80 ^m
No	975 (92.7)	8.0 (5.0–11.0)		12.0 (10.0–15.0)	
Perceived overall health					
Very poor/Poor/Fair	188 (17.9)	9.0 (6.0–13.0)	0.001 ^k	11.0 (8.0–14.0)	<i>p</i> < 0.001 ^k
Good	599 (56.9)	8.0 (5.0–11.0)		12.0 (10.0–15.0)	
Very good	265 (25.2)	7.0 (5.0–11.0)		14.0 (11.0–16.0)	

^kKruskal-Wallis test.^mMann-Whitney U test.[†]Post-secondary education received at universities, polytechnics and colleges.^{††}1 MYR = 0.24 USD.

in this study was higher than males (26.9%). The majority of the study participants had a tertiary education (91.6%). By occupation category, near half were in professional and managerial occupations (46.6%), while general workers and students comprised 13.8 and 28.2%, respectively. Of the overall participants, 38.1% reported an average monthly household income of <MYR3000m while 29.1% reported an average monthly household income of MYR3001-6000. The majority of participants were from urban (66.1%) and sub-urban (23.3%) areas. Slightly over half (56.0%) of the study participants were from the central region. Only a total of 1.6% ($n = 17$) reported having a close family member infected with COVID-19. A higher proportion (16.0%, $n = 168$) reported knowing of friends, neighbours, or colleagues infected with COVID-19. The majority (92.7%) did not have any chronic diseases. The majority perceived their overall health as good (56.9%) or very good (25.2%).

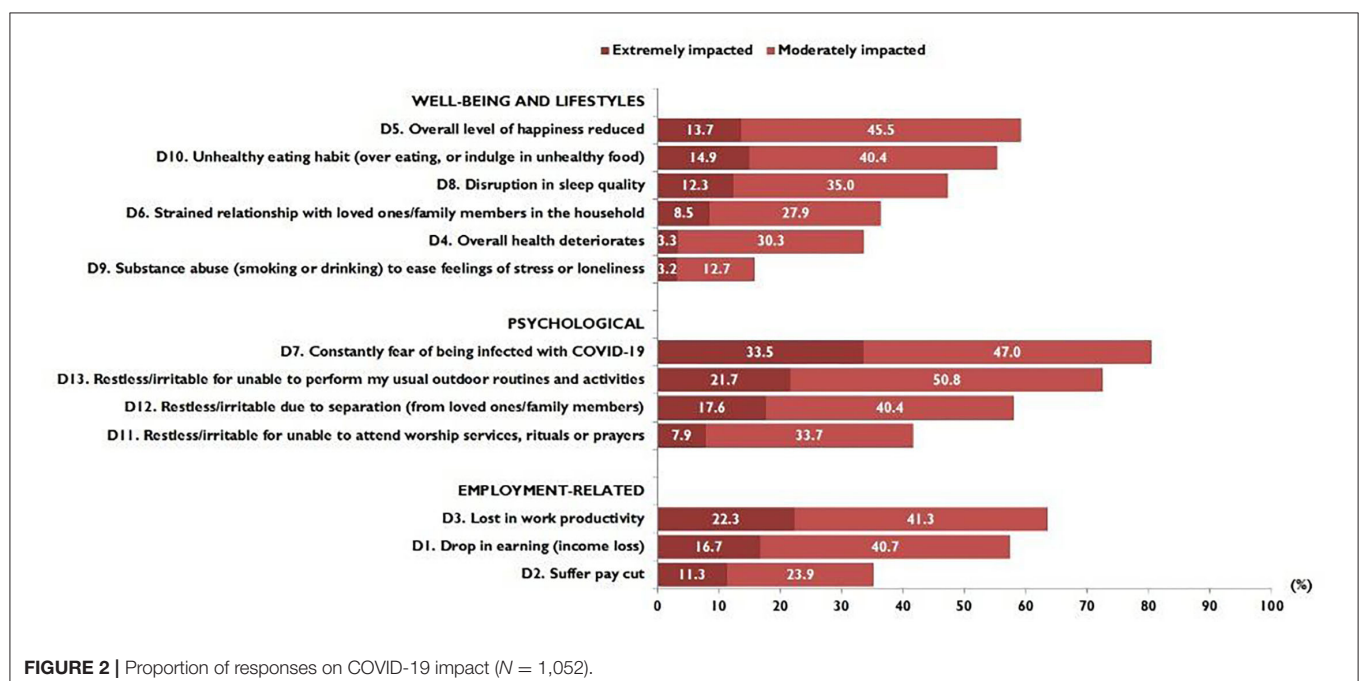
Impact of COVID-19

Figure 2 shows the proportion of responses on the impact of COVID-19 in terms of the well-being and lifestyle, psychological, and employment-related dimensions. Overall, participants demonstrated high rates of psychological impact. The highest proportion reported being constantly in fear of being infected with COVID 19, constantly fearful or irritable over not being able to perform their usual routines, and separated from loved ones/family members. Under the well-being and lifestyle dimension, a large proportion reported an overall lower level of happiness and indulged in unhealthy eating habits. Regarding employment-related impact, a large proportion reported lower work productivity and income loss.

Of the possible maximum score of 26, the median (IQR) was 8.0 (IQR 5.0 to 11.8). **Table 3** shows that participants aged 18–30 years showed a significantly greater median impact scores than the older age groups. There were no significant differences in median impact scores by gender and ethnicity. However, participants who were single reported significantly higher median impact scores than married participants. Participants with an educational level of secondary school and below reported significantly higher median impact scores (median score 9.0; IQR 5.0–14.0) than those with a tertiary education. By occupation category, participants who were general workers reported the highest median impact scores (median score 10.0; IQR 6.0–13.0). A significant inverse association was seen between median impact scores and average household income. There was a gradual decline in median impact scores as income level increased. Participants who perceived their overall health status as very poor, poor, or fair reported the highest median impact scores (median score 9.0; IQR 6.0–13.0).

Coping Behaviours

Figure 3 shows the proportion of responses regarding coping behaviours. Mindfulness coping was most commonly reported by the study participants, followed by physical coping. Only a small proportion reported seeking professional help (23.5%) or reaching out to COVID-19 hotlines (20.6%). Of the possible maximum score of 20, the median (IQR) was 12.0 (IQR 10.0 to 15.0). Participants in the oldest age group reported significantly higher median coping scores (median score 13.0; IQR 10.0–15.0). By ethnicity, the Malay (median score 13.0; IQR 10.0–16.0) and Indian (median score 13.0; IQR 9.5–16.0) ethnic groups reported higher median coping scores, while by region, those from east coast reported higher coping scores (median score 14.0; IQR



11.5–16.0). Participants who perceived their overall health status as very good reported the highest median coping scores (median score 14.0; IQR 11.0–16.0).

Relationship Between Coping and Impact

Table 3 shows all the results for testing the reliability of the measurement models. The results of the measurement model indicate that all the values of composite reliability (which ranged from 0.743 to 0.937) were >0.70 , indicating acceptable construct reliability. Further, the Cronbach's alpha value higher than 0.6 indicates that the constructs have an acceptable level of internal consistency. Meanwhile, convergent validity, evaluated by AVE for all constructs, was >0.5 (except for well-being and lifestyle impact, $AVE = 0.452$). However, according to Hair

et al. (15), $AVE > 0.4$ indicates adequate convergent validity. The discriminant validity assessment through HTMT ratio of correlations method also indicated that all HTMT values were lower than the most restrictive threshold (0.85) proposed by Kline (16), thus indicating adequate discriminant validity.

The PLS-SEM in Figure 4 shows the associations between all the components of coping and impact. The PLS-SEM path model predicting psychological impact shows that help-seeking coping has a direct and significant effect on psychological impact ($B = 0.132$; $p < 0.001$). An inverse association between income and psychological impact was observed ($B = -0.171$; $p < 0.001$). The adjusted R^2 value for the structural model is 0.055, showing that the model explained 5.5% of the total variance in psychological impact.

The PLS-SEM path model predicting well-being and lifestyle impact showed that help-seeking coping has a direct and significant effect on well-being and lifestyle impact ($B = 0.231$; $p < 0.001$). Mindfulness practise and a well-being and lifestyle impact were inversely associated ($B = -0.180$; $p < 0.001$). Likewise, an inverse association between income ($B = -0.080$; $p < 0.001$) and education level ($B = -0.058$; $p = 0.037$) with well-being and lifestyle impact was observed. The adjusted R^2 indicates this model explained 9.5% of the total variance in the well-being and lifestyle impact.

The model for employment-related impact showed that help-seeking coping was significantly associated with higher employment-related impact ($B = 0.194$; $p < 0.001$). Mindfulness practise was significantly associated with higher employment-related impact ($B = -0.096$; $p = 0.080$). An inverse association

TABLE 3 | Results of Cronbach's alpha, composite reliability and average variance extracted.

Construct	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Impact			
Well-being and lifestyle	0.763	0.831	0.452
Psychological	0.679	0.797	0.504
Employment-related	0.715	0.841	0.640
Coping			
Mindfulness practice	0.772	0.837	0.566
Physical coping	0.672	0.743	0.514
Help-seeking	0.866	0.937	0.882

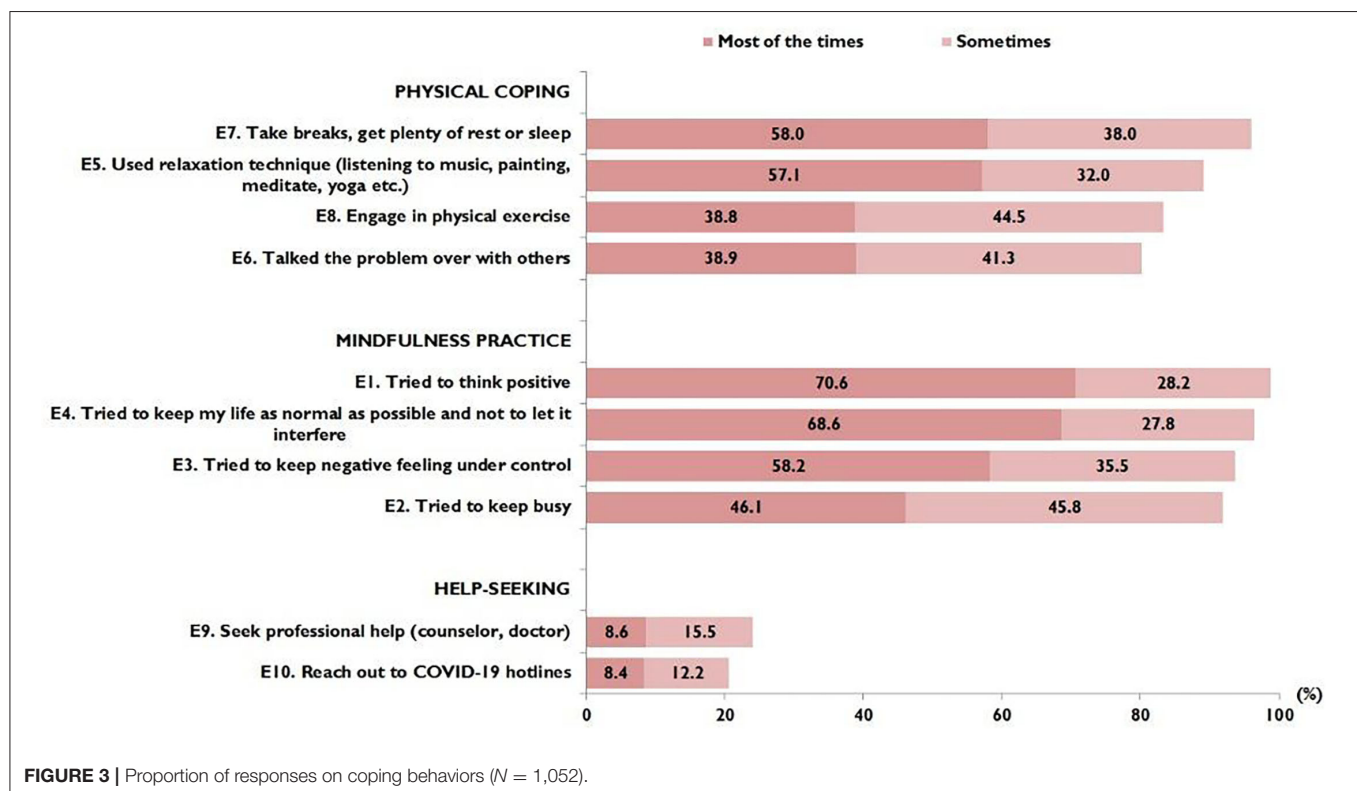


FIGURE 3 | Proportion of responses on coping behaviors ($N = 1,052$).

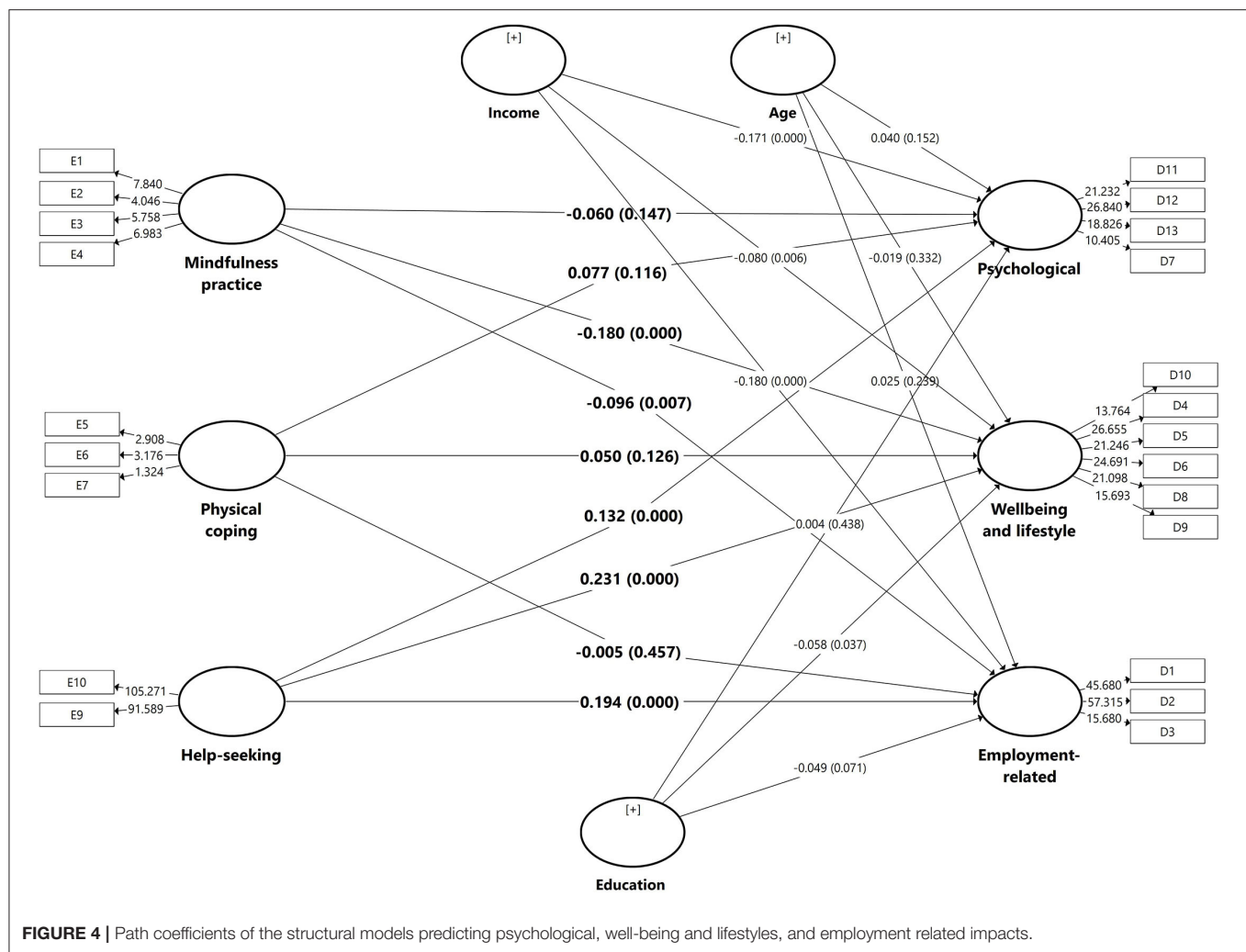


FIGURE 4 | Path coefficients of the structural models predicting psychological, well-being and lifestyles, and employment related impacts.

was observed between income ($B = -0.180$; $p < 0.001$) and employment-related impact. The adjusted R^2 indicates that the total variance explained by the model was 8.4%.

DISCUSSION

We queried the Malaysian public about the impact of the COVID-19 pandemic and their coping behaviours during the implementation of MCO to combat the coronavirus outbreak using self-developed instruments. The EFA extracted three components each for the measurement of impact and coping behaviours. The results of the KMO test, which were above 0.80, indicate acceptable sampling adequacy and imply the appropriateness of factor analysis. It has been suggested that KMO values above 0.80 are considered “meritorious” while values above 0.90 are considered “marvellous” (17). The appropriateness of factor analysis was also supported by the results of Bartlett’s test of sphericity. The values of Cronbach’s alpha and composite reliability of the scales were found to be sufficient and internal consistencies met the adequacy criteria (18). The initial eigenvalues above one for both the impact and

coping scales also suggest that all items fit into the theoretical construct. The results of this study show that the COVID-19 impact scale is structurally valid, as evidenced by factor analysis results with three robust components: well-being and lifestyle, psychological, and employment-related. Likewise, the coping scale with its three components, i.e., mindfulness practise, physical coping, and help seeking, is also valid and reliable. Therefore, we believe that the impact and coping scales have the potential to be used as measurement tools in future studies.

The results of the survey show that the implementation of containment during COVID-19 resulted in a prominent impact on psychological aspects. Most of the participants in this study reported constant fear of coronavirus infection, similarly reported in many other countries around the world (19–21). A high prevalence of a feeling of restlessness or irritability due to being under confinement was reported by our study participants, also similarly reported in other countries (22, 23); this points towards the considerable detrimental effects of COVID-19 containment measures on emotional and psychological health consequences. In this study, measures to contain the outbreak also led to the disruption of well-being and lifestyle, with many

participants reporting a reduction in their overall happiness, engaging in unhealthy eating habits, disruption in sleep quality, and deterioration of overall health. It is recommended to limit COVID-19 impacts by maintaining a healthy lifestyle (e.g., exercising, eating healthy and at regular times, getting enough sleep, avoiding drug and alcohol use), planning a daily routine, getting involved in pleasant activities, and connecting with trusted others to share concerns and feelings (24–26), and should be encouraged to the general public in Malaysia.

It is important to highlight that the insurmountable social isolation, loneliness, boredom, financial hardship, and other pandemic-related bereavements associated with prolonged home confinement and lockdown during the COVID-19 pandemic have been reported to result in a surge of behavioural addiction (27). A surge in the sale of alcohol and use of tobacco and electronic cigarettes has been observed during the lockdown period in Western countries (27–30). Similarly reported in this study, the consumption of alcohol and tobacco were evident. It has been suggested that a strong support system integrating family, society, healthcare providers, and government and legislative bodies is needed to provide support and treatment to people with substance use disorders, as well as prevention by limiting access to controlled substances; these are all important to tackle behavioural addiction and promote addiction-free living during the pandemic (27). Others addictive behaviours associated with the use of information and communications technology (ICT) during self-isolation in the pandemic, which were not assessed in this study, include gambling, video gaming, TV series watching, problematic social media use, watching pornography, or surfing the internet. These activities are often used to reduce stress and anxiety and/or to alleviate a depressed mood or boredom, and also warrant further investigation in future studies (31).

The MCO in Malaysia came into force on 18 March and ended on 8 June 2020, where subsequently the country moved into more lenient movement control orders. The near 3 months of strict movement control and shutdown of many businesses resulted in striking, negative employment-related consequences. In this study, economic consequences were evident by salary reduction and income losses in a short 3-month period, demonstrating the devastating effect of containment during the epidemic. It is a top priority for the country to plan for effective strategies to support affected households, particularly lower-income groups, in preparation for future pandemic containment. To date, as of the end of August, the pandemic is far from over. Although the country has eased containment measures, with almost all economic sectors resuming operations subject to compliance with recommended practises by the World Health Organisation (WHO), COVID-19 infections continue with single- or double-digit cases reported every day. The relaxation of containment measures after quarantine poses a COVID-19 re-emergence risk, as seen in the recent resurgence in COVID-19 cases in Japan and Australia (32–35). Hence, there is a need for campaigns to keep the public alert to the risks of new epidemics, the need for continuous personal protective behaviours and social distancing, and most importantly to be mentally prepared for the possibility of the reinforcement of outbreak containment.

Additionally, setting up mental health and psychosocial support in disaster situations should be a priority in terms of preparedness of the resurgence of COVID-19 or other pandemics (22).

Findings on coping showed that mindfulness practise followed by physical coping strategies were the most common practises used by the study participants during home confinement. Of note, during the MCO period, the Ministry of Health of Malaysia published well-described guidelines on mental health and psychosocial support in COVID-19 (36, 37). The Ministry of Health of Malaysia and other non-government organisations also set up free mental health hotlines to ease COVID-19 lockdown. High hotline usage was reported high during the MCO period in Malaysia (38, 39). Nonetheless, in this study, only a small proportion reported seeking professional help or reached out for hotlines for coping. This perhaps can be explained by our study participants not being severely affected by the COVID-19 pandemic, making them less likely to utilise hotlines or seek professional help. This is further strengthened by the results of the PLS-SEM demonstrating that help-seeking coping was associated with higher psychological, well-being and lifestyle, and employment impacts.

It is worth mentioning that mindfulness coping was inversely associated with all the three dimensions of impact, with significant associations observed in well-being and lifestyle and employment-related impact. These findings perhaps imply that the impact was decreased as a result of the practise of mindfulness. Numerous studies have reported that mindfulness practise brings about various positive psychological effects, including increased subjective well-being, reduced psychological symptoms and emotional reactivity, and improved behavioural regulation (40). Mindfulness-based e-mental health interventions have been recently reported as an innovative and useful approach to confront the mental health aspects of the COVID-19 pandemic and to support psychologically burdened people (41). Another possible explanation could be that the people who practise mindfulness coping were those who were less impacted in all three dimensions of impact. Due to the cross-sectional design, we cannot determine whether the associations observed are causally related or the potential direction of any effects. With regard to physical coping, however, this study found no significant association between physical coping and all three dimensions of impact. Further studies are warranted to determine the association between physical coping and the impact of quarantine and isolation to contain the COVID-19 pandemic.

It has been postulated that the pandemic's economic consequences may disproportionately affect socially disadvantaged people in society (42), as was also evident in this study. Our finding of an inverse association between income level and all three dimensions of impact in the PLS-SEM infers that people with higher financial means were more likely to experience adverse consequences to confinement during the COVID-19 pandemic. Furthermore, education level was also found to be inversely associated with well-being and lifestyle. Both findings imply that socioeconomic status influenced the impact of containment during the COVID-19 epidemic. Hence, the provision of psychological support and coping, as well

as economic subsidies are essential for lower socio-economic groups. COVID-19 experience and health status were found to have no significant influence on impact in the PLS-SEM.

It is worth noting a few limitations of the present study, particularly concerning the study design and data collection method. Firstly, due to the cross-sectional design, the directionality of the association or the causal relationship between coping and impact could not be established; however, the findings provide a basis for acquiring and testing this causal hypothesis. Due to various resource limitations during the disease crisis and movement restriction in Malaysia, convenience sampling using an online web-based survey via a social media platform may lead to selection bias, as reflected in the large sample of females, people of higher education, and the majority being from the central region. Hence, lower-educated people and people living in remote areas were under-represented. Despite the lack of general population representativeness, which may affect the generalisability of our findings, the current study provides useful first-hand information on the impact on the public during MCO and their coping behaviours. It is also worth pointing out that the MCO period was 18 March to 12 May; however, our survey period was 10 May to 7 July 2020; this study queried participants about impact and coping during the MCO period, so may be subjected to recall bias. In view of the above limitations, the findings of this study should be interpreted with caution. It is also important to note that the total variance explained by the by the PLS-SEM models seems small (5.5–9.5%), therefore caution must be taken when interpreting the results. Despite the limitations mentioned above, this study provides importance insights into the assessment of impact of containment and coping behaviours during the pandemic of infectious disease. Future research should emphasise on conducting quantitative content validation to improve the impact and coping scales developed in this study.

CONCLUSION

Our study found that the developed impact and coping measurements have adequate validity and reliability and can be used in future research. All the constructs in the measurements have an acceptable level of internal consistency. The survey findings revealed that psychological impact was the most prominent, followed by impact on well-being and lifestyle. Mindfulness and physical coping were the most commonly used mechanisms in response to movement containment during the coronavirus pandemic. Exploring the relationship between coping and impact revealed that people who seek for health professional help were those with highest levels of impact in the

psychological, well-being and lifestyle, and employment-related components. Coping through mindfulness practise was found to bring improvements in well-being and lifestyle, as well as employment-related impacts. Encouraging use of helplines and seeking professional help are essential in responding to the COVID-19 pandemic. Promoting mindfulness, coping, and resilience to the unpleasant impacts of quarantine is deemed necessary to face the resurgence of COVID-19 or future pandemics.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Malaya Research Ethics Committee (UM.TNC2/UMREC - 922). The participants provided their online informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LPW, KMT, YL, and ZH planned the study. LPW, HA, KMT, HYL, SA, PSKT, and MM obtained the data. LPW, HA, and MD performed the data analysis and data summarization. LPW drafted the manuscript. All authors critically reviewed the manuscript, gave final approval of the version to be published, agreed on the journal to which the article has been submitted, and agreed to be accountable for all aspects of the work.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2021.787672/full#supplementary-material>

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Psychological Distress During COVID-19 Curfews and Social Distancing in Saudi Arabia: A Cross-Sectional Study

Badrah S. Alghamdi^{1,2†}, Yasser Alatawi^{3*†}, Fahad S. Alshehri^{4†}, Haythum O. Tayeb^{5†}, Hanin AboTaleb¹ and Amal Binsalman²

¹ Department of Physiology, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia, ² Pre-Clinical Research Unit, King Fahad Medical Research Center, King Abdulaziz University, Jeddah, Saudi Arabia, ³ Department of Pharmacy Practice, Faculty of Pharmacy, University of Tabuk, Tabuk, Saudi Arabia, ⁴ Department of Pharmacology and Toxicology, College of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia, ⁵ Division of Neurology, Department of Internal Medicine, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

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*Correspondence:

Yasser Alatawi
yasser@ut.edu.sa

[†]These authors have contributed
equally to this work

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Distress During COVID-19 Curfews
and Social Distancing in Saudi Arabia:
A Cross-Sectional Study.
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Background: Coronavirus disease 2019 (COVID-19) has spread to over 150 countries worldwide. Since the first case of COVID-19 was confirmed in Saudi Arabia, cases have continued to escalate exponentially. The COVID-19 outbreak has had a negative effect on mental health and well-being. The study aimed to investigate the effects of the strict national regulations associated with the COVID-19 pandemic on mental health.

Methods: This was a cross-sectional study of a convenience sample of Saudi residents. Saudi residents aged 18 years or older were invited to complete an online questionnaire after one month of a nationwide 24-h curfew between May 6, 2020 and May 13, 2020. We measured psychological distress using the Depression, Anxiety, and Stress Scale-21 (DASS-21). We ran binary logistic regression analyses to detect variables that significantly predicted DASS-21 scores.

Results: A sample of 2252 participants was recruited from the general population of Saudi Arabia. The DASS-21 score means and standard deviations for depression and anxiety for the whole sample (10.73 ± 10.29 and 6.98 ± 8.30 , respectively) were in the range of mild depression and anxiety. In contrast, the mean DASS-21 stress score was within the normal range (11.97 ± 10.80). The mean stress score for healthcare workers was within the normal range (13.70 ± 10.68) but was significantly higher than the mean score for the public (11.56 ± 10.89 ; $P = 0.0006$). Several variables (e.g., age, gender, and history of contact with confirmed COVID-19 cases) were significantly associated with higher DASS-21 scores.

Conclusions: The COVID-19 pandemic has created a psychological burden. Therefore, there is an urgent need to implement emergency public health interventions that ameliorate the risk perception of COVID-19 through the dissemination of adequate and targeted health information that could be a successful measure to mitigate the psychological impact of the Covid-19 pandemic.

Keywords: mental health, public health, COVID-19, psychological distress, Saudi Arabia

INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory distress syndrome coronavirus 2 (SARS-CoV-2), has developed into a worldwide pandemic since December 2019 (1). As of May 2020, over 4.7 million people have been infected worldwide and there have been more than 300,000 deaths (2). The pandemic has had substantial global health, social and economic effects and resulted in large-scale enforcement of curfew regulations (3, 4).

Pandemics are associated with a significant mental health burden (5–8). Studies demonstrating the mental health impact of COVID-19 have accumulated over recent months. Chinese studies have shown that ~35–50% of people have experienced psychological distress owing to the COVID-19 pandemic (9, 10). Additionally, a multinational study has shown that 26.7% of healthcare workers experienced anxiety symptoms during the outbreaks (11). High rates of psychological distress have also been reported in Australia (12), Italy (13), Mexico (14), the UK (15), France (16), Germany (17), Portugal (18), Brazil (19), Japan (20), Nepal (21), and Iran (22). The mental health burden includes stress, anxiety, depression, post-traumatic stress disorder (PTSD), and insomnia. Several of the above studies indicate that younger age, pre-existing mental health difficulties, and chronic conditions are risk factors of psychological morbidity during pandemics. Because many variables may predispose individuals to psychological distress during pandemics, an increase in health-related anxiety is expected during these periods (23, 24). Disruption to daily economic and social activities as a result of social distancing practices and government lockdown regulations is also associated with substantial distress during pandemics (25). The relationship between the aggressiveness of government lockdown regulations and anxiety has not been sufficiently studied. However, the effects of such regulations on mental health may likely vary depending on the sociodemographic and psychosocial characteristics of the population being studied.

The Kingdom of Saudi Arabia (KSA) provides a model for a systematic, aggressive, nationwide plan to combat pandemics. The government dealt with the COVID-19 pandemic decisively and swiftly. COVID-19 reached the KSA on March 2, 2020, when the first cases were recorded. By March 9, schools were closed, government services scaled-down, and travel restrictions imposed. A full curfew was first imposed on some cities on March 23, 2020 and was then enforced nationwide on April 6, 2020. Public prayers in mosques were suspended. In 2012, the KSA experienced an outbreak of another coronavirus, the Middle East respiratory syndrome coronavirus (MERS-CoV), which may have primed the country and increased the responsiveness of the authorities (26). The potential mental health burden related to COVID-19 in the KSA has not been fully quantified. Although strict restrictions on social and economic activities and travel may cause heightened psychological distress, trust in the authorities' efforts and the potential success of these efforts may mitigate the risk of an increased psychological burden (27). Mental health data from the Saudi setting could provide helpful insights into the determinants of psychological health during pandemics and

contribute to comparative studies across countries. Therefore, in this observational cross-sectional study, we aimed to measure the levels of stress, anxiety, and depression experienced by a sample of the public during the strict regulations associated with the COVID-19 pandemic regulations in the KSA.

MATERIALS AND METHODS

Design and Sample

This study was approved by the research ethics committee of King Abdulaziz University (approval no. 234-20). We recruited a convenience sample of Saudi public citizens and residents aged 18 years or older. Web-based digital data collection has been endorsed as an effective way to gain insights into individuals' physical and psychological well-being during pandemics (28). Therefore, given the travel restrictions and enforcement of social distancing, the sample was recruited from the Internet by distributing the study questionnaire on social media platforms and institutional email services. The questionnaire was prepared using one of the author's institutional accounts in Google Forms, a secure online data collection survey tool that allows participants to answer questions conveniently and anonymously. The questionnaire was distributed between May 6 and May 13, 2020, after a month of a nationwide 24-h curfew (201) (Figure 1). Participants were instructed to fill the survey once.

Sociodemographic and DASS-21 Questionnaire

The survey was disseminated in both English and Arabic to facilitate the participation of individuals skilled in both languages. The survey consisted of two sections. The first section contained questions about sociodemographic variables (age, education, marital status, employment status, income, nationality, and Saudi region of residence). We also asked if participants had been diagnosed with COVID-19, if they were healthcare workers and if they had been in contact with a person who had COVID-19. In addition, we inquired whether participants worked as security personnel (e.g., police), as these individuals are responsible for carrying out and monitoring curfew policies in the streets and may therefore be subjected to unique levels of stress.

The second section of the questionnaire contained the Depression, Anxiety, and Stress Scale-21 (DASS-21) (29). The DASS-21 is a simple and validated tool to assess psychological distress in the clinical setting and the community (26, 30). It consists of 21 questions, seven questions for each of the three target mental health phenomena (depression, anxiety, and stress). The scale provides a cutoff value for each subscale. Participants who score above these cutoff values are considered to show mild, moderate, severe, or extremely severe symptoms (30). The total DASS-21 score is also meaningful and denotes the presence of substantial psychological distress. Previous studies have demonstrated the validity of the DASS-21 compared with clinical psychiatric interviews in screening for depression, anxiety, and stress with reasonable sensitivity and specificity (31, 32). The Arabic version of the DASS-21 has been used in published studies (33–35). The DASS-21 has recently shown

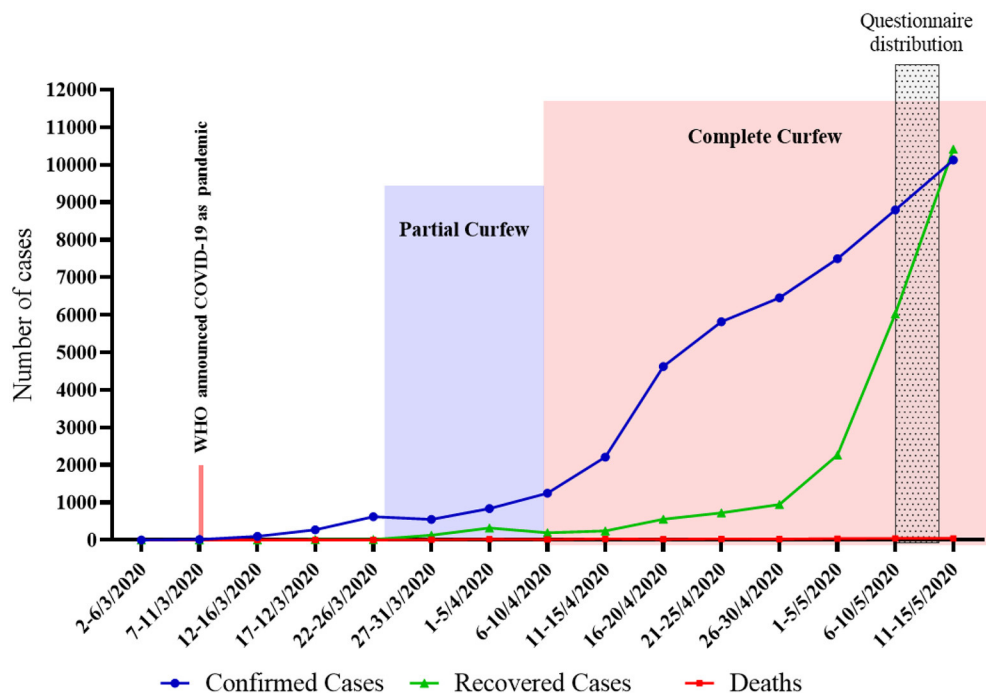


FIGURE 1 | Number of COVID-19 cases in KSA: March 2 (first confirmed case) to May 15 2020. <https://covid19.cdc.gov.sa/ar/daily-updates-ar/>.

meaningful results in several studies in other countries assessing mental health in the context of the COVID-19 pandemic (22, 36).

Sample Size

We used Epi info[®] version 7 to estimate the study sample. The study sample was estimated to be 1651, assuming that 22.1% of the population has psychological distress symptoms (37). The confidence level was set at 95% and the margin of error at 2%.

Statistical Analysis

We used frequencies, percentages, means, and standard deviations for descriptive statistics. We calculated the total and subscale DASS-21 scores and subsequently calculated those scores' means and standard deviations. We used a one-way analysis of variance test and chi-square to search for differences in DASS-21 subscale scores (depression, anxiety, and stress) between participant subgroups of interest (the public, healthcare workers, security personnel), given that healthcare and security personnel may theoretically be subjected to more stress regarding COVID-19. Subsequently, we performed logistic and linear regression analysis to identify risk factors for psychological distress and determine their role in the variability of the DASS-21 subscores. The binary outcomes were coded as "abnormal" for DASS-21 subscores above the established clinical thresholds and as "normal" for scores below those thresholds. We calculated the odds ratios (OR) and 95% confidence intervals (CI) based on the probability of having abnormal DASS-21 subscores. We set the threshold for statistical significance at $P < 0.005$ to minimize

false positives. We performed statistical analysis using SAS software, version 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

We collected a total of 2,334 survey responses. We excluded 64 responses from participants younger than 18 years. Another 18 responses were excluded owing to a discrepancy in the response data. We then analyzed data for the remaining 2,252 responses. The sociodemographic characteristics of all groups are presented in **Table 1**. Most participants were female (65%). Most (60%) were ≤ 38 years; only slightly more than 8% were ≥ 59 years. Nearly 80% of the sample had a Bachelor's degree or higher. A fifth of our participants were unemployed. Most participants (64%) resided in the western region of the KSA. Only 10% were non-Saudi. Healthcare workers and security force personnel represented (19%) and (4.8%) of the total sample, respectively. Only 2% of the sample had been diagnosed with COVID-19.

The means and standard deviations of the depression and anxiety DASS-21 scores for the whole sample (10.73 ± 10.29 and 6.98 ± 8.30 , respectively) were in the range of mild depression and anxiety (**Figure 2**). In contrast, the means and standard deviations of the DASS-21 stress score were within the normal range (11.97 ± 10.80). The mean stress score was within the normal range for healthcare workers (13.70 ± 10.68), but was higher than the mean score of the public (11.56 ± 10.89 ; $P = 0.0006$). There were otherwise no significant differences between DASS-21 scores of the public, healthcare workers, and security force personnel.

TABLE 1 | Sociodemographic characteristics of the study sample.

Variables	Total sample N (%)	Public N (%)	Healthcare workers N (%)	Security forces N (%)
Age (years)				
18–28	797 (35.39)	597 (35.01)	173 (39.59)	27 (24.55)
29–38	551 (24.47)	377 (22.11)	116 (26.54)	58 (52.73)
39–48	402 (17.85)	327 (19.18)	63 (14.42)	12 (10.91)
49–58	311 (13.81)	246 (14.43)	54 (12.36)	11 (10.00)
≥59	191 (8.48)	158 (9.26)	31 (7.09)	2 (1.82)
Gender				
Male	792 (35.17)	550 (32.26)	193 (44.16)	49 (44.55)
Female	1460 (64.83)	1155 (67.74)	244 (55.84)	61 (55.45)
Educational level				
Less than high school	48 (2.13)	43 (2.52)	2 (0.64)	3 (2.73)
High school	415 (18.43)	365 (21.41)	34 (7.78)	16 (14.55)
Bachelor's degree	1,416 (62.88)	1,064 (62.40)	274 (62.70)	78 (70.91)
Master's degree	214 (9.50)	147 (8.62)	55 (12.59)	12 (10.91)
Doctorate	159 (7.06)	86 (5.04)	72 (16.48)	1 (0.91)
Employment				
Employed full-time	939 (41.70)	565 (33.14)	279 (63.84)	95 (86.36)
Employed part-time	84 (3.73)	60 (3.52)	16 (3.66)	8 (7.27)
Unemployed	467 (20.74)	435 (25.51)	32 (7.32)	0 (0)
Student	463 (20.56)	372 (21.82)	88 (20.14)	3 (2.73)
Retired	229 (10.17)	207 (12.14)	19 (4.35)	3 (2.73)
Self-employed	70 (3.11)	66 (3.87)	3 (0.69)	1 (0.91)
Marital status				
Single	851 (37.79)	629 (36.89)	192 (43.94)	30 (27.27)
Married	1,281 (56.88)	983 (57.65)	220 (50.34)	78 (70.91)
Divorced	95 (4.22)	72 (4.22)	21 (4.81)	2 (1.82)
Widowed	25 (1.11)	21 (1.23)	4 (0.92)	0 (0)
Income				
<1331 USD	885 (39.30)	754 (44.22)	122 (27.92)	9 (8.18)
1,331–2,662 USD	504 (22.38)	355 (20.82)	88 (20.14)	61 (55.45)
2,663–5,325 USD	582 (25.84)	440 (25.81)	122 (27.92)	20 (18.18)
<5,325 USD	281 (12.48)	156 (9.15)	105 (24.03)	20 (18.18)
Location				
Middle regions	363 (16.12)	258 (15.13)	77 (17.62)	28 (25.45)
Western regions	1,451 (64.43)	1,082 (63.46)	308 (70.48)	61 (55.45)
Northern regions	111 (4.93)	89 (5.22)	16 (3.66)	6 (5.45)
Southern regions	123 (5.46)	96 (5.63)	17 (3.89)	10 (9.09)
Eastern regions	204 (9.06)	180 (10.56)	19 (4.35)	5 (4.55)
Nationality				
Saudi	2,022 (89.79)	1,542 (90.44)	373 (85.35)	107 (97.27)
Non-Saudi	230 (10.21)	163 (9.56)	64 (14.65)	3 (2.73)
Have you been diagnosed with Covid-19 disease?	Yes	48 (2.13)	33 (1.94)	9 (2.06)
	No	2,204 (97.87)	1,672 (98.06)	428 (97.94)
Has anyone in your family been diagnosed with Covid-19 disease?	Yes	79 (3.51)	57 (3.34)	17 (3.89)
	No	2,173 (96.49)	1,648 (96.66)	420 (96.11)
Have you had contact with any Covid-19 patients?	Yes	59 (2.62)	15 (0.88)	44 (10.07)
	No	2,193 (97.38)	1,690 (99.12)	393 (89.93)

USD, United States dollar; COVID-19, Coronavirus disease 2019.

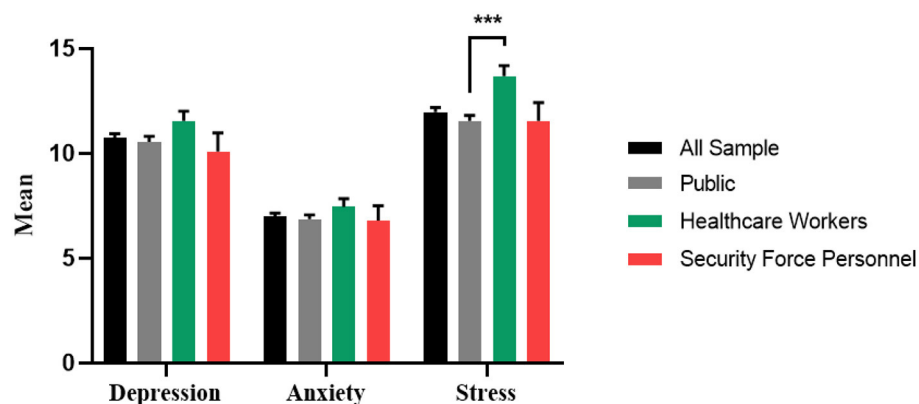


FIGURE 2 | Mean depression, anxiety and stress scores: total sample, public, healthcare workers and security force personnel. *** $P \leq 0.001$.

Figure 3 shows the proportions of participants experiencing different levels of psychological distress as defined by the DASS-21. At least one-third of the population experienced one form of psychological distress. The proportion of healthcare workers who reported stress was significantly higher than that of the public or security personnel ($P = 0.0004$). Otherwise, there were no differences in the proportions of participants with depression or anxiety between the public, healthcare workers, and security personnel ($P = 0.2109$, $P = 0.5662$, respectively).

Using binary logistic regression analysis, we investigated the potential contribution of the independent sociodemographic variables of interest to the DASS-21 subscores (**Figure 4**). Women were more likely to have depression (OR = 1.34, 95% CI = 1.10–1.63, $P = 0.0039$) and stress (OR = 1.40, 95% CI = 1.14–1.72, $P = 0.0015$) than males. Additionally, participants aged ≤ 48 years were more likely to experience abnormal levels of depression, anxiety, and stress compared with participants aged ≥ 59 years ($P < 0.05$). Furthermore, significantly lower levels of depression (OR = 0.43, 95% CI = 0.27–0.68, $P = 0.0003$), anxiety (OR = 0.46, 95% CI = 0.29–0.75, $P = 0.0017$) and stress (OR = 0.48, 95% CI = 0.29–0.78, $P = 0.0033$) were found in participants living in northern regions of the country compared with participants living in middle regions. The public was less likely to have abnormal levels of stress (OR = 0.64, 95% CI = 0.48–0.85, $P = 0.0024$) compared with healthcare workers. Education level, employment status, marital status, income, and nationality had no significant association with DASS-21 subscores. Furthermore, the results of the linear regression models were similar to the logistic regression models, except for the association of being a woman with depression subscore (see **Supplementary Table 1**).

DISCUSSION

This study reports the prevalence of psychological distress in the context of the COVID-19 pandemic and the strict curfew in the KSA. At the time of data collection, the number of COVID-19 cases was climbing exponentially and a nationwide, 24-h curfew had been in effect for an entire month. The literature contains

much evidence that such circumstances during pandemics may result in a considerable burden of psychological distress. In addition to fears of infection and other health-related fears, economic hardship resulting from business and social activities restrictions may place a substantial burden on individuals and families (38, 39). Inevitable differences in perceptions of the effects of authoritative action during pandemics may contribute to increased anxiety or even public unrest. The results from this study show that one-third to one-half of subjects experienced significant levels of psychological distress, with about 10% of the population reporting the most severe level of psychological distress. Some sociodemographic characteristics appeared to be risk factors for higher psychological distress in our sample. Healthcare workers seemed to experience a higher percentage of psychological distress than the public, a finding that is not surprising given previous study findings (11, 39–43). Generally, younger and female subjects in our sample were more prone to psychological distress. This is similar to previous reports in the context of the COVID-19 pandemic (9, 36, 41). It is possible that the effects of sociocultural restrictions on daily life may be greater in young individuals than in older individuals.

In addition, young people may be more likely to follow the news on social media outlets (44). Consistent with our data, recent reports show that Chinese females have more symptoms of PTSD, depression, anxiety, and stress during COVID pandemics (9, 41, 45). Our results indicate that Master's graduates had significantly lower anxiety scores than Ph.D. graduates. Again, this is consistent with Chinese data collected during the COVID-19 pandemic (9). A possible explanation is that educated people are more health aware and tend to monitor their health more frequently (46). Contrary to our results, several studies have reported that low educational level is associated with greater psychological distress (47, 48). This may be because such individuals are 'blunters' of their health risks (i.e., they show avoidant behavior), suggesting a U-shaped association between education and psychological distress during pandemics that requires further study.

The present data are in line with data from other countries in the context of the pandemic and provide additional evidence of

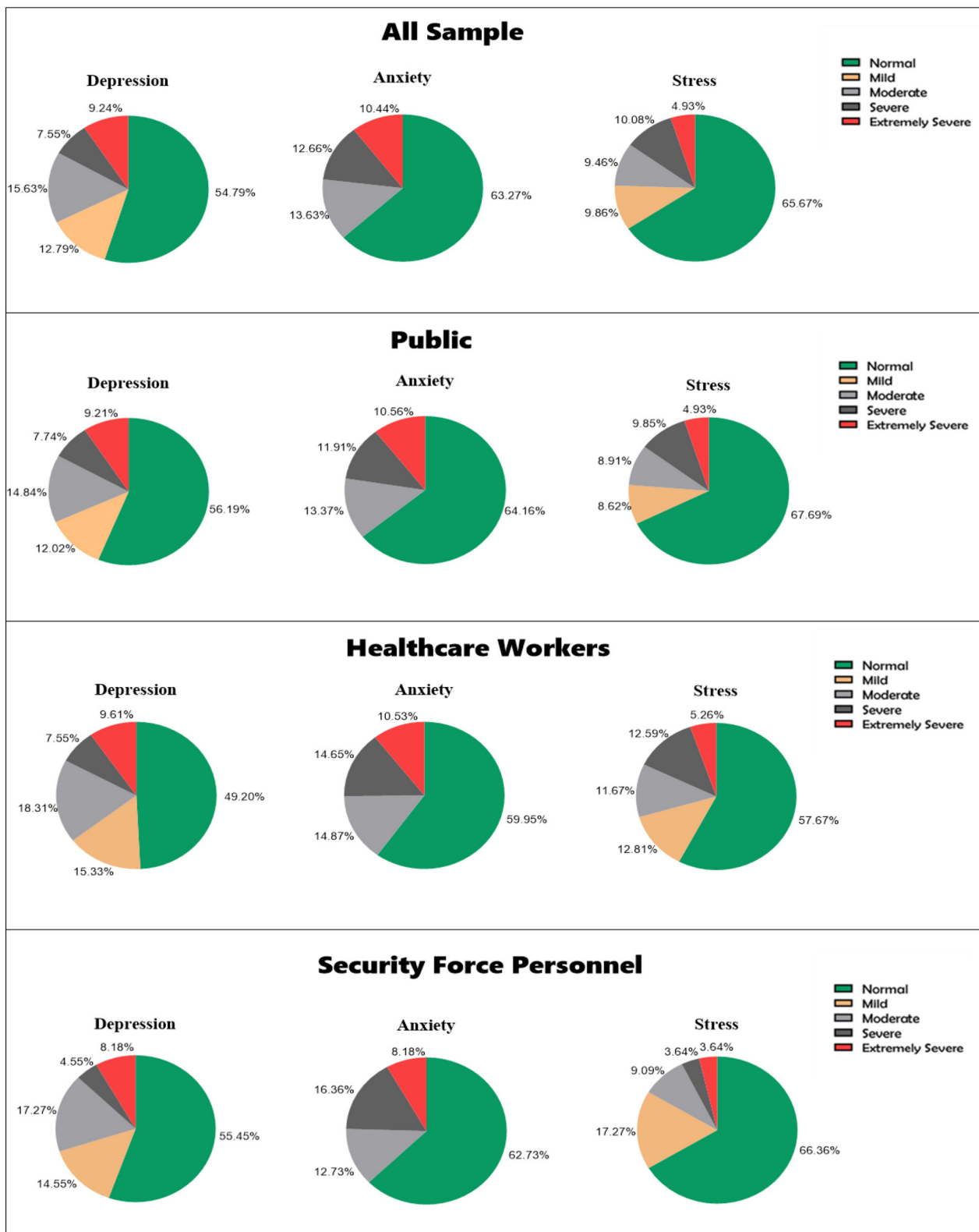
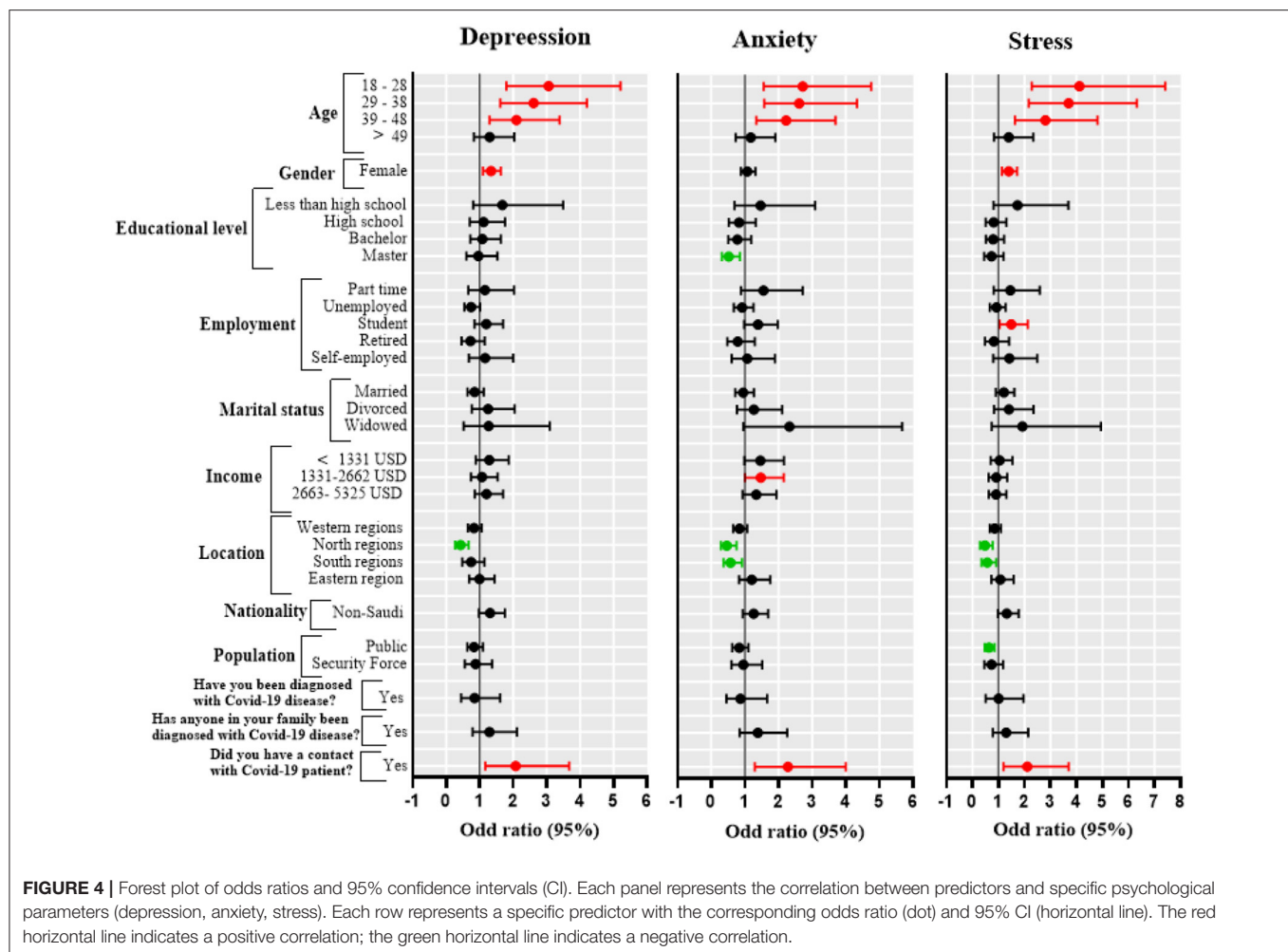


FIGURE 3 | Proportion of participants with different levels of each psychological disorder: total sample.



the mental health burden of the COVID-19 pandemic (9, 10, 12). However (and even though we did not perform a comparative study between countries), there is no evidence from the local Saudi data that the strict curfews and restrictions have led to more severe psychological distress in the KSA than in other countries. The Iranian (22) and Australian (12) populations showed higher DASS scores than Saudi. However, at the time of the Iranian and Australian data collections, there were restrictions on travel and mass gatherings and no strict complete curfews. Scores for Portuguese and Singapore samples were lower than our scores (18, 40), even though the Portuguese study data collection (on March 23) occurred four days after the Portuguese government had declared an emergency state and applied tight restrictions. In the Singapore study, Tan et al. acknowledged the limitations of conducting the study early in the outbreak, limiting the findings' generalizability (40). However, given the many sociocultural, health policy, political and demographic differences between these countries, firm conclusions about the effects of curfews and social restrictions cannot be drawn. Furthermore, the trends in COVID-19 cases and deaths are not homogeneous across countries. The KSA death rate has been one of the lowest in the world (49). The low death rate may be partly related to the strict policies applied in the country and may have indirectly balanced

the potential increase in psychological distress caused by these policies. Another factor that may have balanced out the potential increase in anxiety resulting from tight restrictions is that the curfews and restrictions reduced the chance of individuals coming into contact with COVID-19 cases. Our data show that history of contact with COVID-19 patients was associated with a higher risk of anxiety, which is consistent with previous data showing that the prospect of coming into contact with infected cases during a pandemic significantly increases anxiety during these periods (9, 12, 39, 50).

During pandemics, risk communication with the public plays a crucial role in shaping the psychological response during these difficult times, especially in countries where strict curfews are applied (51). People are more likely to adhere to authority regulations if they believe that the authorities are transparent and provide sufficient clear information. The government of Saudi Arabia held daily press briefings organized and conducted by the Ministry of Health. An application was launched and made available to all citizens. The application allowed people to access data and graphs on pandemic trends and learn about the caseloads in the regions relevant to them (52). Different communication strategies were applied during this pandemic. A media campaign was launched to appeal to

people's logical and emotional sides. The campaign portrayed adherence to health and curfew regulations as a patriotic act and a social responsibility that protects everybody. Evidence suggests that emotional approaches may have a stronger appeal than logical approaches (51, 53). Furthermore, the government instituted heavy fines on breaking curfews to discourage people from spreading the infection, which is another communication strategy that is helpful during pandemics (51).

This study has some limitations. First, this was not a comparative study with simultaneous prospective data collection from different countries; therefore, the data cannot be used to draw firm conclusions about the effect of curfew regulations on a psychological burden during pandemics. Second, we used a convenience sample. This may have resulted in selection bias: individuals with very low or very high anxiety levels may have refrained from participating in the study because they avoid accessing the news media on which the study tool was disseminated. Third, the design was sufficiently powerful to detect significant differences in psychological distress scores but may not have been sufficiently powerful to detect minor differences between some subgroups (such as older adults, who constituted a relatively small proportion of our sample). Fourth, the sample was primarily drawn from the western region of the KSA, limiting the generalizability of the findings to the rest of the country, let alone to other countries.

CONCLUSIONS

To the best of our knowledge, this is the first survey from the KSA to demonstrate the psychological impact of the COVID-19 pandemic. It supplements existing Chinese data on the psychological effects of strict curfews and social restrictions. We showed that there is indeed a psychological burden resulting from the pandemic in the KSA, but that this does not appear to differ from that of other countries with less strict regulations. These findings could inform health policy and further studies to identify appropriate responses to global pandemics. For instance, public health interventions that ameliorate the risk perception of

COVID-19 through the dissemination of adequate and targeted health information could be a successful measure to mitigate the psychological impact of the Covid-19 pandemic. Our data suggest that strict curfews and policy regulations are not necessarily associated with a more significant net psychological burden. However, further studies with purposeful sampling and pre-planned cross-country comparisons are needed.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Committee of King Abdulaziz University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

BA, YA, FA, and HT designed the study, supervised the work and wrote the manuscript. HA and AB collected the data. YA conducted the statistical analysis. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2021.792533/full#supplementary-material>

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Impact of Military Service in Vietnam on Coping and Health Behaviors of Aging Veterans During the COVID-19 Pandemic

Jeanne M. Stellman^{1†}, Steven D. Stellman^{2†}, Avron Spiro III³, Anica Pless Kaiser⁴ and Brian N. Smith⁵

¹ Department of Health Policy and Management, Mailman School of Public Health, Columbia University, New York, NY, United States, ² Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, United States, ³ Massachusetts Veterans Epidemiology Research and Information Center (MAVERIC), VA Boston Healthcare System and Departments of Epidemiology and Psychiatry, Boston University Schools of Public Health and Medicine, Boston, MA, United States, ⁴ National Center for PTSD Behavioral Science Division at VA Boston Healthcare System and Department of Psychiatry, Boston University School of Medicine, Boston, MA, United States, ⁵ National Center for PTSD Women's Health Sciences Division, VA Boston Healthcare System and Department of Psychiatry, Boston University School of Medicine, Boston, MA, United States

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Samer El Hayek,
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Brian O'Toole,
The University of Sydney, Australia

*Correspondence:

Jeanne M. Stellman
jms13@columbia.edu

[†]These authors have contributed
equally to this work and share first
authorship

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Many Vietnam War veterans who experienced military trauma still exhibit PTSD symptomatology. Little is known about how new stressful situations, like the COVID-19 pandemic, affect previously traumatized people or whether they will react differently to them. We explore whether military combat experiences in Vietnam affect veterans' perceived abilities to cope with COVID-19 and whether current PTSD symptoms and later-adulthood reengagement with trauma memories are related to coping. We examine the extent that current PTSD symptoms and trauma reengagement relate to preventive practices. Participants were part of a randomly sampled cohort of American Legionnaires who responded to two previous surveys (1984, 1998), were born 1945–1953 and deployed to Vietnam 1963–1973, thus representing an aging veteran population. A survey supplement assessed coping with the pandemic and adherence to public health guidelines. The response rate was 74% ($N = 507$); 422 (61.6%) completed the COVID-19 supplement. Military experiences were found to affect coping with 41.4% reporting they affected ability to cope with COVID-19. Medium- and high-combat veterans were more likely to report that military experience affected coping than low-combat (OR 2.4, 95% CI 1.51–3.96; 2.6, 95% CI 1.41–4.61, respectively). Those with high PTSD scores had 7.7-fold (95% CI 4.3–13.17) increased likelihood of reporting that their coping was affected, compared to low-PTSD scorers. Few adopted social distancing (4%), staying at home (17%), or ceasing usual activities (32%); high-combat veterans were least likely to stay home. Veterans who practiced handwashing, sanitizer use, mask-wearing, and surface disinfection had significantly higher PTSD scores than those who did not. Veterans with higher scores on the LOSS-SF scale associated more reengagement with trauma memories and were more likely to engage in personal preventive strategies. Analysis of open-ended responses supported these findings. We conclude that fifty years after returning from Vietnam, PTSD scores were high for high-combat veterans,

suggestive of PTSD diagnosis. Military experiences affected coping with COVID both positively and negatively, and may have helped instill useful personal health behaviors. Veterans, especially those with PTSD symptomatology, may have special needs during stressful times, like the COVID-19 pandemic, affecting compliance with recommended practices, as well as their overall health and well-being.

Keywords: Vietnam veterans, COVID-19, PTSD, health behavior, combat, coping, late onset stress symptomatology, aging

INTRODUCTION

Early in the COVID-19 pandemic, Gerber (1), an internist and expert in veterans' health and trauma-informed care, warned of the special burden many Vietnam veterans who had experienced military trauma could face as members of an aging population. (In 2020, the median age of Vietnam veterans was 71) (2). She posited that a number of older veterans would view the COVID-19 pandemic through the lens of their prior wartime experiences and could be retraumatized. Indeed, Gerber described how one of her colleagues, a nurse who had served in Vietnam, "broke when she shared that stories of COVID-19 patients dying in isolation without family at the bedside brought back her time in a Vietnam field hospital caring for mortally wounded soldiers." Retraumatization could be more likely if veterans were forced to become isolated from their usual social support networks by COVID restrictions and preventive practices.

A sizable fraction of the 6.3 million surviving American Vietnam veterans faced heavy combat during their deployment. The cohort from which the current study population was drawn, a random sample of 12,400 male American Legionnaires first assembled in 1983, includes many men who were exposed to combat: 38.1% and 19.4% of these men deployed to Vietnam experienced medium and heavy combat, respectively (3).

Posttraumatic stress disorder (PTSD) symptomatology can vary significantly among veterans with comparable combat experiences, and symptoms within an individual veteran often exhibit a varying course over their lifetime (4–7). PTSD symptoms can also be persistent. In 1998 we observed that 10.5% of our deployed Legionnaires continued to report severe symptoms of PTSD some 25 years after their return from Vietnam (8). Similar findings have been reported in other studies of aging veterans (9, 10). PTSD is also associated with use of maladaptive coping strategies (e.g., substance use, over-working) and poor health behaviors, such as smoking, physical inactivity, and medication nonadherence (11).

Combat veterans who exhibit more PTSD symptoms may have a reduced ability to cope with stressors associated with the COVID-19 pandemic. Sachs-Ericsson and co-workers showed that recent life events associated with PTSD were significantly affected by previous exposure to high levels of combat but not to low levels (12). Similar effects were seen in previously traumatized refugees who were experiencing new critical life events (13).

There also appears to be a relationship between PTSD symptoms and risk perception, with traumatized individuals with clinical or subthreshold levels of PTSD symptoms perceiving

new stressors, unrelated to their original trauma, as more threatening (14). Perceptions of risk, in turn, have also been found to be related to health behaviors (15). With respect to COVID-19, a national survey in the United States found that those who perceived more risk were significantly more likely to engage in frequent handwashing and social distancing (16). It is thus reasonable to hypothesize that veterans with ongoing PTSD symptomatology could have enhanced perception of threats associated with the COVID-19 pandemic and that these perceptions might affect their adherence to recommended public health practices, as well as increase their current levels of distress. Further, those who had experienced military trauma could behave differently from those who did not. Indeed, Haderlein et al. reported that veterans with a clinical diagnosis of PTSD were more likely to receive a COVID-19 test, but were less likely to test positive, which raises the possibility that veterans with PTSD may be perceiving more risk and availing themselves more of testing opportunities (17).

Altered perceptions of risk can also have physiological effects. Experimental studies of undergraduates showed that PTSD symptoms were not only associated with current physical health (e.g., resting blood pressure and heart rate), but also with more negative appraisals of stressors that were presented to them. The more negative appraisals were also associated with increases in cardiovascular response, and threat appraisal was found to mediate the relationship between PTSD symptoms and blood pressure responses (18).

Military Experiences and Subsequent Civilian Life

It is well established that exposure during young adulthood to trauma, such as military combat, increases the risk for development of PTSD symptoms. As veterans age, many also experience loss-related challenges of aging (e.g., bereavement, retirement, role transition and loss, physical and cognitive decline) which can invoke reminders of earlier traumatic events and "lead to increased reminiscence, and possibly distress, among Veterans who had previously dealt successfully with traumatic events" (19). Recent work on a sample of United States (US) veterans from multiple wartime eras found that these effects can be seen across the age spectrum and that pre-pandemic loneliness, depression/PTSD, mindfulness, and purpose in life were most strongly associated with resilience, suggesting that preexisting vulnerability factors, as well as resilience-promoting factors, may also help shape psychological adaptation to the pandemic (7). A study of veterans in the United Kingdom

(UK) similarly observed exacerbation of previous mental health difficulties during the COVID-19 pandemic (20). Another study of UK veterans who had served in the recent Iraq/Afghanistan era found that those who entered the pandemic with existing mental health concerns may be particularly impacted by COVID-19 stressors, further underscoring that the impact of military experiences on coping with the COVID-19 pandemic are not limited to aging Vietnam veterans (21).

Research generally has emphasized negative outcomes associated with war, and especially for older veterans such as those in our study, overlooked processes of reengagement, and in many cases reconciliation with earlier military trauma (22). It is important to note that military service can also provide positive professional experiences, as well as lead to lifelong comradeship and social support networks. Sixsmith and co-workers' observations of British Second World War veterans' wartime and subsequent life experiences showed that for many, their military service provided an opportunity to learn to be more self-sufficient and disciplined and to inculcate habits of personal hygiene (23). Our work with American women who served in military and civilian capacities in Vietnam during the war found that they described many positive aspects of their experiences, such as their sense of camaraderie with their peers and the troops, their ability to meaningfully help others, and the personal and professional growth they experienced by being called upon to carry out work that often expanded their skill set. Had they not been deployed, they would not have experienced many of these opportunities. Many also established enduring friendships and joined organizations, such as The American Legion, related to their service (24).

In the present study we investigated the extent to which early-life military experiences in male US veterans who served in Southeast Asia during the Vietnam War affected their ability to cope with the current COVID-19 pandemic. Specifically, we studied the extent to which prior military experiences and their long-term sequelae, including PTSD symptomatology and later life reengagement with trauma memories, affected their capacity to cope with the pandemic as reflected, for example, in adoption of recommended social and personal protective health behaviors. We sought to answer three questions:

- (1) Did military combat experiences in Vietnam affect veterans' perceived abilities to cope with the COVID-19 pandemic?
- (2) Were current PTSD symptoms and later-adulthood reengagement with trauma memories related to coping?
- (3) To what extent do current PTSD symptoms and trauma reengagement relate to adoption of preventive practices?

MATERIALS AND METHODS

The data were gathered in a long-term study of American Legionnaires of the Vietnam Era begun in 1983 (3, 8). The American Legion is the largest veterans' service organization in the US. From July through October 2020, we surveyed a subgroup of men who had responded to two earlier survey waves in 1984 and 1998 and who had been deployed to Vietnam (as opposed to having been stationed in the United States or elsewhere in the world). Fielding the present survey during the

first summer of the COVID-19 pandemic provided a unique opportunity to investigate whether prior military experiences and combat exposure, as well as their current PTSD symptoms and later life reengagement with trauma memories, affected how these veterans perceived themselves to be coping with the COVID-19 pandemic.

The original cohort of male American Legionnaire veterans was randomly sampled in October 1983 from American Legion Post membership rosters in six States (Colorado, Indiana, Maryland, Minnesota, Ohio, Pennsylvania). The cohort comprised men who had served in the US armed services during the Vietnam era. Efforts were made to include sufficient numbers of men who had been deployed to Vietnam because many more US veterans had served elsewhere in the world during the era. Given the small numbers of women who served in Vietnam (believed to be fewer than 12,000), and their small numbers in Legion rosters, the survey was limited to men. We have reported elsewhere on experiences of female Vietnam veterans (25).

The baseline survey (Wave 1) was fielded in 1984 (3), and a second survey (Wave 2) in 1998 (26). The aims of the study were to obtain and analyze information on the personal, reproductive, family, physical and mental health of the veterans, and on health behaviors, such as smoking, drinking, and substance use, and to determine the extent to which these behaviors and outcomes varied with respect to combat exposure. An additional aim was to characterize the respondents' exposure to herbicides like Agent Orange—using previously developed techniques that have been extensively validated—and its relationship to health outcomes (27, 28). We also considered veterans' attitudes toward and perceptions of the Veterans Administration (VA) and their experiences with its facilities and programs, since the VA is charged with providing for the health and well-being of American veterans (29).

In 2020, we resurveyed a subgroup comprising 729 men who had responded to both previous waves of the survey and, following extensive searches of public records to determine vital status of the original cohort, were believed to be still living. For this pilot survey (Wave 3), we limited the sample to men born 1945–1953, who had been in the armed services between 1963 and 1973, and had deployed to Vietnam.

The survey instrument built upon the one used in Waves 1 and 2, supplemented with additional measures (see below). We included a brief COVID-19 supplement to learn about coping with the pandemic and adoption/use of protective practices. The surveys were mailed with \$5 enclosed and, upon completion, respondents could choose either to receive an additional \$20 or donate it to The American Legion. The survey response rate was 74% (507 responded, 18 additional deaths were discovered, and 26 surveys were undeliverable). Among respondents, 422 men (83%) completed the COVID supplement and comprise the present sample.

Measures

Combat

Combat was assessed at both Waves 1 and 2, using an eight-item Likert scale with five response options (*never to very often*), yielding a total score ranging from 8 to 40 (3, 30, 31). This measure is highly internally consistent (Cronbach's alpha: 0.96,

Wave 1, 0.94 Wave 2), with 0.88 test-retest reliability (32). Combat scores were categorized as low (8-15), medium (16-25), or high (26-40). In the present analysis we used combat exposure as reported in 1984 (Wave 1), since it was closer in time to the event. The 1998 combat score was used for 25 men who had missing items in their 1984 responses. Five veterans without combat scores at either wave were excluded from analyses involving combat exposure.

PTSD Symptoms

To maximize comparability, the same 18-item PTSD measure was administered at all three waves (33). This scale assessed symptom frequency within the past month, using a 5-point response scale, ranging from *Never* to *Very Often*. Items are consistent with the PTSD diagnostic criteria defined by the *Diagnostic and Statistical Manual for Mental Disorders – Version III* (34, 35). Reliability (Cronbach's alpha) was excellent at each wave (0.93 in 1984, 0.95 in 1998, and 0.96 in 2020).

In these analyses, we used the 2020 PTSD data to compute a total score (sum of responses, ranging from 18 – 90) (26, 33). Of the 507 veterans who responded in Wave 3, 20 (4%) did not complete all 18 items at Wave 1. For the 14 men who omitted only one item, and the six that omitted two, we imputed their PTSD scores by substituting the mean of the person-specific mean of 16 or 17 completed items and then summing all 18 items. Using these imputed items for the 20 men increased the mean PTSD score of the sample by <0.01%.

Later-Adulthood Trauma Reengagement

Late-onset stress symptomatology (also known as Later-Adulthood Trauma Reengagement) has been described as a phenomenon of older combat veterans who “experience increased combat-related thoughts, feelings, and reminiscences” that emerge as they get older and suffer age-related stressors/trauma/events (36). We used the 11-item short-form (LOSS-SF) of the 33-item scale originally developed by King et al. (37) to assess this phenomenon. Psychometric properties of the LOSS-SF have been described by Brady et al. (38). The LOSS-SF scale, which is the sum of the 11 items, was highly reliable in our sample (Cronbach's alpha = 0.95). For some analyses of social and preventive practices we categorized the LOSS-SF scale into low [11-24], medium [25-35] and high [36-54] tertiles and calculated odds ratios and trends.

Coping With COVID-19

Respondents were asked whether their military experiences had affected their ability to cope with “the COVID-19 situation” (made it *better*, *worse*, *both better and worse*, or *no impact*). Analyses compared any effect (better, worse, or both) to no effect. We conducted logistic regression analyses of this coping variable using Wave 1 combat scores, Wave 1 and Wave 3 PTSD symptom levels, and Wave 3 LOSS-SF scores as predictors. All respondents were born within a narrow range of years, so we did not control for age.

Open-Ended Responses

Respondents were also provided an open-ended option to further explain how their military experiences may have “helped

or hindered in this situation.” The open-ended question was first coded as yes/no (140 and 282, respectively) to having provided a response. Next, among those who responded, responses were categorized into one of five mutually exclusive categories devised by one author (JMS) and verified by a second (SDS). Discrepancies in scoring were resolved through discussion. The categories were: (1) the military taught them to be disciplined, obey directives and be patient e.g., “Understanding the importance of following the rules” and “hurry up and wait”. (*discipline-patience*); (2) they learned to cope, e.g., “It is what it is.” (*coping*); (3) they explicitly mentioned an emotional need or PTSD, rather than an explicit military experience, e.g., “I have PTSD” (*emotional*); (4) they stated that experiences had neither helped nor hindered (*no effect*); (5) they made a negative or political comment, e.g., “Keeps my anger from the government and news media alive” (*political*). *T*-tests were used to compare the mean values for PTSD and LOSS-SF measures between those who did and did not provide responses in each category.

Preventive Practices

Men were asked whether they engaged in preventive practices regarding COVID. There were three yes/no questions on adoption of *social preventive practices* (social distancing, staying home, carrying out activities as usual) and five three-point response items (*not at all*, *occasionally*, or *frequently*) on *personal preventive practices* (handwashing, sanitizers, wearing masks, wearing gloves, disinfecting surfaces). Analyses of the personal practices contrasted those responding *not at all* or *occasionally* with those responding *frequently*. Because glove wearing was infrequently practiced, it was not analyzed.

Statistical Analysis

Analyses were conducted using SPSS v. 28. Pearson correlations were calculated, means of continuous variables were compared using *t*-tests, distributions were compared using chi-square tests and analysis of variance, and odds ratios were computed using logistic regression.

The study was approved by the Institutional Review Board of Columbia University.

RESULTS

Sample characteristics are described in **Table 1**. By design, the age range at Wave 3 was confined to the interval from 67 to 75 years (born 1945-1953; mean 72.5, standard deviation 1.6). Age is thus not considered to be a likely confounder. The men spent on average 2.8 years in the military (1 year in Vietnam) with a median Vietnam deployment date of August, 1968. The great majority were thus present during the period of peak combat intensity; accordingly, nearly two-thirds (64.3%) experienced medium or heavy combat based on our validated combat scale. It is therefore unsurprising that at baseline (1984), about one-third of the veterans (32.9%) had PTSD scores of at least 49, based on our 18-item PTSD symptom scale (range 18–90). Furthermore, the mean PTSD score increased in a dose-dependent manner with combat exposure, with the heaviest combat veterans scoring 50.9 points on average. Wave 3 introduced the LOSS-SF measure.

TABLE 1 | Characteristics of 422 study respondents who completed the COVID supplement to the Wave 3 Survey*.

Average age at Wave 3, Mean \pm SD	72.5 \pm 1.6
Median month/year began military service	October, 1967
Average no. years in military	2.8
Median month/year deployed to Vietnam	August, 1968
Average no. years spent in Vietnam	1.0
Highest level of education	%
High school graduate or less	36.5
Some college	23.4
Vocational/technical	21.2
College graduate or higher	18.9
Income reported for 2019*	%
Under \$25,000	8.2
\$25,000–\$49,999	43.1
\$50,000–\$99,999	38.8
\$100,000–higher	9.9
Military combat in Vietnam, range 8–40	%
Low (8–15)	35.7
Medium (16–25)	43.9
High (26–40)	20.4
PTSD symptom score, Wave 1	
Percent with score \geq 49	32.9%
Total symptom score, mean \pm SD	43.3 \pm 13.1
PTSD symptom score, wave 1, by level of combat, mean \pm SD	
Low (8–15)	36.9 \pm 10.8
Medium (16–25)	45.1 \pm 11.6
High (26–40)	50.9 \pm 14.5
LOSS-SF score (range 11–55) mean \pm SD	29.6 \pm 9.8
By PTSD symptom score at wave 1	
Low (18–36)	25.9 \pm 9.4
Medium (37–48)	30.7 \pm 10.0
High (49–90)	34.0 \pm 9.8

*There were no significant differences between those who completed the COVID supplement ($n = 422$) and those who did not ($n = 85$), except that a greater percentage of non-completers reported 2019 incomes of \$50,000 or greater (62.2 vs. 48.7%, $p < 0.05$).

Its mean score was 29.6 (SD 9.8), and it similarly increased with combat in a dose-dependent manner. There were no significant differences in any of the foregoing variables between those who did and did not return the COVID supplement, except that income reported in 2020 was significantly higher in those who did not return the supplement.

Military combat was strongly associated with perceived ability to cope with COVID-19. Just over half (51.3%) of veterans with high combat scores responded that their military experience affected their ability to cope with the pandemic, compared to 26.8% of those with low combat scores (OR = 2.9, 95% confidence interval [CI] 1.61–5.14). Since PTSD is clearly related to combat exposure in this cohort (8, 33), we used logistic regression to estimate odds ratios for association of Wave 1 and Wave 3 PTSD symptom scores with perceived coping ability as a binary (yes/no) outcome, as described above (Table 2). Taken separately, PTSD measured at Wave 1 and at Wave 3 were both

TABLE 2 | PTSD and Late Onset Stress Symptomatology (LOSS-SF) scores as predictors of whether military experience affected coping with COVID.

Model no.	Predictor(s)	OR (95% confidence interval)
1	LOSS-SF	1.09 (1.07–1.12)
2	PTSD at Wave 1	Low Ref. Medium 1.10 (0.61–1.98) High 1.37 (0.74–2.52)
	LOSS-SF	1.09 (1.06–1.12)
3	PTSD at Wave 3	Low Ref. Medium 2.12 (1.07–4.17) High 2.44 (1.11–5.37)
	LOSS-SF	1.07 (1.03–1.12)

Odds ratios (ORs) and 95% confidence intervals for association of scores for LOSS-SF, PTSD at Wave 1 (1984), and PTSD at Wave 3 (2020), using logistic regression with coping as binary outcome, and 'no impact' as reference.

LOSS-SF is measured on a continuous scale, range 11–55. PTSD is categorical as Low (18–36), Medium (37–48), or High (49–90).

significant predictors of perceived coping ability; however, the Wave 1 PTSD score is correlated with both PTSD at Wave 3 ($\rho = 0.56$) and LOSS-SF ($\rho = 0.40$), leading to Wave 1 PTSD no longer being a significant predictor in multivariate regressions that included Wave 3 PTSD with or without LOSS-SF (Table 2). The odds ratio for association of the highest level of Wave 3 PTSD with perceived coping, adjusted for LOSS-SF, was 2.44 (95% CI 1.11–5.37) (Table 2).

One-third (33.8%) of veterans who completed the COVID supplement also provided a response to the open-ended coping question (Table 3). Veterans who reported that their military experience affected coping were far more likely to provide an open-ended response than those who said their coping was unaffected (OR = 12.1, 95% CI 7.4–20.0). Veterans with PTSD symptom levels ≥ 49 were more likely to provide a response. Those who commented had an average Wave 3 PTSD score 8.3 points greater than those who did not (47.0 vs. 38.8, $p < 0.001$). Veterans whose responses were categorized as “emotional” had an average Wave 3 PTSD score 11.8 points greater than those with other types of responses (56.8 vs. 45.0, $p = 0.001$). Those whose responses were categorized as “political” had an average Wave 3 PTSD score 9 points greater than those with other types of comments (55.5 vs. 46.5), although this difference was not statistically significant. Veterans whose responses were categorized as “no effect” had an average Wave 3 PTSD score 9.8 points lower than those with other types of comments (38.0 vs. 47.8, $p < 0.05$).

Veterans with higher LOSS-SF scores were also more likely to comment (Table 3). Those who provided a comment had an average LOSS-SF score 5.6 points greater than those who did not (33.3 vs. 27.7, $p < 0.001$), while those whose comments were “emotional” had an average LOSS-SF score 9 points higher than those with other types of comments (40.9 vs. 31.9, $p < 0.001$).

Social Preventive Practices

Few veterans in this sample engaged in social preventive practices (Table 4): 4% practiced social distancing, 16.6% stayed at home;

TABLE 3 | Mean scores (SD) of PTSD and LOSS-SF at Wave 3 for veterans who responded to the open-ended question “Please explain how your military experiences have helped or hindered you in dealing with this situation [COVID-19]”.

	N	PTSD score Wave 3			N	LOSS-SF score Wave 3		
		Mean	(SD)	p-value		Mean	(SD)	p-value
Any open-ended response	132	47.0	(14.5)	***	114	33.3	(9.4)	***
No open-ended response	259	38.8	(14.1)		240	27.7	(9.4)	
Discipline and patience								
Yes	43	46.2	(13.0)	n.s.	39	32.7	(9.2)	n.s.
No [§]	89	47.4	(15.2)		75	33.5	(9.6)	
Emotional								
Yes	22	56.8	(13.9)	***	17	40.9	(6.6)	***
No [§]	110	45.0	(13.8)		97	31.9	(9.2)	
No Effect								
Yes	11	38.0	(10.9)	*	12	29.3	(10.8)	n.s.
No [§]	121	47.8	(14.5)		102	33.7	(9.2)	
Political								
Yes	7	55.5	(11.9)	n.s.	5	37.2	(9.0)	n.s.
No [§]	125	46.5	(14.5)		109	33.1	(9.5)	
Coping								
Yes	30	43.5	(14.8)	n.s.	26	33.4	(8.0)	n.s.
No [§]	102	48.0	(14.3)		88	33.2	(9.9)	

* $p < 0.05$, *** $p < 0.001$, n.s., not significant.

[§]Among veterans who provided at least one open-ended response.

32.3% went about usual activities. However, staying at home varied with Vietnam combat experiences (high combat = 5.7%, medium = 17.8%, low = 20.9%), with high-combat veterans significantly less likely to stay at home compared to low-combat veterans (OR = 0.23, 95% CI 0.08–0.68). Combat was not associated with either social distancing or pursuing usual activities. As shown in **Table 4**, veterans who stayed home had lower mean scores than veterans who did not stay at home both for PTSD (37.5 vs. 42.5, $p < 0.05$) and for LOSS-SF (26.6 vs. 30.1, $p < 0.05$).

Personal Preventive Practices

A large percentage of the veterans reported never or rarely using sanitizers (41.5%) or disinfecting surfaces (57.9%). Handwashing and mask-wearing were practiced frequently (85.5% and 83.0%, respectively). Wave 3 PTSD symptom and LOSS-SF scores were greater in veterans who frequently engaged in all four personal protective practices (handwashing, using sanitizers, wearing masks, disinfecting surfaces). The differences were statistically significant for all LOSS-SF scores, and for all PTSD scores, with the exception of mask-wearing (**Table 4**).

DISCUSSION

For the men in our sample, and for the great majority of those serving in US armed forces during the Vietnam Era, military service occurred in young adulthood. For many, the strict training and discipline associated with their military

service appear to have intersected with their experiences of daily living during the pandemic in both positive and negative ways.

Using a sample of 422 veterans who had been deployed to Vietnam and had responded to previous surveys in 1984 and 1998 and to the COVID supplement in 2020, we examined the impact of their military experience on coping with the COVID-19 pandemic. We also examined whether combat exposure, later-adulthood trauma reengagement, and current PTSD symptom levels were related to their adoption of social and personal preventive practices. Although all respondents had served in Vietnam, their combat experiences varied greatly: 36% had little or no combat exposure while 20% experienced heavy combat. A half-century after their return from Vietnam, the mean PTSD score for the high-combat group reflected clinically significant PTSD symptomatology.

Deployed veterans who experienced medium or high combat exposure more frequently practiced personal protective behaviors, analogous to Sixsmith and co-workers' observations of British Second World War survivors whose wartime and subsequent life experiences had taught them to be self-sufficient and “maintain the level of cleanliness expected of him during his time in the Royal Navy... [and] continue to negotiate and structure their practical lives: managing, resilience and adaptability, and independence” (23). Indeed, about one-third of the open-ended responses in our study fell into the *discipline-patience* category (quoted here verbatim):

“In the Army taking orders what to do and not to do is about. Do as your told and listen makes life continue.”

TABLE 4 | Mean scores (SD) of PTSD at Wave 3 and LOSS-SF according to social and personal preventive practices.

	PTSD score Wave 3				LOSS-SF score Wave 3			
	<i>N</i>	Mean	(SD)	<i>p</i> -value	<i>N</i>	Mean	(SD)	<i>p</i> -value
Social preventive practices								
Social distancing								
No	361	41.6	(14.8)	n.s.	327	29.7	(9.7)	n.s.
Yes	15	45.0	(14.5)		15	30.9	(10.8)	
Staying at home								
No	294	42.5	(14.7)	<0.05	261	30.1	(9.6)	<0.05
Yes	52	37.5	(13.2)		54	26.6	(9.7)	
Activities as usual								
No	95	39.6	(13.7)	n.s.	89	28.1	(9.9)	n.s.
Yes	208	42.4	(15.4)		190	29.7	(10.0)	
Personal preventive practices								
Handwashing								
No	56	34.3	(12.5)	<0.001	50	24.6	(9.4)	<0.001
Yes	330	42.7	(14.8)		302	30.4	(9.7)	
Using sanitizer								
No	150	39.7	(14.2)	<0.05	142	28.0	(9.7)	<0.01
Yes	218	43.4	(15.2)		192	31.1	(9.7)	
Wearing mask								
No	60	38.4	(13.7)	n.s.	59	26.3	(9.2)	<0.01
Yes	318	42.3	(15.0)		286	30.3	(9.8)	
Disinfecting surfaces								
No	201	39.3	(14.1)	<0.001	187	27.9	(9.4)	<0.01
Yes	151	45.0	(15.5)		134	32.4	(9.7)	

“Understanding the importance of following the rules.”

“Hurry up and wait- standing in line.”

“This situation called for strict adherence to the rules for mask wearing, hand washing, distancing, etc. It had to be done and training made me more aware of consequences.”

Similarly, another third of those answering referred explicitly to what the military had taught them:

“Military service groomed me in my ability to cope with covid-19 stress. I am able to deal with following gov’t directions easier.”

“The self discipline to stay home etc. Also to know that the war isn’t won with just one battle.”

The scores reflecting later-adulthood trauma reengagement were significantly related only to having responded at all to the open-ended question and to the “emotional” category and not the categories related to politics and learned behaviors like discipline and patience. Many of the respondents specifically hearkened back to their days in Vietnam.

“Brought back my basic experience of confinement where I observed people around the best taking part in activities and coming and going as they pleased and I was not allowed out of the training area. I don’t like confinement.”

“Tire of death and sickness”

“I was in a bad place, as for difficult place to cope for about 10 months. I seen a lot of experiences about 10–12 bad situations”

“Medical conditions from Agent Orange exposure made it hard to recover from COVID-19”

When the present survey was fielded, COVID-19 had moved beyond the northeastern states into the rest of the United States. Mask-wearing had been mandated in nearly all states where the respondents resided (39), which may explain why mask-wearing is the only social practice in which we observed no significant differences in adoption among combat exposure groups.

The absence of significant differences across combat categories in the qualitative responses supports the contention that the military experience itself provides veterans with positive life experience that can help them through potential adversity and challenges in their post-military lives. By contrast, the magnitude of difference in PTSD between those providing responses and those who did not fill in a response, and the fact that nearly 20% of responses to the open-ended coping question dealt with the veterans’ own emotional health and not with their military experiences, as queried, provides strong support for the negative aspects of the military experience that as Gerber noted, are still powerfully present in many veterans (1). The few men who offered *no effect* comments (their military neither helped nor hindered them in the COVID situation) did not differ significantly from those who did not provide a comment.

Perhaps they were less affected by traumatic exposures while in the military, and as such their military experiences were not as salient in the context of their current lives.

As reported in our earlier survey waves, (26, 33) and in many other studies of Vietnam veterans, combat exposure is significantly related to risk for PTSD symptomatology. Our quantitative data add further evidence that Vietnam veterans carry a special burden affecting their responses to the COVID-19 pandemic. We combined the three coping responses (*easier, more difficult* and *both easier and more difficult*) into a dichotomous any effect/no effect variable, positing that military experiences contribute to both positive and negative coping. The observation that veterans with medium and heavy combat exposure were more likely to respond that their military experiences had affected their ability to cope with COVID is consistent with Sixsmith et al.'s observation that "we tend to investigate wartime experiences through a partial [negative] lens....Wartime experiences and the lives of older people [contain] both positive and negative connotations." Further, it is noteworthy that those with higher levels of PTSD symptoms and trauma reengagement were also more likely to report that their military experiences impacted their ability to cope with the pandemic. Together, these findings underscore the lasting implications of wartime experiences, and are consistent with prior studies showing that trauma histories and related sequelae have implications for coping with future threatening situations (12, 13).

The finding between PTSD severity and staying-at-home behavior is somewhat counter-intuitive. One explanation may be that older veterans with PTSD often report that they try to remain engaged as they report experiencing increased intrusive memories and distress during quieter times when less is going on (22) – which may relate to less stay-at-home behavior. In the words of our respondents:

"I stay busy"

"I miss the interaction with fellow Vietnam Veterans, especially with my civilian friend. Its just not the same."

"Isolation from friends and family members especially grandchildren"

This is also consistent with our work on the importance of social ties during physical distancing (22). As Gerber posits, perhaps "unit cohesion" (transmuting support from one's military unit onto one's family unit) could also help with trauma-related symptoms (1).

Others have observed a relationship between COVID-19 related behaviors and PTSD. Haderlein et al. reported that veterans with a clinical diagnosis of PTSD were more likely to receive a COVID-19 test, but were less likely to test positive, which raises the possibility that veterans with PTSD may be perceiving more risk and hence availing themselves more of testing opportunities (17).

We found that higher PTSD scores were significantly associated with handwashing and disinfecting surfaces, perhaps in response to increased perceived risk. This adherence to COVID-19 preventive practices is an interesting contrast to the group's smoking and drinking habits, where we have consistently observed elevated rates of these habits among those with higher

rates of combat and PTSD (40, 41). Similar findings have been observed in other veteran groups (42). One possible explanation is that handwashing/sanitizers etc. are a kind of drummed in 'military regimented' response that was learned in the service under combat, and that has translated itself to the new dangerous environment in which the veterans found themselves. Two veterans stated, for example:

"The safety washing hand and wearing a mask, taking orders from the Governor, as he wishes"

"Living day to day. Learning to respect senior decisions. Respect others as you want to be respected. Staying clean, to stay healthy. Self-discipline to wear masks where necessary and make every trip to town multi-purposeful. Difficulty- media coverage is politically directed as was the news from Vietnam making my decisions more difficult"

These findings support the importance of examining PTSD and potential health correlates across the life course (43). Also, despite disagreements about the risks, people perceiving greater risks were more likely to implement protective behaviors—especially later (vs. earlier) in March 2020. These findings have implications for risk communication (16).

In our PTSD scale 17 of the 18 items are nearly identical to those in the Posttraumatic Stress Disorder Checklist (PCL) based on DSM-IV (range 17–85) (44), with the additional question making the range of our measure 18–90. A PCL score of 44 is often considered indicative of a diagnosis of PTSD (45, 46). Our mean symptom score for high-combat respondents is 51.0 (± 14.5), and arguably consistent with a probable diagnosis of PTSD. We are currently examining the trajectory of the PTSD symptomatology in this group. Some of the symptoms in this aging population may be late onset. Whatever the course, a large number of men continue to carry psychological burdens related to their service in Vietnam. Our data may underestimate the extent of PTSD among all Vietnam veterans because participants are American Legionnaires who have joined a social organization despite possible PTSD symptoms. It is likely that some with PTSD would not be sufficiently high functioning or have the resources or emotional readiness to be involved in such an organization.

Veterans who endorsed thinking more about their military experiences and reengaging with trauma memories (reflected by higher scores on the LOSS-SF scale) were more likely to engage in personal preventive strategies. It is possible that those veterans who were engaged in a process of life review and making meaning of past military experiences were primed to consider their safety during the COVID-19 pandemic. At the same time, these veterans were less likely to engage in social preventive practices. This may be related to the nature of the later-adulthood trauma reengagement process – instead of avoiding people or situations due to perceived threat or trauma reminders, these veterans may actively seek out wartime friends and opportunities to talk with others about their military experiences. This process unfolds within a social context, and may partially explain these findings.

The associations between military trauma and PTSD symptomatology are well established, but the relationship between the psychological aftermath of deployment and war zone combat and subsequent reactions to new stressful or

threatening situations has not been widely studied. Although more research is needed, clinicians and policymakers should be aware that these populations may be at special risk, especially since adherence to recommended public health practices is essential to controlling the COVID-19 pandemic and similar future emergencies. Veterans may benefit from programs and interventions designed to foster resilience in their personal lives and in the maintenance of relationships and support networks. Despite the passage of time, many veterans who served their country in Vietnam are, indeed, still burdened with “the things they carry” (47). A deeper understanding underlying dynamics of personal behaviors and reactions in this large group is thus an urgent need, as are expanded public health initiatives to provide assistance.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because our agreement with the American Legion to gain access to their private membership was that the data would not be shared. Requests to access the datasets should be directed to Jeanne M. Stellman, jms13@columbia.edu.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board, Columbia University.

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Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

JS and SS created the original cohort, led the first two research waves, and they carried out the analyses. AS, APK, and BS contributed significantly to the modification of the Wave 1 and Wave 2 surveys and participated in conceptualization, analysis, and writing. All authors contributed to the article and approved the submitted version.

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How to Reduce Mental Health Burden in Health Care Workers During COVID-19?—A Scoping Review of Guideline Recommendations

Theresa Halms^{1,2*}, Martina Strasser¹, Miriam Kunz² and Alkomiet Hasan¹

¹ Medical Faculty, Department of Psychiatry, Psychotherapy and Psychosomatics, Bezirkskrankenhaus Augsburg, University of Augsburg, Augsburg, Germany, ² Medical Faculty, Department of Medical Psychology and Sociology, University of Augsburg, Augsburg, Germany

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*Correspondence:

Theresa Halms
theresa.halms@med.uni-augsburg.de

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The COVID-19 pandemic has posed an unprecedented demand and a huge burden for healthcare workers (HCWs) worldwide, with alarming reports of heightened mental health problems. To counteract these mental health challenges, guidelines and recommendations for the support of HCWs during the COVID-19 pandemic have been published. With this scoping review and guideline evaluation, we aim to provide a critical overview of these guidelines and recommendations and to guide policy makers in establishing respective surveillance and care programs. In summary, 41 articles were included in this review which were published between April 2020 and May 2021. Across all articles, the guidelines and recommendations could be clustered into four main categories: “Social/structural support,” “Work environment,” “Communication/Information,” “Mental health support.” Although there was substantial agreement across articles about the recommendations given, empirical evidence on the effectiveness of these recommendations is still lacking. Moreover, most recommendations were developed without involving different members of the target group (HCWs) or other involved stakeholders. Strategies to detect potential barriers and to implement these guidelines in clinical practice are lacking.

Keywords: mental health, COVID-19, healthcare workers, recommendations, resilience

INTRODUCTION

The COVID-19 pandemic has posed an unprecedented demand and a huge challenge for healthcare workers (HCW), including physicians, nurses, interns, allied health professionals and other people working in the healthcare sector, worldwide for more than a year now. A meta-analysis (including 117 studies) investigating the impact of viral pandemics or epidemic outbreaks on HCWs' mental health showed increased levels of anxiety, depression and PTSD in HCWs during and after the outbreaks (1), which were associated with younger age, female gender, lack of social support, working in a high-risk environment and limited job experience (amongst others) (1). Similar findings were reported in another review article focusing exclusively on COVID-19, which showed that poor mental health outcomes were higher in nurses and were linked to inadequate personal protective equipment (PPE), fear of infection and heavy workload (2). Given these alarming reports, the question has been voiced of what can be done to protect HCWs and to reduce the risk of mental health burden during pandemic outbreaks in this crucial target group.

So far, numerous researchers, scientific institutions and health facilities have come forward with recommendations and guidelines on how to provide mental health support for HCWs and to mitigate the negative psychological outcomes of the COVID-19 pandemic. These recommendations range from minor suggestions to complex interventions and differ greatly in the underlying evidence. Due to the lack of scientific studies investigating the effectiveness of the suggested interventions and recommendations, it is uncertain whether they are indeed beneficial to HCWs. Little is known to which extent these guidelines are evidence or consensus-based or even representative. Non-evidence-based guidelines without formal consensus-processes have a significant risk of bias regarding the development of selected recommendations by specific stakeholder groups driven by individual conflicts of interest (3). Moreover, guidelines and recommendation papers can be considered instruments of quality management of the healthcare system aiming at improving quality and effectiveness of diagnostic and treatment procedures (4). Based on this framework, we conducted this scoping review to provide a comprehensive overview on published guidelines and recommendations for the support of HCWs during the COVID-19 pandemic and to critically evaluate these. The overall goal is to provide a comprehensive overview of the available evidence in order to guide policy makers in developing surveillance and care programs to improve mental health in healthcare workers during the pandemic.

METHODS

The search for recommendations and guidelines for the support of HCWs during the COVID-19 pandemic was carried out performing a systematic search using the literature databases PubMed, Cochrane Library and EMBASE using the following keywords: “COVID-19,” “mental health,” “resilience,” “health personnel” and “recommendations.” The search was carried out in May 2021 and all articles included were published between April 2020 and May 2021. Articles were excluded if they did not focus on the support of HCWs during the COVID-19 pandemic, included secondary literature such as pre-existing guidelines and recommendations, were in a language other than English or German or did not include any recommendations or guidance. The present review has been registered with the Open Science Framework (OSF): <https://doi.org/10.17605/OSF.IO/6E4XZ>.

Quality of the Guidelines

Two assessors independently evaluated the included articles using the AGREE II instrument. As stated in the instructions of the AGREE II instrument (5), specific items may not be applicable to particular guidelines. We had to adjust this instrument (which focuses on clinical guidelines) to the given context and thus excluded several items. Items 11, 16, and 21 were excluded due to their inapplicability to non-clinical guidelines and recommendation papers. Items 10, 13, 14, 17, 20, 22, and 23 were excluded as the in this assessment included articles do not meet the methodological or formal requirements needed

in order to apply these items. Each item was rated on a 7-point scale (1- strongly disagree to 7- strongly agree). Scaled domain scores were calculated as percentages of the maximum possible scores, according to the AGREE II methodology, using the following formula: (obtained score-minimum possible score) / (maximum possible score-minimum possible score), where the “obtained score” is the sum of the appraisers scores for each domain [see paragraph IV. Scoring the AGREE II (5)]. Hence, the discrepancies between the two assessors were considered during the process of evaluation. As reported in other studies using the AGREE II instrument, we considered a value >60% using the modified scale as a sufficient quality score and a value >80% as a good quality score (6, 7).

Content of the Guidelines

To provide an overview on the types of recommendations given, two assessors extracted the recommendations and grouped them into different categories and within each category, into different topics. During a mutual process, key topics were derived from the given recommendations and recommendations were assigned to their respective key topic. However, recommendations that were mentioned in <5 out of the included 41 articles and could not be assigned to any of the existing key topics were excluded from the presented overview. The type of categories and topics are reported, together with the total number of articles including each recommendation.

RESULTS

Figure 1 gives an overview of the article selection process. Most of the guidelines covered aspects and interventions on either an individual or an organizational level, whereas only a small number of articles focused on recommendations on a societal level.

Quality of the Guidelines: Assessment via AGREE II

Table 1 provides a detailed overview of the outcomes per article.

Scope and Purpose

This domain evaluates whether the main objectives and the target population were specifically described. The median score of the scope and purpose domain was 75.00% (range 42–94%). Most articles described their overall objectives, questions and target populations sufficiently, however, five articles scored below the pre-specified value of 60%, which we considered to be the threshold value of a sufficient quality score.

Stakeholder Involvement

This domain assesses whether the guideline was developed by including individuals from all relevant professional groups. The median score of this domain was rather poor and reached only 44.44% (range 25–69%). Only five articles scored above 60% in this domain and very few articles considered the views and preferences of the target population (namely HCWs).

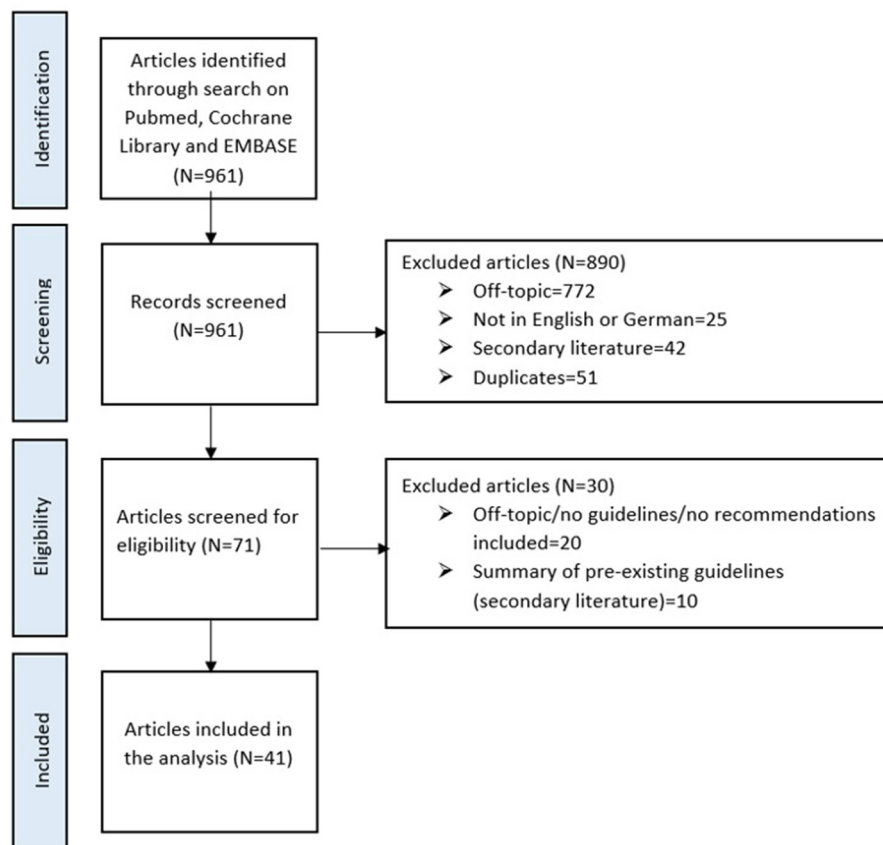


FIGURE 1 | Flow chart of the literature search and selection of articles to be included in this review.

Rigor of Development

This domain assesses the quality of the evidence underlying the recommendations. The median score of the domain rigor of development was very poor and only reached 25.00% (range 7–67%). Apart from one article, all articles scored below 60%.

Clarity and Presentation

This domain evaluates whether the recommendations are specific and unambiguous. The median score of this domain was 58.33% (range 25–100%). Approximately half of the included articles scored under 60%.

Application

This domain focuses on factors related to guideline implementation. The median score of this domain was 33.33% (range 8–79%). Out of the included articles, 38 received scores under 60%. Most of the guidelines failed to describe facilitators and barriers to the implementation of the suggested recommendations.

Overall Assessment

This assessment requires a judgement as to the overall quality of the guidelines. Overall, the guidelines achieved a mean score of 46.24% (range 29–67%). Out of the included articles, 37 scored

below the 60% mark. Hence, according to the assessment, only four guidelines would fulfill methodological standards to reduce the risk of bias.

Content of the Guidelines: Types of Recommendations Given

Specific recommendations have been identified and were clustered into four different categories. These categories and their respective key topics are displayed in **Figure 2**. A detailed overview on which key topic was included in which article can be found in **Table 2**. Out of the included articles, physicians were mentioned as the target occupational group in 11 articles, while nurses were mentioned in 12 articles. Management employees were mentioned in only one article, as well as specialist interns and patients or family members of patients. Allied health professionals, such as midwives or paramedics, were among the target occupational groups in 5 articles. Unfortunately, the majority of the articles (21 out of 41) did not further specify the term HCWs.

Category “Social/Structural Support”

Within this category, **four** key topics were identified. As displayed in **Figure 2**, several articles highlighted the importance of “appreciation” of HCWs by the employers and/or the general

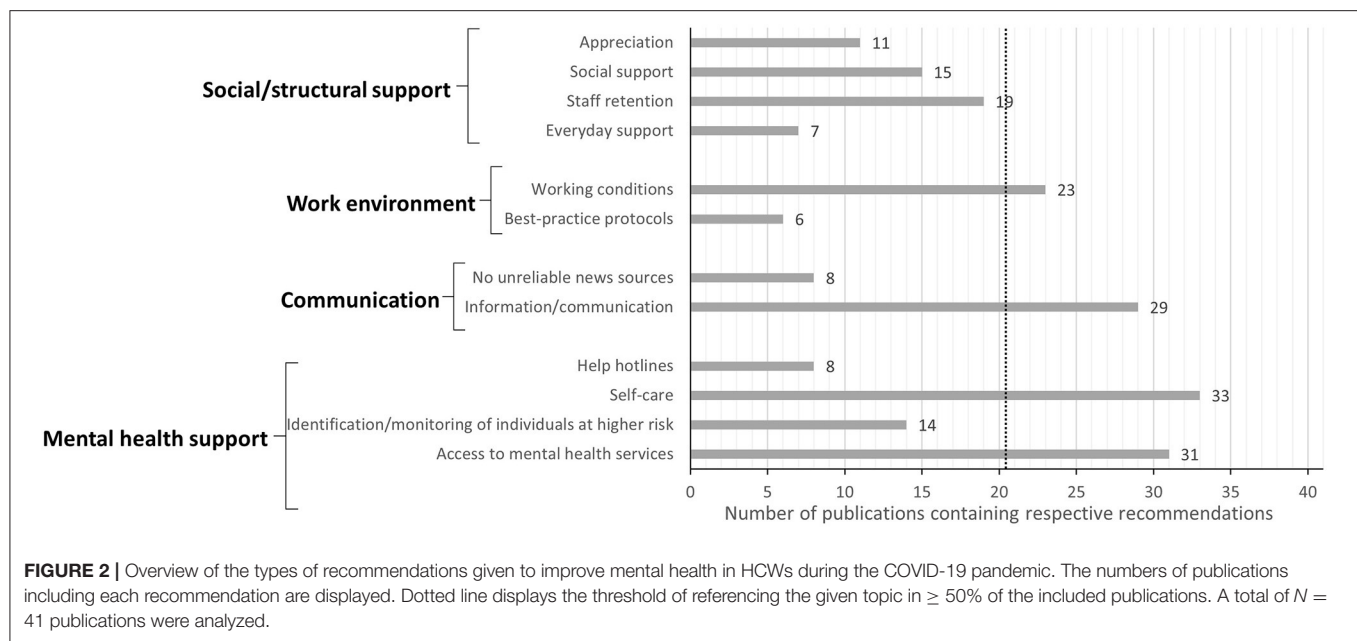
TABLE 1 | Domain scores calculated according to the AGREE II methodology for each of the included articles.

Authors	Title	Scope and purpose	Stakeholder involvement	Rigor of development	Clarity and presentation	Application	Overall assessment
Ahmed et al. (8)	How and when does inclusive leadership curb psychological distress during a crisis? evidence from the COVID-19 outbreak.	65.28%	66.67%	54.17%	54.17%	27.08%	54.17%
Albott et al. (9)	Battle buddies: rapid deployment of a psychological resilience intervention for health care workers during the COVID-19 pandemic.	91.67%	54.17%	54.17%	100.00%	79.17%	66.67%
Alnazly et al. (10)	Anxiety, depression, stress, fear and social support during COVID-19 pandemic among Jordanian healthcare workers.	83.33%	38.89%	14.58%	50.00%	16.67%	33.33%
Arnsten et al. (11)	Physician distress and burnout: the neurobiological perspective.	91.67%	36.11%	28.13%	58.33%	16.67%	41.67%
Awais et al. (12)	Paramedics in pandemics: protecting the mental wellness of those behind enemy lines.	69.44%	31.94%	17.71%	58.33%	35.42%	41.67%
Berkow et al. (13)	An executive strategy to support long-term clinician engagement amid the COVID-19 pandemic.	75.00%	47.22%	21.88%	62.50%	27.08%	45.83%
Billings et al. (14)	Supporting hospital staff during COVID-19: early interventions.	43.06%	34.72%	12.50%	70.83%	33.33%	33.33%
Boktor et al. (15)	Stress and anxiety management during the COVID-19 pandemic (lessons learnt from a cohort of orthopedic registrars redeployed to ITU).	72.22%	63.89%	20.83%	75.00%	20.83%	41.67%
Chew et al. (16)	Psychological and coping responses of health care workers toward emerging infectious disease outbreaks: a rapid review and practical implications for the COVID-19 pandemic.	94.44%	56.94%	67.71%	58.33%	37.50%	66.67%
Collins (17)	COVID-19: nurses have responded, now it is time to support them as we move forward.	65.28%	41.67%	15.63%	75.00%	45.83%	45.83%
Creese et al. (18)	"We all really need to just take a breath": composite narratives of hospital doctors' well-being during the COVID-19 pandemic.	83.33%	55.56%	36.46%	25.00%	33.33%	45.83%
Donnelly et al. (19)	Well-being during coronavirus disease 2019: A PICU practical perspective.	76.39%	56.94%	28.13%	70.83%	56.25%	50.00%
Everly et al. (20)	Leadership principles to decrease psychological casualties in COVID-19 and other disasters of uncertainty.	77.78%	36.11%	27.08%	75.00%	41.67%	50.00%
Fukuti et al. (21)	How institutions can protect the mental health and psychosocial well-being of their healthcare workers in the current COVID-19 pandemic.	77.78%	50.00%	28.13%	75.00%	50.00%	50.00%
Gilleen et al. (22)	Impact of the COVID-19 pandemic on the mental health and well-being of UK healthcare workers.	77.78%	36.11%	18.75%	25.00%	8.33%	29.17%
Gray et al. (23)	A "mental health PPE" model of proactive mental health support for frontline health care workers during the COVID-19 pandemic.	94.44%	68.06%	32.29%	83.33%	70.83%	58.33%
Greenberg (24)	Mental health of health-care workers in the COVID-19 era.	69.44%	40.28%	25.00%	50.00%	37.50%	41.67%
Greenberg et al. (25)	How might the NHS protect the mental health of health-care workers after the COVID-19 crisis?	52.78%	27.78%	20.83%	25.00%	20.83%	33.33%
Hossain et al. (26)	Self-care strategies in response to nurses' moral injury during COVID-19 pandemic.	91.67%	41.67%	14.58%	83.33%	33.33%	41.67%
Hou et al. (27)	Social support and mental health among health care workers during coronavirus disease 2019 outbreak: a moderated mediation model.	76.39%	30.56%	53.13%	33.33%	29.17%	50.00%

(Continued)

TABLE 1 | Continued

Authors	Title	Scope and purpose	Stakeholder involvement	Rigor of development	Clarity and presentation	Application	Overall assessment
Kamran et al. (28)	Effective recommendations for reducing anxiety and depression caused by COVID-19 outbreak in medical staff.	41.67%	25.00%	14.58%	70.83%	25.00%	33.33%
Karnatovskaia et al. (29)	Stress and fear: clinical implications for providers and patients (in the time of COVID-19 and beyond).	69.44%	51.39%	44.79%	91.67%	50.00%	58.33%
Kiser et al. (30)	When the dust settles: preventing a mental health crisis in COVID-19 clinicians.	47.22%	34.72%	10.42%	33.33%	12.50%	29.17%
Labrague et al. (31)	COVID-19 anxiety among front-line nurses: predictive role of organizational support, personal resilience and social support.	86.11%	69.44%	59.38%	50.00%	33.33%	66.67%
Li et al. (32)	Anxiety and related factors in frontline clinical nurses fighting COVID-19 in Wuhan.	91.67%	59.72%	32.29%	50.00%	37.50%	50.00%
Lissoni et al. (33)	Promoting resilience in the acute phase of the COVID-19 pandemic: psychological interventions for intensive care unit (ICU) clinicians and family members.	66.67%	52.78%	20.83%	58.33%	29.17%	45.83%
Markey et al. (34)	Cultivating ethical leadership in the recovery of COVID-19.	79.17%	51.39%	33.33%	41.67%	29.17%	45.83%
Miotto et al. (35)	Implementing an emotional support and mental health response plan for healthcare workers during the COVID-19 pandemic.	72.22%	47.22%	25.00%	50.00%	29.17%	45.83%
Orellano et al. (36)	Peruvian guideline to care the mental health of health providers during COVID-19 pandemic.	77.78%	25.00%	7.29%	58.33%	20.83%	29.17%
Owen et al. (37)	Leadership after a crisis: the application of psychological first aid.	61.11%	38.89%	16.67%	66.67%	29.17%	37.50%
Raudenská et al. (38)	Occupational burnout syndrome and post-traumatic stress among healthcare professionals during the novel coronavirus disease 2019 (COVID-19) pandemic.	83.33%	48.61%	40.63%	41.67%	16.67%	50.00%
Restauri et al. (39)	Burnout and posttraumatic stress disorder in the coronavirus disease 2019 (COVID-19) pandemic: intersection, impact, and interventions.	91.67%	50.00%	45.83%	91.67%	58.33%	62.50%
Ripp et al. (40)	Attending to the emotional well-being of the health care workforce in a New York City health system during the COVID-19 pandemic.	69.44%	61.11%	21.88%	75.00%	62.50%	58.33%
Schneider et al. (41)	Factors mediating the psychological well-being of healthcare workers responding to global pandemics: a systematic review.	75.00%	33.33%	32.29%	33.33%	50.00%	33.33%
Taylor et al. (42)	Mental health treatment for front-line clinicians during and after the coronavirus disease 2019 (COVID-19) pandemic: a Plea to the medical community.	51.39%	36.11%	25.00%	41.67%	54.17%	41.67%
Tomlin et al. (43)	Psychosocial support for healthcare workers during the COVID-19 pandemic.	88.89%	48.61%	32.29%	83.33%	54.17%	58.33%
Tracy et al. (44)	What should be done to support the mental health of healthcare staff treating COVID-19 patients?	73.61%	37.50%	20.83%	75.00%	45.83%	50.00%
Widjaja et al. (45)	Health issues among healthcare workers during COVID-19 pandemic: a psychosomatic approach.	63.89%	41.67%	36.46%	50.00%	33.33%	41.67%
Wilson et al. (46)	Caring for the carers: ensuring the provision of quality maternity care during a global pandemic.	86.11%	38.89%	18.75%	75.00%	45.83%	41.67%
Wong et al. (47)	Healing the healer: protecting emergency health care workers' mental health during COVID-19.	65.28%	51.39%	37.50%	83.33%	54.17%	50.00%
Wu et al. (48)	COVID-19: peer support and crisis communication strategies to promote institutional resilience.	66.67%	44.44%	25.00%	58.33%	33.33%	45.83%



public and recommended to raise more awareness for this aspect. The second key topic features recommendations revolving around the “social support” of HCWs that should be given by a variety of sources, such as family, friends, partners or coworkers. Furthermore, 19 out of the included 41 articles recommended to implement “staff retention,” for example by ensuring adequate compensation, rotating staff, mixing skills or deprioritizing non-essential work projects. Recommendations aiming at everyday support of HCWs (e.g., by providing free transportation, offering more childcare and providing adequate accommodation) were included in seven articles.

Category “Work Environment”

Recommendations concerning the work environment of HCWs can be summarized into two key topics: “working conditions” and “best practice protocols.” Recommendations regarding “working conditions” were mentioned in more than half of the included articles (see **Figure 2**). Here, suggestions to create a safe and employee-oriented work environment were laid out and included aspects such as providing adequate personal protective equipment (PPE) as well as providing ethics education, leadership training to supervisors, specialized job training and promoting professional development. Other strategies frequently recommended to ensure a safe work environment were infection control training and avoiding non-specific and mandatory interventions. The second key topic focuses on best-practice protocols to ensure the safety of clinical procedures. Such protocols include mandatory measures for minimizing HCWs’ risk of contracting and spreading the coronavirus.

Category “Communication”

The category “communication” again covers two key topics: “no unreliable news sources” and “information/communication.” The first topic refers to recommendations concerning the use of

news sources and social media. The second topic refers to how crucial information should be best communicated between team members and supervisors to ensure reliable information transfer (this was mentioned very frequently in 29 articles, see **Figure 2**).

Category “Mental Health Support”

This category focuses on recommendations concerning the mental health support of HCWs during and after the pandemic. Recommendations within this category were summarized into four key topics (see **Figure 2**). One key topic was “help hotlines” intended to provide mental health support while maintaining anonymity. Furthermore, the early identification and the active monitoring of individuals who show early signs of mental illnesses or who are at higher risk of developing mental problems was mentioned frequently. Recommendations focusing on the access to mental health services (psychiatric care or occupational therapy) were also mentioned very often (see **Figure 2**). Recommendations on “self-care” were mentioned most frequently (33 of the included 41 articles). Here, strategies such as self-help groups, peer support and team cohesion as well as encouraging well-being practices on an organizational level were mentioned in more than 50% of the 33 articles. Other strategies to promote self-care included guidance on resilience, stress management and mental health, providing the opportunity to talk to staff members, practicing self-care on an individual level and psychoeducation as well as resilience-building training.

DISCUSSION

Given the potentially wide-ranging mental health impact of COVID-19, protecting HCWs from adverse psychological effects and promoting their mental health and general well-being is critical. Over the course of the last year, several articles have been published, which provide suggestions and guidelines on how to

TABLE 2 | Overview of the key topics included in each publication.

Authors	Title	Appreciation	Social support	Staff retention	Everyday support	Working conditions	Best-practice protocols	No unreliable news sources	Information/communication	Help hotlines	Self-care	Identification/monitoring of individuals at higher risk	Access to mental health services
Ahmed et al. (8)	How and when does inclusive leadership curb psychological distress during a crisis? evidence from the COVID-19 outbreak.			✓		✓							✓
Albott et al. (9)	Battle buddies: rapid deployment of a psychological resilience intervention for health care workers during the COVID-19 pandemic.		✓			✓	✓	✓	✓	✓	✓		✓
Alnazly et al. (10)	Anxiety, depression, stress, fear and social support during COVID-19 pandemic among Jordanian healthcare workers.				✓	✓					✓		✓
Arnsten et al. (11)	Physician distress and burnout: the neurobiological perspective.		✓	✓					✓		✓		
Awais et al. (12)	Paramedics in pandemics: protecting the mental wellness of those behind enemy lines.	✓		✓		✓	✓		✓		✓		✓
Berkow et al. (13)	An executive strategy to support long-term clinician engagement amid the COVID-19 pandemic.			✓		✓	✓		✓				
Billings et al. (14)	Supporting hospital staff during COVID-19: early interventions.		✓	✓		✓			✓		✓	✓	✓
Boktor et al. (15)	Stress and anxiety management during the COVID-19 pandemic (lessons learnt from a cohort of orthopedic registrars redeployed to ITU).			✓							✓	✓	✓

(Continued)

TABLE 2 | Continued

Authors	Title	Appreciation	Social support	Staff retention	Everyday support	Working conditions	Best-practice protocols	No unreliable news sources	Information/communication	Help hotlines	Self-care	Identification/monitoring of individuals at higher risk	Access to mental health services
Chew et al. (16)	Psychological and coping responses of health care workers toward emerging infectious disease outbreaks: a rapid review and practical implications for the COVID-19 pandemic.	✓							✓		✓	✓	✓
Collins (17)	COVID-19: nurses have responded, now it is time to support them as we move forward.												
Creese et al. (18)	"We all really need to just take a breath": composite narratives of hospital doctors' well-being during the COVID-19 pandemic.		✓	✓	✓	✓			✓		✓		✓
Donnelly et al. (19)	Well-being during coronavirus disease 2019: A PICU practical perspective.	✓							✓		✓		✓
Everly et al. (20)	Leadership principles to decrease psychological casualties in COVID-19 and other disasters of uncertainty.								✓				✓
Fukuti et al. (21)	How institutions can protect the mental health and psychosocial well-being of their healthcare workers in the current COVID-19 pandemic.		✓		✓	✓	✓		✓	✓	✓	✓	✓
Gilleen et al. (22)	Impact of the COVID-19 pandemic on the mental health and well-being of UK healthcare workers.					✓			✓		✓	✓	✓
Gray et al. (23)	A "Mental Health PPE" model of proactive mental health support for frontline health care workers during the COVID-19 pandemic.									✓	✓	✓	✓

(Continued)

TABLE 2 | Continued

Authors	Title	Appreciation	Social support	Staff retention	Everyday support	Working conditions	Best-practice protocols	No unreliable news sources	Information/communication	Help hotlines	Self-care	Identification/monitoring of individuals at higher risk	Access to mental health services
Greenberg (24)	Mental health of health-care workers in the COVID-19 era.	✓							✓			✓	✓
Greenberg et al. (25)	How might the NHS protect the mental health of health-care workers after the COVID-19 crisis?	✓							✓			✓	
Hossain et al. (26)	Self-care strategies in response to nurses' moral injury during COVID-19 pandemic.	✓				✓			✓		✓		✓
Hou et al. (27)	Social support and mental health among health care workers during Coronavirus Disease 2019 outbreak: a moderated mediation model.		✓										
Kamran et al. (28)	Effective recommendations for reducing anxiety and depression caused by COVID-19 outbreak in medical staff.					✓		✓	✓		✓		
Karnatovskaia et al. (29)	Stress and fear: clinical implications for providers and patients (in the time of COVID-19 and beyond).										✓		
Kiser et al. (30)	When the dust settles: preventing a mental health crisis in COVID-19 clinicians.	✓	✓	✓									✓
Labrague et al. (31)	COVID-19 anxiety among front-line nurses: predictive role of organizational support, personal resilience and social support.		✓	✓		✓			✓		✓		✓
Li et al. (32)	Anxiety and related factors in frontline clinical nurses fighting COVID-19 in Wuhan.		✓	✓		✓		✓	✓		✓		

(Continued)

TABLE 2 | Continued

Authors	Title	Appreciation	Social support	Staff retention	Everyday support	Working conditions	Best-practice protocols	No unreliable news sources	Information/communication	Help hotlines	Self-care	Identification/monitoring of individuals at higher risk	Access to mental health services
Lissoni et al. (33)	Promoting resilience in the acute phase of the COVID-19 pandemic: psychological interventions for intensive care unit (ICU) clinicians and family members.					✓			✓		✓		✓
Markey et al. (34)	Cultivating ethical leadership in the recovery of COVID-19.					✓			✓		✓		
Miotto et al. (35)	Implementing an emotional support and mental health response plan for healthcare workers during the COVID-19 pandemic.				✓	✓	✓		✓	✓	✓	✓	✓
Orellano et al. (36)	Peruvian guideline to care the mental health of health providers during COVID-19 pandemic.		✓	✓		✓		✓	✓	✓	✓	✓	✓
Owen et al. (37)	Leadership after a crisis: the application of psychological first aid.			✓					✓		✓		✓
Raudenská et al. (38)	Occupational burnout syndrome and post-traumatic stress among healthcare professionals during the novel coronavirus disease 2019 (COVID-19) pandemic.		✓	✓		✓					✓		✓
Restauri et al. (39)	Burnout and posttraumatic stress disorder in the coronavirus disease 2019 (COVID-19) pandemic: intersection, impact, and interventions.			✓		✓		✓	✓		✓		
Ripp et al. (40)	Attending to the emotional well-being of the health care workforce in a New York City health system during the COVID-19 pandemic.	✓	✓	✓	✓	✓			✓		✓		✓

(Continued)

TABLE 2 | Continued

Authors	Title	Appreciation	Social support	Staff retention	Everyday support	Working conditions	Best-practice protocols	No unreliable news sources	Information/communication	Help hotlines	Self-care	Identification/monitoring of individuals at higher risk	Access to mental health services
Schneider et al. (41)	Factors mediating the psychological well-being of healthcare workers responding to global pandemics: a systematic review.		✓		✓	✓		✓	✓		✓		✓
Taylor et al. (42)	Mental health treatment for front-line clinicians during and after the coronavirus disease 2019 (COVID-19) pandemic: a plea to the medical community.		✓								✓	✓	✓
Tomlin et al. (43)	Psychosocial support for healthcare workers during the COVID-19 pandemic.	✓		✓				✓	✓	✓	✓	✓	✓
Tracy et al. (44)	What should be done to support the mental health of healthcare staff treating COVID-19 patients?								✓		✓	✓	✓
Widjaja et al. (45)	Health issues among healthcare workers during COVID-19 pandemic: a psychosomatic approach.			✓						✓	✓		✓
Wilson et al. (46)	Caring for the carers: ensuring the provision of quality maternity care during a global pandemic.			✓		✓		✓			✓		✓
Wong et al. (47)	Healing the healer: protecting emergency health care workers' mental health during COVID-19.	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓
Wu et al. (48)	COVID-19: peer support and crisis communication strategies to promote institutional resilience.	✓							✓	✓	✓		✓

achieve this. To evaluate the quality of these recommendations and guidelines, we used specific domains of the AGREE II instrument. Given the relative novelty of the COVID-19 pandemic, it is not surprising that the given recommendations and guidelines only achieved lower scores in the domains “rigor of development” and “application,” while moderate to high scores were achieved in the domain “scope and purpose.” The low scores can surely be explained by the dynamics of the pandemic that have not allowed for empirical investigations assessing the usefulness of the various recommendations. Overall, very few of the included articles laid the sole focus on the provision of recommendations, but rather presented them as a segment of their work. However, it has been recognized that preserving and improving mental health, resilience and well-being of HCWs poses a challenge that is influenced by environmental, structural, individual and team characteristics. (6). Therefore, we present a short but systematic overview of published recommendations on how to possibly strengthen mental health among HCWs during the COVID-19 pandemic.

Mental Health Support

In most of the selected publications, authors emphasized the need for promoting better **self-care** of HCWs during this pandemic. Indeed, a basic component is meeting physical daily needs, such as supplementation of healthy nutrition and hydration, fitness, rest, and sleep. In the current setting (e.g., shortage of staff and time), these self-care aspects might often fall short for HCWs. Amongst the strategies for self-care practices on the individual level, diaphragmatic breathing (26, 28, 29, 32, 43), meditation (42, 43), maintaining a positive mind set (16, 29), mindfulness-, relaxation-, and problem-solving training (16, 26, 29, 32, 36, 39, 43, 45, 47) as well as maintaining personal interests, activities, and the connection to loved ones (16, 28, 32, 36, 43, 45–47) were mentioned frequently. Interestingly, avoiding maladaptive coping strategies (e.g., excessive alcohol consumption, overeating and prescription drugs) were only mentioned in two articles (46, 47). Interventions to encourage self-care on the organizational level included well-being courses, yoga or gym classes (12, 22, 23, 40) and providing opportunities for staff to talk about their experiences to enhance support and team cohesion (9, 14, 19, 43, 46). As reviewed, these recommendations on self-care are quite diverse and affect physical, psychological and social well-being of HCWs. It is possible that employees may not take up or use these offers due to lack of time or motivation after a long work shift. Strategies to overcome these potential barriers were not discussed in most articles. Finally, one must note that mental conditions like anxiety or depression itself of a certain degree can also result in barriers for the affected individual to promote self-care.

Recommendations addressing access to **mental health services** consist of (1) early identification of “at-risk” individuals (due to pre-existing experiences or mental health issues) so that plans can be put in place to support them, (2) actively monitoring anyone who has been exposed to a potentially traumatic event, (3) available access for staff members to psychological or psychiatric support (e.g., helplines, online self-help programs, trauma focused PTSD treatment) (8–10, 12, 14–16, 19–24, 26, 31, 33, 35–38, 40–48). Providing psychological care and monitoring

staff who are at higher risk of developing a mental disorder **after** the pandemic begins to recede were recommended in only five articles (14, 18, 24, 25, 37). Most guidelines seem to neglect the potentially ongoing stress and burden HCWs might face after pandemic (e.g., postponed surgeries and treatments, structural changes in the healthcare systems, staff shortage). Barriers and limiting factors for the use of mental health services, such as lack of anonymity or accessibility, were scarcely addressed in the included articles.

Social/Structural Support

Interventions to improve mental well-being through social and structural support were also mentioned across many articles, which overlap to some extent with the strategies and topics mentioned above. Authors stressed the pivotal role of an appropriate **appreciation, acknowledgment, and professional validation** within the team and in particular as an integral part of the leadership style (12, 16, 19, 24–26, 30, 40, 43, 47, 48). Individual strategies include basic rules for respectful interaction, such as “giving thanks” (29). However, the majority of authors remained vague about specific strategies to actively show and promote appreciation, acknowledgment and validation. Organizationally, leaders are required to listen, learn and act (34). Not only in times of crisis is *an ethical, inclusive and effective leadership* required (e.g., leading by example, providing personal and professional support, involving staff in decision-making and action plans, establishing a human connection by validating an individual’s feelings and thoughts) (8, 20, 34). Other strategies, such as providing free food and drinks, to show appreciation might not be sufficient. Authors highlight the role of **support**, both at the individual (e.g., family, friends, communities) and at the organizational level (peer support programs, online support, support from leaders). In respect to the recommendations concerning social support, it is noted that this aspect greatly depends on the support system and the resources of each individual. On that basis, the University of Minnesota Medical Center proposed an approach taken from the military framework. They developed a psychological resilience intervention founded on a peer support model (Battle Buddies) with 2 key elements: A Battle Buddy to provide peer support and a mental health consultant assigned to the unit (9).

Communication

In times of crisis, it is important to provide **high-quality and transparent communication and accurate information updates** to all staff (14). Existing research shows that uncertainty leads to stress and anxiety (49). Stress increases with high work demands but co-occurring low work control (43). Therefore, leaders should provide staff with transparent and current updates so they are best prepared for what they are going to face and reflect on the risks and challenges (14, 43). That is especially important at the beginning of a crisis. Surprisingly, avoiding unreliable news sources and social media is recommended only by eight articles (9, 28, 32, 36, 39, 41, 43, 46). That raises the question whether the influence of social media and news is underestimated in this context. Authors further emphasize the need of **listening to staff input and feedback** (9, 11, 13, 14, 16,

19, 20, 28, 31, 33, 34, 36, 37, 40, 43, 44). Leaders should provide the opportunity to talk to them and implement regular feedback mechanisms. For implementation, it requires practical strategies. Once again, the shortage of time, exhaustion and staff shortage might be limiting factors.

Work Environment

Authors often mentioned the need of adequate organizational support through the implementation of a safe and employee-oriented work environment. This includes the provision of **complete and quality Personal Protective Equipment (PPE) and supplies** to prevent infection, provision of accurate and timely information regarding the disease, employing best-practice protocols and guidelines, and implementation of **infection control trainings** (10, 12–14, 18, 21, 22, 31, 36, 38–41, 46, 47). Moreover, a few authors took into consideration that an employee-oriented work environment should promote professional development and provide specialized job training (16, 18, 22, 26, 35). Where possible, work environment should be optimized to support appropriate nutrition, rest (e.g., “take a minute” room) and sleep periods. While mandatory training and supervision programs (on the clinical skills required to deal with COVID-19 as well as on the potentially traumatic situations) might be beneficial for the team, some team members may have negative feelings and doubts toward mandatory interventions. Individual attitudes, preferences and sentiments might therefore have adverse effects on the team and counteract these interventions. This is not addressed in most articles. Another overlooked, yet crucial factor, is ensuring an adequate income as well as appropriate working hours for all occupational groups working in the healthcare system. While recommendations concerning these aspects might appear too obvious to be mentioned, it is necessary to stress their importance and potential consequences.

General Remarks

Overall, recommendations on how to improve mental health in HCWs during the COVID-19 pandemic were targeted at various levels: from societal aspects to senior management and healthcare professionals. The relevance of protecting and promoting HCWs mental well-being must be viewed as a worldwide problem, as studies show the negative effects pandemics and epidemics have on the mental health of HCWs in several countries across Asia, Northern America, Middle East, Europe and West Africa (1). Additionally, a recent review showed an increase in the turnover intention in nurses in post-pandemic studies, posing the risk of further aggravating staff shortage (50). These circumstances can lead to a vicious cycle, putting more pressure on those remaining in their professions. Only few of the reviewed publications included intervention programs specifically designed to enhance mental health care for HCWs to face psychological challenges during the pandemic. Interestingly, most articles only focus on the time of the acute crisis and neglect what might happen when the crisis is over. However, we must be aware that the COVID-19 pandemic is rather a marathon, not a sprint (48). Against this background, we were surprised not to find a relevant number of recommendations regarding the prevention

of mental health burden after the end of the pandemic. In that regard, only few of the reviewed publication described strategies and interventions to support HCWs’ mental health after the crisis. Another pivotal, but so far neglected factor might be an adequate income for HCWs. Without ensuring a fair income, there might be little incentive to choose the profession and this in turn might cause staff shortage in the future. The potential consequences include e.g., higher workloads and more working hours for HCWs in the future, which might affect the work-life balance and cause even more physical and mental strain. Breaking this vicious circle is long overdue and should be addressed by political decision-makers. Government should provide healthcare organizations with sufficient resources (and appropriate income) to implement recommendations that fit their needs and adapt them to their context.

This review should be considered in light of some limitations. First, available publications for this review varied greatly regarding the publication type, which makes direct comparisons difficult and prevented us from conducting a formal systematic analysis. As reported by some of the authors, few of the recommendations and suggestions have substantial empirical evidence to support them. Second, our initial search may have neglected certain terms, however, re-inspecting our search by adding other potentially relevant key terms provided no additional articles suitable for our assessment. Further, we initially limited the search to the database Pubmed. Adding the databases Cochrane Library and EMBASE during the process of revision yielded in no additional publications. Moreover, we did not pre-specify our reported outcome categories and did not register this work in PROSPERO, as scoping reviews are not accepted for registration by PROSPERO. However, we instead registered our review on OSF Registries. The reason for our inductive approach was that no previous work was available, and we aimed at providing the very first overview assessing the quality of the guidelines. Furthermore, checking all included articles for the aspect of telemedicine showed that, surprisingly, only five articles mentioned telemedicine. This potential limited availability during a pandemic that may be derived from the underreporting in the selected publications, can be challenging for HCWs who are quarantined or who live in areas with limited access to mental-healthcare services. Next, the quality of the analyzed publication was low compared to standard medical guidelines. Especially the low scores for stakeholder involvement and rigor of development are a relevant source of bias.

Nevertheless, the urgency to develop specific psychological support intervention protocols for HCWs is apparent, not only in times of crisis. We believe that there are lots of measures that organizations, individuals, and national societies can take to minimize the impact of COVID-19 on the mental health of HCWs. However, it is essential to implement some of the described measures to allow for early-detection and early-intervention in HCWs facing tremendous stress and burden. At this stage, one must conclude that despite a huge amount of available publications, evidence- and consensus-based guidelines on how to detect, prevent and treat psychiatric conditions in HCWs are lacking. The reasons for this gap were described in the previous paragraphs. While possible treatment options

for HCWs with mental conditions during the pandemic can be extrapolated from available high-quality guidelines on how to treat e.g., anxiety, depression, trauma or alcohol dependency, more research is needed regarding the earlier detection and prevention in the vulnerable group of HCWs. Finally, in a pandemic, the perspective of different healthcare systems and cultures must receive far more attention.

CONCLUSION

Our scoping review could identify four main categories of guidelines and recommendations to improve mental burden in health-care workers during the pandemic; namely “Social/structural support,” “Work environment,” “Communication/Information,” “Mental health support.” Although there was substantial agreement across articles about the recommendations given, empirical evidence on the effectiveness of these recommendations is still lacking. Moreover, most recommendations were developed without including the various members of the target group (HCWs) or other involved stakeholders. Thus, future recommendations should include

these multi-disciplinary perspectives and hopefully will be able to also build a more solid empirical evidence base.

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All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Impact of the COVID-19 Lockdown on Quality of Life in Pregnant Women

Jingjie Ma¹, Ating Wang¹ and Hang Zhou^{2,3*}

¹ Department of Nutrition, Baoji Maternal and Child Health Hospital, Baoji, China, ² Clinical Medical College, Yangzhou University, Yangzhou, China, ³ Department of Clinical Nutrition, Northern Jiangsu People's Hospital, Yangzhou, China

Background: The COVID-19 pandemic has been associated with significant impacts on mental health and well-being of populations worldwide. However, little is known about its significant impact on psychological aspects of vulnerable population groups such as pregnant women. Therefore, the aim of the study was to determine the psychological impact of the COVID-19 pandemic among pregnant women in mainland China.

Methods: A cross-sectional survey was performed between July and August 2020 using a modified validated 40-item questionnaire which consisted of sociodemographics, attitude, lifestyle changes and the Impact of Event Scale (IES) toward COVID-19 using snowball and convenience samplings.

Results: A total of 1,078 participants were included in the study. The mean age of participants was 29.4 ± 4.0 years. Overall, the mean IES of participants was 30.6 ± 12.8 (i.e., moderate-to-severe stressful impact) amidst the COVID-19 pandemic, with 63.9% of participants had an IES score ≥ 26 . Despite increased family and social support, more than half of participants also reported increased feeling of being horrified, apprehensive and helpless.

Conclusions: The COVID-19 pandemic has several psychological impacts on pregnant women. Therefore, based on these valuable data of pregnant women collected, we recommend that a thoughtful planning and time preparation by the government would definitely help to reduce the negative impacts caused by the COVID-19 pandemic and restore the quality of life among pregnant women. Further research is needed to identify vulnerable groups including pregnant women to better adapt and inform mental health interventions and policies by health authorities.

Keywords: IES, psychiatry, pregnant women, China, stress

INTRODUCTION

The emergence of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) firstly appeared in Wuhan, Hubei province, China, in late December 2019 (1). Within just a few months, it has already evolved into a pandemic. As of December 2021, more than 281 million confirmed cases and 5 million deaths have been reported (2). Since the COVID-19 is a highly infectious respiratory disease, isolation is needed to reduce the disease transmission of the COVID-19 pandemic, especially to the vulnerable groups. In addition, social isolation reduces the peak in COVID-19 cases (3).

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Homa Mohammadsadeghi,
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Dongxu Wang,
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Technology, China

*Correspondence:

Hang Zhou
hangzhou1988@hotmail.com

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Pregnant women are considered a vulnerable group for contracting the SARS-CoV-2 (4). In addition, they have increased risk of developing severe illness from COVID-19 when compared to non-pregnant individuals (5). The findings might be due to the physiologic changes in pregnancy including decreased lung capacity, increased heart rate, increased risk for developing thromboembolic disease. Therefore, higher adverse outcomes associated with COVID-19 including morbidity and mortality rate has been reported in pregnant women (6).

World Health Organization has recommended social isolation between individuals, especially in COVID-19 heavily-affected areas to reduce the mortality rate (7). Although social isolation reduces the transmission of SARS-CoV-2 between individuals, a significant reduction in social relationships would make them feel lonely and abandoned (8). Studies have reported that pregnant women are susceptible to stress and emotional instability (8–11). Therefore, it is suggested that social isolation can cause pregnant women to develop anxiety and depression. Therefore, the COVID-19 pandemic has posed huge and complicated challenges associated with mental health, quality of life and lifestyle changes among pregnant women (4–6).

Previous studies reported the stressful impact in the general population during the early stages of COVID-19 pandemic, and their stressful impact continued to increase over time from January 2020 until April 2020 (1, 12, 13). However, there have been few studies that have reported the mental well-being of pregnant women amidst the early stages of the COVID-19 pandemic (11, 14). During the severe acute respiratory syndrome (SARS) epidemic in 2004, higher rates of death and complications were reported in pregnant women when compared to non-pregnant individuals (15, 16). As the COVID-19 pandemic is still ongoing, there are rising concerns over an increase in stressful impact among pregnant women. Therefore, the aim of the present study was to determine the psychological impact and quality of life among pregnant women amid the early stages of the COVID-19 pandemic.

MATERIALS AND METHODS

Quantitative data were collected using a cross-sectional study design which was administered between July 2020 and August 2020 on the Chinese social media platform. Only pregnant of Chinese nationality aged ≥ 18 years who were Chinese-speaking were eligible for the study. Sampling methods including convenience and snowball samplings were employed in the study. No monetary incentives were given to participants for their study participation. The minimum number of participants needed for the study was calculated using the formula as described by Naing et al. (17). The research study protocol was reviewed and approved by the Ethics Committee of the Baoji Maternity and Child Health Care Hospital, and performed in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) and CHERRIES guidelines (18).

Impact of Event Scale

The self-administered IES questionnaire used in the study has been validated in Chinese language for assessing the extent of psychological impact following the COVID-19 pandemic in Chinese population (11). It is consisted of 15-items and composed of two subscales (i.e., intrusive and avoidance) with a Cronbach's alpha of 0.81. All items in IES questionnaire were scored on a 5-point Likert scale: 0 for not at all, 1 for rarely, 3 for sometimes, 5 for often. A total IES score of ≥ 26 was used to suggest the presence of moderate-to-severe psychological impact following the COVID-19 pandemic.

Family and Social Support Amid the Early Stages of the COVID-19 Pandemic

Participants were asked to respond to the following questions regarding the impact of the COVID-19 pandemic on family and social support: support from family members, support from friends, sharing of feeling with others, sharing of feeling with other family members, and caring for family members' feeling (with a Cronbach's alpha of 0.84) (1). The response options were based on a 5-point Likert scale. A lower score was used to indicate limited support received from family members and friends following the COVID-19 pandemic (1).

Mental Health-Related Lifestyle Changes Amid the Early Stages of the COVID-19 Pandemic

Questions regarding the mental health-related lifestyle amid the COVID-19 pandemic including: pay more attention to their mental health, spend more time to relax, rest and exercise were also included in the study. These questions had a Cronbach's alpha of 0.82. The response options were designed on a 5-point Likert scale, ranging from 1 (much decreased) to 5 (much increased) (19, 20). A lower score obtained by participants was used to suggest that there were less favorable changes in their lifestyle amid the COVID-19 pandemic (19, 20).

Other Measures of Negative Mental Health Impacts Amid the Early Stages of the COVID-19 Pandemic

A self-administered multiple choice questionnaire with a Cronbach's alpha of 0.86 was used to evaluate the negative mental health impacts (e.g., stress from financial, home, work situations) following the COVID-19 pandemic (1). There were six multiple choice questions which were aimed to determine if the participants encountered negative health impacts, including from their workplaces and due to the COVID-19 pandemic based on a 5-point Likert scale ranging from 1 (much decreased) to 5 (much increased) (1).

Statistical Analysis

Statistical analysis was performed using SPSS ver. 24.0 (IBM Corp., Armonk, NY, USA). Cronbach's alpha was used to measure the reliability and consistency of the factor loadings for the questionnaires used in the study. A Cronbach's alpha value > 0.6 was deemed acceptable in social science research (21).

TABLE 1 | Sociodemographic characteristics of pregnant women by trimesters of pregnancy.

	All (<i>n</i> = 1,078)	Trimesters			<i>P</i> -value
		1st (<i>n</i> = 252)	2nd (<i>n</i> = 531)	3rd (<i>n</i> = 295)	
Age (years)	29.4 ± 4.0	29.0 ± 3.7	29.6 ± 4.2	29.3 ± 4.1	0.179
Education level, <i>n</i> (%)					
Secondary school	325 (30.1)	71 (28.2)	182 (34.3)	72 (24.4)	0.009
Higher qualification	753 (69.9)	181 (71.8)	349 (65.7)	223 (75.6)	
Healthcare workers, <i>n</i> (%)					
No	992 (92.0)	18 (7.1)	36 (6.8)	32 (10.8)	0.101
Yes	86 (8.0)	234 (92.8)	495 (93.2)	263 (89.2)	
Employment status, <i>n</i> (%)					
Full-time	614 (57.0)	145 (57.5)	298 (56.1)	171 (58.0)	0.074
Part-time	42 (3.9)	17 (6.7)	18 (3.4)	7 (2.4)	
Unemployed	422 (39.1)	90 (35.7)	215 (46.5)	117 (39.7)	

Sociodemographic characteristics of participants were evaluated using descriptive statistics. Normally distributed variables were reported as mean ± standard deviation. Categorical variables were presented as frequency [percentage, (%)]. The relationship between independent variables and mental health outcomes was assessed by using Chi-square tests. A $P < 0.05$ was used to denote statistical significance.

RESULTS

Participant Characteristics

Of 1,680 participants who were invited to participate in the study, only 1,078 participants were included in the final analysis with a complete rate of 64.2% (Table 1). The reasons for declining to participate were not interested in the study ($n = 502$) and lack of time ($n = 100$). The mean age of participants was 29.4 ± 4.0 years, with more than half of participants (69.9%) had higher qualification. Majority of participants were in 2nd trimester of pregnancy, followed by 3rd and 1st trimesters of pregnancy (27.4 and 23.4%, respectively). More than half of participants were from Southwest China (74.1%), followed by East China (25.2%), Southwest China (0.4%), and South Central China (0.3%). None of the participants were diagnosed positive for the SARS-CoV-2 virus. All participants were married at the time of the study. Only a small minority of participants were healthcare workers (8.0%). More than half of participants were working full-time (57.0%), followed by unemployment (39.1%) and part-time (3.9%).

Family and Social Support Amid the COVID-19 Pandemic

Amid the COVID-19 pandemic, majority of participants reported increased support they received from their family members (91.6%) and friends (78.6%) (Table 2). Also, more than half of participants reported increased sharing of their feeling with their family members (86.9%) and others (92.9%) when they felt blue amid the COVID-19 pandemic. In addition, majority of

TABLE 2 | Changes in family and social support by trimesters of pregnancy.

	Trimesters			<i>P</i> -value
	1st (<i>n</i> = 252)	2nd (<i>n</i> = 531)	3rd (<i>n</i> = 295)	
Getting support from friends, <i>n</i> (%)				
Decreased	5 (2.0)	10 (1.9)	2 (0.7)	0.342
Increased	199 (79.0)	423 (79.7)	225 (76.3)	
Same as before	48 (19.0)	98 (18.5)	68 (23.1)	
Getting support from family members, <i>n</i> (%)				
Decreased	4 (1.6)	10 (1.9)	2 (0.7)	0.020
Increased	229 (90.9)	496 (93.4)	262 (88.8)	
Same as before	19 (7.5)	25 (4.7)	31 (10.5)	
Shared feeling with family members, <i>n</i> (%)				
Decreased	3 (1.2)	10 (1.9)	2 (0.7)	0.668
Increased	221 (87.7)	460 (86.6)	256 (86.8)	
Same as before	28 (11)	61 (11.5)	37 (12.5)	
Shared feeling with others when feeling blue, <i>n</i> (%)				
Decreased	4 (1.6)	12 (2.3)	3 (1.0)	0.101
Increased	238 (94.4)	495 (93.2)	268 (90.8)	
Same as before	10 (4.0)	24 (4.5)	24 (8.1)	
Caring for family members' feelings, <i>n</i> (%)				
Decreased	1 (0.4)	8 (1.5)	7 (2.4)	0.246
Increased	196 (77.8)	404 (76.1)	234 (79.3)	
Same as before	55 (21.8)	119 (22.4)	54 (18.3)	

participants reported increased caring for their family members' (77.4%) amid the COVID-19 pandemic. Participants in 1st and 2nd trimesters of pregnancy were more likely to receive support from family members and care for family members' feelings than participants in 3rd trimester of pregnancy ($P = 0.020$).

Mental Health-Related Lifestyle Changes Amid the COVID-19 Pandemic

Majority of participants (51.9%) reported that they had paid more attention to their mental well-being and more time to relax (46.1%) amid the COVID-19 pandemic (Table 3). Also, majority of participants reported no changes on the time spent to rest (54.2%). On the other hand, majority of participants reported reduced time spent to exercise (42.0%) amid the COVID-19 pandemic. There were no differences in mental health-related lifestyle among participants with different trimesters of pregnancy (all $P > 0.05$).

Attitudes Toward the COVID-19 Pandemic

Majority of participants (54.6%) knew about the SARS-CoV-2 and its relevant prevention knowledge well (Table 4). Also, more than half of participants were concerned about the COVID-19 progress control (57.6%) and thought that COVID-19 pandemic was far away from them (59.2%). More than three-fourth of participants (77.6%) agreed that "pregnant women were more vulnerable to the COVID-19 pandemic than others." No differences in attitudes toward the COVID-19 pandemic among participants with different trimesters of pregnancy were reported (all $P > 0.05$).

TABLE 3 | Awareness and lifestyles by trimesters of pregnancy.

	Trimesters			P-value
	1st (n = 252)	2nd (n = 531)	3rd (n = 295)	
Pay attention to mental health, n (%)				
Decreased	6 (2.4)	18 (3.4)	8 (2.7)	0.429
Increased	130 (51.6)	287 (54.0)	142 (48.1)	
Same as before	116 (46.0)	226 (42.6)	145 (49.2)	
Time spent to rest, n (%)				
Decreased	9 (3.6)	28 (5.3)	14 (4.7)	0.448
Increased	98 (38.9)	213 (40.1)	132 (44.7)	
Same as before	145 (57.5)	290 (54.6)	149 (50.5)	
Time spent to relax, n (%)				
Decreased	77 (30.6)	163 (30.7)	101 (34.2)	0.138
Increased	126 (50.0)	253 (47.6)	118 (40.0)	
Same as before	49 (19.4)	115 (21.7)	76 (25.8)	
Time spent to exercise, n (%)				
Decreased	108 (42.9)	205 (38.6)	140 (47.5)	0.086
Increased	96 (38.1)	207 (39.0)	91 (30.8)	
Same as before	48 (19.0)	119 (22.4)	64 (21.7)	

TABLE 4 | Attitudes toward COVID-19 by trimesters of pregnancy.

Trimesters				P-value
1st (n = 252)	2nd (n = 531)	3rd (n = 295)		
Know SARS-CoV-2 and relevant prevention knowledge well, n (%)				
Yes	131 (52.0)	306 (57.6)	149 (50.5)	0.099
No	121 (48.0)	225 (42.4)	146 (49.5)	
Concerned about the COVID-19 progress control, n (%)				
Yes	146 (57.9)	309 (58.2)	166 (56.3)	0.860
No	106 (42.1)	222 (41.8)	129 (43.7)	
COVID-19 pandemic is far away from me, n (%)				
Yes	144 (57.1)	318 (59.9)	176 (59.7)	0.752
No	108 (42.9)	213 (40.1)	119 (40.3)	
Pregnant women are more vulnerable to the COVID-19 than others, n (%)				
Yes	203 (80.6)	414 (78.0)	220 (74.6)	0.239
No	49 (19.4)	117 (22.0)	75 (25.4)	

IES

In our study, the overall mean IES in participants was 30.6 ± 12.8 , indicating the presence of moderate-to-severe stressful impact amid the COVID-19 pandemic in participants (Table 4). Regardless of their trimesters of pregnancy, all participants had a mean IES score ≥ 26 (30.9 in 1st trimester of pregnancy, 30.2 in 2nd trimester of pregnancy, and 30.9 in 3rd trimester of pregnancy, $P=0.674$). Amid the COVID-19 pandemic, more than half of participants who had an IES score ≥ 26 (63.9%). The overall mean for intrusion and avoidance of participants were 13.9 ± 6.6 and 16.7 ± 7.0 , respectively. No differences in mean intrusion and avoidance among participants with different trimesters of pregnancy (all $P>0.05$).

TABLE 5 | Negative health impacts by trimesters of pregnancy.

	Trimesters			P-value
	1st (n = 252)	2nd (n = 531)	3rd (n = 295)	
IES	30.9 ± 11.6	30.2 ± 12.8	30.9 ± 13.6	0.674
IES ≥26, n (%)	167 (66.3)	338 (63.7)	184 (62.4)	0.629
Increased stress from work, n (%)				
Yes	165 (65.5)	349 (65.7)	224 (75.9)	0.005
No	87 (34.5)	182 (34.3)	71 (24.1)	
Increased financial stress, n (%)				
Yes	163 (64.7)	381 (71.8)	226 (76.6)	0.009
No	89 (35.3)	150 (28.2)	69 (23.4)	
Increased stress from home, n (%)				
Yes	145 (57.5)	317 (59.7)	177 (60.0)	0.811
No	107 (42.5)	214 (40.3)	118 (40.0)	
Pregnant women feel horrified due to the COVID-19, n (%)				
Yes	150 (59.5)	332 (62.5)	173 (58.6)	0.495
No	102 (40.5)	199 (37.5)	122 (41.4)	
Pregnant women feel apprehensive due to the COVID-19, n (%)				
Yes	146 (57.9)	334 (62.9)	184 (62.4)	0.390
No	106 (42.1)	197 (37.1)	111 (37.6)	
Pregnant women feel helpless due to the COVID-19, n (%)				
Yes	186 (73.8)	383 (72.1)	226 (76.6)	0.374
No	66 (26.2)	148 (27.9)	69 (23.4)	

Other Measures of Negative Mental Health Impacts Amid the Early Stages of the COVID-19 Pandemic

More than half of participants reported increased work stress (68.5%), financial stress (71.4%) and home stress (59.3%) amid the COVID-19 pandemic (Table 5). In addition, majority of participants reported increased feeling of being horrified (60.8%), apprehensive (61.6%) and helpless (73.7%) amid the COVID-19 pandemic. Only trimester of pregnancy was associated with two of the measures of negative mental health impacts amid the COVID-19 pandemic, which were “increased stress from work” and “increased financial stress” ($P < 0.05$).

DISCUSSION

Our study investigated the psychological impact of the pregnant women in mainland China amid the COVID-19 pandemic during the early stages of the pandemic. In addition, our study provided some nationwide data on the stressful impact and social support in pregnant women. Since the COVID-19 outbreak, an increase of 20% in mental illness cases has been reported in populations (22). However, there are few studies that have investigated the impact of the early stages of COVID-19 pandemic on mental health and quality of life in pregnant women, who have increased risk of developing certain morbidities from COVID-19 because of their physiological changes during pregnancy (11, 23–25). Factors such as inability to purchase food items, fear of becoming sick, and isolation

of lockdown may also increase psychological distress, especially among pregnant women with lower socio-demographic status (23). In addition, they have higher risk of suffering poor mental health conditions amid the COVID-19 pandemic (23).

In our study, the overall mean IES was 30.6 ± 12.8 and 63.9% of participants had an IES score ≥ 26 , which provided evidence that our pregnant women experienced moderate-to-severe stressful impact amid the early stages of the COVID-19 pandemic. A study by Wu et al. reported that Chinese pregnant women had higher rate of depressive symptoms amid the COVID-19 pandemic (25). In addition, the authors reported that the COVID-19 pandemic significantly increase the risk of thoughts of self-harm in pregnant women (25). It is suggested that pregnancy is also a factor that can increase vulnerability for developing mental health disorders including anxiety and depression (8).

Our study findings had identified increased stressful impact among pregnant women, which highlighted the strong needs and potential interventions to improve their mental health during this extremely difficult period. Due to the unpredictable nature of the COVID-19 situation, it can trigger some psychological and mental health distresses (1, 13). Several studies reported that exposure to COVID-19 pandemic and its impact on daily life aspects including quality of life, relationship, lifestyle, family and social support are some of the important predictors of the mental health issues (1, 11, 12, 20, 26). Mental health disorders are considered a common cause of morbidity in pregnant women with 22% of women experiencing anxiety and 12% of women experiencing depression (27, 28). It is possible that since pregnant women are more vulnerable to infections during pregnancy due to their naturally suppressed immune system, pregnant women are more likely to be psychologically affected because of the increased morbidity and mortality rate of COVID-19 reported. In addition, they are also further vulnerable to anxiety because of the increased concern about the possible vertical transmission of SARS-CoV-2 to their fetus (25).

Our study reported that overall there was increased family and social support received among pregnant women amid the COVID-19 pandemic. Our results were in line with other studies which reported that amid the COVID-19 pandemic, individuals were more likely to care for their family members' feelings and share their feelings with family members (1, 11, 26). It is suggested that amid the COVID-19 lockdown period, the slower pace of life allows individuals to spend more time supporting and connecting with their family members and friends (1, 26). Therefore, more qualitative and thorough research studies are needed to understand the possible mechanisms behind these findings.

Strengths of our study included the use of validated modified questionnaire to assess psychological impact and quality of life in pregnant women. In addition, our study was one of the first studies to investigate the psychological health impact of the COVID-19 pandemic among pregnant women within the Chinese context. Since our study only involved Chinese pregnant women, our results may not reflect the psychological impact of the larger population of pregnant women from different

countries with different severity of COVID-19 pandemic. This is because pregnant women from different countries might experience different severity levels of COVID-19 pandemic and maternal healthcare support provided by the healthcare systems in their countries. On the other hand, pregnant women might more likely to cope with the stress during the COVID-19 pandemic due to the support received from family members and friends, even without the COVID-19 pandemic. Therefore, we recommend more exploratory studies on the mental health status and its associated factors amid the COVID-19 pandemic among pregnant women because these findings are imperative to designing appropriate mental health education for mitigating negative mental health consequences. Our study did not assess the vaccination willingness/status in pregnant women; however, this might have an impact on the quality of life in pregnant women. Therefore, future studies should investigate if there is a difference in quality of life between pregnant women who had and had not been vaccinated against SARS-CoV-2 (29, 30). The association of the support received from family and friends with stress from work, home and financial aspects in pregnant women with different severity of IES scores should be investigated in larger studies. The use of convenience sampling in our participant recruitment may be associated with sampling bias, which limits the generalizability of our findings. In addition, since our results were derived from a cross-sectional study design, it is very challenging and difficult for our study to draw causal inferences. Therefore, our study findings need to be interpreted with caution.

In conclusion, the COVID-19 pandemic has caused several psychological impacts on Chinese pregnant women. Our study provided significant insights regarding the quality of life in pregnant women who remain at high threat for developing mental health problems amidst the pandemic. We recommend that a thoughtful planning and time preparation by the government would definitely help to reduce the negative impacts caused by the COVID-19 pandemic and restore the quality of life among pregnant women.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, upon reasonable request.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of the Baoji Maternity and Child Health Care Hospital. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JM, AW, and HZ: conceptualization, formal analysis, methodology, writing—original draft, writing—review, and editing. All authors contributed to the article and approved the submitted version.

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Health Care Professionals' Perception of Stress During COVID-19 Pandemic in Iran: A Qualitative Study

Ashraf Rouhbakhsh¹, Rahim Badrfam¹, Ali-Akbar Nejatisafa^{1,2}, Marzieh Soori³, Sayedeh Elham Sharafi¹, Farnaz Etesam¹, Nazila Shahmansouri¹, Mohammad Arbabi^{1*} and Ahmad Ali Noorbala¹

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Sciences, Iran

*Correspondence:

Mohammad Arbabi
marbabid@gmail.com

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¹ Department of Psychiatry, Psychosomatic Research Center, Tehran University of Medical Sciences, Tehran, Iran, ² Research Center for Cognitive and Behavioral Sciences, Tehran University of Medical Sciences, Tehran, Iran, ³ Department of Psychiatry, Psychosomatic Research Center, Tehran University of Medical Sciences, Tehran, Iran

Background: The health care professionals have a unique role in controlling the pandemic of COVID-19 and decreasing its mortality and morbidity. The burden of care and psychological impact of working in this circumstance can be unfavorable for many caregivers. In this qualitative study, the health care professionals' perception of stress during COVID-19 pandemic in Iran was assessed and several implications were proposed.

Materials and Methods: The participants were selected among staff who were providing medical services to patients with COVID-19 infection at the largest teaching hospital in Iran. Quota sampling was used to include physicians, nurses, and other paramedics. The grounded theory was selected to develop interview questions. Moreover, the thematic approach was applied to analyze the data content and data analysis was performed based on open and axial coding following the implementation of codes in MAQDA software.

Results: A wide range of psychological reactions including anxiety, feelings of guilt, depression, and anger were detected in the staff. Uncertainty accompanied by the pandemic of COVID-19 and shortcomings in preparation for crisis management were recognized as the two main sources of stress among health care professionals.

Conclusion: Based on the findings of the study, it is important to identify and evaluate the mental health needs of healthcare professionals. To reduce stress among health staff at COVID-19 care centers, it seems that the optimal strategy is simultaneous improvement in equipment and crisis management.

Keywords: COVID-19, health personnel, mental health, stress, qualitative study

INTRODUCTION

As of today, we have witnessed the spread of an invisible enemy which was envisaged as pneumonia of an unknown origin in late December 2019. The first reported cases of the disease and consequently the outbreak of the disease worldwide made the World Health Organization (WHO) determined to call it a pandemic. The disease was named COVID-19 and so far (14 November 2021), more than 252 million people have been infected and more than 5 million have died. Iran is among the countries with the highest number of people affected and the highest number of deaths due to COVID-19 in the Middle East (1).

Working in this crisis condition like the previous epidemics in the world (2) or natural disasters (3) put a heavy burden on the physicians, nurses, and other health care staff in the referral hospitals (4). The staff are directly involved with the virus and as a result, they should encounter the risk of transmitting the disease to themselves or their families. The other problems include mandatory quarantine or relative isolation, serious limitations in personal protection equipment (PPE), and minimum rest breaks (5, 6). Such problems and challenges result in psychological stress, followed by possible psychiatric manifestations, including anxiety, depression, and stigma (7–9). The staff's mental health problem is a critical issue since decreased care for patients and increased medical errors may be the adverse outcomes (10). Identifying these obstacles can be the first step in addressing and establishing mental health care for the staff (11). In dealing with such issues, regional and cultural features as a determining factor should be taken into account (12). This can help control the epidemic more quickly and accelerate the improvement of social conditions (2). Given the value of qualitative studies, it seems that such studies may help to better understand the staff subjective experiences regarding their stress and its consequences in working environment (13).

In this study, a qualitative research was designed to evaluate health care professionals' perception of stress during the COVID-19 pandemic in Iran.

MATERIALS AND METHODS

Participants

Participants were recruited from staff members of different departments who were involved in the care of patients with COVID-19 infection in the largest teaching hospital of Tehran. Quota sampling was used to include physicians, nurses, and other paramedics. Participants were invited to be interviewed individually and sampling was continued until saturation. The time and place of the interview were scheduled keeping in view the convenience of the participants. At the end of sampling, 5 physicians, 10 nurses, and 5 other medical staff were included in the study. Of these, 11 were women and 9 were men. Before starting the interviews, the study was approved by the Ethics Committee of Tehran University of Medical Sciences (the Code of Ethics: IR.TUMS.VCR.REC.1399.044).

Research Instruments

The 32-item consolidated criteria for reporting qualitative research (COREQ) checklist was used as the study tool in this qualitative research. This checklist is used to provide a clear and comprehensive report of qualitative studies and includes the components needed to evaluate in depth interviews, components related to characteristics of groups, research team, study design, data analysis, and reporting (14). Accordingly, approaches such as cross-cutting data and searching for patterns and themes, and other necessary components of qualitative studies were applied (15).

Domain 1: Research Team and Reflexivity

Personal Characteristics

Two interviewers of the study were psychiatrists. The first interviewer was a woman and the fellow of psychosomatic medicine, and the second interviewer was a man and the professor of psychiatry. They had extensive experience in the field of psychosomatic disorders and worked at the largest medical hospital in Iran.

Relationship With Participants

The interviewers talked to health care professionals and a good relationship was established between them and the participants. Both of them had complete personal care equipment during the interview. Also, in these short conversations, which were conducted after identifying the individuals with the inclusion criteria, a discussion was held in a short session (10 min) about the objectives of the study and the reasons for doing the research. In these short sessions, before starting the main interview session, interviewers' concerns about the mental health of staff and their efforts to reduce their stress were discussed.

Domain 2: Study Design

Theoretical Framework

The grounded theory was used to design the study (16).

Participants

Consecutive sampling was used for selection of participants (17). The total number of participants in the study was 20, of which 11 were female and 9 were male. Three people who had inclusion criteria were reluctant to participate. After selecting the final 20 cases, all of them participated in the study.

Setting

At the time of the interview, only health care professionals and interviewers were present. The interview room had a proper ventilation system, and both interviewers had full personal protective equipment. These interviews were conducted in the early days of the COVID-19 epidemic in Iran, with the aim of examining perceptions of stress among medical staff and assessing their needs in order to take effective measures to address the problems.

Data Collection

The questions, questionnaires, and guidelines were designed and modified before the study began. For the pilot phase of the study, prior to the main interview, a preliminary interview was

conducted by each of the interviewers with individuals who had the inclusion criteria. All interviews were conducted in one session and were not repeated. Some important points were noted during the interview, but most of it was arranged in written form. Each session lasted about half an hour. The final text for each participant was re-submitted to medical staff for completion or correction.

Domain 3. Analysis of Findings

Data Analysis

In this study, semi-structured interviews were implemented to give the participants freedom for creativity in their responses. The interview contained open-ended questions in different topics covering experiences of staff in caring patients with COVID-19 infection. Interview questions were developed based on a theoretical insight as well as professional team discussion. Individual appointments were made for conducting the interviews, which were held at the participants' workplace in a quiet room. All interviews were recorded using a smartphone. Before starting the interview, the participants were given information about the study and asked whether they wanted to participate utilizing an informed consent. After multiple reviews of the data, key concepts were selected by code formatting. Categories were derived based on the relationship between the codes and then formulated. The relationship between categories was demonstrated, and the thematic approach was used for content analysis (18, 19). According to Bengtsson's view, the purpose of content analysis is to organize and extract meaning from the data collected and to draw realistic conclusions (20). After removing irrelevant details, data gathering was continued until no new information was obtained. The correlation between the obtained data was evaluated in the inference stage. Finally, through process analysis, patterns that illustrated the results of the content analysis were identified and formulated. Data analysis was performed based on open and axial coding and after implementation of codes in MAXQDA software. The collected information was provided solely to the researchers to maintain confidentiality. In total, 20 interviews were conducted and 187 codes were obtained. These codes were also classified into 12 categories with 46 subcategories.

Reporting

The study report was elaborated by participants' quotations. They were written in accordance with the themes, categories, and subcategories obtained. The consistency between the data presented and the findings was observed. The main themes were clearly presented in the findings, and various themes and sub-themes were discussed.

RESULTS

The total number of participants in this study was 20 individuals [11 females (55%) and 9 males (45%)]. Among them, 5 were physicians, 10 were nurses, and 5 were other paramedics. The average age of the participants in the study was 35.5 years ($SD = 8.46$). The minimum age was 23 and the maximum age was 51 years. Nine participants worked in the intensive care unit

(ICU), five in the infectious diseases ward, three in the respiratory diseases ward, and three in the internal medicine ward. The average work experience of the staff was 10.5 years ($SD = 7.45$), which included at least 1 year and a maximum of 26 years.

Most of the participants reported experiencing stress in the face of COVID-19 epidemic working conditions. They were very anxious, deeply affected by the death of their patients, and worried about the transmission of the disease to their families. During the interviews, they talked about stress manifestations, awareness, and understanding of different aspects of COVID-19 and crisis management. Also, the suggested solutions for overcoming the existing situation were discussed.

In this study, 4 themes were found; they are uncertainty accompanied by the pandemic of COVID-19 (explains the experience of stress), shortcomings in preparation for crisis management (explains the experience of stress), manifestations of stress, and mental health needs. Each theme consisted of several categories and sub-categories (Tables 1, 2).

DISCUSSION

In this qualitative study, by emphasizing on two main dimensions of the disease through raising "how" and "why" questions (13), an attempt was made to gain insight into how stress is experienced and how it is manifested among health care staff who are involved with COVID-19 patients. In our study, health care professionals experienced stress in several ways as they enumerated anxiety, depression, anger, feelings of guilt, and a sense of hopelessness and burned out as the main symptoms of the stress during providing care for patients.

In a multicenter study about health care workers' (HCWs) mental health status in Iran during COVID-19 pandemic, depression was negatively associated with most quality of life domains, yet, social support was positively correlated with physical function, energy, and emotional well-being (21). In another multicenter study in Iran, the prevalence of posttraumatic stress disorder among HCWs was reported to be more than one third of the whole population (22). Also, in another multicenter study in Iran, about 40% of HCWs had moderate to severe anxiety which was more severe in women, nurses, and younger people (23).

Thus, it seems that the experience of stress among HCWs in Iran, in terms of above categories, is the dominant image of their mental state during COVID-19 pandemic so far. The perceived strong sense of danger associated with feelings of ambiguity regarding the pandemic and the unsolved mysteries created by the virus has been the experience of another group of HCWs in Iran during the recent pandemic (24).

In our study, the uncertainty accompanied by the COVID-19 epidemic in conjunction with inconsistent medical information and obscurity of the disease could have been the main causes of stress among staff and other factors like downward trend in disease could reduce or even eliminate their stress.

In a study conducted at a teaching hospital following the outbreak of severe acute respiratory syndrome (SARS) in 2003, the obscurity of the disease, was one of the

TABLE 1 | Uncertainty and crisis management related to perception of stress by medical staff during COVID-19 epidemic.

Themes	Categories	Subcategories	Segments
"Uncertainty" accompanied by the COVID-19 pandemic (Explains the experience of stress)	Predisposing factors	The inconsistency in medical information	"One doctor expresses an opinion, while another doctor says a contradictory opinion about the disease"
		The obscurity of the disease	"In the early phase, we were under stress because we had no information and no one guided us"
		The likelihood of transmission to the family	"We still have concerns of our family being infected. We should not meet our parents because they are old"
		Unforeseen exposure to infectious droplets	"We are concerned about unexpected exposures and the ways of protection"
		The likelihood of getting infected	"I am very worried about getting infected due to my asthma"
		Being shocked in the early days	"The first week was very stressful. There was no preparation at all; the medical system denied the health crisis"
		Resource allocation	"Making decision is difficult on several issues such as concerns about patient's priorities for critical care and ICU and the necessity to retain employees who are reluctant to stay in the work place"
	Protective factors	Visiting patients who have recovered	"It can be motivating to see patients who have recovered"
		Believing in better prognosis in youth	"Most of us are young and therefore we are at lower risk"
		Paying attention to the positive aspects of COVID-19	"Human beings are members of a whole, in creation of one essence and soul"
Shortcomings in preparation for crisis management	Predisposing factors	Hoping not to get infected	"I'm not worried because most people are asymptomatic; I think I'm not infected"
		Self- reassurance due to personal care	"I'm a medical staff and more aware about personal hygiene, so it will be easier for me to handle the problems; therefore, I will not be infected"
		Reducing the stress by observing the downward trend of the disease	"When we see that the process of hospitalization and admission of patients is improved, we are less concerned"
		Shortage of personal protective equipment (PPE)	"If there are only masks and gloves, there would be a lot of stress, but it would be easier if I have complete PPE"
	Protective factors	Personal problems	"My sister-in-law was infected and only I knew, and now I have to take care of her along with my work"
		Management factors	"There was the lack of coordination. A more coherent and orderly plan should have been provided. That is, tasks had to be identified, and division of labor should be done"
		Resource management	"If the cost spent on treating infected staff, sick leave, and on a possible CT scan was allocated to PPE, both the stress and the suffering of colleagues would decrease"
		Spiritual factors	"We put our trust in God"
		Altruism	"We tried to come up with the idea that we were serving our people"

important factors for fear and stress in caregivers similar to our study (2). In general, uncertainty is a strong stressor and there are, of course, individual differences in its impacts (25). In our study, this feature was also reported by a group of staff as a stressor associated with COVID-19.

Mental symptoms of anxiety, such as worry and life-threatening stress, were seen among health personnel in our study. A similar experience has been reported with staff at one of the COVID-19 care centers in Wuhan, China (7). Cai et al. examined the psychological status of health care providers during the outbreak of the COVID-19 and reported increased stress among them (26).

Psychological stress can be identified by its acute or chronic somatic symptoms (27). Headaches and palpitation were among the manifestations of stress among our participants. In addition, they were psychologically affected by hearing the deaths of COVID-19 patients. Among the stressful manifestations of the SARS epidemic, concerns about the transmission of the disease to the family were the typical ones. Anxiety and anger were other manifestations of health staff which are the same as the feeling of our health care providers (2).

In a study in Wuhan, Zhu et al. reported unprecedented psychological stress in the medical staff dealing with COVID-19 patients (11). The staff's concern about the transmission of the disease to themselves and their families, as a stressful experience,

TABLE 2 | Manifestations of stress and mental health needs related to perception of stress by medical staff during COVID-19 epidemic.

Manifestations of stress	Anxiety	Negative impact of stress on personal life	"Stress had a disruptive effect on my daily and personal life"
		Mental symptoms of anxiety	"I'm very worried"
		Avoiding work	"Two or three persons didn't work and left the ward and went out"
		Somatic symptoms	"I had headache and palpitation"
	Depression		"We feel low. We are not happy and do not laugh. During morning sessions, we are mostly tired"
	Anger		"We got into a fight; one colleague got angry and left work"
	Feelings of guilt	Transmission of infection to the family	"I feel guilty if I transmit the disease to my family; I feel guilty about my family"
		Patient death	"They always complained about the services and care. The patient could have survived"
	Hopelessness		"Most colleagues are frustrated and don't know when COVID-19 is going to end"
	Feeling exhausted		"The stress of dealing with patients, the stress of family, and the fact that we can be carriers all make us unsettled"
Mental health needs	Crisis management	Careful monitoring and control of infection	"They are very carefree, especially in providing guards and services and monitoring and controlling infection"
		Obtaining public and charitable donations	"The friends of one of our colleagues donated money. We provided financial assistance to our service staff"
		Choosing the right encouragement based on one's work experience	"Financial incentives may not be very important to experienced staff, but it does motivate the younger"
		Providing adequate protection equipment	"At least, staff should be provided with personal protective equipment. We provide N95 masks for three or four shifts. This is not correct"
		Appropriate distribution of equipment	"The allocation of the equipment and its distribution among the colleagues must be done to benefit everyone"
		Legal support for physicians and nurses	"Tariffs for nursing services have been in place for 10 years but have not yet been implemented. This should be verified and the budget should be allocated to it"
		Appreciation	Anything that makes the staff happy is favorable. So, appreciation is effective and its effect would be synergized if they receive appreciation from hospital and authorities outside; such effect from outside is more important"
		Increasing the number of staff required per shift	"They need to increase the number of personnel per shift"
		Compensatory leave	"They have to say you can go on leave for 2 extra weeks"
		Reducing the number of shifts	"Our encounters with patients should be reduced; that is, the number of our shifts should be decreased"
	Stress management	Reducing job discrimination	"Many of our colleagues are now leaving because they are afraid of COVID-19. Of course, there must be a difference between us and them. We agreed to come and work"
		Planning for unexpected events	"Planning and management must be done for future incidence"
		Distribution of responsibilities	"Many other wards of the hospital were closed; if they were working, we could get help from them to reduce the long shifts duration"
		Reducing family exposure	"Even my sister-in-law is undergoing chemotherapy; my wife has not been able to see her sister for a month because of my job. After all, my children are carriers"
		Stress management training	"We need to learn how to lessen psychological and emotional strains when we go home or in the ward"
		The need for availability of a psychologist / psychiatrist in the ward	"It would be better to talk in the group meetings we have, such as the morning report sessions, about what to do with our anxiety"
		Improving the quality of communication between professors and residents	"If, instead of the representatives, the residents themselves speak directly to the professors, the staff will be more encouraged"
		Participation of professors alongside residents	"Residents realized that the situation was so critical that the professors themselves came to work directly with the patients, and as a result, the collaboration of residents gradually improved"

(Continued)

TABLE 2 | Continued

Arranging quarantine for staff	"To reduce the risk of transmission, we will be quarantined in the hospital for 10 days, then another group will come"
Producing educational content for family members	"If they are trained through a program like a video clip, their negative perception would decrease"
Facilitating access to a psychologist / psychiatrist	"We really need a psychologist because a lot of residents have major problems. In a crisis, they really lose the power of reasoning due to stress. If there would be a place to help, it will be effective"

and the unknown nature of the disease as a stressor in their study is similar to our results. The unpredictability of COVID-19 disease has also been emphasized as an important factor in causing stress among individuals in previous research (12).

Conditions such as insufficient information in the early stages of COVID-19 spread and difficulty in deciding on new treatments have been highlighted as stressors in some other studies (5–7). Also in a recent research in Iran, nearly half of HCWs (nurses) had good knowledge about the disease, its transmission, and related treatment methods (28). It seems that increasing education in this field and transferring national and international scientific experiences is one of the beneficial approaches to fill this educational gap. Also, due to the pandemic conditions, the use of online training programs, expanding virtual training options, and identifying and introducing reliable and accurate sources of information may be helpful approaches in overcoming the challenges created by COVID-19 infection.

Lack of protective equipment was one of the causes of stress in the management of COVID-19 disease in our study. Unfortunately, similar conditions and limitations were observed in previous research as well (7). In the field of crisis management, the need for adequate equipment has been the chief concern of our medical staff. Zhu et al. have cited this as a contributing factor in reducing stress, anxiety, and depression (11).

Considering the shortcomings in crisis management, the main stressor in our study was lack of adequate protective equipment and the major stress reliever was resource management in health care staff. Crisis management through careful monitoring and control of infection, and provision of adequate protective equipment in tandem with stress management through availability of a psychologist/psychiatrist are mental health measures to reduce stress in caregivers.

Relative shortage of care equipment, mentioned in our study, can be attributed to the economic problems in Iran (29). This issue, along with the unfavorable crisis management conditions, has exacerbated the situation in monitoring and controlling the affected cases. It seems that the existing restrictions on protective equipment, along with other economic problems in Iran, including concerns about the living conditions of people in the community have complicated the situation. However, the effect of other social, cultural, and political factors cannot be neglected (30) and the synergistic influences of several measures such as financial and human resource management, support measures, and crisis management seem to have a role in improving the situation (31).

The main prerequisite in crisis management as part of the health care staff's needs is strict monitoring and control of infection. This requirement has been emphasized in some other studies (5). Similar to some studies of COVID-19, inadequate education on infection control has been associated with higher levels of anxiety and depression (32).

Our study showed that health care professionals have reported the value of personnel incentives, feelings of gratitude, proper distribution of equipment, and the reduction of occupational discrimination. In a qualitative study, Olofsson et al. pointed out that nursing is a risky occupation due to encountering with stressful diseases (33). They argued that failure to respond appropriately to their demands could induce feelings of hopelessness and powerlessness.

The burnt-out feeling experienced by emergency medicine assistants and the need for psychologic support for appropriate coping with occupational problems were emphasized in previous research (34).

One of the protective factors for stress in our study was the influence spiritual beliefs and altruism among medical staff. In some studies, the relationship between spiritual beliefs and altruism with better mental health situation has been reported among health care providers. McKee et al. reported that people with stronger spiritual beliefs showed greater resistance to the negative effects of stress at work (35). Consistent with several studies, spirituality and faith have been reported as a source for coping with adverse health conditions (36). In a review study in Iran, regarding the role of spirituality and religion in dealing with crisis, such an approach has been introduced as a way to help create mental relaxation. The study also emphasizes resorting to such beliefs and feelings in the face of the recent pandemic crisis (37).

CONCLUSION

Based on the findings of the current study, it is important to identify and evaluate the mental health needs of healthcare professionals. To reduce stress among health staff at COVID-19 care centers, it seems that simultaneous improvement in equipment and crisis management are optimal strategies. Providing facilities for staff stress management seems to be effective as well. However, it seems that in order to help improve the mental health of HCWs, further studies should be conducted in other fields related to mental health.

One of the findings of our study was the lack of knowledge about the baseline mental health status of HCWs. Also, the

role of various factors such as economic factors in shaping the perception of stress among HCWs was indicated. A more detailed multicenter research evaluating the impact of these factors is required to be performed in the future as our study was conducted in a single center.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethical Committee of Tehran University of Medical Sciences (the Code of Ethics: IR.TUMS.VCR.REC.1399.044). The patients/participants provided their written informed consent to participate in this study.

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AUTHOR CONTRIBUTIONS

All authors: conception and design of the study, searching for articles, and writing the final manuscript.

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Perceptions and Expectations of School-Based Professionals Surrounding School-Based Mindfulness Training in Appalachia During the COVID-19 Pandemic: A Qualitative Study

Ilana Haliwa^{1*}, Hannah Layman², Jessica Coffman², Amy Snodgrass³, Pamela Santer⁴, Brittney Barlett⁵, Kate Long⁵, Ashley Mason⁶, Gretchen Pfost⁶, Jenny Harden⁷, Geri Dino² and Traci Jarrett²

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Mohammadreza Shalbafan,
Iran University of Medical
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Reviewed by:

Mahtab Motamed,
Tehran University of Medical
Sciences, Iran
Bonnie Kaiser,
University of California, San Diego,
United States

*Correspondence:

Ilana Haliwa
ih0010@mix.wvu.edu.edu

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¹ Department of Psychology, West Virginia University, Morgantown, WV, United States, ² WVU School of Public Health, West Virginia Prevention Research Center, Morgantown, WV, United States, ³ Department of Rural Health, West Virginia University, Morgantown, WV, United States, ⁴ Wellness Center, WVU Parkersburg, Parkersburg, WV, United States, ⁵ Try This West Virginia, Charleston, WV, United States, ⁶ School of Physical Therapy, Marshall University, Huntington, WV, United States, ⁷ Greenbrier County Schools, Rupert, WV, United States

Background: School-based professionals often report high burnout, particularly in geographic areas like Appalachia, where school-aged children are exposed to high levels of adverse childhood experiences, which may be exacerbated by the COVID-19 pandemic. While school-based mindfulness trainings can reduce burnout, their efficacy is influenced by the expectations of intervention personnel ahead of implementation. The present study assessed expectations and perceptions of a school-based mindfulness training among school personnel in 21 Appalachian schools during the COVID-19 pandemic.

Methods: Upon enrollment in the training, staff ($N = 191$) responded to open ended survey questions regarding perceived impacts of COVID-19 on students, expected benefits and barriers to school-based mindfulness, and perceived community acceptance of mindfulness.

Results: School personnel identified social isolation and lack of structure as negative impacts of COVID-19 on students. Expected benefits of classroom mindfulness included improved coping skills, focus, and emotion regulation, whereas barriers included lack of time and student ability level (e.g., age, attention). While most respondents indicated that their community was accepting of mindfulness practices, some noted resistance to and misperceptions of mindfulness, which may illustrate the influence of local cultural norms and values on the acceptability of mental health interventions.

Conclusions: Overall, these findings suggest positive expectations and relative perceived support for mindfulness practices within these Appalachian communities, including in response to negative impacts of the COVID-19 pandemic on students.

Adapting practices and language to accommodate barriers such as time, student ability, and cultural misconceptions of mindfulness may increase the feasibility and efficacy of these interventions.

Keywords: mindfulness, COVID-19, Appalachia, compassion fatigue, burnout

INTRODUCTION

School-based professionals, such as classroom teachers and school staff, play a critical role in both the education and social-emotional development of their students. Unfortunately, school personnel often report high levels of stress and burnout (1–3) that contribute to high turnover rates (4, 5). Appalachia, a geographic and cultural region in the Eastern United States surrounding the Appalachian Mountains (6), provides alarming statistics in this regard. For example, in West Virginia, the only state fully within Appalachia, up to 32% of first-time teachers leave the profession in their first 4 years (7). In West Virginia and Kentucky, an average of 9–10% of all teachers leave the profession, annually (7, 8).

One critical reason for this high turnover rate is compassion fatigue, a form of burnout that is heavily documented among persons in “helping” professions, such as teachers (9, 10). Compassion fatigue involves first- or second-hand exposure to the trauma of others, including teaching or counseling students with Adverse Childhood Experiences (ACEs; e.g., not meeting basic needs due to low family income, divorce, or separation of a parent or guardian). This may be of particular concern in Appalachia, a region that is largely rural, and where regional household income is significantly lower than the national average (11), as rurality and low-income have been associated with higher likelihood of experiencing ACEs (12–15).

Moreover, stress related to the current COVID-19 pandemic may exacerbate the impact of ACEs in Appalachian communities, due to factors such as decreased access to basic services, heightened risk of domestic violence from caregivers, social isolation, and economic challenges (16). Widespread classroom closures during the early stages of the pandemic are also predicted to have long-term consequences for the wellbeing of school-aged children, particularly those from disadvantaged or distressed populations (17, 18). Finally, re-introduction to the classroom following an extended period of remote learning may also represent a source of distress for both students and school personnel (19–21). As such, Appalachian school personnel may experience increased compassion fatigue and burnout due to increased primary and secondary trauma both during and in the aftermath of the pandemic.

Some trainings, such as school-based mindfulness, may have the potential to attenuate burnout in the face of these heightened personal and secondary experiences of trauma. School-based mindfulness involves the use of exercises (e.g., physical movement, guided breathing) to increase mindfulness, defined as the non-judgmental attention to the present moment (22), among students and school personnel (23, 24). While mindfulness is associated with lower burnout among teachers, staff, and administrators (25) and school-based mindfulness

trainings have been shown to reduce burnout and compassion fatigue among teachers (24, 26–28), little research exists within the context of a global pandemic.

As with many school-based interventions, perceptions of programming are critical in determining the acceptability and effectiveness of implementation (29–31). For example, one study found that teachers who endorsed more positive perceptions of a school-based social-emotional training reported greater implementation fidelity [i.e., dosage and quality of delivery; (31)], which is a significant predictor of program effectiveness (32, 33). Interviews with school-based intervention developers (30), teachers, and students (29) have also identified positive expectations and perceptions (or, “buy-in”) of intervention administrators as a key component to successful intervention delivery and impact. Expectations and perceptions of school-based mindfulness may be influenced by cultural contexts. In areas such as Appalachia certain community characteristics, such as resistance or mistrust of new people or ideas, may be a barrier to implementation of contextually novel or alternative programming, such as mindfulness training (34, 35). Additionally, perceptions of school-based mindfulness trainings may be further influenced by the context of the COVID-19 pandemic. For example, though school personnel may perceive increased potential benefits from interventions to reduce burnout, there are also unique barriers to implementation, including challenges associated with altering program delivery to fit virtual or hybrid classrooms, social distancing guidelines, and abbreviated school hours. The purpose of this study was to identify the perceived need for school-based intervention as a result of the pandemic in Appalachia, as well as the expected benefits and barriers to school-based mindfulness interventions among school personnel, in order to inform tailoring of future interventions to promote support and buy-in, thereby increasing the chances of intervention success.

METHOD

In fall 2020 and winter 2021, school personnel across 21 West Virginia elementary schools and two pre-schools were selected to participate in an online training to implement Kidding Around Yoga, a school-based mindfulness-based approach to yoga, as part of two grant-funded efforts (36). In addition to the physical practice of yoga, Kidding Around Yoga incorporates mindfulness practices including breathing exercises, mindful walking, and meditation. This program is aimed at helping teachers lower stress and anxiety and promote resilience in the children and themselves. The West Virginia Prevention Research Center partnered with the funded organizations to conduct an evaluation of the program implementation and outcomes. This

study was reviewed and approved by West Virginia University's Institutional Review Board (Approval # 2006044813). Electronic informed consent to participate in this study was obtained from all participants.

Training

Due to COVID-19 restrictions, all trainings were offered online. Two types of Kidding Around Yoga training programs were offered, EduKAY and OKAY. EduKAY is a 6-h training led by a live online instructor that provides teachers with the skills to implement the Kidding Around Yoga curriculum in their classroom. EduKAY includes techniques to introduce mindful physical activity, yoga, meditation, and mindfulness in general into academic settings. The OKAY certification program is a combination of live sessions and self-paced video series that can be completed up to 5 months after participants are registered. To become certified, participants must submit a video recording of themselves teaching a class and must attend a live 4-h workshop session.

Recruitment

Schools from both urban and rural communities in West Virginia were invited to participate in the training. Schools for each of the two participating grants were identified either by (1) the level of economic distress of their student population, as specified by the grant or, (2) *via* a statewide listserv of schools, Facebook groups, direct school outreach, and school partners.

Data Collection

Prior to program implementation, school personnel were invited to participate in an online survey to assess barriers and potential facilitators of conducting mindfulness programming in schools, in general. Email invitations and up to three reminders were sent to 335 participants who enrolled in the online Kidding Around Yoga trainings. Of that number, 191 consented and completed a pre-intervention survey (response rate 57%) in which they responded to open-ended questions about perceived benefits and barriers to engaging in the use of mindfulness techniques in school settings and community perceptions of mindfulness (See **Table 1**).

Responses were analyzed using thematic qualitative analysis (37). First, all three reviewers reviewed responses to each open-ended survey question and performed inductive coding, identifying core themes for each question. This round of coding was followed by a thorough reading by the primary author in which each theme was examined for consistency and divergence from its operational definition. Coding rules based on the operational definitions for each category were developed, and responses were independently coded based on those definitions by three independent coders. In the results, we provide the percentage of participants who endorsed each theme (i.e., the number of participants who endorse the theme out of the total number of participants who responded to the survey question). We also report percent agreement across independent coders, as calculated by the number of instances of agreement on coding (i.e., statements coded consistently across reviewers) out of total

TABLE 1 | Open-ended survey questions.

COVID-19 impact

"COVID-19 has changed the educational landscape. What do you think is the biggest impact on your students and their families as a result of COVID-19?"

Expected benefits

"What do you think the benefits of mindful practice and/or mindful classrooms might have on you personally?"

"What do you think the benefits of mindful practice and/or mindful classrooms might have on your students?"

Expected barriers

"Do you anticipate barriers to practicing mindfulness in your classroom? If so, what do you think they will be?"

Community acceptance

"Do you feel like mindfulness practice is accepted in your community? Why or why not?"

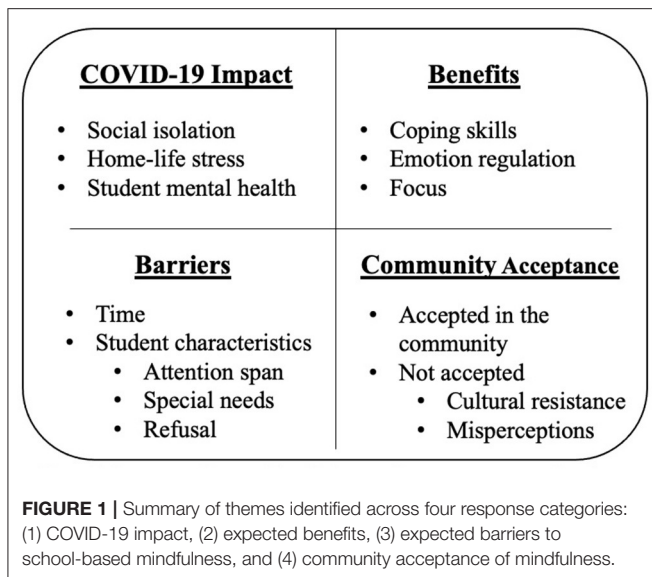
items coded for each theme. Percent agreement across themes ranged from 90.10 to 100%.

RESULTS

This study sought to identify elementary school personnel's perceived need for school-based mindfulness in the context of the COVID-19 pandemic, and the expected benefits and barriers associated with this programming. Participants were 191 school personnel enrolled in the online Kidding Around Yoga training. The majority were female (95.2%; 4.3% male, 0.5% preferred not to answer) and White (94.1%; 1.6% Black/African American; 0.5% Asian; 0.5% preferred not to answer; 3.2% other, or more than one race). The majority of participants had 7 or more years of education experience (68.3%; 9.8% 5–6 years; 11.5% 3–4 years; 4.9% 1–2 years; 5.5% <1 year) and time spent working in the school system was varied (16.6% <1 year; 18.2% 1–2 years; 20.9% 3–4 years; 13.4% 5–6 years; 31.0% 7+ years). Overall, we identified response themes across four domains: (1) perceived impact of COVID-19 on students, (2) anticipated benefits of school-based mindfulness training, (3) anticipated barriers to school-based mindfulness training, and (4) perceived community acceptance of mindfulness practices (See **Figure 1**).

COVID-19 Impact

Participants were asked to describe what they perceived as the most significant impacts of the COVID-19 pandemic on students and their families (123 respondents). Overall, school personnel reported concerns that their students were suffering from social isolation, exacerbated home-life stressors, and worsened mental health. The most cited impact of the pandemic, overall, was social isolation of students and their families (40.65% of respondents, 91.06% agreement). This included social isolation of students from their peers (*"Limited amount of social interaction that has made it harder for students to relate to each other."*), as well as social isolation within the home for students from distressed families. For example, some participants highlighted a *"lack of in-person socialization and touch... many students' home lives*



are not the best and these students have really struggled in many aspects while being quarantined.”

In addition to social isolation, respondents perceived that home-life stressors were another significant impact of the pandemic on their students (25.20% of respondents, 91.06% agreement). These stressors included lack of resources (“I have students who have families losing employment, working out of state, and one without basic needs.”) and greater parental stress (“The children are in school less and home more. This causes stress on parents who are having trouble getting their children to learn.”). These added familial stressors, along with existing histories of abuse were additional concerns (“Students that are victims of abuse and neglect are going unnoticed since they are not physically at school. I am worried about the impact socially, mentally, physically, and emotionally on our students.”).

Finally, respondents were also concerned about worsened mental health across their students (13.82% of respondents; 91.87% agreement). Concerns centered around the above stressors as well as general fear of the unknown, negatively impacting students’ wellbeing overall.

Expected Benefits

In order to determine what benefits participants expected from training, and to determine whether these were salient with respect to the aforementioned impacts of COVID-19 on students, participants were asked three separate questions in which they were prompted to describe expected benefits of incorporating school-based mindfulness for (1) themselves (123 respondents), (2) their students (126 respondents), (3) and in the context of the COVID-19 pandemic (120 respondents). Improved ability to cope with distress emerged as a primary theme across responses, with respect to personal ability to cope (53.66% of respondents, 99.19% agreement), student ability to cope (57.14% of respondents, 91.34% agreement), and

ability to cope specifically within the context of the COVID-19 pandemic (41.67% of respondents, 91.67% agreement). Participants highlighted expecting mindfulness training to promote feelings of calmness, clarity, and positive cognition (“Mindfulness allows my mind to calm down. It allows me to think more clearly and appropriately. It provides a more peaceful day with more positive thoughts.”). Further, participants largely emphasized that the training would benefit themselves and their students by providing coping tools for stressful situations both within the classroom and those outside of the classroom (“I believe it will provide them [students] with strategies to work through often stressful, traumatic situations even outside of the classroom.”). These benefits were expected to extend to the ability to cope with the stress of the COVID-19 pandemic (“Mindful practice will help my students cope with COVID. Teaching them how to deal with their inner emotions and feelings will give them strategies to cope with how they are feeling.”).

Though mentioned less consistently, improved student emotion regulation (30.95% of respondents, 95.28% agreement) and student focus (22.22% respondents, 97.64% agreement) emerged as two additional themes throughout participants’ responses. Respondents also associated greater emotion regulation and ability to focus to improve student behavior and academic performance (“... Mindfulness can help improve attention and focus, which will aid in better grades. Giving students a guide to help them regulate their emotions and generate better behavior in school.”).

Expected Barriers

Participants were also asked to describe perceived barriers to school-based mindfulness (125 respondents). The most common response to this question was that, upon enrollment, participants did not anticipate any barriers (40.80% of respondents, 96.00% agreement). Of those who did perceive potential barriers, time was identified as a significant barrier (20.80% of respondents, 98.40% agreement). For example, one participant noted that “...time constraints may be the biggest barrier in the general classroom setting.” For some respondents, these time constraints were exacerbated by changes to the school schedule during the COVID-19 pandemic such as reduced hours (“Space and time. We are right now in hybrid so teachers feel the need to use this time to get as much done because we only see the students 2 times a week.”).

Finally, certain student characteristics, such as age, attention span, ability-level, and reluctance to participate (19.20% of respondents, 99.20% agreement) were also identified as potential barriers to school-based mindfulness. Specifically, participants were concerned that younger students and students with special needs would struggle to engage with mindfulness practices within the classroom (“... I have 4- and 5-year-olds. I also have special needs students. Their attention spans are very short. I could apply them [mindful classroom practices] but only in short forms.”). In addition, some participants were unsure that their students would be willing to participate in the exercises due to feelings of vulnerability and uncertainty about the subject (“I feel the biggest barrier to practicing mindfulness in my classroom would be my students feeling vulnerable. Many students are not used to the

concept of mindfulness and are probably uncertain of how to feel about it.”).

Community Acceptance

Participants responded to an open-ended question about whether they perceived their community to be accepting of mindfulness practices (121 respondents). Of respondents, 42.99% perceived that their community was accepting of mindfulness practice (94.22% agreement). Participants specifically mentioned the support of parents and school communities due to their shared understanding of students experience of trauma (*“Yes. I think our community and school system is very aware and supportive of mental health and mindfulness practices to help our students because we have such a large amount of students who come from traumatic experiences/households.”*).

However, 28.10% of respondents (90.10% agreement) reported a lack of support for mindfulness practice within their community. Some of these respondents attributed this lack of support to misperceptions or misunderstanding of mindfulness practices (*“I feel like much of our community sees it as a waste of time and some “hippie” program.”*). Community resistance to certain contextually novel concepts, like mindfulness, were also cited as reasons for a lack of community support (*“It is a very conservative community that may be hesitant to accept practices that are not considered western.”*). This resistance was attributed by some to the uniquely rural and conservative nature of Appalachia itself (*“Probably not- we are a rural, Appalachian community. Anything “new” or “different” isn’t easily trusted.”*).

DISCUSSION

This study used qualitative data analysis to understand perceived impacts of the COVID-19 pandemic on students in Appalachia, as well as expectations and perceptions of a school-based mindfulness training and community acceptance of mindfulness, among staff across 21 Appalachian schools. School-based mindfulness techniques have the capacity to help both staff and students cope with stressful life experiences, including those related to COVID-19, and prevent or reduce burnout (24, 26–28). These practices may be particularly helpful in rural areas where the prevalence of ACES is relatively high (12–14) and may be exacerbated by certain global stressors, such as the COVID-19 pandemic (16). Given that expectations and buy-in are critical predictors of the success of school-based programming (29–31), it is crucial to understand expectations and perceptions related to mindfulness within targeted communities to maximize acceptability, feasibility, and implementation.

Overall, school personnel reported three main concerns regarding the impacts of the COVID-19 pandemic on students: social isolation, exacerbation of home-life stressors, and worsened mental health. This is consistent with early research pointing to exacerbation of ACES during the pandemic, including stress related to social isolation (38, 39), exacerbation of home-life stressors (40, 41) and worsened mental health (42, 43) among school-aged children due to the pandemic. Further, as the effects of the pandemic are hypothesized to be intensified for individuals already at risk for ACES (i.e.,

those with low-income, individuals in rural communities), Appalachian students may represent a particularly high-risk population for the development or worsening of ACES due to the pandemic (11–15). Given this increased risk for Appalachian students, it holds that school personnel may bear the burden of increased risk of burnout and compassion fatigue as they return to interacting with and supporting these students. As such, incorporation of school-based interventions that have been shown to attenuate burnout and support student mental health will be critical.

Promisingly, participants generally reported positive expectations with respect to school-based mindfulness. Expectations included greater ability to cope with distress for both school personnel and their students, both generally and specific to pandemic related distress. Additionally, respondents expected additional benefits for their students because of school-based mindfulness, including improved emotion regulation and focus. This is consistent with existing evidence demonstrating improvements in coping strategies, emotion regulation, and focus among students and school personnel following implementation of school-based mindfulness interventions (24–28).

In addition to expected benefits, participants also reported some expected barriers to school-based mindfulness. Respondents reported that time was a significant barrier to implementing school-based mindfulness, particularly given reduced in-person interaction with students due to the COVID-19 pandemic. Further, certain student characteristics were identified as potential barriers to school-based mindfulness, including age, attention span, ability level, and apprehension or refusal. Thus, these may be important considerations to incorporate into school-based mindfulness trainings. For example, brief practices that can be easily implemented both virtually and in-person throughout the school day may circumvent time barriers, including those related to COVID-19. Indeed, existing evidence suggests the efficacy of mindfulness practices as brief as 5-min long (44). Further, it may be critical to introduce mindfulness practices accessible to a wide range of age and ability levels and evidence-based mindfulness practices are available for children as young as pre-school age and for a variety of ability levels (26, 45, 46). Information and education about the availability and effectiveness of these adaptations might be valuable to include in future trainings.

Survey responses also suggest that almost half of respondents perceived mindfulness practices to be accepted within their community. These findings are promising and suggest that, given exacerbated experiences of trauma and burnout within these regions during the COVID-19 pandemic, Appalachian schools may be fertile ground for incorporating mindfulness as a tool to help school personnel and students improve their coping skills, increase emotion regulation, and focus, and attenuate burnout. Despite this, 28.10% of respondents did suggest that mindfulness practices were *not* accepted within their community. Common reasons included misunderstanding of mindfulness as a practice (e.g., perceived as “hippie” or not in alignment with western religion) and cultural resistance to new or different practices. These results are consistent with prior research suggesting that

communities in rural Appalachia may be initially distrusting or suspicious of novel or unfamiliar interventions (34, 35). However, school-based mindfulness may be particularly beneficial in rural Appalachian communities, given their disproportionately high levels of ACES and teacher burnout (7, 8, 12–14). As such, it may be necessary to adapt some classroom mindfulness training and intervention language to promote greater acceptability within these communities. For example, including educational materials for parents may help to prevent misunderstanding and dispel myths surrounding mindfulness practice. Adaptation of trainings using language that is more familiar and accessible (e.g., using terms such as “relaxation” and “stress relief” rather than “mindfulness”; or “focused breathing” rather than “meditation”) may also be beneficial in easing suspicion of novel interventions.

The present study is not without limitations. While qualitative coding of data allows the researchers to understand various dimension of participant experience, including perceived benefits and barriers, additional research could incorporate quantitative assessments of changes across many of the themes mentioned throughout the present survey responses, including mental health and burnout, using validated scales. Further, data for the present study was collected largely during the fall of 2020, a unique time-period during which many schools were operating remotely due to the COVID-19 pandemic. Thus, while the present findings provide unique insight into perceptions of a school-based mindfulness training in Appalachia during a time of significant stress for teachers and staff, some of these findings may not generalize to post-pandemic times (i.e., COVID-19 related barriers to implementation). Finally, responses were collected from staff at schools that had already accepted funding to conduct school-based mindfulness trainings, and thus responses may be skewed to reflect more favorable responses and perceptions. However, findings from the present study provide an initial understanding of perceptions and expectations related to school-based mindfulness within these unique Appalachian communities. Future research studies can build upon these findings by incorporating quantitative assessments of change across these identified themes using validated scales and by replicating this study within samples of school-based professionals who have *not* already agreed to participate in a mindfulness training.

In summary, school personnel reported concerns about their students in relation to social isolation, worsened home-life stressors, and decreases in mental health due to the COVID-19 pandemic. Participants generally anticipated school-based mindfulness to be beneficial for themselves and their students, in improving coping skills, emotion regulation, focus,

and attenuating related effects of the pandemic. However, lack of time and student ability-levels were identified as potential barriers. While many respondents reported that their community was accepting of mindfulness, some were less confident, citing cultural resistance to novel practices and misperceptions of mindfulness. Taken together, these findings suggest that Appalachian school communities are promising candidates for school-based mindfulness interventions, given positive expectations and relative perceived support for mindfulness practices within the community. Incorporating shorter mindfulness practices accessible to a range of ability levels and adapting trainings to use language that is more familiar and accessible within communities may increase the feasibility and efficacy of these interventions within schools.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by West Virginia University Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

BB, KL, AM, and GP were instrumental in funding and implementation of study programming. TJ organized the database. IH, HL, and JC performed the statistical analysis. IH wrote the first draft of the manuscript. HL and TJ wrote sections of the manuscript. All authors contributed to conception and design of the study, manuscript revision, read, and approved the submitted version.

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A Wake-Up Call: Recognizing and Reimaging Responses to Children's Mental Health and Protection Needs as an Integral Part of the COVID-19 Pandemic

Mireia Solerdelcoll^{1,2*}

¹ Department of Child and Adolescent Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, ² Department of Medicine, University of Barcelona, Barcelona, Spain

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic is an unprecedented worldwide crisis that presents unprecedented risks to the safety, wellbeing and development of the world's children. The pandemic-related economic breakdown and psychosocial impact have increased the existing child psychosocial needs and highlighted the weaknesses of mental health systems globally (1). Moreover, the harmful effects of COVID-19 and related control measures are not distributed equally, and the most damaging and longest-lasting consequences are likely to impact those who are already most disadvantaged or vulnerable (2). The pandemic is also exposing the fact that the harmful effects are not equally distributed and particular vulnerable and already disadvantaged groups, such as children from low-income and middle-income countries (LMICs), those with neuropsychiatric conditions or disabilities, and those in vulnerable social circumstances (for instance, refugee or migrant children, and children living in alternative care or overcrowded settings), might be at even greater risk of poor educational, social and mental health outcomes because pre-existing failures in human rights protection are worsened (3, 4).

If the pandemic has taught us anything, it is that mental health is profoundly affected by the world around us. Socio-economic and cultural factors and humanitarian crises like the COVID-19 pandemic can lead to severe and lasting psychosocial distress (5). Children are subject to multiple influences throughout their lives, and mental health is also a reflection of their circumstances, personal experiences, and cultural context (6). This opinion article provides an overview of the foundational role of culture and environmental contexts on children's mental health and wellbeing under the COVID-19 circumstance and discusses recommendations and considerations on how culturally sensitive approaches can promote and protect mental health and care for the most vulnerable youth in these challenging times.

SPHERES OF INFLUENCE ON CHILDREN'S MENTAL HEALTH AND WELLBEING

Culture and contexts shape how mental disorders are experienced, understood and addressed. For children and young people understanding mental health means recognizing that is entwined with societal and family values, cultural standards, social expectations, and developmental capacities (7). For example, perceptions of acceptable behavior, appropriate social functioning, expectations of

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*Correspondence:

Mireia Solerdelcoll
mireia.solerdelcoll_arimany@kcl.ac.uk
orcid.org/0000-0003-2250-494X

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happiness and personal growth, and experiences of adversity are understood differently in different cultural contexts, affecting understanding of mental health and wellbeing. As a result, the successful implementation of mental health policies and programmes need to take into consideration familiar, cultural, social, political, and environmental contexts. When these different perspectives and cultural contexts inform responses to mental health, they can lead to prioritizing interventions that are more beneficial, acceptable and that build on the strengths of those societies (8).

Over time and as the pandemic unfolds, children are subject to multiple influences that lead to positive and negative trajectories. These differences often stem from cultural stereotypes and norms, powerful social determinants of mental health, but are also linked to family and community behaviors and expectations (9).

Recognizing a socio-ecological framework, multiple factors shape the mental health of children and youth (10). It is molded by the worlds of parents and caregivers, communities and schools, and large-scale social determinants such as poverty, conflict, and pandemics (11). At critical moments of child development, these experiences and environments can contribute to pre-existing vulnerabilities and harm mental health and wellbeing, but they also offer unique opportunities to promote and protect mental health and resilience (7, 12). A recent UNICEF report synthesized six life domains that have the greatest impact on children's development: physical and mental health and wellbeing; economy and equality; learning and human capital formation; violence and conflict; family relationships and social networks (9).

THE ROLE OF PARENTING IN ADDRESSING MENTAL HEALTH AND PSYCHOSOCIAL ASPECTS

The role of parenting is foundational to children's mental health (13). Positive parenting skills become even more important when schools are closed, social services are disrupted, and children are confined at home. Positive parenting can foster adolescents' capacity for resilience in the face of adversity and have long-lasting effects on health and education. Across diverse cultural contexts, warm relationships between caregivers and children can lead to positive outcomes, including higher self-esteem, reduced stress, better mental health and fewer psychological and behavior problems (14, 15). However, parents' psychological distress reduces their parenting skills and leads to impaired parent-child interactions (16). A key approach to laying the foundation for youth mental health requires providing care for caregivers and encouraging engaged parenting. To achieve good mental wellbeing as part of COVID-19 response efforts, we must ensure that the family's basic needs are met and that the rights of children are fully promoted and protected. Supporting parents and caregivers should be addressed through collaborative

networks between key actors such as governments and local authorities, intergovernmental organizations, community-based and civil society actors, and healthcare professionals, by the implementation of social protection measures that include financial and nutritional support, family-friendly policies, and parent training and counseling programs. When social inequalities remain unaddressed, mental health interventions are less effective. Thus, inequality is an important determinant of mental health, and it is worsening as a result of the pandemic. Mental health and psychosocial response require recognition of the syndemic co-occurrence and interaction of health burdens and sociocultural context (17). Family environments marked by poverty or limited resources will bear the full brunt of COVID-19 and associated containment measures (3). High-stress home environments increase the likelihood of family conflicts, as well as emotional and behavioral problems, domestic abuse and violence. Therefore, the effectiveness of public health strategies and programmes in global mental health should strategically address the social determinants (6). Enabling families to cope with this situation will require reducing stressors and economic instability and increasing parenting capabilities, along with mental health support. An effective COVID-19 response promotes responsive caregiving and nurturing connections, ensures mental health care for caregivers, and provides parents training to respond to children's mental health challenges. Mental health programmes must prioritize caregivers by providing support to manage stress and conflict and enhancing coping strategies, prioritizing targeted support for families and children at particular risks, such as those facing violence and groups with previous vulnerabilities (e.g., mental and substance use disorders) (18).

EDUCATION ENVIRONMENTS

Information, education, and online materials on mental health and psychosocial wellbeing have been produced by many institutions and organizations to provide immediate help and coping strategies for managing infection containment-related psychological stress during the COVID-19 pandemic and beyond (19). Despite the window of opportunity presented by the use of digital technology for various mental health care tasks, caution is needed as barriers to access and use of different telehealth resources may increase existing disparities in access to mental health care. Two-thirds of the world's school-age children have no internet connection at home and in the context of COVID-19 and prolonged school closures, it can lead to isolation, loss of learning, and perpetuate inequalities that already divide youth from the poorest households, rural areas, and LMICs from their peers. Aside from the important academic benefits of schooling, schools have an essential role in shaping the mental wellbeing of young people by providing a structured and supervised space for socioemotional development, friendship and social support networks, protection from risk-taking behaviors, and often represent a key access point for food, which negatively affects mental health (1).

Abbreviations: COVID-19, coronavirus disease 2019; LMICs, low-income and middle-income countries.

Schools provide a critical platform to promote and protect children's and young people's mental health and reach children in need of care, those who might otherwise not have access to mental health services. In countries at all income levels, especially in LMICs, evidence shows that school-based interventions that focus on developing social, emotional, problem-solving and coping skills are linked to mental health benefits. As a result, learning environments are critical platforms where cost-effective and culturally acceptable interventions can foster inclusion and promote and protect mental health (20, 21).

We suggest that an inter-agency collaboration between child protection actors, education, and mental health professionals should be adopted in the design and development of programs for preventing, identifying, and delivering psychosocial support to children and adolescents and their caregivers (22).

EXPERIENCES OF STIGMA AND DISCRIMINATION

Despite growing media and community awareness of the importance of mental health and the establishment of children's mental health as a core priority of governments and other stakeholders, it is still widely stigmatized and misunderstood. The influences of stigma on mental health are complex and can work bi-directionally, instigating and exacerbating mental health conditions (23). Additionally, stigma can intersect and combine with other forms of discrimination, such as gender, race, socioeconomic status, sexual orientation, or disability, to lead to poor mental health and hamper efforts to promote mental health and protect vulnerable children and youth. Mental health is widely stigmatized and influenced by laws, policies, the media, attitudes, and cultural norms that perpetuate stereotypes and limit opportunities for children and youth to grow, learn, and prosper (24, 25).

Against a backdrop of rising awareness of mental health issues, there is now an opportunity to promote good mental health for every child, protect vulnerable children, and care for children facing the greatest challenges. Making that happen will require not only investment in mental health across multiple sectors, including primary health care, education, and social protection sectors, but also requires societies to break the silence surrounding mental health, by addressing stigma, promoting understanding and a positive state of wellbeing for children and their caregivers (6).

Racial discrimination devalues, disempowers and, whether felt directly or indirectly, significantly harms children's mental health and wellbeing. Research suggests that the effect of racism on mental health is profound, complex, entrenched and pervasive (26, 27). Racism is a social determinant of health that has a profound impact on health status and affects mental health in multiple ways: by disparities in educational access and outcomes; increased and prolonged levels of exposure to stress; the internalization of negative stereotypes related to race and damaging self-esteem; disadvantage and discrimination as a factor limiting the access to health care, and can also impact the diagnosis of mental health conditions. Perceived

racial discrimination is associated with increased symptoms of depression, anxiety, post-traumatic stress disorder, poor sleep, reduced self-regulation, and increased rates of risky behaviors, substance use or delinquency. Additionally, experiences of racism can result in a downstream effect of racial inequality, such as intergenerational and historical trauma (27). Thus, recognizing the cultural background as an integral part of the person and addressing the roots of discrimination is essential to safeguard mental health. A core commitment to a culturally sensitive approach to mental health care for young people and adjusted to their particular needs and challenges must be a guiding principle. Recent mental health guidelines call on practitioners to raise their awareness of discrimination; conduct culturally aware assessments; establish an individualized and culturally appropriate treatment approach; and provide multidisciplinary assistance (28).

RESILIENCE

Human resilience depends on a combination of multiple biological, psychological, social, and ecological systems interacting as a combination of co-occurring and co-dependent elements in ways that help individuals to regain, sustain, or improve their mental wellbeing in contexts of adversity (29). In the context of exposure to adversity, Ungar argued that resilience is both the capacity of individuals to navigate their way to the psychological, social, cultural, and physical resources that sustain their wellbeing, and their capacity individually and collectively to negotiate for these resources to be provided and experienced in culturally meaningful ways (30). Resilience requires the ability to navigate seven tensions: access to material resources; relationships; power and control; social justice and cohesion; and being especially relevant for this opinion article: a personal and collective sense of identity, purpose and belonging; and cultural adherence and cohesion to local, global or cultural practices, beliefs, including religious beliefs, and values (31). Fostering resilience in children and youth requires recognizing the unique qualities in diverse cultural forms with specific values and concepts of mental health, needs, and resources (32).

While the measures adopted by public health authorities to prevent and control the spread of COVID-19 were necessary to reduce the disease burden, accumulating evidence suggests that pandemic-related restrictions have resulted in an increase in known risk factors for mental health problems and have contributed to the risk of deepening social, educational, and health inequalities, exacerbating pre-existing vulnerabilities for marginalized and disadvantaged children and families (33). Overall, the data published to date suggest that while some children demonstrated resilience, a significant cohort of children and adolescents appear to be experiencing psychological distress related to the COVID-19 crisis (34, 35). As the pandemic has progressed, referrals to child mental health services have increased, reaching record demands (36).

Studies of resilience show that regulatory capacities and changes to cognitions are unsustainable unless other co-occurring social and physical resources, such as family,

housing, and natural environment are adequate and facilitated (37). The promotive and protective factors and processes enable resilience when they express sensitivity to contextual and cultural dynamics. Thus, heightened awareness of how resilience interventions can meaningfully respond to the COVID-19 pandemic has the potential to enable mental health practitioners to better support positive mental health outcomes in children. To this end, mental health professionals need to work in multidisciplinary teams to promote interventions that promote resilience tailored to the cultural and contextual norms of different populations who can facilitate access to protective socioecological supports while treating disorders (38).

CONCLUSIONS AND FUTURE DIRECTIONS

To promote good mental health for every child, protect vulnerable children and care for children facing the greatest challenges, we outline a framework on the foundation of three core principles: commitment to strengthening leadership and partnerships, backed by investment in supporting mental health; Communication to break down stigmas around mental health, opening conversations and improving mental health literacy; and Action to strengthen the capacity of health, education, social protection and other workforces, to better support families, schools and communities, and to improve data, research and evidence (6).

The impact of the COVID-19 pandemic on children's mental health has raised serious concerns and has generated an enormous amount of speculation, media coverage and academic studies. So far, no event has aroused so much interest in the global media about the state of mental health as now. Part of the media coverage of COVID-19 has focused on disseminating information and raising awareness about the effects of the

pandemic on mental health, however, a framework for action is needed (39).

This opinion article aimed to deepen knowledge and raise awareness of the key cultural and contextual factors affecting children and advocate for responses that improve children's lives in the current context. Hence, after governments, academics, and other stakeholders have shown a public commitment and broad communication to better mental health, we crucially conclude by calling governments, health institutions, and non-governmental organizations to commit to act in key areas and prioritize the needs of children and young people in any implementation of COVID-19 responses. If children's needs are not appropriately addressed, the mental health consequences for a generation of children could far exceed the immediate health and economic impact of the COVID-19 pandemic, leaving long-term social and economic consequences (22).

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The author confirms being the sole contributor of this work and has approved it for publication.

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COVID-19 Related Stress and Mental Health Outcomes 1 Year After the Peak of the Pandemic Outbreak in China: the Mediating Effect of Resilience and Social Support

Jingchu Hu^{1†}, Yiting Huang^{1†}, Jiayu Liu¹, Zhiying Zheng¹, Xiuhua Xu¹, Yunfei Zhou¹ and Jianhong Wang^{2*}

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Edited by:

Mohammadreza Shalbafan,
Iran University of Medical
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Reviewed by:

Davod Afshari,
Ahvaz Jundishapur University of
Medical Sciences, Iran
Moloud Radfar,
Urmia University of Medical
Sciences, Iran

*Correspondence:

Jianhong Wang
wangjianhong0755@163.com
Jingchu Hu
hujingchu@gmail.com

[†]These authors have contributed
equally to this work

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¹ Department of Anxiety Disorders, Shenzhen Clinical Research Center for Mental Illness, Shenzhen Kangning Hospital, Shenzhen, China, ² Shenzhen Clinical Research Center for Mental Illness, Shenzhen Kangning Hospital, Shenzhen, China

Background: COVID-19 outbreak have a long-term negative impact on mental health. Meanwhile, it may also provide opportunities for positive outcomes (e.g., post-traumatic growth). Resilience and social support could serve as psychological resources to protect individuals against the detrimental effects of the COVID-19 crisis and enable people to develop positive changes during challenging times.

Objective: By testing the roles of resilience and social support in the relationship between COVID-19 related stress and negative mental health outcomes (depression and anxiety), as well as the relationship between COVID-19 related stress and positive mental health outcomes (post-traumatic growth, PTG), this study aimed to investigate the psychological mechanisms involved in different mental health outcomes induced by COVID-19.

Methods: An online survey was conducted 1 year after the peak of the COVID-19 outbreak (from April to August 2021) in China. The survey includes demographic questionnaires and six scales: the Impact of Event Scale-Revised for COVID-19 (IES-RC), the 10-item Connor-Davidson Resilience Scale (CD-RISC-10), the Perceived Social Support Scale (PSSS), the Center for Epidemiological Studies Depression Scale (CES-D), the Generalized Anxiety Disorder scale (GAD-7) and the Posttraumatic Growth Inventory (PTGI). The structural equation model (SEM) was used to evaluate the relations and mechanisms between COVID-19 related stress and resilience, social support in depression, anxiety, and PTG.

Results: A total of 771 Chinese subjects completed the questionnaire, including 416 (54%) females. COVID-19 related stress was associated with anxiety ($P < 0.001$), PTG ($P < 0.001$), and depression ($P < 0.001$). Resilience was related to depression ($P < 0.001$), anxiety ($P < 0.001$), and PTG ($P < 0.001$). Social support was associated with depression ($P < 0.001$), anxiety ($P < 0.001$), and PTG ($P < 0.001$). Under SEM analysis, resilience mediated the effects of COVID-19 related stress on

depression and post-traumatic growth. Social support mediated the impacts of COVID-19 related stress on post-traumatic growth, depression, and anxiety. The path coefficients of the mediation effects were statistically significant.

Conclusions: The current findings suggest that COVID-19 related stress has a double-edged effect on mental health. Depression, anxiety, and PTG coexist in Chinese individuals 1 year after the peak of the pandemic. Resilience and social support serve as important protective factors of mental health, safeguard people from the negative mental health outcomes of the COVID-19, and promote PTG.

Keywords: COVID-19, stress, mental health, social support, resilience

INTRODUCTION

The Coronavirus-19 (COVID-19) pandemic began as viral pneumonia in China in December 2019 and has posed a severe threat to people's mental health globally with its lethal spread. The rapid development of the pandemic and the following restrictive quarantine measures (e.g., isolation at home) had a profoundly psychological impact on most people. A nationwide survey conducted at the peak of the pandemic in China reported that around 35% of the respondents experienced psychological distress (1). Another Chinese study found that 53.8% of the respondents had experienced psychological impacts of the COVID-19 pandemic on a moderate or severe level, with 8.1% of respondents reporting moderate to severe stress levels by early 2020 (2). These negative mental health outcomes may attribute to the stress induced by the COVID-19 pandemic, as some researchers indicated that COVID-19 related stress made people more vulnerable to developing mental health issues (3, 4). Recent studies further confirmed an association between COVID-19 related stress and negative mental health outcomes (5–7). Besides, some researchers found that COVID-19 related mental health outcomes are not static but dynamic events that fluctuate with the number of infected cases (8). Therefore, it is crucial to understand the mental health outcomes and the influencing factors in periods with different infected cases during the COVID-19 pandemic. In early 2021 (one year after the peak of the pandemic in China), as a result of effective treatments and preventions made by the government, China continued to report a lower number of new coronaviruses confirmed cases (28 confirmed cases by 1 April 2021) and 0 new deaths (9, 10) (see **Figure 1**). However, few studies explored the impact of COVID-19 related stress on mental health outcomes after a sharp drop in infection cases and deaths.

Despite the mental health concerns of the COVID-19 pandemic attracting significant attention, recent researchers questioned whether COVID-19 acts as a stressful event and offers opportunities for people to grow (8, 11). Previous studies demonstrated that the phenomenon of post-traumatic growth happened after the SARS pandemic (12). Post-traumatic growth (PTG) was defined as positive change after experiencing the trauma in people's self and life (13). The development of PTG encouraged individuals to appreciate more about their life, improve self-perception, and develop intimate relationships with

others after surviving from trauma (13, 14). A nationwide survey among 2038 Chinese university students reported that 66.9% experienced post-traumatic growth during the COVID-19 pandemic (15). Nevertheless, only a few studies have investigated post-traumatic growth and the potential mechanisms involved during the COVID-19 pandemic. None of the studies discussed post-traumatic growth caused by COVID-19 related stress and the associated psychosocial factors 1 year after the peak of pandemic.

Among all the possible influencing factors on the mental outcomes induced by the COVID-19 pandemic, resilience has been recognized as a significant influence factor (8, 16). Resilience refers to the cognitive process of adapting well in the face of adversity (17). The framework proposed by previous researchers suggested that resilience is the central part of the recovery from trauma or adversity (18). It can be considered as personal strength for individuals to protect their mental health and enable them to cope with traumatic events (19, 20). Recent studies indicated that a higher level of resilience in individuals predicted lower depression symptoms and anxiety symptoms during the COVID-19 pandemic (21–23). As a positive resource, other research also found that resilience could facilitate the development of PTG (16, 24). When people go through the adversity of COVID-19, resilience may work as a crucial factor in reducing the stressful experience, consequently maintaining people's mental health. In line with this, abundant research has demonstrated the indirect effect of resilience between stress and mental health outcomes such as depression and anxiety (7, 25).

In the meantime, the social-cognitive theory underlined the salience of social support in facilitating active cognitive processing and finding positive meaning (26). Social support is defined as the assert of effective social networks and supportive relationships with the therapeutic effects on mental health (27). It can serve as a buffer to the severity of the traumatic events and foster people's recovery from the difficulties (27). As a coping resource, empirical studies indicated that a higher level of support from family, friends, and significant others would predict a higher level of post-traumatic growth under the context of the COVID-19 pandemic (28–30). Meanwhile, perceived social support works as a protective factor in reducing depression and anxiety during the COVID-19 pandemic (31, 32). In addition to the direct effects, a recent study proved the indirect impact of social support in the association between perceived stress and

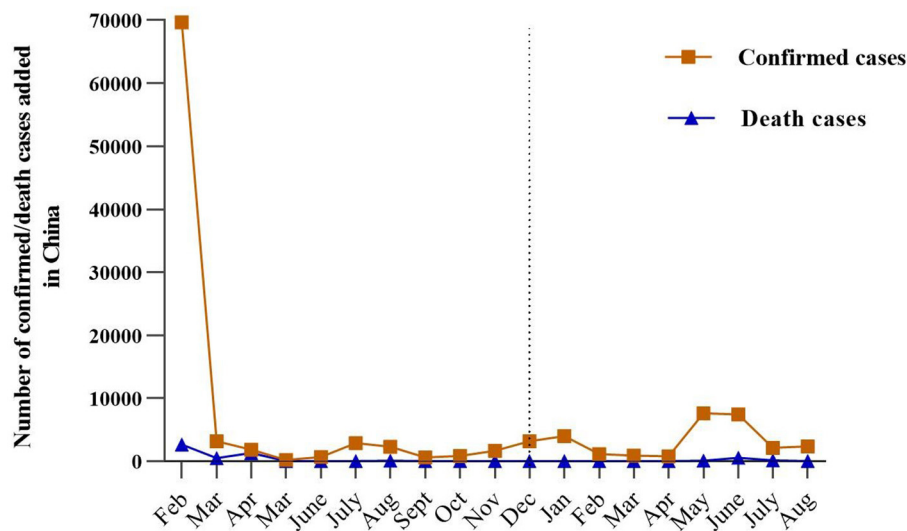


FIGURE 1 | Trajectory of the COVID-19 pandemic in China (including Hong Kong, Macao, and Taiwan) with the number of confirmed and deaths cases added each month from February 2020 to April 2021. The left side of the dotted line is 2020, and the right side is 2021.

depression (33). Moreover, social support is recognized as an important source of mental health for Chinese people under collectivist culture (34).

Although extensive research confirmed the negative impacts of COVID-19 related stress on individuals' mental health, it is still unclear whether there are any positive impacts of COVID-19 related stress and the potential mechanisms underlying them. Since China is the first country that experienced a sharp fall in the number of confirmed coronavirus cases for 1 year (see **Figure 1**), the research into mental outcomes affected by COVID-19 related stress among Chinese people could provide leads for further investigations in the process of stress-related growth in the new stage of the pandemic. Thus, the purpose of this study is to evaluate the indirect roles of resilience and social support between COVID-19 related stress and negative/positive mental health outcomes (depression, anxiety, and PTG) among the Chinese 1 year after the peak of the COVID-19 pandemic. The framework of the current study was proposed and shown in **Figure 2**. The study addressed the following hypotheses: (1) COVID-19 related stress is positively associated with depression, anxiety, and post-traumatic growth. (2) Resilience and social support are negatively associated with depression and anxiety but positively associated with post-traumatic growth. (3) Resilience and social support mediate the relationship between COVID-19 related stress and mental health outcomes (depression, anxiety, and post-traumatic growth).

METHODS

Participants and Procedures

A cross-sectional online survey was conducted 1 year after the peak of the COVID-19 outbreak (from April to August 2021) in China. The present study was approved by the

Institutional Review Board of Kangning Hospital (code: 2020-3-20-2). This study used the structural equation model (SEM) for the data analysis, and the previous research suggested the sample size of the structural equation model should be over 200 (35). A total of 771 participants was recruited, which included 54% female (for more specific demographic information, see **Table 1**). All of participants were provided informed consent before filling out the survey. Considering the spread of the epidemic, an online platform performed the data collection procedure, www.wjx.cn, a widely used survey distribution and data collection website in China. To ensure the data reliability, except all participants were anonymous, we set up validation questions in the questionnaire. Participants that included in following data analysis should meet (1) answered the validation questions correctly (e.g., What is the capital city of China?) (2) answered all the questions thoughtfully. Finally, all eligible participants were provided the same compensation.

MEASUREMENTS

COVID-19 Related Stress

The COVID-19 related stress was assessed by the Chinese version of the Impact of Event Scale-Revised Version (IES-R) (36, 37), a 22-item measure reaction adapted to the COVID-19 related events (**Supplementary Table 1**). According to the last seven days' stress level caused by the COVID-19, participants were required to rate on a five-point Likert scale from 0 ("not at all") to four ("extremely"). The adapted items, for example, "I tried not to think about COVID-19". This scale includes three dimensions: intrusion, avoidance, and hyperarousal. The Cronbach's α coefficient was 0.852 in the present sample.

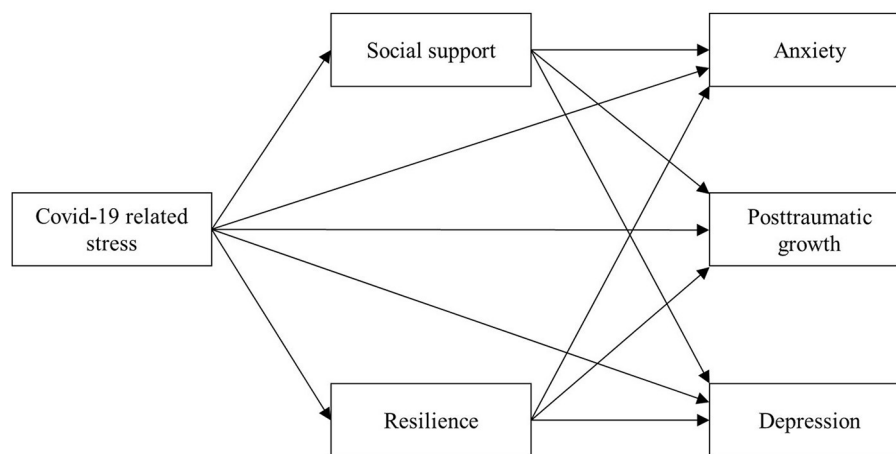


FIGURE 2 | Hypothesized conceptual framework indicating the relationships among the COVID-19 related stress, social support, resilience, and mental health outcomes (depression, anxiety, and posttraumatic growth).

Generalized Anxiety Disorder Scale

Participants' anxiety symptoms were assessed by the Chinese version of the Generalized Anxiety Disorder (GAD-7) scale (38, 39). Based on the past 2 weeks' experience, participants rated how often they have been bothered by the seven anxiety symptoms from 0 (not at all) to three (nearly every day). The total score of this scale ranges from 0 to 21. The Cronbach's α coefficient for this measure was 0.842.

Post-traumatic Growth Inventory

The Chinese version of the Posttraumatic Growth Inventory (PTGI) (14, 40) was used to measure post-traumatic growth. The scale consists of 21 items with five dimensions: relating to others, new possibilities, personal strength, spiritual change, and appreciation of life. Six-point Likert scale was used for this scale from "I did not experience this change as a result of my crisis" to "I experienced this change to a Very great degree as a result of my crisis". The single item score ranged from 0 to five, and the total score ranged from 0 to 105. A higher score indicates a higher level of post-traumatic growth. The Cronbach's α coefficient for the PTG inventory was 0.944 in this study.

Center for Epidemiological Studies Depression Scale

The original English version of the Center for Epidemiological Studies Depression Scale (CES-D) is a 20 items scale that measures the participant's depression symptoms during the last week, rating from 0 (rarely or none of the time) to three (most or all of the time) (41). The total score of this scale is 60. The participant's score higher than 15 implies clinically depressive symptoms (40). The Chinese version of CES-D that had been validated in previous studies was performed in this study (42, 43). For the present study, the Cronbach's α coefficient for the CES-D was 0.908.

Multidimensional Scale of Perceived Social Support

The Chinese version of Multidimensional Scale of Perceived Social Support (MSPSS) (44, 45) is a 12-item self-reported measure and was used to measure the level of social support from three dimensions: family, friends, and others. The scale is a seven-point Likert scale from one (very strongly disagree) to seven (very strongly agree), the higher scores that participants rated indicated higher perceived social support. The Cronbach's α coefficient for this scale is 0.894.

10-Item Connor-Davidson Resilience Scale

The 10-item Connor-Davidson Resilience Scale (CD-RISC-10) is a 10 items scale measured in a five-point Likert scale from 0 (not true at all) to four (true nearly all the time) (46). The translated Chinese version was used in this study (47). The scale score ranges from 0 to 40, the higher score suggesting a better resilience capability. For the present sample, Cronbach's α coefficient was 0.846.

Data Analysis

Data analyses were performed with IBM SPSS statistical version 23.0 (IBM Corp) and Mplus 8.3. Only completed questionnaires were included in the analysis, and there were no missing data. To examine the hypotheses, descriptive analysis, correlation analysis, and structural equation modeling were conducted, respectively. Demographic information, like gender and age, was provided by number (n) and percent (%). The continuous mental health variables, like the COVID-19 related stress and PTG, were provided by mean (M) and standard deviation ($S.D.$). Kolmogorov-Smirnov statistical test was run to examine the normality of data distribution. The results showed that data were not normal distribution. Therefore, the Spearman correlation analyses were carried out to explore the associations among the key variables. The statistical significance was set at $P < 0.05$, and all tests were two-tailed. As the data were not

TABLE 1 | Participant demographic information ($N = 771$).

Characteristics	<i>n</i>	%
Sex		
Male	355	46.0
Female	416	54.0
Whether in only-child family		
Yes	285	37.0
No	486	63.0
Age, y		
<20	29	3.8
20–29	398	51.6
30–39	278	36.1
40–49	57	7.4
50–59	9	1.2
Education		
≤ Junior high school	7	0.9
Senior high school	46	6.0
College	122	15.8
Undergraduate	554	71.9
≥ Postgraduate	42	5.4
Household income, yuan[#]		
<50,000	54	7.0
50,000–100,000	190	24.6
100,000–200,000	309	40.1
200,000–500,000	188	24.4
500,000–1,000,000	27	3.5
>1,000,000	3	0.4
Career		
Worker	64	8.3
Former	5	0.6
Student	126	16.3
Medical staff	21	2.7
Educational, scientific and Cultural personnel	45	5.8
Enterprise manager	334	43.3
Government/public Institution personnel	84	10.9
Migrant worker	25	3.2
Other	67	8.7

[#] 1 yuan = 0.16 dollar, updated by January 6th, 2022.

normal distribution, bootstrapping (with 5,000 re-samples) was adopted in Structural equation modeling to test the significances of relationships among the key variables by controlling all demographic variables (i.e., conceptual model), and especially we would like to explore how COVID-19 related stress may shape three mental health outcomes directly or indirectly by the social support and resilience variables as mediators. The following related indices were used to examine the final model fit (48): a non-significant chi-square (χ^2), the root mean square error of approximation (RMSEA < 0.08), the comparative fit index (CFI > 0.09), and the Tucker–Lewis index (TLI > 0.90). *Post hoc* power analysis indicated 771 participants showed a good fit

the model with power close to one when RMSEA was between 0 and 0.08.

RESULTS

Descriptive Statistics and Correlation Analysis

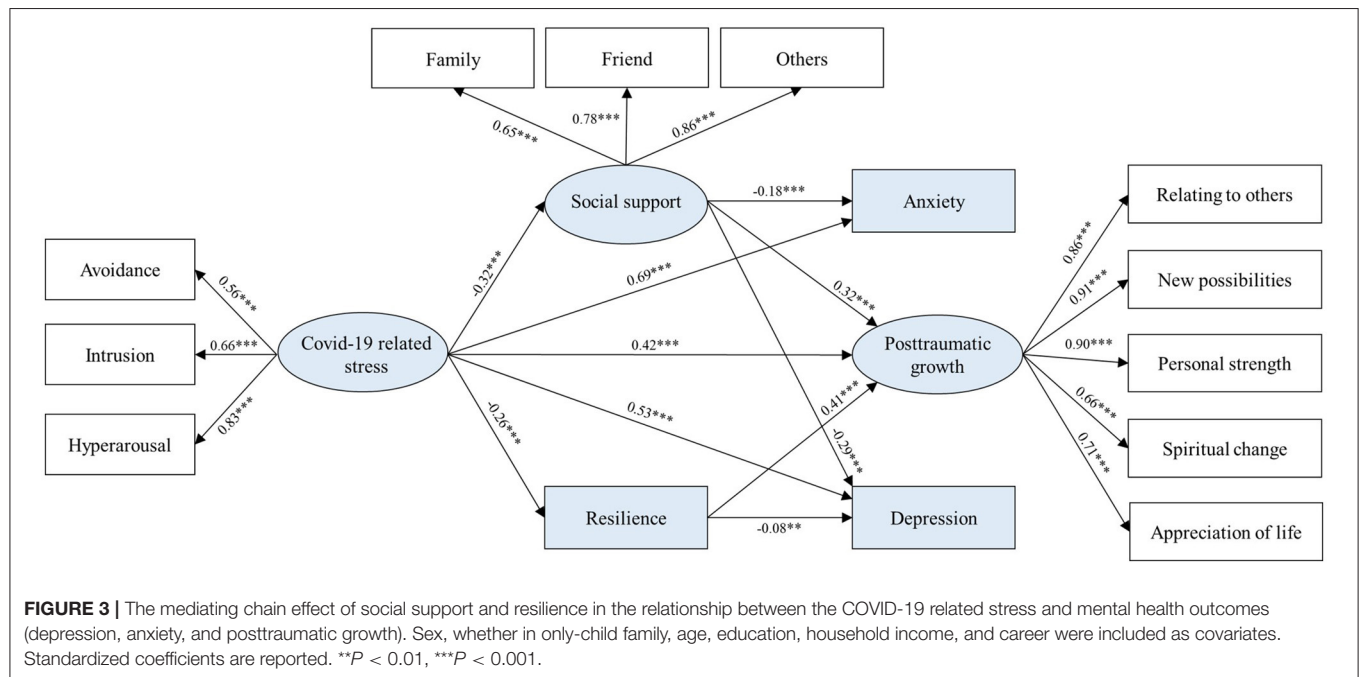
A total of 771 eligible participants were included in the final analysis. **Table 1** presents demographic characteristics. Bivariate correlation analyses were performed to investigate possible associations among the key study variables. Means, standard deviations, and correlations of the key study variables are shown in **Table 2**. The result indicated that the COVID-19 related stress was positively related to anxiety [$r_{(769)} = 0.609$, $P < 0.001$], PTG [$r_{(769)} = 0.213$, $P < 0.001$], and depression [$r_{(769)} = 0.497$, $P < 0.001$], supporting hypothesis 1. Resilience was negatively associated with depression [$r_{(769)} = -0.0386$, $P < 0.001$] and anxiety [$r_{(769)} = -0.297$, $P < 0.001$], while positively associated with PTG [$r_{(769)} = 0.395$, $P < 0.001$]. We found similar results in social support, which was negatively associated with depression [$r_{(769)} = -0.482$, $P < 0.001$] and anxiety [$r_{(769)} = -0.384$, $P < 0.001$], but positively associated with PTG [$r_{(769)} = 0.355$, $P < 0.001$]. Besides, the results of the correlation provided insights for further investigation.

Structural Model and Mediation Analysis

The SEM was used to explore the direct effect of the COVID-19 related stress on anxiety, PTG, and depression, as well as mediating pathways involving social support and resilience. At the same time, the COVID-19 related stress includes three latent variables: intrusion, avoidance, and hyperarousal; PTG includes five latent variables: relating to others, new possibilities, personal strength, spiritual change, and appreciation of life; social support includes three latent variables: family, friend, and others. The initial model analysis found the pathway that resilience mediated the relationship between the COVID-19 related stress and anxiety was not significant ($b = 0.01$, $P = 0.281$), therefore, this pathway did not enter the final model (**Figure 3**). The following information is about the final model. The fit indices indicated a good model fit, $\chi^2 = 619.90$, $df = 144$, $P < 0.001$, RMSEA = 0.07 with 90% CI [0.060, 0.071], CFI = 0.92, TLI = 0.90. The conceptual model mentioned in the introduction was confirmed, except only one mediation pathway was not significant after controlling demographics variables. As shown in the final model, the COVID-19 related stress positively predicted anxiety, PTG, and depression. The higher COVID-19 related stress was related to the lower social support, and further related to the higher anxiety, and the higher depression. The same results were achieved when resilience was the mediator, except the resilience to anxiety pathway was not significant. However, when it came to the PTG, the direct and indirect effects were inconsistent when social support and resilience were mediators in the relationship between the COVID-19 related stress and PTG, which indicated that both mediators were suppressed mediators. Specifically, the higher COVID-19 related stress predicted lower social support and resilience, resulting in a lower PTG. The direct

TABLE 2 | Descriptive statistics and correlations between key variables.

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. COVID-19 related stress	26.83	10.43	–					
2. Anxiety	4.70	3.46	0.609***	–				
3. PTG	48.54	21.24	0.213***	0.070	–			
4. Depression	12.91	9.90	0.497***	0.738***	–0.024	–		
5. Social support	62.39	11.09	–0.175***	–0.384***	0.355***	–0.482***	–	
6. Resilience	26.36	5.84	–0.161***	–0.297***	0.395***	–0.386***	0.494***	–

*** $P < 0.001$.

and indirect effects with 95% CI of all mediation pathways are presented in **Table 3**.

DISCUSSION

Due to effective COVID-19 prevention measures, China was the first country to experience a great fall of coronavirus cases and achieved control of the pandemic during last year (49). Nevertheless, the COVID-19 pandemic has impacted mental health and developed COVID-19 related mental problems among Chinese people (50, 51). The present study supported three of our hypotheses, which were (a) COVID-19 related stress was positively associated with depression, anxiety, and post-traumatic growth; (b) resilience and social support were negatively associated with depression and anxiety but positively associated with post-traumatic growth; (c) resilience and social support mediated the relationship between COVID-19 related stress and mental health outcomes (depression, anxiety, and post-traumatic growth). Consistent with our first hypothesis, COVID-19 related stress positively predicted depressive and anxiety symptoms. These results are in line with the previous studies that

indicated individuals who perceived more stress about an event were more vulnerable to developing further mental problems (6, 52).

Meanwhile, Chinese people reported post-traumatic growth one year after the peak of the COVID-19 outbreak in the current study. Our results confirmed that individuals could learn and recover through adversity, which referred to post-traumatic growth reported in previous literature (12, 53). The current study also demonstrated that the COVID-19 related stress promoted Chinese people to develop post-traumatic growth. This result integrates well with the previous findings that indicate psychological distress and growth coexisted after facing adversity (54–56). Interestingly, post-traumatic growth was not correlated with depression and anxiety symptoms, indicating that the two types of changes were independent. One year after the peak of the COVID-19 pandemic, Chinese people developed both positive and negative changes after experiencing the COVID-19 related stress.

The current results also support our hypothesis 2, resilience and social support were negatively correlated with COVID-19 related stress, depression, anxiety and positively correlated

TABLE 3 | Direct pathway and indirect pathway coefficients of the final model.

		<i>b</i>	<i>S.E.</i>	95% CI	<i>P</i>
COVID-19 related stress - > Anxiety	Direct pathway	0.689	0.030	[0.626, 0.743]	< 0.001
	Indirect pathway (mediated by social support)	0.058	0.014	[0.035, 0.091]	< 0.001
COVID-19 related stress - > PTG	Direct pathway	0.421	0.040	[0.343, 0.499]	< 0.001
	Indirect pathway (mediated by social support)	-0.101	0.024	[-0.155, -0.061]	< 0.001
	Indirect pathway (mediated by resilience)	-0.108	0.023	[-0.158, -0.068]	< 0.001
COVID-19 related stress - > Depression	Direct pathway	0.526	0.039	[0.447, 0.601]	< 0.001
	Indirect pathway (mediated by social support)	0.093	0.019	[0.060, 0.136]	< 0.001
	Indirect pathway (mediated by resilience)	0.021	0.009	[0.007, 0.041]	0.015

with posttraumatic growth. As shown in previous studies, we confirmed the well-established negative link between resilience and psychosocial factors. For instance, Afshari et al. investigated resilience among nurses from hospitals and identified that the increase in stress was associated with a lower level of resilience during the COVID-19 pandemic (57). Another study also demonstrated the negative association between resilience and psychosocial problems, including depression and anxiety (58). Thus, understanding the importance of these psychological factors help with the improvement of Chinese's resilience, especially when being involved in a stressful environment arising from pandemic. Similarly, social support was negatively associated with stress, depression, and anxiety symptoms in China (59). Hence, public health management is encouraged to facilitate policies that include training in resilience and supplying social support to attenuate the negative mental impact of the COVID-19 pandemic and achieve post-traumatic growth.

Furthermore, our study confirmed hypothesis 3, resilience and social support played indirect roles in the association between COVID-19 related stress and negative as well as positive mental health outcomes. Resilience and social support are essential sources to facilitate mental well-being and improve people's understandings of meaning in life (17, 26). Recent studies reported that people might not seek help to relieve themselves due to the low resilience and perceived social support under the stress of the COVID-19 pandemic, which in turn results in new mental health problems (3, 4). In the case of the current study, COVID-19 related stress exacerbated the prevalence of depressive and anxiety symptoms by decreasing the Chinese people's perceived social support. The association between COVID-19 related stress and depressive symptoms was similarly mediated by resilience, but not anxiety symptoms. The results suggest that social support has a more significant role than resilience in explaining the impacts of COVID-19 related stress on anxiety symptoms. The restrictive measures on social distancing and quarantine in China may account for the critical

role of social support in Chinese mental health during the pandemic, as social support resources may not be available when needed (60).

The decrease in resilience and perceived social support had a negative effect on post-traumatic growth as well. For one thing, COVID-19 related stress directly and positively predicted post-traumatic growth. As the previous studies illustrated, people gain post-traumatic growth from trauma or difficult conditions (13). For another, resilience and social support suppressed the prediction of COVID-19 related stress on post-traumatic growth. Under the pandemic, people with higher perceived stress experienced less resilience and social support, consequently perceiving less post-traumatic growth. However, in the whole effect, COVID-19 related stress still facilitated the development of post-traumatic growth. The challenges of COVID-19 related stress led to positive changes in Chinese people's attitudes and values toward life (61). A semi-structured interview study evaluated Chinese people's experience of post-traumatic growth and implied that people had a desire to improve relationships with their family and friend (61). However, the current study suggested that a higher level of COVID-19 related stress decreased Chinese people's resilience and perceived social support. Thus, the PTG targeted training can consider as future interventions to increase social support and resilience, therefore, to recover from the pandemic-related psychological distress.

LIMITATIONS

This study has some limitations. First, the findings on the COVID-19 related stress were examined by cross-sectional data. It is difficult to make causal inferences on the association without testing the long-term consequences of the COVID-19 pandemic. Researchers are encouraged to expand the findings by designing a longitudinal experiment. Second, in the study,

we only selected the Chinese public as our participants, which is hard to be representative of the whole population. Future studies can also study the different populations, including COVID-19 survivors, to further explore the mental health consequences of the COVID-19 pandemic and provide new insights to the local community and mental health services (4). Finally, the response bias from participants is possible for the self-reported design. Overall, more research is needed to generalize the results in the current study by performing cautiously.

CONCLUSIONS

In all, the current study expands the understanding of the positive and negative psychological impacts in the aftermath of the COVID-19 pandemic. Our findings suggested that COVID-19 related stress positively predicted depression, anxiety, and post-traumatic growth. Resilience and social support concurrently mediated the associations. In anticipation of an increase in COVID-19 related stress in other countries, interventions are needed to address the emergent challenges in the future. For instance, mental health services could be prepared to screen and identify mental health issues, as a result, to provide proper treatments. Moreover, public health policies and strategies encouraged to design to facilitate resilience and social support (e.g., helping people connect during isolation or telepsychiatry) adapted to COVID-19 specific needs (62).

DATA AVAILABILITY STATEMENT

The generated datasets for this study can be found in the OSF (<https://doi.org/10.17605/OSF.IO/5Z36P>).

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ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board of Kangning Hospital. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JH, YH, and JW: designed the study. YZ, XX, and JL: participated in the data collection. YH: analyzed the data. JH: advised on methodology. JH, YH, and JL: drafted the manuscript. JH, YZ, and JW: edited the manuscript and supervised data collection. All authors contributed to the article and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

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Longitudinal Impact of the COVID-19 Pandemic on Older Adults' Wellbeing

Javier López^{1*}, Gema Pérez-Rojo¹, Cristina Noriega¹, Jose Angel Martínez-Huertas² and Cristina Velasco¹

¹ Department of Psychology and Pedagogy, School of Medicine, Universidad San Pablo-CEU, CEU Universities, Madrid, Spain, ² Department of Cognitive Psychology, Universidad Autónoma, Madrid, Spain

Background: The COVID-19 pandemic is a major stressful life event. This pandemic is causing significant changes in older adults' daily life affecting their physical and mental health. Psychological wellbeing is a protective variable when facing adverse circumstances, like the COVID-19 pandemic. This study analyzes the impact of COVID-19 on older adults' psychological wellbeing (personal growth and purpose in life) over time.

Materials and Methods: One hundred ninety-two people over 60 years old participated in a longitudinal study. Data were collected in three time points: during the lockdown on March 2020, when the lockdown finished (4 months after baseline), and during the third wave (10 months after baseline). We used latent growth curve models to assess the linear longitudinal trajectories of psychological wellbeing.

Results: Older adults did not show worse psychological wellbeing over time. Age has a positive impact on purpose in life. Furthermore, being a male, worrying about adverse effects of COVID-19, family functioning, resilience, personal growth, and acceptance associated with purpose in life.

Discussion: These results suggest that despite the difficult circumstances experienced during the COVID-19 pandemic, older adults have used protective variables for their psychological wellbeing.

Keywords: longitudinal study, older adults, personal strengths, personal growth, purpose in life

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*Correspondence:

Javier López
jlopezm@ceu.es

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INTRODUCTION

The COVID-19 pandemic has spread quickly in most countries and it has had incidence everywhere. Spain has been one of the most damaged countries during the first wave. The COVID-19 ease of transmission and the greater impact caused in the population group of older adults have the potential to affect older adult's psychological wellbeing (1). Life purpose (experimenting life meaning and direction) and personal growth (developing actions that improve talents and potential) are the core components of psychological wellbeing among older adults (2, 3).

A previous cross-sectional study found that the perceptions and psychological strategies that older adults use to cope with COVID-19 related difficulties (e.g., social isolation, becoming infected, losing a loved one) are more relevant than the nature of COVID-19. Specifically, showing better perceived health, resilience, family functioning, gratitude, and acceptance were associated with higher levels of personal growth and purpose in life (4).

The longitudinal studies analyzing the COVID-19 impact on older adults' wellbeing have shown mixed findings. Stressful events and losses impact people very differently (5). For example, in a study conducted in Sweden, life satisfaction showed a marginal but non-significant increase over time (6). In another study conducted in Finland, a significant decrease in quality of life from 2017–2018 to 2020 was found (i.e., before and during COVID-19 lockdown) (7). Also, the quality of life of older adults receiving home care services significantly decreased during the pandemic compared with the previous year (8). Another study conducted in Canada found that quality of life and wellbeing worsened over time in the period between before lockdown and 3 months after the first lockdown began and between the period before lockdown and the second lockdown. In contrast, they did not find any difference between the two lockdown periods (9).

In contrast, quality of life total scores significantly increased from April–May 2020 to July–August 2020 for older adults from the UK (10). In a study conducted in Chile, the resilience levels tended to increase from the pre-COVID period to the COVID outbreak, but there was no association between increased resilience and decreased depressive symptoms over time (11).

Moreover, the studies analyzing the pandemic effects on older adults are limited. And the research studying older adults' mental health during the pandemic has mainly focused on mental health problems (e.g., loneliness, anxiety, and depression). Only a few studies have focused on older adults' personal strengths or wellbeing. Furthermore, most studies considering mental health variables during the pandemic include the younger population who answered online surveys (4, 11, 12).

Given the potential impact that the COVID-19 pandemic may have on older adults' mental health, it is necessary to identify protective factors of their psychological wellbeing (8). For this, the development of longitudinal studies that evaluate the impact of the pandemic at different time points are needed (6, 10). The stress process model developed by Lazarus and Folkman proposes that primary stressors (such as COVID-19) can cause distress in the person. However, the impact of the stressor on the person's wellbeing depends on how they perceive the situation and the personal resources they put into practice to cope with it (13). Considering this model, we conducted a longitudinal study in which we analyzed the psychological wellbeing experienced by older adults during the COVID-19 pandemic and variables associated.

MATERIALS AND METHODS

Participants were older adults over 60 years old living in the community in Spain. We collected participants through the snowball sampling technique, social media (Twitter, WhatsApp, LinkedIn) and older adult's organizations. The first assessment (baseline wave 1) was a previous cross-sectional study of community-dwelling older adults from Spain assessed 3 weeks after the beginning of the lockdown restrictions (4). The second assessment (wave 2) was completed in July 2020 (a period without lockdown characterized by social distancing measures, some mandatory restrictions and a low rate of infections). The third

assessment (wave 3) took place in January 2021 (during the third wave of the COVID-19 pandemic, which involved a high rate of infections and confirmed COVID-19 deaths and new restrictions were set). Participants who completed the survey in at least two time points were included in the study. In total, 64 participants were eliminated because they did not meet inclusion criteria: 47 were not living in Spain, and 17 were not living in the community. More specifically, 192 people aged 60 years or older completed the survey in T1, 167 in T2, and 126 in T3. In total, 192 participants responded the survey on T1 and T2. Most responded all the questionnaires on T1 and T2 ($n = 167$ participants). Nevertheless, some participants responded the survey on T2 but not all the questionnaires and they were excluded from the analyses ($n = 25$ participants). Moreover, 126 participants responded all the questionnaires on T1, T2, and T3.

Data were collected through a web-based survey. We included sociodemographic characteristics, self-perceived health, and aspects related to the COVID-19 pandemic. We also administered the following standardized questionnaires:

- The Family APGAR (14). The scale includes 5 items. They cover a person's family functioning (adaptability, partnership, growth, affection, and resolve). There are three response options ranging from 0 (hardly ever) to 2 (usually) and the sum score from 0 to 10. Higher scores indicate higher family functioning. We used the Spanish version (15), which showed good reliability in our sample (Cronbach's $\alpha T1 = 0.840$; $\alpha T2 = 0.827$; $\alpha T3 = 0.713$).
- Brief Resilient Coping Scale (BRCS) (16). The scale includes 4 items. They cover a person's resilience. Response options range from 1 (nothing) to 5 (a lot) and the sum score from 4 to 20. Higher scores reflect higher levels of resilience. The Spanish version (17) showed adequate reliability in our sample (Cronbach's $\alpha T1 = 0.742$; $\alpha T2 = 0.772$; $\alpha T3 = 0.876$).
- Gratitude subscale of the Values in Action Inventory of Strengths–Short Form (18). The subscale includes 5 items. They cover a person's gratitude. Response options range from 1 (very different to me) to 5 (very similar to me) and the sum score from 5 to 25, with higher scores indicating higher gratitude. The Spanish version (19) showed good reliability in our sample (Cronbach's $\alpha T1 = 0.868$; $\alpha T2 = 0.900$; $\alpha T3 = 0.924$).
- The Acceptance and Action Questionnaire—II (AAQ-II) (20). The scale includes 7 items. They cover a person's experiential avoidance and psychological inflexibility. Response options range from 1 (not at all true) to 7 (completely true) and the sum score from 7 to 49. Higher scores show higher experiential avoidance and psychological inflexibility. The Spanish version (21) showed good reliability in our sample (Cronbach's $\alpha T1 = 0.899$; $\alpha T2 = 0.896$; $\alpha T3 = 0.899$).
- Personal growth and Purpose in life Subscales of the Ryff's Psychological Wellbeing Scales (22). The subscales include 7 and 6 items, respectively. They cover a person's personal growth (how much they use their talents and potential) and purpose in life (how often they lives had meaning, and direction). Response options range from 1 (never) to 7 (always). Higher scores reflect higher personal growth and

TABLE 1 | Descriptive analysis along the three measurement occasions of the longitudinal study.

	Mean	SD				
Age	68.22	5.85				
	N	%				
Gender						
Men	58	30.3				
Women	134	69.7				
Marital status						
Single	28	14.6				
Married	109	56.7				
Divorced	22	11.5				
Widower or widow	33	17.2				
	T1		T2		T3	
	%		%		%	
Perceived health						
Poor	4.9		4.8		5.6	
Fair	23.1		17.8		14.3	
Good	47.8		53.1		60.3	
Very good	24.2		24.3		19.8	
	%		%		%	
	Yes	No	Yes	No	Yes	No
COVID-19 consequences						
Symptomatology	12	88	6.6	93.4	11.9	88.1
Hospitalization	1.2	98.8	3.6	96.4	1.6	98.4
Loved one hospitalization	23.1	76.9	31.7	86.3	26.2	73.8
Loss of a loved one	14.3	85.7	23.4	76.6	21.4	78.6
	Mean	SD	Mean	SD	Mean	SD
Purpose in life	28.8	5.5	28.6	4.3	29.3	5.0
Personal growth	31.5	5.7	32.2	5.5	31.9	6.1
Experiential avoidance	19.5	7.1	19.5	7.0	18.1	6.7
Family functioning	13.8	1.9	13.8	1.7	13.9	1.4
Resilience	16.2	2.9	15.4	3.0	15.9	3.5
Gratitude	7.7	2.9	7.6	3.1	7.6	3.1
Worrying about adverse effects of COVID-19	1.4	0.8	1.5	0.8	1.5	0.8

T1–T3 = measurement occasion. N = 192 (T1), 167 (T2), 126 (T3).

purpose in life. These Spanish version (23) showed good reliability for both personal growth (Cronbach's α T1 = 0.748; α T2 = 0.832; α T3 = 0.825) and purpose in life (Cronbach's α T1 = 0.872; α T2 = 0.842; α T3 = 0.894).

An informed consent form was attached to the survey, and each participant consented to participate after reading and agreeing with the informed consent information.

To calculate the linear longitudinal trajectories of life purpose and personal growth, we conducted different latent growth curve models. When personal growth and life purpose showed a statistically significant change, a full model with time-invariant and time-varying predictors was fitted to analyze the correlates of change. We used lavaan package (24) in R software to analyze the models fit. To manage missing data, we used Maximum Likelihood (ML) and Full Information Maximum Likelihood (FIML) estimators.

RESULTS

A total of 192 community-dwelling older adults from Spain completed at least two measures and met the inclusion criteria. Most participants were women (69.7%), were living with their spouse or partner (56.7%), and reported having good (47.8%) perceived health. At baseline, 40 people had a close relative or friend who had been hospitalized, 25 lost a loved one due to COVID-19, 23 suffered from COVID-19 symptomatology, and 2 had been hospitalized. **Table 1** shows means, SDs, and percentages of all the variables in the three time points.

Linear Longitudinal Trajectories

Life purpose showed good data fit in the latent growth curve model [$\chi^2_{(2)} = 1.791$, $p = 0.408$, CFI = 1.009, TLI = 1.00, RMSEA = 0.001 [0.001–0.138], SRMR = 0.032]. Purpose in life did not show a statistically significant intercept due to variables and was

standardized based on the baseline ($b = 0.003$, $SE = 0.065$, $z = 0.040$, $p = 0.968$) and a statistically significant increment over time ($b = 0.072$, $SE = 0.034$, $z = 2.120$, $p = 0.034$). The intercepts' variance was statistically significant (0.451 , $SE = 0.086$, $z = 5.249$, $p < 0.001$), while the variance of the slopes was fixed to zero (the covariance between the intercept and the slope was not statistically significant: 0.16 , $SE = 0.029$, $z = 0.531$, $p = 0.596$). These results mean that there is a general longitudinal linear increase of purpose in life among the study, and those individuals present differences in their initial status but they have a similar longitudinal growth.

On the contrary, personal growth presented a not-statistically significant intercept due to variables and was standardized based on the first time point ($b = 0.019$, $SE = 0.071$, $z = 0.273$, $p = 0.785$) and did not increase over time significantly ($b = 0.037$, $SE = 0.037$, $z = 0.975$, $p = 0.329$). The intercepts' variance was statistically significant (0.711 , $SE = 0.124$, $z = 5.730$, $p < 0.001$), but the variance of the slopes was not statistically significant (0.058 , $SE = 0.057$, $z = 1.011$, $p = 0.312$). The covariance between the intercept and the slope was not statistically significant (-0.048 , $SE = 0.069$, $z = -0.700$, $p = 0.484$). Thus, no longitudinal growth was found for personal growth along the study.

Longitudinal Trajectories With Time-Invariant and Time-Varying Predictors

Since purpose in life was the only subscale of psychological wellbeing that showed a statistically significant increase over time, a full latent growth curve model with time-invariant and time-varying predictors was fitted. We observed less fit to the data in this model compared with the baseline model. However, the model residuals in purpose in life were adequate ($\chi^2_{(108)} = 190.778$, $p < 0.001$, CFI = 0.874, TLI = 0.884, RMSEA = 0.063 [0.048–0.078], SRMR = 0.066). Table 2 shows the estimates of these latent growth curve models.

When considering the time-invariant predictors of purpose in life, age showed a significant positive association with its intercept, that is, there was a positive association of age with purpose in life. Gender showed a significant positive relationship with the slope of purpose in life, being men tending to present a more important increase of purpose in life than women. Regarding the time-varying predictors, we observed different covariances between the change of purpose in life and the change of the predictors. Specifically, there was a positive covariance with family functioning, resilience, and worrying about adverse effects of the pandemic, and principally with personal growth. We also found a negative covariance with avoidance and gratitude.

DISCUSSION

Given the significant impact that the COVID-19 pandemic is generating on the population worldwide, the developed scientific literature is extensive. Most studies include cross-sectional data and focus on the psychological influences of the COVID-19 pandemic. We examined the impact of this pandemic on

TABLE 2 | Results from latent growth curve model with predictors for purpose in life.

	Purpose in life		
	Estimate	SE	z-value
Intercepts and slopes			
Intercept (mean)	−0.019	0.041	−0.456
Slope (mean)	0.083	0.025	3.306**
Intercept (variance)	0.067	0.024	2.833**
Slope (variance)	—	—	—
Intercept and slope covariance	0.008	0.008	0.936
Path estimates			
<i>Time-invariant predictors</i>			
Gender (ref: women) → Intercept	−0.171	0.402	−0.426
Gender (ref: women) → Slope	3.577	1.211	2.953**
Age (years) → Intercept	0.761	0.388	1.961 [†]
Age (years) → Slope	0.179	0.879	0.203
<i>Time-varying predictors</i>			
Personal growth	0.301	0.030	10.086**
Avoidance	−0.211	0.032	−6.544**
Family functioning	0.067	0.027	2.461*
Resilience	0.189	0.033	5.648**
Gratitude	−0.221	0.032	−6.949**
Worrying about adverse effects of COVID-19	0.069	0.026	2.625**

$N = 192$. ** $p < 0.01$. * $p < 0.05$. $t = p < 0.10$. ML and FIML estimations. Given that the continuous predictors were standardized, their estimations can be understood as standardized estimates. Time-varying predictor parameters were fixed to be equal across measurement moments.

wellbeing with a longitudinal study developed in older adults from Spain. Our first aim was to determine the level personal growth and purpose in life throughout the COVID-19 pandemic. Contrary to the expected negative impact of the pandemic across different governmental restrictions (1), we did not find any negative effect of COVID-19 on wellbeing. In fact, older adults aged 60–95 perceived a linear increase of purpose in life.

At the same time, the majority showed stable personal growth levels. Previous literature supported that while personal growth tends to decline with age, some stressful situations, such as cancer status, were found to slow the decline in personal growth (2). We found that a potentially stressful situation, such as the COVID-19 pandemic, has no significant impact on the levels of personal growth among older adults. Personal growth was not affected negatively by the conditions of the pandemic.

Because of the highest mortality risk in older adults and the forced or voluntary social isolation to keep the social distance, older adults have been described in social media as the population group most affected by the COVID-19 pandemic (11). Also, WHO (1) predicted a great pandemic impact among

older adults' mental health. Nevertheless, our study showed that media channels and health organizations could, perhaps, have maintained an ageism attitude. Older adults are more capable and have more strengths than many professionals have considered. Older adults increased their psychological wellbeing. Specifically, their personal growth remained stable while their purpose in life increased over time.

Cross-sectional studies found vulnerabilities in purpose in life. Age by itself has shown negative correlations with purpose in life. However, purpose in life changes depending on how older adults cope with life events, finding improvements associated with several psychological processes such as flexible self-perceptions and the use of adaptive coping strategies. Purpose in life has increased in our study because the pandemic offers them opportunities to develop resources to overcome future challenges. COVID-19 could have increased older adults' flexibility and coping strategies to achieve previously valued goals (2). Aging is a time of personal discovery. There are opportunities to learn new skills (25). Moreover, situations valued as less satisfying before COVID-19 can be perceived now as more satisfying (6).

Furthermore, men and participants who experienced lower avoidance, better family functioning, higher resilience levels, and better personal growth reported higher purpose in life. Surprisingly, lower gratitude and worrying more about adverse effects of COVID-19 were associated with a higher purpose in life.

Our results also support that the advantages related to gender observed in the beginning of the COVID-19 pandemic (7) are not attenuated through the pandemic. The effects persist over time. The pre-existing gender inequalities—socially and economically—have been amplified by the pandemic (26). Male older adults experience not only better quality of life in the early part of the COVID-19 pandemic in Sweden than in previous years, but also a better purpose in life of life from the start of the pandemic to the second wave in Spain.

Older adults are better able at regulating their emotions due to increasing their attention to positive emotions and prioritizing emotional goals as they become increasingly aware of limitations on their time and lifespan. Therefore, they experience more psychological wellbeing (25). In contrast, suppression, the inhibition of emotion, is a negative predictor of wellbeing (2). Given these findings, it is not surprising that older people showing more experiential avoidance (i.e., the resistance to contact with their unwanted thoughts, emotions, or body sensations) were related in our study with less purpose in life.

Regarding participants' social links with their close relatives, they did not change during the lockdown. The telephone was the most used way to contact their family (8). Family functioning could be related to psychological wellbeing in our longitudinal study since it is a variable related to social contacts and social support (27). Moreover, the absence of relational strain (i.e., relational harmony) predicted higher wellbeing (2). Hence, determining ways to improve family functioning will be important to enhance wellbeing during the pandemic.

A significant positive relationship between resilience and purpose in life was found. Previous literature support that when coping with life events and difficulties, many people can increase

their sense of purpose and life meaning (28, 29). Resilience is a developmental process in which people, including older adults, achieve a successful adaptation to adversity and stressful events. The COVID-19 pandemic is a major stressful life event that confronts older adults' resilience and purpose in life.

In line with other studies (30), gratitude is related to purpose in life negatively because it is positively related to recognizing others while it did not show any association with recognizing oneself. Gratitude is a self-transcendent emotion that facilitates a prosocial orientation toward others. Thus, we hypothesized that gratitude would involve the goals of being close to and helping another person. Gratitude is others-oriented instead of self-oriented, while purpose in life is more self-oriented. Moreover, this negative relation could be because the present research did not distinguish between actual gratitude and remote gratitude. However, more studies are needed to clarify if and how the others' motivation goals related to gratitude mediate the decrease of purpose in life.

A second unexpected result is the positive relationship found between worrying about the adverse effects of COVID-19 and purpose in life. Coinciding with previous studies (31), life purpose is related to being able to find meaning in life experiences, including difficulties. People who show higher levels of life purpose evaluate negative events in a more adaptive and proactive way, perceiving and giving them explanations with meaning linked to their personal values. Likewise, people with higher levels of life purpose have more varied resources to face life's challenges, buffering the possible negative effect of stressors using strategies that help regulate emotions in a more adaptive manner. In this way, they would be better prepared to respond to emotional demands more effectively. Worrying about the adverse effects of COVID-19 has varied throughout the longitudinal study. This variation has generated a series of negative consequences in individuals that have caused changes in the purpose in life of the participants to better cope with these changes in worrying about adverse effects of COVID-19. Nevertheless, future research is needed to delve deep further into this result and to analyze how worrying about adverse effects of COVID-19 is associated with the increase of purpose in life.

Older adults' personal growth during COVID-19 pandemic is associated with purpose in life positively. These are the core components of psychological wellbeing and are connected variables (3). Previous studies focused on aspects of personal growth using autobiographical memories, narratives of major life goals, and stories of life transitions found that all such elements of personal growth have been positively associated with wellbeing (2).

These findings have some limitations. First, our research study is limited by its small sample size and may not represent the cultural, geographic, and socioeconomic or financial characteristics of Spain. Participants (Spanish natives or migrants from other countries; retired, employed, or unemployed older adults, etc.) had universal and guaranteed access to health services. Nevertheless, we were able to compare changes in older adults' wellbeing across the COVID-19 pandemic due to its longitudinal design. Second, this study only considered older adults living in the community, without severe cognitive

impairment, and who volunteered to complete a web-based survey. Future studies are needed to cover the impact on people living in nursing homes and with cognitive impairment. Furthermore, older adults who do not use social media or information/communication technology devices may be more vulnerable to social isolation, particularly during the pandemic. Quality of life for this group may be lower compared with those who are more confident and readily use technology and communication device. Further research is needed to focus on older adults who do not use social media or information/communication technology devices.

Third, the paper did not measure the outcomes before the COVID-19 lockdown as the first time of data collection was in March 2020. Nevertheless, age itself has been associated with declines in purpose in life and personal growth. Fourth, purpose in life and personal growth are two of the six psychological wellbeing described in Ryff's model. However, we included these two variables since they are key dimensions in psychological functioning and have been described in the scientific literature as the main components of eudaimonia (3).

Nevertheless, this study suggests that older adults maintained their psychological wellbeing levels during the COVID-19 pandemic. These results also support that pandemic by itself may not be as relevant for older adults' wellbeing as their appraisals and personal resources they use to cope with COVID-related challenges. Some sociodemographics also influenced older adults' wellbeing. Therefore, being male and older, worrying about adverse effects of COVID-19, family functioning, resilience, gratitude, and acceptance showed significant associations with purpose in life.

A previous longitudinal study has shown that older adults did not evidence higher depression or anxiety than during the initial lockdown (32). Our research does not go along with the ageist viewpoint of the vulnerable and frail older adults often offered during this pandemic. Our results highlight that older adults have psychological and social resources that helped them to cope with adversity. Older adults have got over past stressful situations that could be empowering them to master adverse situations such as the COVID pandemic.

Among older people, having a good purpose in life is an important personal wellbeing goal. Older adults are a heterogeneous group. Since chronic traumatic events are highly

prevalent stressors among older adults and still many of them show high levels of life purpose, the development of resources that improve psychological wellbeing is needed (e.g., resilience, acceptance, and family functioning). However, the high levels of life purpose reflected in this study should not underestimate other mental health's indicators. Furthermore, more studies are needed to delve into mental health components to mitigate the impact of the pandemic on older people. Considering that despite vaccination there are no indicators that the pandemic will end shortly, older adults' wellbeing has to continue being evaluated, especially if strict restriction measures are set again.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of the University of San Pablo CEU (reference 436/20/26). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JL: conception and design, data interpretation, drafting and writing the article, and revising it. GP-R: design, data collection, and writing parts of the article. CN and CV: data collection and writing parts of the article. JM-H: data analysis and revising for critical analysis. All authors contributed to the article and approved the submitted version.

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Mental Health Factors That Guide Individuals to Engage in Overconsumption Behavior During the COVID-19 Pandemic: A Cross-Cultural Study Between USA and Ecuador

Velasco Franklin^{1*}, Lanchimba Cintya^{2,3}, Paz y Miño Mariel⁴ and Díaz-Sánchez Juan Pablo⁵

¹ Department of Marketing, Universidad San Francisco de Quito USFQ, Quito, Ecuador, ² Departamento de Economía Cuantitativa, Facultad de Ciencias Escuela Politécnica Nacional, Quito, Ecuador, ³ Institut de Recherche en Gestion et Economie Université de Savoie Mont Blanc (IREGE/IAE Savoie Mont Blanc), Annecy, France, ⁴ Head of Psychology Department, Director of Mental Health Clinic, Universidad San Francisco de Quito USFQ, Quito, Ecuador, ⁵ Tenured Lecturer IDEA Research Group, Departamento de Economía Cuantitativa Escuela Politécnica Nacional, Quito, Ecuador

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Mohammadreza Shalbafan,
Iran University of Medical
Sciences, Iran

Reviewed by:

Mireia Solerdelcoll,
Institute of Psychiatry, Psychology &
Neuroscience, United Kingdom
Jingchu Hu,
Shenzhen KangNing Hospital, China

*Correspondence:

Velasco Franklin
fvelasco@usfq.edu.ec

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Background: This study tests a framework that examines the role of several mental health factors (mood, wellbeing, health consciousness, and hoarding) on individuals' overconsumption behavior under the novel coronavirus context. This examination is relevant to public health literature because it increases our knowledge on how the context of COVID-19 pandemic affects people's mental health and provides answers to why individuals engage in overconsumption behavior. Additionally, this research also follows a cross-cultural perspective aiming to understand how individuals from different cultural orientations cope with the psychological effects of the COVID-19 pandemic.

Methods: This is a cross-sectional study that compares samples from two countries: Ecuador ($n = 334$) and USA ($n = 321$). Data was collected via an online survey. The timing of data collection was set during the mandatory lockdowns and social distance measures taken by both countries to fight against the COVID-19 virus breakout. Partial least squares structural equation modeling was used to test the theorized framework. Multi-group analysis was used to explore cultural orientation differences among the relationships included in the model.

Results: The results indicate that individuals' mood state has a positive relationship with health consciousness, as people try to regulate their health concerns by maintaining positive perceptions of their subjective wellbeing. Further, the increased concern individuals express in their health is responsible for them to engage in overconsumption behavior. Cultural orientation (individualism vs. collectivism) moderates the relationship between mood and health consciousness. No moderation effect was found for the relationship between health consciousness and overconsumption.

Conclusions: The COVID-19 pandemic has generated negative effects in individuals' mental health. Findings from this study suggest that maintaining a positive mood is important for individuals at the time of mandatory lockdowns, and this effort is related to a greater concern and awareness of their health. Further, health consciousness is responsible to stimulate overconsumption behavior. This chain of effects can be explained by individuals' interest in their wellbeing. Culture plays a role in these effects. People from individualistic countries (USA) compared to people from collectivistic countries (Ecuador) demonstrate greater motivation in maintaining their positive mood by showing greater health consciousness.

Keywords: COVID-19, health consciousness, overconsumption, wellbeing, hoarding activity, culture, individualism—collectivism

INTRODUCTION

The Coronavirus Disease 19 (COVID-19) pandemic has had a tremendous impact on people's lives, especially affecting the mental health of individuals (1). High levels of threat have governed people's sentiments in the marketplace (2). People are experiencing a "collective trauma" in the form of mental health issues such as depression, anxiety, and stress (3–5), and are reflecting on their health habits and overall wellbeing (6). These conditions have caused an unprecedented disruption in the public health, forcing retailers, and households to adapt quickly to the new context (2, 7).

One particular behavior that people have unveiled since the emergence of COVID-19 is overconsumption, such as stockpiling food, medicines, cleaning products, and other essential items (8). Due to overconsumption, the marketplace (e.g., retailers and healthcare providers) have suffered from a lack of supply of goods during the COVID-19 pandemic. Previous literature has pointed out the role of the marketplace in helping consumers to cope with high-threat situations and mental health factors (9). In this study we interpret overconsumption as a tactic used by people to help alleviate the impact of stressor factors associated with the forced lockdowns and social distancing measures related to COVID-19. Moreover, we follow a cross-cultural perspective to identify if differences in cultural orientation at the country level (10) manifest in individuals' mental states, self-regulatory tactics, and coping strategies. These differences can be explained by previous literature describing how culture affects individuals' judgments based on construals of the self and others (11). This cross-cultural perspective is important as it not only considers differences in societies cultural values, but also how countries adopted different measures to prevent and control COVID-19 virus breakout. Drawing from these arguments, this study explores several mental states acting as drivers of people's overconsumption behaviors. Overall, these mental states are predicted to have an influence on individuals' ability to emotionally self-regulate.

More specifically, this study aims to investigate the antecedents of overconsumption behavior by exploring the chain of effects of several mental health factors (e.g., mood, subjective wellbeing, health consciousness, and hoarding tendency). We use a cross-cultural approach to examine the

relationships among these factors, considering that people react differently when coping with the COVID-19 outbreak and that mental health characteristics differ from one society to another. We strategically chose two markets to compare the effects, the USA and Ecuador, as they represent the extremes of individualistic and collectivistic cultural orientations (10). Data collection occurred during the mandatory lockdowns and social distancing measures, in April and May 2020, for both countries. The impact of COVID-19 in these countries is alarming, as both are included on top of the rankings of COVID-19 cases and deaths per capita according the World Health Organization (12).

Mood Impact on Health Consciousness

Mood states represent an important set of affective factors that guide people's behavior in different situations (13). A particularly relevant characteristic of mood is that it is easily influenced by situational factors (14). Individuals subjectively perceive their mood as having a positive (cheerful, peaceful, optimistic) or a negative (anxious, sad, depressed) feeling state, and this state often contrasts with other mental states (13). In this study we examine the link between mood and health consciousness. Health consciousness is defined as the degree to which health concerns are integrated into a person's daily activities (15). Because individuals' mood often guides them to be more attentive to information congruent their feeling state (13), we argue that a positive mood is strategically sustained in people by an increased concern for their health.

For this argument we follow the insights reported by extensive psychology literature that associate mood in generating bias evaluations with mood-congruent directions (16–18). For instance, an individual who has a positive mood would very likely want to protect that positive mental state by selectively making positive judgments about their health situation. Also, we can expect individuals to become more attentive to the beneficial or detrimental aspects of their wellbeing when mood regulation is a priority to them (19). Thus, we are predicting that mood has a positive relationship with health consciousness.

H₁ Positive mood is positively associated with health consciousness.

Influence of Health Consciousness on Overconsumption

When people are asked about their health, they use a reference point for comparison (19). For example, individuals might compare their current health with a pre COVID-19 health state. Depending on the situation, this mental process may result in either relief or concern feelings. Mujcic and Frijters (18) interpreted health consciousness with an economic utility function—that is, perceiving gains (e.g., “I feel healthy”) or losses (e.g., “I feel concern about my health”). The authors further discuss that people often experience a “shock” when feeling no control over their health situation. Therefore, it is expected that at higher levels of health concern, people will start having a notion of deterioration of their subjective wellbeing. Interestingly, this cognitive process generates in individuals a strong motivation to strive toward recovering the health spirit or at least to try to sustain it through their *resource expectations*. This process reveals that individuals try to regulate their health concerns by applying approach or avoidance coping tactics. We propose that one of those tactics is engaging in overconsumption, which refers to purchasing and consuming goods in an excessive manner (20). Overconsumption involves a mental calculation practice that is deliberative in people and responds to marketplace practices and situations (20), such as accumulating large quantities of essential goods during mandatory lockdowns to “feel better” about the self. These high levels of health concern correspond to the COVID-19 threat and individuals’ lack of power to freely purchase goods when they are ordered to stay at home and maintain social distancing. By strategically focusing on overconsumption, we indirectly point to the marketplace as being a relevant instrument for people to engage their motivation to sustain their mental wellbeing (21).

Three studies provide insights on how overconsumption serves as a tactic for individuals to cope with negative mood. A recent study shows that individuals are willing to purchase extra bottles of a sport drink when experiencing negative feelings (22). Another study shows how individuals are willing to engage in purchasing more food products that help improve one’s state of health when their health consciousness motivates them to improve their wellbeing (9). Also, there is evidence that health concern could be interpreted as a personal value—an enduring belief about what is fundamentally important (23). As such, health consciousness could be conceptualized as a possession or a unique resource that induces overconsumption behaviors in an individual experiencing chronically high levels of concern.

In sum, we predict that health consciousness has a positive relationship with overconsumption.

H₂ Health consciousness is positively associated with overconsumption.

The Mediating Effect of Subjective Wellbeing

Subjective wellbeing refers to an individual’s mental state, characterized by the articulation of positive or negative thoughts about the self and by expressing an overall assessment of the degree of satisfaction about different aspects of the individual’s

life (24, 25). Subjective wellbeing also has been used to describe an individual whose stability, coping skills, happiness, confidence, and sense of being grounded (26) contribute to their perseverance in the face of challenges, providing a combination of “feeling good and functioning effectively” (27). This happens because optimal mental health is conceived as a complete state of wellbeing when emotions are under control (28).

What is interesting about subjective wellbeing is that it acts as an important motivational resource for individuals to regulate their emotions and mental health outcomes (e.g., stress, depression, and health concerns) (26–29). We argue that subjective wellbeing is the psychological mechanism that drives individuals’ efforts to try to sustain their positive mood when experiencing increased health consciousness due to the threat of COVID-19.

Behavioral researchers use the term *positive psychological capital* to define this facet of people’s pursuit of their wellbeing (30). Subjective wellbeing is a mental state characterized by putting in the necessary effort in challenging times (self-efficacy): showing confidence, resilience, and optimism and having hope when adversity is present in individuals’ lives (27). When people perceive having control of their mental health, they are more inclined to use adaptive strategies to cope with everyday emotions (31). These tactics result in individuals’ exhibition of approach or avoidance attitudes or behaviors to cope with certain mental health issues (31). For example, people’s ability, effort, and focus could be staying alert to their health status in order to suppress negative wellbeing outcomes (i.e., psychological distress and anxiety related to the forced lockdowns and social distancing measures provoked by COVID-19).

Even though the human brain is wired to use past experiences and coping skills as mechanisms to increase the odds of adapting to threat situations or obtaining desired outcomes (32), the COVID-19 pandemic has presented unprecedented mental health issues (e.g., isolation, lockdown, social distancing, and trauma) and unending uncertainty. In fact, the great majority of individuals have not been able to maintain a lifestyle that contributes to their wellbeing (1, 3, 33). As a consequence, the anxiety resulting from people’s efforts to sustain their wellbeing has instead generated *maladaptive responses* and *copied behaviors* that contradict their emotional wellbeing. Therefore, we predict that one of these maladaptive responses or coping behaviors is expressed in the form of excessive health concerns.

H₃ Subjective wellbeing mediates the relationship between mood and health consciousness.

The Mediating Effect of Hoarding Tendency

When increased feelings of uncertainty and threat exist around public health, it is common to find in individuals a rise in hoarding tendency (34). Hoarding is a compulsive behavior to purposely engage in repetitive purchases to accumulate goods in an excessive manner when negative events or feelings are salient in people’s daily lives (35). Moreover, hoarding is considered a type of mental disorder, as it is an expression of obsessive and compulsive levels of anxiety (36). When people use hoarding to cope with uncertainty (i.e., high levels of concern for one’s health), their behavior in the marketplace is demarcated as

an automatic reaction characterized by rapid decision-making processes, by displaying a decreased sensitivity approach, and by an urgent need for immediate possession of goods (34).

In high-threat situations, like the COVID-19 pandemic, the levels of anxiety and stress in public health exacerbate the fear of not accumulating essential products, as people have scarce opportunities to shop during lockdowns (36). As a result, individuals regulate their mental states (e.g., health concerns) by engaging in overconsumption.

H₄ Hoarding mediates the relationship between health consciousness and overconsumption.

The Moderating Effect of Individualism (vs. Collectivism)

Culture is known to influence how people perceive, express, and experience the link between emotions and mental distress (37). Furthermore, those beliefs seem to affect how individuals react to their level of concern for their health and mental distress (38). As mentioned by Kowal et al. (39) the role of culture has been widely studied for decades and debates are still going on in terms of how cultural factors may act as a buffer to the environmental stressors or, on the contrary, exacerbate stress levels (39). Since in individualistic societies people care most about the self (9, 37), it is expected that individualists would demonstrate a deeper level of motivation to sustain their positive mood and health. On the other hand, in collectivistic societies people care more about others (9), so it could be expected that their inner motivation to sustain a positive mood and health will be weaker compared to individualists. However, we must not forget that acting only on one needs pleasure, leads to more stress for individuals in quarantine times. We propose that an individualistic (vs. collectivistic) cultural orientation exacerbates or attenuates the effects of the relationships between the constructs included in the model. In particular, we focus on the moderating effect in the following two links: (a) the relationship between mood and health consciousness, and (b) the relationship between health consciousness and overconsumption.

Culture serves as natural guidance for people on how to deal with their value-identification processes (40, 41). People in individualistic societies are individual-centric and demonstrate a resilient orientation toward autonomy and self-efficacy (9, 42). In individualistic societies people prioritize their own interests and goals over those of the group (40). Individuals in individualistic societies by default focus on personal wellbeing and their material needs compared to individuals from collectivistic societies (37). However, it should be stressed that during the current quarantine, people have been forced to renounce their personal enjoyment (e.g., sports, concerts, shopping, travel, social gatherings) for the sake of group needs (39). In fact, it would be expected that the more individualistic individuals are, the higher the chances they would not adhere to epidemic prevention measures (43). Thus, individualistic societies might maintain mood and health consciousness by prioritizing their needs over the collective health of society, thus generating, as stated by Maaravi et al. (43), higher chances of not adhering to epidemic prevention measures, less vaccination and more death tolls.

On the other hand, people living in collectivistic societies demonstrate being interdependent with their community and assign relevance to social norms when forming their attitudes and engaging in consumption behaviors (9, 42). An important characteristic of collectivistic societies, key to the scope of this study, is that individuals in these societies are willing to make personal sacrifices because in their consumption goals interest is placed in the society's wellbeing (42). Thus, for collectivistic people, others' welfare is as highly relevant as their own welfare, while individualistic people care about the private self.

H₅ Individualism (vs. collectivism) moderates the relationship between mood and health consciousness.

Hofstede (44) labeled individualistic societies, with people's strong concern about the self and immediate family, and as having an emphasis on self-fulfillment as a characteristic. Another significant characteristic of individualistic societies is how people in these societies strive for norms like *living up to one's potential* (40, 42). In this sense, individualistic societies are fundamentally transaction oriented (e.g., purchasing goods at their own will guided by their self-interest). Given these characteristics, we propose that people living in individualistic countries will exhibit more overconsumption when their health concerns are dominant in their minds. This happens because individualism implies one's effort to accumulate resources (i.e., food, medicines, vitamins, cleaning products, and so forth) and having them at immediate disposal to deal with one's self-interests (e.g., deal with one's health concerns provoked by COVID-19-related forced lockdowns and social distancing measures). Therefore, as described by Kowal et al. (39) it might be reasonable to think that the emotional cost of this quarantine period would be greater in individualistic cultures (39). In fact, collectivistic (vs. individualistic) cultures put more emphasis on group harmony over personal interests and enjoyment (9).

At the other extreme, people in collectivistic societies think about others before taking action. The social norm of "being obliged" to others, salient in collectivistic societies (38–40), can cause people in these societies not to engage as much in overconsumption when coping with health concerns. Because collectivism is characterized by a communal orientation, with people having a mindset for the common good and a focus on maintaining harmony and avoiding conflicts with others (9, 40), it is reasonable to expect their priority will not be stockpiling goods. Thus, this expression will indirectly evidence a lower likelihood of using the marketplace to cope with their health concerns. Collectivism societies strive for group harmony; thus, less stress is developed in the process of helping others (9).

H₆ Individualism (vs. collectivism) moderates the relationship between health consciousness and overconsumption.

MATERIALS AND METHODS

Sample Characteristics and Data Collection

The reference population for this study is American and Ecuadorian customers. According to Hofstede (9), the USA has a highly individualistic cultural orientation, while Ecuador is high

in collectivism (44). Institutional Review Board (IRB) approved this study's procedure for using an anonymous, Internet-based, cross-sectional survey. All participants were informed that their participation was voluntary and consent was implied when accepting to answer the questionnaire. Participants were invited through social media channels and email invitations to fill out a survey concerning the impact of COVID-19 on their mental health and consumption habits. Snowball and convenience sampling were used to recruit participants. Data collection took place between April and May 2020, a time when both countries were heavily impacted by the virus outbreak and government implementation of mandatory lockdown restrictions and social distancing measures. Two surveys were designed for the present study: one for American customers and another for Ecuadorian customers. We used the *back-translation technique* (45) to translate the questionnaire into Spanish for data collection in Ecuador. Three waves of social media invitations to participate in the study were sent using the institutional accounts of a private mental health clinic and the universities' accounts. After screening participants and identifying them as those who usually shop for themselves or their families, the final sample was made up of 655 participants, mean age of 34.88 years ($SD = 12.28$). The sample of American customers includes 321 participants with a mean age of 29.47 years ($SD = 10.95$), and 46% were female. Meanwhile, the sample of Ecuadorian customers is 334 with a mean age of 39.98 years ($SD = 11.27$), and 53% were female. Apart from age and gender, other demographic variables such as number of household members and employment status were collected. **Table 1** summarized the sample characteristics.

Measures

Our literature review of the constructs included in the model provides the basis for the design of the questionnaire. Scale adaptations from previous marketing studies on mental health, overconsumption, and psychological factors were used. All items were measured using a seven-point scale. All items and their validity scores are listed in **Table 2**.

To address the potential for common-method bias in our study we ran two tests. We used Kock's (46) full collinearity test for common-method bias in Partial Least Squares Structural Equation Modeling (PLS-SEM) models (46). This test resulted in none of our items showing a VIF higher than 3.3, as they ranged between 1.07 and 2.71. Thus, the test results were optimal.

Data Analysis

In order to test the proposed model and hypotheses we used PLS-SEM to simultaneously assess the measurement and the structural model, and to estimate the differences between the path coefficients of the USA and Ecuador models. PLS-SEM is considered a reliable data analysis technique to study relationships among variables and is considered suitable to test exploratory models (47, 48). Smart Partial Least Squares SmartPLS version 3.3.2 software (49) was used to compute the items' psychometric properties and factor loadings, as well as to estimate model fit statistics, compute path coefficients, and perform multi-group analysis.

TABLE 1 | Sample demographic characteristics.

Characteristics	No. (and %) of respondents	
	Ecuador	USA
Sex		
Male	171 (51.20)	118 (36.76)
Female	163 (48.80)	203 (63.24)
Respondent age		
Young adults (18–34 y)	92 (27.54)	187 (58.26)
Middle adults (35–49 y)	194 (58.08)	110 (34.27)
Old adults (50–64 y)	31 (9.28)	22 (6.85)
Elders (>65 y)	17 (5.09)	2 (0.62)
No. Household members		
Children (0–12 y)	112	78
Teenagers (13–19 y)	135	127
Adults (20–65 y)	270	291
Older adults (>65 y)	25	17
Employment status		
Employed	219 (65.57)	205 (63.86)
Unemployed	115 (34.43)	116 (36.14)

RESULTS

Measurement Model

First, we evaluated the psychometric properties of the constructs included in the model. Convergent validity was assessed by the average variance extracted (AVE) scores and composite reliability (CR) for all variables. AVE scores were above the 0.5 threshold as Hair et al. (47) recommended (47). Second, we found that the CR scores for all constructs were robust and above 0.8. Third, the constructs demonstrated adequate reliability indices, as Cronbach's alpha for all constructs was above 0.7. To further check the reliability of the constructs, we followed Henseler et al.'s (50) recommendation and confirmed that the heterotrait-monotrait indices were below the maximum value of 0.9 (50). Finally, all outer loadings were significant and the rho_A indicators were higher than 0.7 (51). **Table 2** summarizes the constructs' psychometric properties.

Then we performed the analysis for the discriminant validity. All tests were successful. The average shared variance of each construct and its diagonal values, illustrated in bold in **Table 3**, exceed the shared variance with other constructs (Fornell-Larcker criterion). **Table 3** shows the heterotrait-monotrait ratio (HTMT) above the diagonal, the square root of the AVE in the diagonal (bold), and correlations between the constructs under the diagonal.

Structural Model

We first followed the steps recommended by Evermann and Tate (55) and Shmueli et al. (56) to assess the goodness-of-fit of the model by evaluating it with the partial least squares predict *PLSpredict* metric (55, 56). Results from this analysis demonstrate the predictive power of our model since all indicator values were above zero. In addition to this indicator, we checked if

TABLE 2 | Study's measures and indicators.

Composite/Indicators	Indicator loading	AVE	Composite reliability	Cronbach's alpha
Mood (52)		0.873	0.932	0.854
I am in a good mood.	0.930			
I feel happy.	0.939			
At this moment I feel nervous or irritable.				
Hoarding Tendency (53)		0.784	0.916	0.863
Getting rid of stuff is difficult for me.	0.903			
I tend to hold on to my possessions.	0.890			
Unless I have a really good reason to throw something away, I keep it.	0.863			
Health Consciousness (54)		0.584	0.807	0.652
I'm alert to changes in my health.	0.736			
I'm concerned about the health of others.	0.817			
Throughout the day I am aware of what foods are best for my health.	0.735			
Overconsumption (21)		0.605	0.821	0.677
Comparing what is happening now vs. pre-COVID-19 "I buy more than before"	0.766			
Medicines and vitamins				
Cleaning products	0.835			
Groceries	0.728			
Subjective well-being (23, 24)		0.990	0.997	0.995
Now, I appreciate more the life that I had before.	0.995			
Now, I can do things that I didn't do before.	0.995			
I should totally change my lifestyle as soon as this ends.	0.995			
Covid				
Do you have a relative or friend who has been diagnosed with COVID-19? (Yes or No)	1.00			
Do you have any relative or friend who is high risk of COVID-19 contagion? (Yes or No)	1.00			
Do you know someone, close to you, that died from COVID-19? (Yes or No)	1.00			

TABLE 3 | Discriminant validity.

Construct Name	O	CO	HC	H	MO	W
Overconsumption (O)	0.778					
COVID-19 (CO)	0.031	0.923				
Health consciousness (HC)	0.202	0.177	0.764			
Hoarding (H)	0.145	0.156	0.172	0.886		
Mood (MO)	0.164	0.244	0.148	0.028	0.934	
Wellbeing (W)	0.091	0.827	0.137	0.279	0.335	0.995

the standardized root mean square residual coefficient (SRMR) demonstrates that the model has an adequate fit. The SRMR of the model is 0.06, which is below the threshold of 0.08 suggested by Henseler et al. (57). Apart from SRMR, other indicators for model fit demonstrated the robust predictive performance of our model ($d_{ULS} = 0.77$; $d_G = 0.286$; Chi-Square = 187.04; and NFI = 0.88).

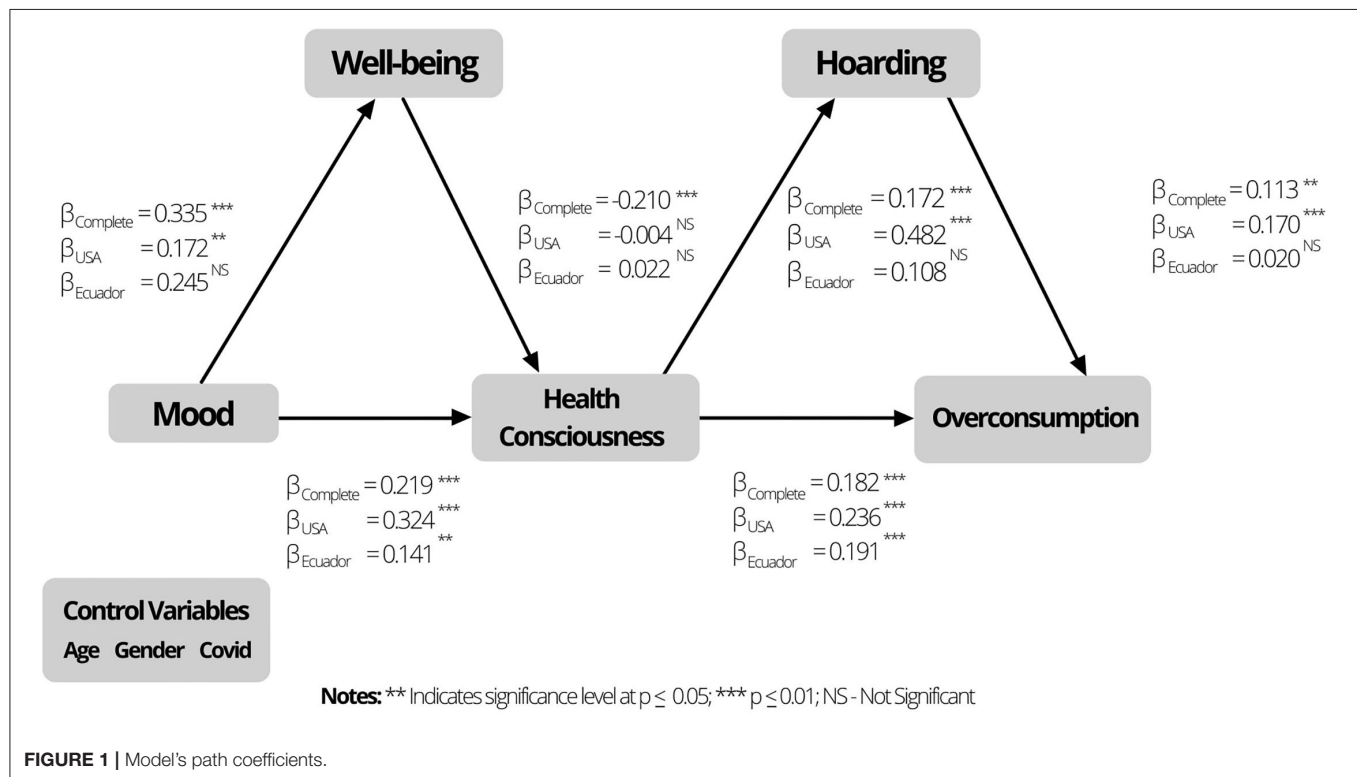
Second, hypothesis testing was performed by computing the path coefficients among the constructs included in the model. These path coefficients and statistic tests are included

in **Table 4**. H_1 states that customers' mood influences the level of health consciousness. The path coefficient ($\beta = 0.219$, $p < 0.001$) supports our hypothesis. We also found supporting evidence that health consciousness has a positive relationship with overconsumption behavior, as the path coefficient ($\beta = 0.182$, $p < 0.001$) is positive and statistically significant. Thus, H_2 was supported. **Table 4** presents the path coefficients for the structural model. **Figure 1** illustrates the model's path coefficients.

Third, we focused on the mediation effects included in the model. Hypothesis 3 (H_3) predicts that subjective wellbeing mediates the relationship between mood and health consciousness. The indirect effect ($\beta = -0.070$, $p < 0.001$) confirms this prediction. This mediation effect was also examined by performing a more elaborate mediation test, using Preacher and Hayes's (58). Model 4 method (58). Consistent with our expectations, we found a statistically significant indirect effect of wellbeing ($\beta = 0.04$, $SE = 0.01$, $CI = [0.02-0.06]$, $p < 0.001$) that provides evidence of a partial mediation of wellbeing. Hypothesis 4 (H_4) predicts that hoarding mediates the relationship between health consciousness and overconsumption. The indirect effect ($\beta = 0.020$, $p < 0.05$) confirms this prediction. Further examination for this mediation effect, using a statistical approach similar to that used for H_3 , resulted in a statistically significant indirect effect of wellbeing (β

TABLE 4 | Path coefficients.

Paths	Complete model			USA			Ecuador		
	β	t-statistic	P-value	β	t-statistic	P-value	β	t-statistic	P-value
H₁ Mood → Health consciousness	0.219	4.392	0.000	0.324	4.856	0.000	0.141	2.178	0.030
H₂ Health consciousness → Overconsumption	0.182	3.956	0.000	0.236	3.547	0.000	0.191	2.677	0.008
Mood → Wellbeing	0.335	9.774	0.000	0.172	2.442	0.015	0.245	1.414	0.158
Wellbeing → Health consciousness	−0.210	5.052	0.000	−0.004	0.075	0.940	0.022	0.150	0.880
Health consciousness → Hoarding	0.172	4.235	0.000	0.482	9.437	0.000	0.108	1.103	0.271
Hoarding → Overconsumption	0.113	2.566	0.011	0.170	2.849	0.005	0.020	0.232	0.817



$= 0.03$, $SE = 0.01$, $CI = [0.01-0.06]$, $p < 0.001$) that provides evidence of a partial mediation of hoarding. **Table 5** includes the direct and indirect effects statistics of our further analysis of the mediation effects.

Although the focus of the study is on the hypothesized mediating effects, the model implicitly proposes health consciousness as the mediator between mood and overconsumption. The indirect effect ($\beta = 0.030$, $p < 0.05$) provides support for this mediating effect.

Multi-Group Analysis

The multi-group analysis was the statistical technique we used to test the moderating effect of cultural orientation (i.e., individualism vs. collectivism). We followed the steps recommended by Matthews (59) when performing this analysis (59). The first step was to identify and divide the study population into two groups of interest (individualistic

and collectivistic cultural orientation) based on participants' nationality: US participants and Ecuadorian participants. The second step was to confirm the existence of invariance between the two groups (50, 59). We applied the measurement invariance of composite models (MICOM) procedure to compare the explained invariance for the USA and Ecuador groups. These initial tests were successful, as the original correlations are greater than or equal to the 5% quantile. Furthermore, full invariance was established, as the mean original difference values and variance original values fall between their corresponding 95% confidence intervals. The third step was to estimate the differences between path coefficients for both subsamples using permutation (59). When these differences are statistically significant, an individualistic (vs. collectivistic) cultural orientation is found to have a moderating effect. The results indicate that cultural orientation (individualism vs. collectivism), determined by country (USA vs. Ecuador),

TABLE 5 | Mediation analysis results.

Structural relationships	Indirect effect	t-value
H₃ Mood → Wellbeing → Health consciousness	0.25***	2.18
H₄ Health consciousness → Hoarding → Overconsumption	0.22***	2.54
Mood → Health consciousness → Overconsumption	0.03*	2.12
Mediation effect of Wellbeing (Process Macro, Model 4 indicators)		
Direct effect mood → Health consciousness without mediator	0.12***	4.04
Direct effect mood → Health consciousness with mediator	0.08**	2.59
Indirect effect	0.04***	
Mediation effect of Hoarding (Process Macro, Model 4 indicators)		
Direct effect Health consciousness → Overconsumption without mediator	0.29***	5.06
Direct effect Health consciousness → Overconsumption with mediator	0.26***	4.52
Indirect effect	0.03***	

*** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$.

moderates three relationships, as they are significantly different when comparing the two groups. **Table 6** shows the results of the multi-group analysis.

Following Matthews's (59) suggestion to use the permutation p -value as a test to identify significant differences between groups, it is evident that there is a marginally significant difference between the two groups in the impact of mood on health consciousness. In individualistic societies this effect is stronger compared to collectivistic societies ($\beta_{USA} = 0.324$, $\beta_{Ecuador} = 0.141$, *Permutation* p -value = 0.100). This finding provides partial evidence to support H_5 .

There was no statistically significant difference between the USA and Ecuador groups in the impact of hoarding on overconsumption. The effect of the relationship between hoarding and overconsumption does not differ between individualistic and collectivistic societies ($\beta_{USA} = 0.236$, $\beta_{Ecuador} = 0.191$, *Permutation* p -value = 0.818). Therefore, H_6 was not supported.

Interestingly, we found a significant difference between the two groups in the impact of health consciousness on hoarding ($\beta_{USA} = 0.482$, $\beta_{Ecuador} = 0.108$, *Permutation* p -value = 0.001). Additionally, we found a significant difference between the two groups in the impact of hoarding on overconsumption ($\beta_{USA} = 0.170$, $\beta_{Ecuador} = 0.020$, *Permutation* p -value = 0.033).

DISCUSSION

COVID-19 has affected countless people all around the world (1, 5). Recent statistics count more than 95 million cases and more than 2 million deaths globally (10). The consequences of the COVID-19 crisis affect both individuals and the economy.

In fact, the increase in positive cases forced governments to continue to take drastic measures such as lockdowns to avoid the spread of the virus in their respective countries. Although these measures have had a positive impact on containing the virus, the effects on the mental health in people are visible (1, 5). In this study we examine several mental health factors and their influence on overconsumption behavior. We explore the chain of effects among mood states, health consciousness, subjective wellbeing, and hoarding, and their impact on overconsumption behavior, using a cross-cultural approach.

The aim of this study was to test a theoretically model focused on understanding overconsumption behavior in times of COVID-19. Based on a unique dataset with data collected in the USA and Ecuador, we find that a positive mood is positively associated with health consciousness. This result is congruent with previous studies that report how individuals' behaviors are guided by their mood state (13). Thus, in times of COVID-19 individuals demonstrating positive mood are motivated to maintain those positive feelings by staying alert of their health situation. Our results also provide evidence that health consciousness is positively associated with overconsumption. Therefore, our results indicate that individuals use overconsumption behavior as tactic to cope with the stress (e.g., avoid changes in their mood and stay healthy) associated to the pandemic. This result is in line with previous studies that suggest how individuals use their consumption behavior (e.g., panic buying) to maintain their wellbeing (9, 21).

We provide partial evidence for the mechanisms included in the model. First, our results indicate partial evidence for subjective wellbeing as the mechanism that drives individuals to sustain their positive mood through higher health consciousness. Because subjective wellbeing is about maintaining positive thoughts about the self (24, 25), individuals are in need to maintain stability and control over themselves (30). Thus, this motivation seems to be responsible for the positive relationship between one's mood and health consciousness. In addition, we provide partial evidence for hoarding as the psychological determinant that drives people to engage in overconsumption when they try to cope with health concerns. In contexts with increased feelings of uncertainty hoarding tendency rises as a way to accumulate resources (34). Our results suggest that hoarding acts as the coping strategy for individuals to engage in overconsumption to sustain their health. This is consistent with previous research that suggests that hoarding is a key psychological mechanism that drive people's behavior (36).

Regarding the role of culture, our data provide evidence that culture is a moderating factor of several relationships among the mental health factors included in the model. Our focus was on two relationships. First, we found that in individualistic societies, like the USA, people have a strong desire to protect their positive mood through elevating their concern for their health. In collectivistic societies, like Ecuador, this effect is significantly weaker. Interestingly, we found no support for the moderating effect of individualism (vs. collectivism) on the relationship between health consciousness and overconsumption. We might explain this finding as a demonstration of how COVID-19 has

TABLE 6 | Multigroup analysis.

Paths	β_{USA} (1)	$\beta_{Ecuador}$ (2)	B Permutation Difference (1,2)	2.50%	97.50%	Permutation P-values
H ₅ Mood → Health consciousness	0.324	0.141	0.183	−0.204	0.207	0.100
H ₆ Health consciousness → Overconsumption	0.236	0.191	0.045	−0.176	0.172	0.818
Mood → Wellbeing	0.172	0.245	−0.073	−0.137	0.133	0.295
Wellbeing → Health consciousness	−0.004	0.022	−0.026	−0.171	0.172	0.182
Health consciousness → Hoarding	0.482	0.108	0.374	−0.157	0.163	0.001
Hoarding → Overconsumption	0.170	0.020	0.150	−0.163	0.168	0.033

negatively impacted the mental health of people (1, 3), no matter where they live or what culture they belong to.

This study opens up a new conversation, as it raises a question. While it is true that a positive mood is generated by responding to one's own (individualistic) demands (40) and generating overconsumption, there is an important degree of stress that this attitude could generate (39, 43). That is to say, we are talking about people who belong to an individualistic society as a self-regulated person-, but at what price? Or from whom?

On the other hand, collective societies that strive for the common good (9) have a lower level of health consciousness. This notion could be explained by how collectivistic societies adhere more to first think about others instead of the self (9). Thus, the levels of virus contagions are reduced as individuals don't want to feel guilty about spreading the virus to others. In collectivistic societies where, communal goals are a priority over achieved of individual interest, we can expect less levels of stress about individual health consciousness. Thus, it is valid to question what is better? What is worse? Do governments and societal institutions should position their public messages to counter COVID-19 virus breakout using claims that emphasize in care for others or care for the self. Thus, this study opens this and other research questions that future research might want to address.

Theoretical Contribution

This study makes numerous contributions to public health literature. First, it builds on the extant literature linking mental health and compulsive behaviors (20–22, 39, 43). Regarding people's efforts to regulate their feelings and emotions in congruence with their positive mood states, our findings suggest that subjective wellbeing and hoarding are relevant factors on which individuals rely to cope with uncertainty and threat contexts like the ones produced by the COVID-19 crisis. We also indirectly find evidence that the marketplace constitutes an important tool for people when dealing with high levels of health concern and mental distress. When individuals engage in overconsumption they rely on the marketplace to cope with their anxiety and accumulate essential products to alleviate health concerns. This is in line with previous research that highlights the role of the marketplace in support of individuals mental health (20). Thus, this study links the mood-maintenance and mood-congruence consumer psychology literature with actual empirical

evidence for compulsive behaviors produced by negative public health contexts.

Second, our study also adds to the developing stream of research on health consciousness, subjective wellbeing, hoarding, and overconsumption. It complements the research body of cross-cultural effects in mood-regulation studies (60–62). Our results suggest that culture moderates the effects of the relationships between mood and health consciousness, between health consciousness and hoarding, and between hoarding and overconsumption.

Third, our study reports differences on how culture affects individuals' judgments based on construals of the self and others. This cross-cultural perspective we followed in this study not only considers differences in societies cultural values, but also how countries adopted different measures to prevent and control COVID-19 virus breakout. Therefore, we provide empirical results that observe how macro-level decision making from governments and local authorities related to control or maintain public health have an influence on individuals' mental health and consumption behaviors (e.g., panic buying and overconsumption). Recent COVID-19 research is reporting similar effects (63–66) that support our findings.

Implications for Public Health

Our results also have important practical implications. First, we show that in the context of COVID-19 people's mental state impacts overconsumption behavior, even in different countries like the USA and Ecuador. Subjective wellbeing requires redoubled attention from public health institutions since it drives individuals' efforts to sustain a positive mood by increasing their health consciousness.

Our findings also indicate that individuals' hoarding tendencies are responsible for the compulsive behaviors that cause supply shortages. Very often, public health officials do not have control over the continuous supply of products. When individuals unnecessarily accumulate essential goods, they contribute to exacerbate the anxiety imposed by COVID-19 by increasing the levels of mental distress for households who find empty shelves. Further discussion of the relevance of the supply chain and operations management for the marketplace is crucial. The novel coronavirus has created supply shortfalls for many products, and procurement

departments from public health institutions must use new techniques to quickly find new suppliers at the lowest operational costs.

People's stockpiling behavior exhibiting around the world could be expected to generate gains for consumer goods manufacturers and retailers. However, for the general public health, overconsumption causes higher levels of anxiety and stress as people strive for maintaining their mental wellbeing. Certainly, public health campaigns are recommended to use communication themes and messages highlighting the common good and demonstrating that overconsumption leads to increased anxiety.

Limitations and Future Research

This study is not free of limitations. First, our results might be exclusively related to the specific case of the US and Ecuadorian markets. It would be interesting to address our same research questions in different empirical contexts—that is, with different nationalities or cultural values. Second, we dealt with a cross-sectional dataset. Perhaps a longer perspective (i.e., repeating the survey once the pandemic is controlled) would provide complementary results. Third, we assume that both countries under consideration (US and Ecuador) adopted similar measures and length of lockdowns which might not be exactly the case although the data collection process took place during lockdowns. Fourth, our study might suffer from typical limitations of cross-cultural research that uses country-level as unity of analysis to identify differences in cultural orientations. Future research may consider to replicate our findings using an individual-level unit of analysis.

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DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comité de Bioética Universidad San Francisco de Quito. Written informed consent was not provided because this was an online survey, informed consent was approved electronically.

AUTHOR CONTRIBUTIONS

Data collection duties was equality distributed among all authors. VF and LC performed the data analysis. All authors contribute equally to plan the scope of the research and develop the research questions, to the writeup of the manuscript, and gave final approval of the version to be submitted to the journal.

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The Effect of Perceived Threat Avoidability of COVID-19 on Coping Strategies and Psychic Anxiety Among Chinese College Students in the Early Stage of COVID-19 Pandemic

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Edited by:

Mohammadreza Shalbafan,
Iran University of Medical Sciences,
Iran

Reviewed by:

Seyedmohammad Mirhosseini,
Mashhad University of Medical
Sciences, Iran
Majid Yousefi Afrashteh,
University of Zanjan, Iran
Chiara Massullo,
European University of Rome, Italy
Winnie Cheng,
Tung Wah College,
Hong Kong SAR, China

*Correspondence:

Wenpei Zhang
zwpahut@ahut.edu.cn

[†]These authors have contributed
equally to this work and share first
authorship

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Jinnan Wu[†], Yelianghui Zheng[†], Shankuo Xiong, Wenpei Zhang* and Shanshan Guo

Department of Business Administration, School of Business, Anhui University of Technology, Ma'anshan, China

Background: The novel coronavirus disease 2019 (COVID-19) outbreak has seriously threatened the mental health of college students. This study intended to invest whether perceived threat avoidability of COVID-19 relates to psychic anxiety among college students during the early stage of the COVID-19 pandemic, as well as the mediating roles of COVID-19-specific wishful thinking and COVID-19-specific protective behaviors in this relationship.

Methods: A cross-sectional study was conducted in China, using a random sampling method (February 6–25, 2020). Self-reported questionnaires were conducted online included the Perceived Threat Avoidability of COVID-19 Scale, COVID-19-specific Wishful Thinking Scale, COVID-19-specific Protective Behaviors Scale, and the Hamilton Psychogenic Anxiety Scale. The data were analyzed using Structural equation modeling and Bootstrapping procedure.

Results: A total of 2922 samples were collected in this study. Perceived threat avoidability of COVID-19 is negatively related to psychic anxiety ($\beta = -0.158, p < 0.001$), and both COVID-19-specific wishful thinking ($\beta = -0.006, p = 0.029, 95\% \text{ CI: } [-0.012, -0.001]$) and protective behaviors ($\beta = -0.029, p < 0.001, 95\% \text{ CI: } [-0.043, -0.018]$) mediate this relationship. Also, COVID-19-specific wishful thinking is found to correlate with COVID-19-specific protective behaviors negatively ($\beta = -0.112, p < 0.001$).

Conclusion: Perceived threat avoidability of COVID-19 contributes to psychic anxiety among college students. COVID-19-specific wishful thinking strategy plays a negative mediating role and increases the level of anxiety; COVID-19-specific protective behaviors strategy plays a positive mediating role and reduces the level of anxiety; meanwhile, wishful thinking also suppresses college students from adopting protective behaviors.

Keywords: anxiety, cognition, coping strategy, COVID-19, mental health

INTRODUCTION

The novel coronavirus disease (COVID-19) pandemic, declared as a public health emergency of international concern by the World Health Organization (WHO) on 30 January 2020 (1), carries a global and acute threat to public health (2). In addition to the threat to physical health, the unpredictable spread of COVID-19, as well as the lack of social interaction caused by mandatory social distancing, seriously threatens the public's mental health (e.g., fear and anxiety) (3). Moreover, constant COVID-19-related rumors on the Internet aggravate group panic and cause anxiety among different groups (4, 5). Compared with other periods of the COVID-19 pandemic, COVID-19 creates more unknowns to the general public and healthcare workers in the early stage of the COVID-19 pandemic, such as unknown virus sources, pathogenic mechanisms, effective treatments, and preventive measures. The uncertainties brought by these unknowns make the public more susceptible to anxiety in the early stage of the COVID-19 pandemic (6). Therefore, it is valuable for researchers and policy-makers to identify the predictors of public anxiety toward the COVID-19 pandemic and reveal the underlying mechanism in the early stage of the COVID-19 pandemic.

Previous research has found that young adults (e.g., college students) are more sensitive to information about the pathogen, infectiousness, cure rates and mortality of the severe acute respiratory syndrome (SARS), whose negative emotional responses such as anxiety and panic are more pronounced than other groups (7, 8). More specifically, Sun et al. (9) suggested that college students are more vulnerable to the psychological consequences of the COVID-19 pandemic. Several studies have shown that the COVID-19 pandemic leads to the deterioration of mental health conditions in college students, such as significantly high levels of depression (10) and the generation of anxiety (11). However, the mental health of college students has received much less attention than that of healthcare workers. In the early stage of the COVID-19 pandemic in China, the first country reporting the COVID-19 pandemic to the WHO, Chinese college students were not only exposed to the direct threat of unknown COVID-19, but also were required to adhere to strict home quarantine policies and receive distance learning. These changes in their lives and studies have damaged physical health, limited social interaction, reduced physical activities, and altered learning styles, leading to a significant increase in psychic anxiety symptoms among Chinese college students (12, 13). Further, in the early stage of the COVID-19 pandemic, Chinese college students' anxiety levels were higher than the norm score of other adults, and non-medical college students had more severe anxiety than medical college students. Because non-medical college students have more uncertainties about the COVID-19 pandemic and feel more anxiety than medical college students who have a rich background of medical knowledge, and they need more psychological support in terms of cognitive and negative emotional interventions (14). In addition, the larger size of non-medical students makes the results of this study more widely beneficial. Hence, this research aims to narrow the gap in the existing literature by focusing on which

factors relate to COVID-19-related psychic anxiety among non-medical college students in the early stage of the COVID-19 pandemic in China.

The existing studies on COVID-19-related anxiety of college students have well examined the prevalence and levels of anxiety, and the demographic and coping antecedents of anxiety. First, Tang et al. (13) found that the proportion of clinically elevated anxiety symptoms was 15.4% in a top university in China. Islam et al. (15) indicated that 18.1% of Bangladeshi college students suffered from severe anxiety disorders. Second, several studies have examined the relationship between demographic factors (e.g., sex, age, residence, nationality, parents' social status, etc.) and COVID-19-related anxiety of college students (15–18). Third, studies on the effects of coping strategies and social media use on anxiety found that positive problem-focused and emotion-focused coping strategies were related to a low level of COVID-19-related anxiety among college students (19, 20). These three streams of research provide valuable insights into our understanding of college students' anxiety during the COVID-19 pandemic. However, little is known about whether and how perceived threat avoidability of COVID-19, which is inherent in uncertainties of COVID-19 in the early stage of the pandemic in China, causes college students' psychic anxiety.

Research based on the terror management theory, which understands the impact of COVID-19 threat on people, suggests that people respond differently to COVID-19 threat, and ineffective coping may produce psychological distress, emphasizing the important role of coping in COVID-19 and psychological distress (e.g., anxiety) (21, 22). Further, cognitive appraisal theory, which is used to explain stress appraisal and coping, can provide a theoretical basis for analyzing the specific processes by which individuals cope with COVID-19 in different ways (23). Cognitive appraisal theory states that negative emotions (e.g., psychic anxiety) are responses of individuals after a series of appraisals and coping with harmful environmental events (6, 24, 25). Individuals generally make a primary *threat appraisal* regarding the severity of the threat itself (i.e., perceived threat severity), followed by a secondary *coping appraisal* regarding their ability to cope (i.e., perceived threat avoidability in this study), and finally adopt *coping strategies* including emotion-focused coping (EFC) and problem-focused coping (PFC) (6, 23, 26). Confronted with the COVID-19 pandemic, a major unexpected harmful event, individuals widely have a high level of threat evaluation of COVID-19 and induce psychic anxiety (9, 24, 27). While few studies to date have examined the effect of coping appraisal (e.g., sense of control) on the COVID-19-induced psychic anxiety (28), the underlying mechanism for explaining this effect is underexplored. Further, previous studies have supported the association of positive PFC and EFC strategies with low levels of COVID-19-induced anxiety among college students during the COVID-19 pandemic (19, 20), and the prevention of mental health deterioration in college students by scientific coping methods (e.g., quarantine policy) (29), suggesting a possible beneficial role of coping strategies in coping appraisal and psychic anxiety. Chen and Liang (30) further confirmed that coping appraisal influences users' behavioral intention through the mediations of PFC and

EFC strategies. Thus, this study seeks to narrow the gaps in theories by examining the relationship between college students' coping appraisal (perceived threat avoidability of COVID-19) and their psychic anxiety, as well as the mediation of EFC and PFC strategies toward COVID-19.

Among EFC strategies such as wishful thinking, expressing emotions, self-criticism, and social withdrawal (31), wishful thinking has been proven to be one of the most important coping strategies influencing individuals' anxiety and behavioral responses (32–35). Therefore, this study focuses on wishful thinking and its relation to perceived threat avoidability and psychic anxiety. Further, Folkman and Lazarus (35) noticed that some forms of EFC strategies could affect PFC strategies. A recent study demonstrates a negative effect of wishful thinking on PFC when users face an information technology threat (36). Thus, this study further tests the relationship between wishful thinking and protective behaviors in the context of the COVID-19 pandemic.

The rest of this paper is organized as follows. Our hypotheses are described at first. Next, methodology and data analysis results are presented. Then, we conclude this paper by discussing the findings, theoretical and practical implications, limitations, and future directions.

HYPOTHESES DEVELOPMENT

Perceived Threat Avoidability of COVID-19 and Psychic Anxiety

The basic assumption of cognitive appraisal theory is that emotion is an individual's perceived beneficial or harmful response to environmental events and is a complex conceptualization of the appraisal process (6). Cognitive appraisal theory consists of two core concepts: appraisal and coping. The appraisal can be further divided into primary appraisal, in which individual evaluates whether the environmental event has anything at stake for him or her, and secondary appraisal, in which the individual evaluate if anything can be done to prevent harm or control the stimuli events (35, 37, 38). Lazarus (6) and Folkman et al. (37) suggested that the results of appraisal influence individuals' psychological well-being and emotional responses.

In the early stage of the COVID-19 pandemic in China, COVID-19 brought new stimuli to the college students, such as concerns about one's own or family's physical health, freedom of social activities restricted by quarantine, fear of infection from the virus, insufficient information, and inadequate supplies (39, 40). When they were confronted with these stimuli from a COVID-19 outbreak, they would assess their ability to overcome or prevent the COVID-19 threat on their own or with government guidance. This appraisal results in their perceived threat avoidability of COVID-19 (coping appraisal) in this study. According to cognitive appraisal theory (37), the perceived threat avoidability of COVID-19 would affect their psychological well-being. If students believe that they can effectively prevent COVID-19 by taking some COVID-19 precautions, which means they have a high level of perceived threat avoidability of COVID-19. In that case, their psychic anxiety symptoms will be alleviated. Recent

studies have also confirmed that perceived controllability, in turn, alleviates students' anxiety levels (24, 28). Based on this discussion, we propose the following hypothesis:

H1: Perceived threat avoidability of COVID-19 negatively correlates with college students' psychic anxiety.

Mediating Effect of COVID-19-Specific Wishful Thinking

Coping is another core concept of cognitive appraisal theory, defined as the person's cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing exceeding the person's resources (23). The processes of coping are divided into two types: EFC, which refers to pacifying or controlling the emotion aroused by the stressful situation, or to dismiss the emotional discomforts, and PFC, which refers to doing something to change for the better the problem causing the distress (35, 38). Folkman et al. (26) indicated that coping is highly correlated with cognitive appraisal and that different types of coping styles can have different effects on psychological symptoms (37). In other words, coping strategies play a mediating role between cognitive appraisal and psychological well-being.

Wishful thinking is a form of EFC, in which the individual avoids the effects of an environmental event by fantasizing or hoping that the situation will disappear or end suddenly, which is an escape-avoidance type of coping (26) and is a negative non-adaptive coping strategy (31). In the context of the COVID-19 pandemic, when people perceive that the threat is avoidable and the harm can be avoided through some measures, they will reduce the use of EFC such as wishful thinking (36). At the same time, previous studies have shown that wishful thinking negatively affects individuals' mental health (41), is predictive of negative emotions (34), and increases the levels of anxiety (42, 43). Based on this, we propose the following hypothesis:

H2: COVID-19-specific wishful thinking mediates the relationship between perceived threat avoidability of COVID-19 and psychic anxiety.

Mediating Effect of COVID-19-Specific Protective Behaviors

In the context of the COVID-19 pandemic, various protective behaviors (e.g., wearing protective devices outside the home, reducing exposure to others, washing hands, etc.) in response to the pandemic's prevention and control can be considered a form of PFC (44). If people are aware that they can prevent infection or reduce harm from COVID-19 by taking specific COVID-19 coping measures (high perceived threat avoidability). In that case, they will tend to actively adopt COVID-19 protective behaviors to protect their health and lives (24). According to cognitive appraisal theory (37), COVID-19-specific protective behaviors, as a PFC strategy, are not only influenced by perceived threat avoidability but also alleviate anxiety symptoms. Recent studies with Turkish health care workers (45) and Chinese university students (19) have shown a negative relationship between PFC and anxiety in response to the COVID-19 outbreak. Thus, this

paper proposes the following hypothesis for the mediating effect of COVID-19-specific protective behaviors:

H3: COVID-19-specific protective behavior mediates the relationship between perceived threat avoidability of COVID-19 and psychic anxiety.

The Relationship Between COVID-19-Specific Wishful Thinking and COVID-19-Specific Protective Behaviors

Folkman and Lazarus (35) suggested a correlation between EFC and PFC strategies and that different types of EFC strategies have different effects on PFC strategies. Wishful thinking, a form of EFC strategy, refers to an individual's effort to cognitively escape from or avoid a situation by simply fantasizing or hoping the situation will go away or somehow be over (41). It will lead to individuals' misperceptions of the threat. Then people are not motivated to take PFC strategies, because they are not sufficiently concerned about the situation and are less likely to take protective measures (36). Research in the information technology threat domain has shown that inward EFC strategies, including wishful thinking, has a negative effect on PFC strategies. In the context of the COVID-19 pandemic, COVID-19-specific wishful thinking could have a negative effect on COVID-19-specific protective behaviors. Thus, this paper proposes the following hypothesis.

H4: COVID-19-specific wishful thinking is negatively associated with COVID-19-specific protective behaviors.

MATERIALS AND METHODS

Sample

This research used a random sampling method and the data was collected *via* an online questionnaire survey on the Wenjuanxing¹ survey platform. The respondents are college students from 10 universities located in Anhui, central China. This research was conducted from 6 February 2020 to 25 February 2020 to obtain college students' data in the early stage of the COVID-19 pandemic. These ten universities were selected out of 115 universities in Anhui province using the random number table method. We contacted the counseling agencies of these 10 universities and asked them to randomly select 2–3 counselors. Then we distributed the hyperlink and quick response (QR) code of the questionnaire to these selected counselors of each college, who further distributed the hyperlink and QR code to the students of their respective colleges. The questionnaire could be accessed and completed by participants *via* computer, mobile phone, or pad. The setting function of the Wenjuanxing survey platform was requested that one questionnaire could only be completed once for each IP address to ensure the validity of the questionnaire. A total of 3,088 questionnaires were collected in this research. After eliminating 166 invalid questionnaires with short response time, missing values, and consistency of question items, 2,922 valid questionnaires were retained. This research

was approved by the Research Ethics Committee of School of Business at Anhui University of Technology (SB-AHUT-REC-2020-02-HS01). All participants gave their informed consent for inclusion prior to the survey.

Of the 2922 participants, 40.3% ($n = 1,179$) were male, 59.7% ($n = 1,743$) were female, and the mean age was 19.91 ($SD = 1.48$). The percentage of students in economics and management was 49.7% ($n = 1,451$), 27.5% ($n = 803$) in science and engineering, 10.4% ($n = 305$) in humanities, 10.2% ($n = 298$) in arts, and 2.2% ($n = 65$) in other categories. The percentages of students with a health status of "very poor" was 0.1% ($n = 2$), of "poor" was 1.0% ($n = 28$), of "average" was 20.4% ($n = 596$), of "good" was 47.2% ($n = 1,380$), and of "very good" was 31.3% ($n = 916$). The percentage of students living in the hospitals and unified quarantine was 0.3% ($n = 9$), 14.9% ($n = 436$) in high-risk areas and unified quarantine, 78.4% ($n = 2,291$) in high-risk areas and self-quarantine, 4.7% ($n = 137$) in medium-risk areas and self-quarantine, 1.7% ($n = 49$) in low-risk areas. The participants were distributed in Anhui, Jiangsu, Zhejiang, Shandong, Hunan, Hubei, Henan, Hebei, Guangdong, Gansu, Inner Mongolia, Xinjiang and other provinces. The demographic characteristics of the study sample are shown in **Table 1**.

Measurements

We adapted and revised several scales or multi-items to measure the perceived threat avoidability of COVID-19, the COVID-19-specific wishful thinking, and the COVID-19-specific protective behaviors. Two bilingual experts (Chinese and English) translated

TABLE 1 | Baseline/socio-demographic characteristics of the sample ($N = 2,922$).

Category	Frequency	Percentage
Sex		
Male	1,179	40.3
Female	1,743	59.7
Age	Mean = 19.91; SD = 1.48	
Speciality		
Economics and management	1,451	49.7
Science and engineering	803	27.5
Humanities	305	10.4
Arts	298	10.2
Other	65	2.2
Health status		
Very poor	2	0.1
Poor	28	1.0
Average	596	20.4
Good	1,380	47.2
Very good	916	31.3
Risk level of living area		
Hospitals and unified quarantine	9	0.3
High-risk areas and unified quarantine	436	14.9
High-risk areas and self-quarantine	2,291	78.4
Medium-risk areas and self-quarantine	137	4.7
Low-risk areas	49	1.7

SD, standard deviation.

¹ www.wjx.cn

the original scales from English to Chinese in parallel, and two other bilingual scholars conducted a back-translation. Next, proper adjustments were made accordingly after discussing and identifying inconsistent contents between the original and back-translated versions. Finally, we slightly adjusted the items to fit the COVID-19 pandemic in the Chinese context. Psychic anxiety was measured using a Chinese revision of The Hamilton Anxiety Scale (HAMA) widely used in China. Before conducting hypotheses testing, we examined all scales for reliability, convergent validity and discriminant validity, and the results indicated that they all had good psychometric properties in the present study.

Perceived Threat Avoidability of COVID-19

In this research, the perceived threat avoidability of COVID-19 was measured using three items which were revised from the Perceived Avoidability Scale developed by Liang et al. (36) to better reflect the context of the COVID-19. The following are the three items: "The threat posed by COVID-19 can be prevented," "I can protect myself from the COVID-19 threat," and "Overall, I think the COVID-19 threat is manageable." All items were 7-point Likert scaled (1 = strongly disagree, 7 = strongly agree), with higher scores indicating higher levels of perceived threat avoidability of COVID-19. The Cronbach's α of this scale was 0.831.

COVID-19-Specific Wishful Thinking

COVID-19-specific wishful thinking was measured using four items which were revised from the Wishful Thinking Scale developed by Liang et al. (36) to reflect the context of the COVID-19 better. The following are the four items: "I fantasized that COVID-19 would go away or somehow be over with," "I fantasized that I would somehow come across a magical solution for it," "I fantasized that all of a sudden COVID-19 disappears by itself," and "I fantasized that everything turns out just fine as if nothing happened." All items were 7-point Likert scaled (1 = strongly disagree, 7 = strongly agree), with higher scores indicating higher levels of EFC with wishful thinking. The Cronbach's α of this scale was 0.874.

COVID-19-Specific Protective Behaviors

Due to the lack of a COVID-19-specific Protective Behaviors Scale, we developed a 5-item scale based on the safety protective measures against COVID-19 recommended by the WHO (46) and the Chinese Center for Disease Control and Prevention. The following are the five items: "Wearing protective equipment when going out," "Reducing contact with others," "Enhancing personal hygiene," "Enhancing family hygiene," and "Cleaning yourself when you come home from outside." All items were 5-point Likert scaled (1 = never and 5 = always), with higher scores indicating higher levels of COVID-19-specific protective behaviors. The Cronbach's α of this scale was 0.878.

Psychic Anxiety

The HAMA is widely used to assess anxiety levels around the world, and the Chinese version of the HAMA used in the present study has been widely used in the Chinese population, and its psychometric properties have been effectively validated (47). The

HAMA is one of the first scales commonly used in psychiatric clinics and contains 14 items (48). The HAMA classifies anxiety factors into two categories: somatic and psychic anxiety. We selected seven items on psychic anxiety, namely the Hamilton Psychogenic Anxiety Scale (HAMA-PSY). All items were 5-point Likert scaled (1 = never and 5 = always), which contained the following seven items: "I feel worried, concerned, and feel that the worst thing is going to happen," "I feel uneasy, nervous, and cannot relax," "I am afraid of being alone, in a car, going out and in crowds," "I have difficulty sleeping, wake up easily, dream a lot, wake up tired," "I have difficulty concentrating, poor memory," "I lose interest in past hobbies, depression, early awakening," and "I am nervous, apprehensive, shaking hands, frowning, stiff expressions, swallowing, fast heartbeat, fast breathing, fluttering eyelids, easy sweating when communicating with others." The Cronbach's α of this scale was 0.890.

Analysis Strategy

Data analysis was performed by the statistical package for Social Science (IBM-SPSS) v26.0 and Mplus v8.3. Firstly, to test whether there was a common method bias problem for the research dataset, Harman's one-factor test was conducted with IBM-SPSS (v26.0). If the variance explained by the first principal component was less than 50% of the total variance, which indicates a low probability of common method bias (49). Secondly, confirmatory factor analysis (CFA) was conducted with Mplus (v8.3) to further validate the results of Harman's one-factor test, comparing the Chi-square (χ^2) and degree of freedom (df) of the four-factor model and the one-way model. If the χ^2 and df of the four-factor model were significantly lower than the one-way model, which further indicated that the common method bias problem of the research was not significant (50). Scale reliability, validity, and correlation analysis were conducted with IBM-SPSS (v26.0) before conducting model hypothesis testing. The Cronbach's alpha is used to evaluate the reliability of the scale. The Cronbach's alpha coefficient is greater than the cutoff value of 0.70, indicating that the scale has good reliability (51). Then, the hypotheses proposed in this study were tested by Mplus (v8.3). Several commonly used fit indices were used to evaluate the model, including $\chi^2(df)$, Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). Since χ^2 test is highly affected by sample size (52), when the sample is large, it can lead to an inflated χ^2 statistic (53). Therefore, the model fitted better when CFI and TLI > 0.95, SRMR < 0.08 and RMSEA < 0.08 (54). Finally, the bias-corrected non-parametric percentile Bootstrap method was used to test the mediating effects by Mplus (v8.3) with 95% confidence interval and 5,000 iterations. If the 95% confidence interval does not contain 0, the mediating effect is significant (55). In the model analysis, perceived threat avoidability of COVID-19 was analyzed as the independent variable, psychic anxiety was analyzed as the dependent variable, and COVID-19-specific wishful thinking and COVID-19-specific protective behaviors were analyzed as mediating variables. In terms of control variables considered, sex, age, health status, and risk level of living area were initially considered in this study based on previous studies (56–58), and

then the control variables to be included in the model calculation will be determined based on the results of correlation between these variables and the dependent variable.

RESULTS

Reliability, Validity Analysis, and Correlation Analysis

The Cronbach's alpha is used to evaluate the reliability of the scale (51). As shown in **Table 2**, each scale's Cronbach's alpha coefficient in this study was greater than 0.7, showing that the scales have reliability (51). Standardized factor loadings and average variance extracted (AVE) values were used to evaluate convergent validity. **Table 2** shows that all observed variables had standardized factor loadings larger than 0.5 (59), the AVE values of each factor were greater than 0.5 (60), and the composite reliability (CR) values ranged from 0.834 to 0.879, all of which were greater than 0.8 (51). These findings suggested that the scales employed in this study had good convergent validity. The discriminant validity of the scale was evaluated using the square root of AVE and the correlation coefficient between factors. **Table 3** shows the variables' mean, standard deviation, and correlation coefficients for all variables as well as the square root of AVE for four latent variables. According to the results provided in **Table 3**, the square root of AVE (bold values on the diagonal of **Table 3**) is greater than the correlation coefficients between the variables, indicating that the scales have good discriminant validity (61). Meanwhile, perceived threat avoidability of COVID-19 was negatively correlated with COVID-19-specific wishful thinking ($r = -0.040$, $p < 0.05$) and psychic anxiety ($r = -0.226$, $p < 0.001$), but positively correctly with COVID-19-specific protective behaviors ($r = 0.192$, $p < 0.001$). COVID-19-specific wishful thinking was negatively correlated with COVID-specific protective behaviors ($r = -0.109$, $p < 0.001$), and was positively correlated with psychic anxiety ($r = 0.130$, $p < 0.001$). Meanwhile, COVID-specific protective behaviors were negatively correlated with psychic anxiety ($r = -0.193$, $p < -0.001$). For the control variables, health status ($r = -0.227$, $p < 0.001$) and age ($r = 0.128$, $p < 0.001$) were significantly correlated with psychic anxiety, while sex ($r = 0.034$, $p = 0.068$) and risk of living area ($r = 0.004$, $p = 0.830$) were not significantly correlated with psychic anxiety. Therefore, these two variables were included as

control variables in the subsequent structural equation modeling and mediation tests. The correlation coefficient results provide preliminary support for the hypotheses.

Common Method Bias

Considering that the self-reported data collected in this research is subjective in nature, the results may be influenced by common method bias (CMB) (62). To test whether CMB exists in the dataset of this research, this paper used Harman's one-factor test to conduct an unrotated exploratory factor analysis on all scale question items. The first principal component explained 27.228% of the variance, which was lower than 50% of the total variance, indicating that the likelihood of the existence of CMB in the data was low. Considering the problems with the Harman's one-factor test (63), this study used confirmatory factor analysis (CFA) to further test for CMB. The CFA results displayed in **Table 4** show that fitting results of the four-factor model [$\chi^2(df) = 637.632$ (141), CFI = 0.984, TLI = 0.980, SRMR = 0.031, RMSEA = 0.035] was obviously better than the single-factor model [$\chi^2(df) = 16343.193$ (147), CFI = 0.468, TLI = 0.381, SRMR = 0.194, RMSEA = 0.194] and $\Delta\chi^2(\Delta df) = 15705.561$ (6), $p < 0.001$, indicating that there was no significant CMB in the data set of this research.

Hypothesis Testing

After incorporating demographic variables (age and health status) as control variables into the structural equation model, the model fit indices ($\chi^2/df = 5.213$, CFI = 0.976, TLI = 0.971, SRMR = 0.046, RMSEA = 0.038) indicated that the hypothesized model fit was well. The results are presented in **Figure 1**. Perceived threat avoidability of COVID-19 was negatively related to psychic anxiety ($\beta = -0.158$, $p < 0.001$), thus supporting H1. Perceived threat avoidability of COVID-19 negatively correlated with COVID-19-specific wishful thinking ($\beta = -0.057$, $p < 0.05$), which, in turn, positively related to psychic anxiety ($\beta = 0.106$, $p < 0.001$), thus providing preliminary evidence for H2. Perceived threat avoidability of COVID-19 positively correlated with COVID-19-specific protective behaviors ($\beta = 0.210$, $p < 0.001$), which, in turn, negatively related to psychic anxiety ($\beta = -0.136$, $p < 0.001$), thus providing preliminary evidence for H3. Finally, COVID-19-specific wishful thinking had a negative relation to COVID-19-specific protective behaviors ($\beta = -0.112$, $p < 0.001$), thus supporting H4.

Mediating Effect Test

The bias-corrected non-parametric percentile bootstrap method was used to examine the mediating effects of COVID-19-specific wishful thinking and COVID-19-specific protective behaviors in the relationship between perceived threat avoidability of COVID-19 and psychic anxiety by Mplus (v8.3), and the results of the analysis are presented in **Table 5**. The findings suggest the indirect effect of perceived threat avoidability of COVID-19 on psychic anxiety through COVID-19-specific wishful thinking was significant ($\beta = -0.006$, 95% CI: $[-0.012, -0.001]$, not including 0), thus supporting H2. As expected in H3, the indirect effect of COVID-19-specific protective behaviors was significant ($\beta = -0.029$, 95% CI: $[-0.043, -0.018]$, not including 0).

TABLE 2 | Results of reliability and validity.

Factor	Factor loadings	Cronbach's alpha	AVE	CR
COVID-19 PTA	0.727~0.855	0.831	0.627	0.834
COVID-19 WT	0.700~0.877	0.874	0.645	0.878
COVID-19 PB	0.621~0.864	0.878	0.592	0.877
PA	0.508~0.858	0.890	0.518	0.879

AVE, average variance extracted values; CR, composite reliability values; COVID-19 PTA, Perceived threat avoidability of COVID-19; COVID-19 WT, COVID-19-specific wishful thinking; COVID-19 PB, COVID-19-specific protective behaviors; PA, psychic anxiety.

TABLE 3 | Mean, SD, correlation coefficients, and square root of average variance extracted values.

	Mean	SD	1	2	3	4	5	6	7
1. COVID-19 PTA	5.610	0.872	0.792						
2. COVID-19 WT	3.348	1.402	−0.040*	0.803					
3. COVID-19 PB	4.534	0.567	0.192***	−0.109***	0.769				
4. PA	2.028	0.670	−0.226***	0.130***	−0.193***	0.720			
5. Sex	—	—	−0.099***	0.036	0.136***	0.034			
6. Health status	4.090	0.745	0.197***	−0.035	0.181***	−0.227***	−0.084***		
7. Risk level of living area	1.990	0.699	−0.011	−0.036	0.027	0.004	0.043*	−0.054**	
8. Age	19.910	1.475	−0.060**	0.048**	−0.048**	0.128***	0.028	−0.059**	−0.051**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

SD, standard deviation; COVID-19 PTA, Perceived threat avoidability of COVID-19; COVID-19 WT, COVID-19-specific wishful thinking; COVID-19 PB, COVID-19-specific protective behaviors; PA, psychic anxiety.

Bold values on the diagonal are the square root of average variance extracted (AVE) values.

TABLE 4 | Fit indices of the factor models.

	$\chi^2(df)$	RMSEA	SRMR	CFI	TLI	$\Delta \chi^2(\Delta df)$
Four-factor model	637.632 (141)	0.035	0.031	0.984	0.980	—
Three-factor model	7384.090 (144)	0.131	0.138	0.762	0.718	6,746.458 (3)***
Two-factor model	9992.695 (146)	0.152	0.137	0.676	0.621	2,608.605 (2)***
Single-factor model	16343.193 (147)	0.194	0.194	0.468	0.381	6350.498 (1)***

*** $p < 0.001$.

RMSEA, Root Mean Square Error of Approximation; SRMR, Standardized Root Mean Square Residual; CFI, Comparative Fit Index; TLI, Tucker Lewis index; $\Delta \chi^2$: Chi-square value increment; Δdf : degree of freedom increment.

DISCUSSION

Grounded on cognitive appraisal theory, the current study examined the impact of perceived threat avoidability of COVID-19 on psychic anxiety among college students, the mediating role of COVID-19-specific wishful thinking and protective behaviors in the early stage of the COVID-19 pandemic, and the effect of COVID-19-specific wishful thinking on COVID-19-specific protective behaviors. The findings show that perceived threat avoidability is related to college students' psychic anxiety. College students with low threat avoidability experience high psychic anxiety, further supporting prior findings focusing on the general samples in China who came from various provinces, ranging in age from 17 to 90 years old, with various statuses of education and health (24). As we expected, COVID-19-specific wishful thinking, a negative EFC strategy, plays a mediating role in the relationship between perceived threat avoidability and psychic anxiety. Consistent with prior findings, we confirm that when individuals perceive a high level of threat avoidability, they will reduce wishful thinking (36) and experience a low level of anxiety symptoms (43, 64). Furthermore, our results support the mediating effect of COVID-19-specific protective behaviors, a positive PFC strategy, in the relationship between perceived threat avoidability and psychic anxiety. These findings confirm the argument that perceived threat avoidability influences individuals' positive PFC behaviors (36), which, in turn, reduces their anxiety symptoms (19, 65, 66). Finally, our results found that COVID-19-specific wishful thinking has a negative effect on COVID-19-specific protective behaviors. In addition, the results also showed that health status and age among

the control variables were significantly associated with psychic anxiety. A possible reason for the higher levels of mental anxiety among college students in poorer health is that students in poorer health are more likely to suffer from health impairment due to COVID-19 (57) and therefore feel higher levels of anxiety, and a possible reason for the higher levels of mental anxiety among older students is that seniors now face considerable uncertainty regarding their educational and economic futures (67) and therefore feel higher levels of anxiety.

This study makes several contributions to the literature on the psychic anxiety effect of COVID-19 and the cognitive appraisal theory. First, drawing upon cognitive appraisal theory (6, 26), the paper contributes to our understanding of COVID-19 induced psychic anxiety by identifying secondary appraisal, i.e., perceived threat avoidability in this study, which has been underestimated. Previous studies have well documented the influence of primary appraisal on anxiety from the perspective of perceived threat susceptibility and severity of COVID-19 (27, 68), but few researchers have examined the influence of perceived threat avoidability on psychic anxiety. This omission could seriously limit our understanding of the different levels of psychic anxiety among college students. The current study focuses on the neglected important role of college students' perception of threat avoidability in predicting psychic anxiety in the early stage of the COVID-19 pandemic, and thus greatly extends COVID-19 studies on threat and mental health.

Second, we reveal the roles of two different forms of coping strategies in mediating the relationship between perceived threat avoidability and psychic anxiety based on the cognitive appraisal theory. The studies that have been conducted on the mediating

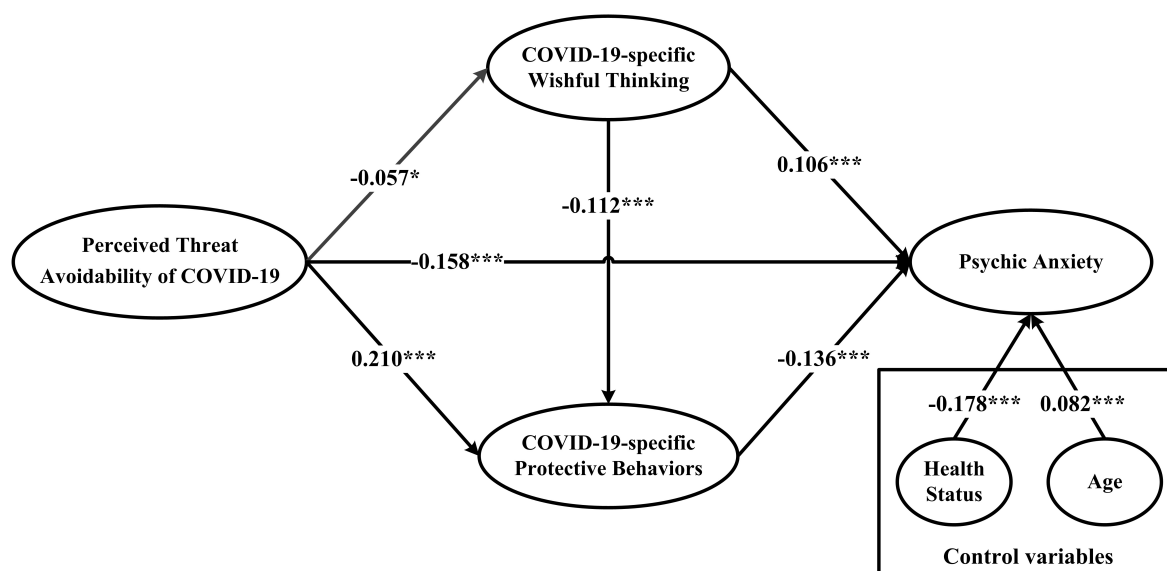


FIGURE 1 | Structural model testing results, Path coefficients are standardized ($N = 2,922$; $*p < 0.05$, $***p < 0.001$). $\chi^2/df = 5.213$, CFI = 0.976, TLI = 0.971, SRMR = 0.046, RMSEA = 0.038. Two control variables (health status and age) were included in the model.

mechanisms of coping strategies in COVID-19 threat and anxiety may focus on external ones, such as quarantine strategies (29), and lack the exploration of internal cognitive coping strategies. Whereas in studies of internal cognitive coping strategies, although existing studies have investigated the direct effects of coping strategies on anxiety (19, 20), little is known about the antecedents of EFC and PFC coping strategies and whether these two types of coping strategies mediate the relationship between perceived threat avoidability and psychic anxiety. This study firstly focused on important negative EFC coping strategies (i.e., COVID-19-specific wishful thinking) and positive PFC coping strategy (i.e., COVID-19-specific protective behavior) toward COVID-19 threat, and revealed how perceived threat avoidability reduces psychic anxiety *via* decreasing wishful thinking and increasing protective behaviors. By doing so, we not only support previous findings of the effect of perceived threat avoidability on wishful thinking and protective behaviors (36), also open the “black box” between COVID-19-specific threat avoidability and psychic anxiety.

Third, this study complements and extends cognitive appraisal theory by theorizing and validating the relationship between two specific strategies (EFC and PFC). Although Folkman and Lazarus (35) argued that some forms of EFC strategies might impede PFC strategies, a recent study by Liang et al. (36) further demonstrated such effect of inward EFC on PFC behaviors in the context of information technology threat, little study has updated this effect in the context of human life and health threat. As a response, this study draws attention to COVID-19-specific wishful thinking (a specific form of inward EFC), and demonstrates that COVID-19-specific wishful thinking negatively correlates with COVID-19-specific protective behaviors. Advancing a step beyond previous studies examining the independent role of coping strategies (19, 20), the present

study improves the understanding of the joint role of different coping strategies in COVID-19-related psychic anxiety. This finding thus contributes to cognitive appraisal literature by providing evidence to the argument of Folkman and Lazarus (35) and supporting the prior finding of Liang et al. (36) in a different context.

Our study has several practical implications for mental health management practice. First, the findings of this study suggest that college students’ perceived threat avoidability is negatively

TABLE 5 | Results of mediating effects.

	Estimate	S.E.	p-value	95% CI	
				Lower	Upper
COVID-19 PTA → PA					
Total	−0.193	0.023	0.000	−0.239	−0.147
Direct	−0.158	0.024	0.000	−0.203	−0.111
Total indirect	−0.035	0.007	0.000	−0.050	−0.024
Indirect					
COVID-19 PTA → COVID-19 WT → PA	−0.006	0.003	0.029	−0.012	−0.001
COVID-19 PTA → COVID-19 PB → PA	−0.029	0.006	0.000	−0.043	−0.018

S.E., standard error; CI, confidence interval; COVID-19 PTA, Perceived threat avoidability of COVID-19; COVID-19 WT, COVID-19-specific wishful thinking; COVID-19 PB, COVID-19-specific protective behaviors; PA, psychic anxiety. The bias-corrected non-parametric percentile Bootstrap method, with 95% confidence interval and 5000 iterations, was used to test the mediating effects by Mplus (v8.3). The COVID-19 PTA was analyzed as the independent variable, PA was analyzed as the dependent variable, and COVID-19 WT and COVID-19 PB were analyzed as mediating variables. Control variables included health status and age.

associated with their psychic anxiety. It means that the level of psychic anxiety among college students can be mitigated by increasing their perceived threat avoidability when facing a serious life and health threat from public health emergencies such as the COVID-19 pandemic. For example, the governments are recommended to announce information about COVID-19 immediately on official websites, clarify social rumors, and invite reputable experts to popularize knowledge of COVID-19. These initiatives can educate college students to recognize the threat controllability of COVID-19 scientifically and accurately, thus increasing their perceived threat avoidability (24).

Second, our findings suggest that COVID-19-specific protective behaviors contribute to low psychic anxiety among college students. It is consistent with the established beneficial effects of positive protective behaviors in the COVID-19 pandemic (19, 69). Therefore, prevention policy-makers and college administrators should develop scientific and rigorous safety measures, such as strict social isolation, regular window ventilation, wearing masks, and washing hands correctly when going out, and guide college students, to abide by these safety measures. In this case, college students' confidence could be increased in avoiding infection with and fighting off COVID-19.

Third, our findings also indicate that COVID-19-specific wishful thinking increases psychic anxiety directly and indirectly by impeding COVID-19-specific protective behaviors, which offer a new direction to the practice of mental health management. Therefore, we argue that it is equally important to educate college students (and the general public) to understand the potentially harmful effect of wishful thinking (34, 41) and give up this negative EFC strategy. For example, mental health education or counseling institutions could design psychological coaching programs to help students be aware of how wishful thinking generates and affects their psychic anxiety.

Some methodological limitations in this study should be further noted. First, this study collected college students' self-reported data, which may be affected by social desirability limitations inherent in most research (70). Future research can minimize this limitation by taking precautions to combat socially desirable responses recommended by Mick (71). Second, we used cross-sectional data to test the hypothesized model, implying the inability to draw causal conclusions (72, 73). Future studies can reexamine the causal connections by incorporating the experimental or longitudinal design. A third methodological limitation is related to the representativeness of the present sample. The current survey was completed by college students

from 10 universities in Anhui province. Therefore, potential selection biases might have influenced the generalization of our findings. Hence, more studies are recommended to replicate the present findings with more representative samples from more universities in other provinces in China, which may bolster the relevance of such findings to a broader audience.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The current study was approved by the Ethics Committee entitled "Institutional Review Board of the School of Business, Anhui University of Technology." The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JW, YZ, and SX co-drafted and wrote the manuscript. YZ, JW, and WZ revised the manuscript and finally approved the version to be published. YZ and SX analyzed and interpreted the data. SG provided feedback to improve the manuscript. JW supervised the data gather process. All authors contributed to the article and approved the submitted version.

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Relationship Between Psychological Impacts of COVID-19 and Loneliness in Patients With Dementia: A Cross-Sectional Study From Iran

Fatemeh Mohammadian¹, Mahya Rezaee², Arash Kalantar², Niayesh Mohebbi² and Mahtab Motamed^{1*}

¹ Psychiatry Department, Tehran University of Medical Sciences, Tehran, Iran, ² Clinical Pharmacy Department, Tehran University of Medical Sciences, Tehran, Iran

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Mariola Bidzan,
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Vahid Rashedi,
Iran University of Medical
Sciences, Iran

*Correspondence:

Mahtab Motamed
motamed88@gmail.com

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Mohammadian F, Rezaee M,
Kalantar A, Mohebbi N and
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Objectives: Although the COVID-19 pandemic has affected people all around the world, the elderly is at a higher risk of suffering from its consequences. One of the serious concerns is developing loneliness and post-traumatic stress symptoms, which may contribute to cognitive decline at older ages. This study aimed to examine the psychological responses and loneliness in elderly patients diagnosed with dementia.

Methods: Twenty-one patients diagnosed with dementia, with ages older than 40, and 19 caregivers were enrolled in the study. The patients have undergone a comprehensive neuropsychiatric interview and were assessed with De Jong Gierveld Scale for loneliness and Impact of Event Scale—Revised (IES-R). The severity of dementia was assessed by Functional Assessment Staging Tool (FAST Scale) and the Montreal Cognitive Assessment (MoCA).

Results: No significant difference was seen in patients and caregivers in the IES-R and loneliness scales. A higher level of avoidance and social and total loneliness were seen in higher FAST levels (p -value: 0.046). There was a negatively significant correlation between MoCA score and avoidance. Hyperarousal was significantly correlated with emotional loneliness in patients.

Conclusion: We found a direct relationship between cognitive decline and the psychological impacts of COVID-19. Our results highlight the need for more comprehensive studies to further investigate the influence of the pandemic on the worsening of cognitive impairment and loneliness in patients with dementia.

Keywords: COVID-19, dementia, loneliness [source: MeSH], pandemic, psychological distress

INTRODUCTION

The COVID-19 pandemic has affected billions of people all around the world in many aspects. Besides the growing number of cases every day, people all over the world experience political, socio-economic, and psycho-social impacts (1). The spread of the virus has forced nations to develop policies such as lockdown protocols and physical or social distancing (2). While these regulations are crucial to halt the transmission of the coronavirus and help relieve the pressure on the healthcare system, social isolation leads to an increase in the prevalence of mental health

problems such as depression (3), generalized anxiety disorders (4), insomnia (5), as well as feeling of loneliness among individuals (2).

Despite affecting all age groups, the older people are at a higher risk of suffering from prolonged social restrictions (6). Adults aging 65 and higher and anyone with pre-existing medical conditions are more likely to experience the complications from COVID-19 (7). Considering the elevated risk of developing a serious illness in these vulnerable groups of people, they need to limit their social contacts (8). One of the serious concerns is developing loneliness amid older people in this challenging time (9).

Loneliness is defined as a negative subjective feeling of deficient relationships and being alienated from others (10). It is the state of being unhappy with the quantity or quality of the current social attachments (11). In a study conducted in Sweden, loneliness was strongly correlated with an increased risk of all-cause mortality and developing chronic disorders in older adults, including hypertension, stroke, cardiovascular disease, and cognitive impairment (10). Loneliness is a key contributor to a wide range of mental health problems as well as poor physical health outcome (6). Older people are reported to have a higher level of loneliness as they have experiences of death of loved ones, retirement, and chronic illnesses (12).

According to some cultural beliefs in Iran as a traditional country, it is not socially and culturally accepted for an old person to be very outgoing, have multiple gathering with his or her own friends, making new friends, or start a romantic relationship. In this culture, a wise old person is pictured as a quiet and introvert one who is more occupied in deep thoughts. Regarding all these beliefs, talking and complaining about loneliness is highly stigmatized.

There exists proof that engaging in activities and social interactions are associated with better physical and mental health in older people (13).

Additionally, due to the complications of maintaining social relationships under the new COVID-19-related regulations, effort and attention should be directed toward the vulnerable groups, and they must be provided with social support (2).

Neurocognitive disorders, of which dementia is the major form, are a broad class of impairments in cognition, frequently in the older population. Due to the growth of the elderly population in the world, the number of patients with dementia is also increasing, which is mostly seen in developing countries where two thirds of patients with dementia live. There were 35.6 million people living with dementia worldwide in 2010, and this is estimated to increase to 65.7 million by 2030 and 115.4 million by 2050. The estimated prevalence of dementia in people aged 60 years and older is 8.7% in the Middle East and North Africa region—about 2.3 million people—and this is expected to rise to 4.4 million by 2030 (14).

Dementia interferes with cognitive function and performing activities of daily living. As a result, individuals may feel a sense of loss in their independence and a disruption to their sense of self. Evidence supports that social isolation and the lack of social integration may contribute to cognitive decline at older ages (15).

Patients with dementia have limited access to accurate information about COVID-19 and have problems remembering

and following healthcare-related instructions, such as wearing a mask and personal hygiene, thus increasing their risk of infection. The safety and effectiveness of the COVID-19 vaccine and the specific side effects of the different types of vaccine in patients with dementia should be assessed comprehensively (16, 17).

On the other hand, people with dementia who lived in nursing homes are isolated from society and community because they could not use virtual communication tools. Obviously, the elderly in these centers lost face-to-face contact with family members in the COVID-19 crisis, which could lead to social isolation and loneliness (18).

Liu et al. demonstrated the negative impact of the COVID-19 pandemic crisis on patients with dementia and their caregivers. This review emphasized the negative burden of the pandemic on patients with dementia, which was categorized in six domains of well-being, including well preventing, well diagnosing, well treating, well supporting, well living, and well dying (19).

The COVID-19 crisis, as an infectious disease outbreak, could impact people's emotions in various aspects and thus could emphasize the emergent need for a novel questionnaire designed to assess behavioral changes and an increased level of anxiety. Riad et al. designed the COVID-19 Induced Anxiety Scale to evaluate the potential anxiety source in the general population, which could be utilized in the elderly population (20). In a study conducted in Poland, post-traumatic stress disorder (PTSD) symptoms related to COVID-19 worsened in both healthy people and patients diagnosed with depression and anxiety, and a lower emotional well-being was associated with a higher severity of PTSD (21).

Several studies demonstrated the relationship between post-traumatic stress symptoms and loneliness in adults. A recent study conducted in 2021 revealed that a longitudinal association between subtypes of loneliness and post-traumatic stress symptoms exists among older adults (22). Targeting the early psychiatric symptoms in response to a trauma, such as the COVID-19 pandemic, can ameliorate the feeling of loneliness.

This study aimed to examine the psychological responses and loneliness in older patients admitted to the dementia outpatient clinic of Roozbeh Hospital, Tehran, Iran, during the COVID-19 outbreak. We predict that patients with more severe dementia may suffer from loneliness due to higher PTSD symptoms related to COVID-19.

MATERIALS AND METHODS

Participants

Patients with dementia who were diagnosed by a cognitive neurologist and referred to the dementia outpatient clinic were consecutively recruited to the study after obtaining their informed consent. This study was conducted between September 2020 and November 2020, about 6 months after the first peak of the COVID-19 pandemic in Tehran, Iran.

Inclusion Criteria

The inclusion criteria included patients older than 40 years with a diagnosis of dementia syndromes, including Alzheimer's disease, vascular dementia, or combined dementia (Alzheimer's disease and vascular dementia), Lewy body dementia, and

frontotemporal dementia based on the Diagnostic and Statistical Manual of Mental Disorders criteria as assessed by a neurologist.

Exclusion Criteria

The exclusion criteria involved major psychiatric disorders, such as depression, schizophrenia, psychotic disorders causing rapidly progressing dementia, treatable causes of dementia such as metabolic disorders, history of severe liver, renal, and heart failure, and unwillingness to participate in the study at any time and for any reason.

Procedure

For the first step, the patients' demographic characteristics, including age, marital status, place of residence, occupation, level of education, and history of psychiatric illness, were completed using the researcher-designed questionnaire. The patients have undergone a comprehensive neuropsychiatric interview held by an expert neurologist or psychiatrist. The researchers evaluated the patients and their caregivers for symptoms of COVID-19 infection in the last 3 months.

In the next step, the patients and caregivers were assessed for loneliness using the De Jong Gierveld Scale. The participants were then assessed for psychological reactions to COVID-19 with the Impact of Event Scale (IES-R) questionnaire. Since patients with mild and moderate dementia were included in this study, they had the necessary cooperation and cognitive capacities to complete the utilized questionnaires.

The patients' cognitive status was assessed using the Montreal Cognitive Assessment (MoCA) battery (23) and Functional Assessment Staging (FAST) scale (24).

Instruments

The De Jong Gierveld Scale

This is an 11-item questionnaire which scores social loneliness (5 items) and emotional loneliness (6 items) and is validated in Farsi (25). The content validity of the questionnaire based on Waltz and Bausell's content validity index was acceptable (0.881), and it had appropriate internal consistency (α : 0.778). Hosseinabadi R et al. demonstrated that the Persian version of the 11-item De Jong Gierveld Scale had significant correlations with the Philadelphia Geriatric Center Morale Scale and also showed acceptable concurrent validity and reliability of this scale for measuring loneliness in Iranian older adults (25).

Impact of Event Scale Questionnaire

The questionnaire includes 22 questions with three subscales, including avoidance (8 questions), intrusive thoughts (8 questions), and hyperarousal symptoms (6 questions). Each question is answered on a Likert scale of 0 to 4. In patients scoring higher than 33, a diagnosis of post-traumatic stress disorder should be considered. The questionnaire is validated in Farsi. The Cronbach's alpha coefficients for the three subscales of the IES-R were high (ranging from 0.84 to 0.93), and the average inter-item correlation was between 0.42 and 0.62. Construct validity was evaluated using maximum likelihood exploratory factor analysis

(MLEFA). In MLEFA, the Kaiser–Meyer–Olkin test value was 0.931 and Bartlett's test value was 6,022.415 ($p < 0.001$) (26).

The Montreal Cognitive Assessment

The MoCA test, developed by Nasr al-Din et al. for mild cognitive impairment (MCI) and dementia, evaluates the different domains of cognitive functioning (27). The reliability of this test was 92%, based on Cronbach's alpha, and its internal consistency was 83%. The maximum score of the test is 30, with a score of 26 or higher considered to be normal. This test, which is executed within 10 min, includes different domains: short-term memory (5 points); executive function, including Trail Making Test-B, Clock Drawing Test, and visuospatial function test (cube copying) (5 points); attention and working memory (6 points); language, including naming, repetition, and fluency (6 points); abstraction (similarity) (2 points); and orientation to time and place (6 points). Patients with scores of 26 or higher did not have any cognitive impairments (normal MoCA), whereas patients with scores lower than 26 probably had cognitive impairments (28). Rashedi et al. found a sensitivity of 94% and a specificity of 90% for MCI and Alzheimer's disease, with a cutoff score of 20 (23).

Functional Assessment Staging Tool

FAST is a reliable and valid assessment technique for evaluating functional deterioration in dementia patients throughout the entire course of the disease. The FAST scale is categorized into seven stages of dementia, in which stage 6 and above are correlated with a severe stage of dementia (24). The Persian version of FAST was evaluated by Noroozian et al. The area under the receiver operating characteristic curve was calculated as 0.952. It had a sensitivity of 92.2% and specificity of 98.0% for the differentiation of normal cognition from MCI and a sensitivity of 99.0% and specificity of 93.7% for the discrimination of subjects with Alzheimer's disease from MCI (29).

Sample Size Calculation

The sample size in this study is calculated using the following formula (30, 31):

$$\text{Sample size} = \frac{Z_{(1-\frac{\alpha}{2})}^2 / SD^2}{d^2} \approx 41$$

where $\alpha = 0.05$,
SD = 1.64, and
 $d = 0.5$.

Statistical Analysis

The collected data were analyzed using IBM SPSS v.22 (IBM Corp., Armonk, NY, USA), and appropriate statistical tests were performed. The significance level was determined as $P < 0.05$.

Ethical Considerations

Written informed consents were obtained from all subjects prior to enrollment in the study. The study protocol was approved by the local ethics review committee of Tehran University of Medical Sciences (ethical approval number: IR.TUMS.MEDICINE.REC.1400.611).

TABLE 1 | Demographic characteristics of patients and caregivers.

Variable	Patients	Caregivers	P-value
Age (mean \pm SD)	59.76 \pm 9.71	56.57 \pm 11.78	0.345
Gender (N)			0.536
Female	9	10	
Male	12	9	
Marital status			0.451
Single	4	2	
Married	17	17	
Education (N)			0.087
Illiterate	3	2	
Primary	13	5	
High school diploma	3	7	
University	2	5	
Working status (N)			0.567
Unemployed	14	11	
Employed	7	8	
Past psychiatric history (N)			0.987
Positive	10	9	
Negative	11	10	
History of COVID-19 in a family member (N)			0.121
Positive	15	9	
Negative	6	10	

All the p-values are non-significant.

TABLE 2 | Clinical characteristics of patients.

Variable	Number
Type of cognitive impairment	
MCI ^a	8
Alzheimer's dementia	1
Vascular and mixed dementia	2
Dementia of Lewy body	3
Traumatic brain injury	5
Parkinson's disease	1
FAST ^b level	
3	10
4	9
5	2
MoCA ^c (mean \pm SD)	22.4 \pm 3.4

^aMild cognitive impairment. ^bFunctional assessment staging tool. ^cMontreal cognitive assessment.

RESULTS

Demographic and Clinical Characteristics of the Sample

Twenty-one patients and 19 caregivers were enrolled in the study. As shown in **Table 1**, no significant difference existed between caregivers and patients in terms of demographic characteristics.

The clinical characteristics of patients are reported in **Table 2**. The majority of our patients ($n = 8$) had a diagnosis of MCI with Alzheimer's disease, followed by those with mixed dementia ($n = 5$).

Almost half of the number of patients ($n = 10$) were at stage 3 in FAST, nine were at stage 4, and only two were at stage 5.

TABLE 3 | Impact of event scores in patients and caregivers.

Impact of events	Patients	Caregivers	P-value
Avoidance	12.38 \pm 3.73	12.78 \pm 3.22	0.713
Intrusive thoughts	7.04 \pm 3.78	7.89 \pm 4.50	0.526
Hyperarousal	9.90 \pm 3.22	9.73 \pm 5.49	0.908
Total score	29.33 \pm 8.69	30.42 \pm 10.44	0.724
Impact of events level			0.333
<24	8	7	
24–32 (clinical concern)	5	5	
33–38 (probable diagnosis of PTSD ^a)	6	2	
>39	2	5	

All the p-values are non-significant. ^aPost-traumatic stress disorder.

TABLE 4 | Loneliness scores in patients and caregivers.

	Patients	Caregivers	P-value
Emotional Loneliness	3.52 \pm 1.12	3.84 \pm 1.38	0.433
Social loneliness	2.85 \pm 1.01	2.57 \pm 1.16	0.429
Total score	6.38 \pm 1.68	6.43 \pm 1.77	0.942
Loneliness level			0.627
1	1	0	
2	17	16	
3	3	3	

All the p-values are non-significant.

IES-R Scores in Patients and Caregivers

We have examined the impact of COVID-19 in patients and their caregivers with the IES-R. The scores are reported in **Table 3**. No significant difference was seen in patients and caregivers in the IES-R scale. Thirteen patients and 12 caregivers scored above 24 in the IES-R, in whom a clinical diagnosis of PTSD should be further considered.

Loneliness Scores in Patients and Caregivers

Additionally, loneliness was scored in patients and caregivers. The detailed report of the loneliness scores can be found in **Table 4**. Most of the patients ($n = 17$) experienced a moderate level of loneliness, whereas three of them experienced severe loneliness. Similarly, 16 caregivers had a moderate level of loneliness, while only three of them experienced a severe level of loneliness.

Relationship Between Demographic and Clinical Characteristics With IES-R Scores and Loneliness in Patients and Caregivers

There were no significant differences in the impact of events based on age, gender, and working and marital status in either the patients or the caregivers. No differences were seen in patients with and without a history of psychiatric disorders. The difference in IES-R scores was not significant between individuals whose family member had COVID-19 and those whose family member did not have COVID-19.

TABLE 5 | Relationship of cognitive impairment with impact of event and loneliness scores.

	FAST level	Mean \pm SD	P-value
Avoidance	3.00	11.20 \pm 2.52	0.046
	4.00	12.44 \pm 4.24	
	5.00	18.00	
Intrusive thoughts	3.00	5.90 \pm 3.03	0.138
	4.00	8.88 \pm 4.28	
	5.00	4.5 \pm 0.70	
Hyperarousal	3.00	8.80 \pm 2.78	0.252
	4.00	10.55 \pm 3.67	
	5.00	12.50 \pm 0.70	
Impact of event score (total)	3.00	25.9 \pm 6.24	0.209
	4.00	31.88 \pm 10.72	
	5.00	35	
Emotional loneliness	3.00	3.20 \pm 1.13	0.268
	4.00	3.66 \pm 1.11	
	5.00	4.5 \pm 0.71	
Social loneliness	3.00	2.40 \pm 0.70	0.028
	4.00	3.00 \pm 1.00	
	5.00	4.50 \pm 0.50	
Loneliness (total)	3.00	5.60 \pm 0.47	0.032
	4.00	6.67 \pm 0.47	
	5.00	9.00 \pm 0.0	

Similarly, we could not find any difference between loneliness scores based on age, gender, working and marital status, and past psychiatric history either in patients or in caregivers. The loneliness level was not different between individuals whose family member had COVID-19 and those whose family member did not have COVID-19.

Relationship of Cognitive Impairment IES-R Scores and Loneliness in Patients

A higher level of avoidance was seen in higher FAST levels (p -value: 0.046) (Table 5). Higher social loneliness scores and total loneliness scores were seen in patients with FAST 5 in comparison with those with FAST 3 or 4 (Table 5). There was a negatively significant correlation between MoCA score and avoidance (p -value: 0.046). No significant correlation was seen with total or subtypes of loneliness.

Relationship of IES-R Scores and Loneliness Scores in Patients

For the next step, we examined the correlation of IES-R scores and loneliness scores in patients and caregivers. Hyperarousal was significantly correlated with emotional loneliness in patients, while in caregivers such a correlation was not seen.

The total score of IES was instead significantly correlated with emotional loneliness (p -value: 0.012) in caregivers. Besides this, there was a positive relationship between avoidance and total scores in loneliness in caregivers (p -value: 0.040).

DISCUSSION

In the present study, majority of patients and caregivers reported moderate levels of loneliness, and nearly half of patients and caregivers scored above 24 in the IES-R. Total and social loneliness was higher in patients with higher FAST stages. A higher level of avoidance was seen in patients with higher FAST stage and lower MoCA score.

Based on the pandemic management theory, individuals go through seven phases when facing a pandemic. It starts with an orientation phase, in which individuals assess the situation and their coping resources. This phase is followed with short adaptability. Consequently, acute and chronic phases of negative consequences occur, which are characterized by symptoms like anger, sadness, post-traumatic stress symptoms, and fatigue and which may lead to a full-blown illness. However, these phases could end up in positive consequences, such as a positive attitude toward life and empathic behavior. Maintaining affective communication with others, contact with one's identity, construction of a life sense, and a perception of wholeness are necessary to sustain a healthy identity during the pandemic (32). This illustrates that timely addressing post-traumatic stress symptoms and loneliness would prevent further negative consequences of COVID-19.

Loneliness in Older Patients

According to studies from many countries like United States and Austria, older adults experienced loneliness following the COVID-19 pandemic (33–36). Seifert et al. demonstrated that older people's loneliness was increased in a sample of 1,990 older adults aged 65 to 95 after the implementation of physical distancing due to the Switzerland government's regulations (33). In contrast, there are some recent evidence from Austria or Germany suggesting that loneliness was not increased during the COVID-19 outbreak (34–36). According to a recent review, the adaptive ability of older people in the face of COVID-19 may vary based on social, cultural, and economic factors (37). In a study in German and Polish populations during the COVID-19 pandemic, older people were found to have a higher level of quality of life, wellbeing, and life satisfaction and a lower level of anxiety. The authors associated this to higher education, financial stability, and limited access to news (38). This underscores the need for such investigations in different countries worldwide as well as in developing countries like Iran.

The mediators of developing loneliness in older people are not well studied. Women, individuals living alone with no children and with lower income, and individuals who are unsatisfied with their contact with neighbors are reported to be at a greater risk of loneliness (33). In our study, majority of patients and caregivers reported moderate levels of loneliness, although our findings showed no difference in patients and their caregiver in terms of the level of loneliness. This may be due to the collective culture of Iran, where older people are supported by their children and grandchildren, protecting them from feeling lonely. It should also be noted that there might be stigmas toward expressing loneliness, and feeling lonely may be translated to being weak or

not having strong religious beliefs. As a result, loneliness may be underestimated or masked.

Avoidance and Loneliness

We found a positive relationship between cognitive decline and loneliness. The COVID-19 pandemic has posed numerous risks to people with dementia (39). Patients with dementia were influenced by the COVID-19 pandemic through various ways, including difficulties in remembering and following new emerging guidelines, deprivation from a cognitively enriched environment, increased feeling of anxiety as well as depression, and sense of loneliness (40–42).

Apart from the above-mentioned impacts of COVID-19, it should be noted that, as dementia progresses, experiencing some levels of loneliness is due to decreased participation in social activities and less social engagement.

One might also speculate that individuals with cognitive decline are not able to develop more effective and active mechanisms of facing a trauma.

According to our findings, patients with more cognitive decline are more likely to present avoidance as a response to the stress related to the COVID-19 pandemic. Such defense mechanisms may underlie the increased loneliness in people with a deeper cognitive decline.

This can be seen as a two-way relationship, where avoidance may theoretically result in increased loneliness and cognitive decline, on one hand, and loneliness worsens avoidance and cognitive decline in the other. Although we have found a direct correlation between loneliness and avoidance in caregivers in this study, such correlation was not significant in the patients.

Jun Holwerda et al. showed that, after risk factor adjustment, older populations with a feeling of loneliness were more likely to develop dementia, so the prevention of feeling lonely may protect the vulnerable older population from cognitive decline both in the group of patients with cognitive impairment and their caregivers with currently intact cognition status (43).

Right after the occurrence of a stressful event and before the emergence of avoidance response can be considered as a golden time for monitoring for stress responses in patients with dementia and utilizing appropriate psychotherapeutic interventions to withhold the cascade which otherwise may ultimately end up in cognitive decline and loneliness.

Hyperarousal and Loneliness

Emotional loneliness was positively correlated with hyperarousal in patients. According to the hypervigilance hypothesis of loneliness, lonely individuals show higher previgilance for social threats (44). Meng et al. reported a positive correlation between loneliness and alertness in college students in China, where a feeling of fear played a mediating role (45). In a study by Layden et al., loneliness was associated with increased resting state functional connectivity between several nodes involved in tonic alertness (46). In line with these findings, it can be assumed that the higher hyperarousal response to COVID-19 in our patients have led to greater feelings of loneliness.

Strengths and Limitations

Utilizing the IES-R questionnaire and the De Jong Gierveld Scale, we could assess the effect of COVID-19 in patients with dementia in different aspects. To the best of our knowledge, this is the first study to examine the relationship between loneliness, IES-R, and cognitive decline in COVID-19.

The most important limitation of this study was the small sample size due to limited access to patients and their caregivers during the COVID-19 pandemic, considering that tele-visits are not widely used in our country and not easily utilized by the older people.

Another study limitation is the heterogeneity of our patients in terms of the type of dementia, which included MCI, Alzheimer's disease, mixed vascular dementia, and Lewy body dementia. According to the diverse characteristics of each dementia syndrome, various behavioral and psychiatric reactions to a specific stressful event could be expected.

Filling out the questionnaires would be difficult for some patients with cognitive decline. However, it is better to use simpler questionnaires with the cooperation of the patients' caregivers in the case of more severe stages of cognitive disorders.

The cross-sectional notion of our study prevents us to elaborate a causal relationship between loneliness and the COVID-19 pandemic. Moreover, we have not explored the loneliness feeling in dementia patients or their caregivers before the COVID-19 pandemic, so we could not determine the temporal effect of the pandemic on loneliness severity. Therefore, we utilized the IES-R and, in correlation to loneliness, De Jong Gierveld Scale to be able to indirectly investigate the effect of the COVID-19 pandemic as a stressful event on the loneliness of dementia patients and their caregivers.

Similarly, it was not possible to determine the effect of the pandemic on the exacerbation or acceleration of cognitive impairment in patients with dementia.

CONCLUSION

This study was a pilot observational study that evaluates the effect of the COVID-19 pandemic on the aggravation of loneliness in patients with dementia and their caregivers. Our results highlight the need for more comprehensive studies to further investigate the influence of the pandemic on the worsening of cognitive impairment and loneliness in patients with dementia.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Tehran University of Medical Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FM: 30% (study design, drafting, analyzing the data, and data monitoring). MR and AK: 15% (collecting the data and

documentation and reviewing the manuscript). NM: 10% (study design and reviewing the manuscript). MM: 30% (study design, drafting, analyzing the data, and data monitoring). All authors contributed to the article and approved the submitted version.

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Manifestation of Generalized Anxiety Disorder and Its Association With Somatic Symptoms Among Occupational and Physical Therapists During the COVID-19 Pandemic

Musaed Z. Alnaser^{1*}, Naser Alotaibi¹, Mohammed Sh. Nadar¹, Fahad Manee¹ and Hesham N. Alrowayeh²

¹ Occupational Therapy Department, Faculty of Allied Health Sciences, Kuwait University, Kuwait City, Kuwait, ² Physical Therapy Department, Faculty of Allied Health Sciences, Kuwait University, Kuwait City, Kuwait

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Samer El Hayek,
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*Correspondence:

Musaed Z. Alnaser
ot_alnaser@hsc.edu.kw

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Purpose: The purpose of the study was to examine the level of generalized anxiety disorder among occupational and physical therapists during treatment sessions and its association with somatic symptoms during the COVID-19 pandemic.

Methods: A descriptive cross-sectional design was used in this study. Data were collected during the month of April 2021, and the study included occupational and physical therapists who practiced during COVID-19 from March 2020 to March 2021. The generalized anxiety disorder scale (GAD-7) and a modified patient health questionnaire (mPHQ-15) were used to examine self-reported anxiety and somatic symptoms among the study participants. The independent *t*-test was used to determine differences between groups based on GAD-7 and mPHQ-15 results. Spearman's correlation test and chi-squared test were used to find the relationships between different variables such as anxiety and somatic symptoms.

Results: The study ($n = 98$ participants) included 56 occupational and 42 physical therapists. An 84% response rate was achieved. GAD-7 final score was $\mu = 9.21 \pm 5.63$ with 27% reporting no anxiety, 14% mild, 38% moderate, and 21% severe. Independent *t*-tests on GAD-7 scores showed significant differences between therapist specializations [$t_{(96)} = -2.256$; $p = 0.026$] and between therapists residing with or without their parents [$t_{(96)} = -2.536$; $p = 0.013$]. The mPHQ-15 final score was $\mu = 9.52 \pm 5.54$ with 13% reporting no symptoms ($n = 13$), 20% mild ($n = 20$), 38% moderate ($n = 37$), and 29% severe ($n = 28$). GAD-7 and mPHQ-15 scores were moderately positively correlated [$r_{(96)} = 0.569$; $p < 0.000$]. The chi-squared test showed a significant association between GAD-7 levels of anxiety and mPHQ-15 levels of somatic symptoms [$\chi^2_{(9, N=98)} = 70.62$ $p < 0.000$]. Therapists reported that the quality (76%) and effectiveness (20%) of their rehabilitation services were negatively impacted by the COVID-19 pandemic.

Conclusion: The majority of study participants experienced moderate to severe anxiety and associated somatic symptoms. During COVID-19, ongoing psychological counseling of healthcare professionals such as occupational and physical therapists is required to maintain positive mental health. Implications for practice are presented.

Keywords: psychological symptoms, physical symptoms, mental health, healthcare professionals, occupational therapists, physical therapists, anxiety, somatic

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a communicable respiratory tract disease that emerged in Wuhan, China in December 2019. The coronavirus spread rapidly and was declared a pandemic by the World Health Organization (1). COVID-19 continues to spread worldwide and by November 2021 over 250 million cases have been reported and over 5 million deaths (1). Healthcare organizations in every region have assembled all possible resources to deal with the pandemic. Overworked healthcare professionals caring for massive numbers of COVID-19 patients experienced extraordinary psychological stress related to high risk of infection amongst themselves as well as sickness and death among colleagues (2–4). The fact that the majority of healthcare professionals had no infectious disease expertise exacerbated the situation (4).

Kuwait is 17,820 square kilometers (6,880 square miles) in size with the population of 4,336,000 million (5). The first COVID-19 case in the country was recorded in February 2020 (6). The first wave of COVID-19 was observed between March and May 2020, and the second wave was observed between January and March 2021 (7). Between March 2020 and 2021, the number of COVID-19 cases was close to 200,000 (6). As the number of cases increased, local administrators assigned additional healthcare persons for treating and caring of COVID-19 patients. In addition, other areas of healthcare services, such as rehabilitation, continued to provide services to patients. Individual workloads increased due to strict COVID-19 precautionary measures such limitations on the number of workers per site and deactivating healthcare professionals with preexisting chronic diseases.

Anxiety is an emotional state with three interacting components: psychological, behavioral, and physical. Anxiety can be experienced at different levels of intensity, frequency, and duration of episodes (8). DSM-V generalized anxiety disorder (GAD) is defined as excessive anxiety and worry due to events or activities that occur most days over a period of at least 6 months. Excessive anxiety and worry may lead to impairment in social and occupational areas (9). Mallorquí-Bagué et al.'s review (8) highlights the link between anxiety and somatic symptoms. GAD is generally associated with developing somatic symptoms including headache, irritability, impaired concentration, sleep disturbance, fatigue, muscle and joint pain, and dizziness (8, 10–13). COVID-19 research indicates that moderate to severe levels of anxiety due to the pandemic is associated with

somatic symptoms such gastrointestinal ailments, fatigue, and difficulty sleeping (10, 14, 15). Furthermore, when healthcare professionals interact with patients with or without COVID-19, they experience increased levels of anxiety and somatic symptoms (16–19).

Healthcare professionals have experienced varying levels of anxiety during the COVID-19 pandemic around the world (16–31). They were found to be positive for anxiety, depression, stress, insomnia, somatization symptoms, poor psychological wellbeing, and obsessive-compulsive symptoms (22, 29, 30). Moreover, young or female healthcare professionals were more inclined to psychological issues compared to older or male colleagues (16–18, 20, 22, 23, 30, 32). Close contact with COVID-19 patients was a major factor affecting levels of fear, anxiety, and depression (16, 19–21, 27, 30, 32, 33). In addition, Gündoğmuş et al. (31) highlighted an increase in depression, anxiety, and stress during the second peak of the pandemic.

In the Arab world including Kuwait, COVID-19 research studies among healthcare professionals are limited, and more investigations need to be done (22). We found few studies that examined anxiety among healthcare professionals including physicians, nurses, allied health, and pharmacists in Kuwait (2), Oman (1), Saudi Arabia (6), United Arab Emirates (2), and Jordan (1) (20–26, 34–38). They concluded that healthcare professionals experienced significant level of anxiety ranging from 10 to 40% on the moderate to severe levels. Moreover, we found few studies that examined anxiety of the general population in Kuwait (1), Saudi Arabia (2), and Algeria (1) (21, 36, 39, 40). Similarly, they found high rate of anxiety among the general population. All the studies concluded that the pandemic had considerable impact on the mental health of healthcare professionals as well as the general populations. All the studies also recognized the importance of immediate psychological attention and intervention.

Additionally, we found a single study that directly investigated anxiety among physical therapists in South Korea (41), with no studies examining anxiety among occupational therapists explicitly. Insight into this area could help to gauge the level of anxiety among this population and its associated somatic symptoms, and possibly lead to recommendations for improving the mental health for those in need. Thus, the purpose of the study was to examine the level of anxiety among occupational (OTs) and physical therapists (PTs) who have interacted with patients throughout the COVID-19 pandemic.

MATERIALS AND METHODS

Study Design

A descriptive cross-sectional design was used in this study. Variables relating to anxiety and physical symptoms were self-reported. Variables were measured on an ordinal scale.

Participants

The target population was composed of OTs and PTs working in inpatient and outpatient settings of rehabilitation clinics in Kuwaiti governmental hospitals. Private sectors were not included because they would employ very limited number of OTs and PTs. Also, the logistics of approaching such sporadic centers were difficult. Inclusion criteria included therapists who worked during the COVID-19 pandemic from March 2020 to March 2021. The exclusion criteria included therapists that did not work during the specified period of the pandemic or had a history of anxiety disorder. Also, individuals with the history of anxiety disorders were excluded from the study because they would likely differ in their mental health characteristics than individuals without the history of anxiety disorders.

Reporting Tools

The generalized anxiety disorder assessment (GAD-7) is a self-administered screening test to identify probable causes and severity of anxiety (42). GAD-7 is used with adults aged 18 years and older. It includes seven items on a 4-point Likert scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Scoring ranges from 0 to 21 with scores of 5, 10, and 15 set as cut-off points for mild, moderate, and severe anxiety, respectively. Further evaluation is recommended when a score is 10 or greater.

The Patient Health Questionnaire (PHQ) is a self-administered version of the PRIME-MD diagnostic instrument for common mental disorders (43). PHQ-15 comprises 15 somatic symptoms from the PHQ. The 15 items are scored on 3-point Likert scale (0 = not bothered at all, 1 = bothered a little, and 2 = bothered a lot). The total PHQ-15 score ranges from 0 to 30 and scores of 5, 10, and 15 are set as the cut-off points for mild, moderate, and severe levels of somatization, respectively. However, due to cultural sensitivities, two items (question #4: menstrual cramps or other problems with your periods, and #11: pain or problems during sexual intercourse) were removed from the questionnaire. After adjustment, the modified PHQ-15 (mPHQ-15) was comprised of 13 somatic symptoms. The total mPHQ-15 score ranged from 0 to 26 and scores of 3, 18, and 13 were set as the cut-off points for mild, moderate, and severe levels of somatization, respectively. Clinical and occupational healthcare settings have demonstrated high reliability and validity for the PHQ-15 (44).

Procedure

Ethical approval was obtained from the Institutional Review Boards of the local University Health Science Center and the Ministry of Health. The data collection was conducted during the month of April 2021. The departments heads sent the online survey link *via* WhatsApp and invited OTs and PTs to participate in the study. One week later, the departments

heads were reminded to resend the link and to encourage participation in the study. Participants' names and phone numbers were only known to the departments heads, and no identifications of the respondents were included on the survey to insure anonymity. After reviewing the demographic data, participants who did not meet the inclusion criteria were excluded from the study. The entire survey was in English because all OTs and PTs in Kuwait must have had proficient English education background. The online survey included demographic information as well as GAD-7 and mPHQ-15 questionnaires. Therapists were instructed *via* the social media application that clicking on the link would indicate their consent to participate in the study. Following completion of the GAD-7 and mPHQ-15, the respondents were asked to answer two questions related to the quality (do you feel that the quality of therapy interventions was affected by the COVID-19 pandemic? (Yes/No) and effectiveness (how would you rate the effectiveness of rehabilitation interventions during the COVID-19 pandemic?) of the rehabilitation services during the COVID-19 pandemic. The entire survey took a maximum of 15 min to complete. This research protocol complied with the tenets of the Declaration of Helsinki.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) version 25 was used for analysis. Descriptive statistics were used to summarize demographics and questionnaire results. The independent *t*-test was used to determine differences between groups based on GAD-7 and mPHQ-15 results. Spearman's correlation test and chi-squared test were used to find the relationships between different variables. Cramer's *V*-test was used to determine level of association. A value of $p < 0.05$ was set as the threshold for significance.

RESULTS

The survey was sent to 116 therapists and the response rate was 84%. The study included 98 participants (56 OTs; 42 PTs). Of these, 90 were female and 8 were male. The ages ranged from 22 to 52 years old with a mean of 31.86 ± 8.97 years. Years of experience ranged from 1 to 29 years with a mean of 8.08 ± 7.10 years. Participants' area of practice included pediatrics ($n = 46$), neurology ($n = 36$), and orthopedics ($n = 16$). Twenty-four percent of therapists contracted COVID-19, however, they were not certain on how they contracted the coronavirus (**Table 1**).

GAD-7 overall final score was $\mu = 9.21 \pm 5.63$ and its frequency distribution levels were 27% with no anxiety ($n = 26$), 14% mild ($n = 14$), 38% moderate ($n = 37$), and 21% severe ($n = 21$; **Table 2**). For GAD-7, item #1 "feeling nervous, anxious or on edge" (47%), item #3 "worrying too much about different things" (56%), and item #6 "becoming easily annoyed or irritable" (42%) were the most reported anxiety symptoms with "more than half the days" and "nearly every day" responses (**Table 3**). The independent *t*-test showed significant differences between OTs and PTs for the GAD-7 scores [$t_{(96)} = -2.256$, $p = 0.026$] with PTs having a greater anxiety mean ($\mu = 10.67 \pm 5.56$) than OTs ($\mu = 8.13 \pm 5.49$). Also, the independent *t*-test on

TABLE 1 | Demographics of occupational and physical therapy participants.

	OT	PT	N
N (%)	56 (57%)	42 (43%)	98 (100%)
Infected	10 (18%)	13 (31%)	23 (24%)
Gender			
Male	1 (12.5%)	7 (87.5%)	8 (8%)
Female	55 (61%)	35 (39%)	90 (92%)
Area			
Neurology	12 (21%)	24 (57%)	36 (37%)
Pediatric	28 (50%)	18 (43%)	46 (47%)
Orthopedic	16 (29%)	00 (00%)	16 (16%)
Age			
M ± SD	27.12 ± 5.11	38.17 ± 9.16	31.86 ± 8.97
Experience			
M ± SD	4.23 ± 2.93	13.21 ± 7.78	8.08 ± 7.10

TABLE 2 | Levels of anxiety and somatic symptoms among the OT and PT respondents.

	OT n = 56	PT n = 42	All n = 98
Anxiety			
None	18 (32%)	8 (19%)	26 (27%)
Mild	9 (16%)	5 (12%)	14 (14%)
Moderate	19 (34%)	18 (43%)	37 (38%)
Severe	10 (18%)	11 (26%)	21 (21%)
Somatic			
None	9 (16%)	4 (10%)	13 (13%)
Mild	12 (21%)	8 (19%)	20 (20%)
Moderate	20 (36%)	17 (40%)	37 (38%)
Severe	15 (27%)	31 (13%)	28 (29%)

GAD-7 scores showed significant differences between therapists residing with their parents vs. therapists residing without their parents [$t_{(96)} = -2.536$; $p = 0.013$]. Therapists residing with their parents had greater anxiety ($\mu = 10.15 \pm 5.92$) than therapists residing without their parents ($\mu = 7.10 \pm 4.20$). The chi-squared test of independence showed a significant association between area of practice and GAD-7 levels [$\chi^2_{(30,N=98)} = 50.88$; $p = 0.010$]. Therapists working in the area of neurology had greater anxiety ($\mu = 10.64 \pm 5.80$) than therapists working in the areas of pediatrics ($\mu = 8.57 \pm 5.23$) or orthopedics ($\mu = 7.88 \pm 6.00$). Cramer's V-test showed a strong association between the variables ($V = 0.509$). However, based on GAD-7 scores there was no correlation with ages of therapists [$r_{(96)} = 0.058$; $p = 0.572$] and with years of experience [$r_{(96)} = 0.076$; $p = 0.457$].

The overall mPHQ-15 final score was $\mu = 9.52 \pm 5.54$, indicating an overall moderate level of somatization. The frequency distribution for mPHQ-15 was as follows: 13% of participants had no symptoms ($n = 13$), 20% mild ($n = 20$), 38% moderate ($n = 37$), and 29% had severe symptoms ($n = 28$; **Table 2**). For mPHQ-15, item #2 "back pain" ($n = 39$, 40%), item

TABLE 3 | Occupational and physical therapists report on the high responses of GAD-7.

Item*	Response		Cumulative %
	More than half the days (%)	Nearly every day (%)	
1. Feeling anxious	27	15	42 ^b
2. Not to stop worrying	28	12	40
3. Worrying too much	27	26	53 ^a
4. Trouble relaxing	15	14	29
5. Restless that	10	8	18
6. Easily annoyed	21	20	41 ^c
7. Felling afraid	24	15	39

*Condensed version of the complete items.

^{a,b,c}Most reported anxiety symptoms.

TABLE 4 | Occupational and physical therapists report on high responses of mPHQ-15.

Item*	Bothered	
	A little %	A lot %
1. Stomach pain	48	10
2. Back pain	45	40 ^c
3. Joints, arm, leg pain	35	27
5. Headache	61	16
6. Chest pain	30	00
7. Dizziness	36	15
8. Fainting spells	18	03
9. Feeling heart pound	24	09
10. Shortness of breath	26	11
12. Constipation or diarrhea	38	07
13. Nausea or indigestion	47	11
14. Tired or low energy	33	47 ^a
15. Trouble sleeping	32	44 ^b

*Condensed version of the complete items.

Items #4 and #11 were removed.

^{a,b,c}Most reported bothered somatic symptoms.

#11 "feeling tired or low energy" ($n = 46$, 47%), and item #12 "trouble sleeping" ($n = 43$, 44%) were the most reported somatic symptoms along with "bothered a lot" (**Table 4**). GAD-7 and mPHQ-15 overall scores were moderately positively correlated [$r_{(96)} = 0.569$; $p < 0.000$]. The chi-squared test of independence showed a significant association between GAD-7 levels of anxiety and mPHQ-15 levels of somatic symptoms [$\chi^2_{(9,N=98)} = 70.62$; $p < 0.000$]. Cramer's V test showed a strong association between the variables ($V = 0.490$).

Our data showed that 76% of respondents thought that the quality of their rehabilitation services was negatively impacted by the COVID-19 pandemic. Also, when respondents were asked about the effectiveness of their rehabilitation services, 20% of them believed that their rehabilitation services were not effective. On the other hand, some respondents thought that the effectiveness of their rehabilitation services were the same (14%), somewhat effective (43%), or effective (23%).

DISCUSSION

This study showed that the majority of OTs and PTs who practiced during the COVID-19 pandemic in the State of Kuwait experienced moderate to severe GAD. However, our findings were not consistent with the South Korea's study, who reported milder level of anxiety PTs than our participants (41). Based on the DSM-V (9) definitions of moderate and severe anxiety, these occupational and physical therapists might experience social and occupational difficulties, and therapists with severe anxiety should receive professional medical intervention. Moreover, the respondents mainly experienced anxiety symptoms such as worrying too much, feeling anxious, annoyance and irritation, and feeling afraid due to the possibility of catching the coronavirus from patients attending rehabilitation services. Our findings paralleled the trends in other recent studies of the general population and healthcare professionals the Arab countries and around the world who reported having moderate to severe anxiety during the COVID-19 pandemic (10, 20–23, 29–31, 34, 45). Our results showed that neither the number of years of experience nor ages of the healthcare professionals had any influence on anxiety levels. Due to the unprecedented nature of COVID-19, therapists most likely were not prepared with adaptive strategies to cope with the new experience. However, this was not the case in other studies that were conducted in Kuwait, Oman, Saudi Arabia, United Arab Emirates, and Jordan, which found younger and female healthcare professionals to have experienced greater anxiety (20, 22, 23, 38).

Our findings showed that family living arrangements had an effect on the level of anxiety. Respondents residing with their parents reported greater anxiety symptoms on the GAD-7 questionnaire compared to respondents residing without their parents. This could be explained by the fact that therapists living with family were concerned about catching the coronavirus from patients and transmitting it to their parents, who were more likely to be older adults and, therefore, at greater risk for severe illness and/or death. Similar concerns among healthcare professionals have been reported in other studies (20, 23, 26, 46, 47).

In term of professions, PTs reported a significantly higher score on GAD-7 than OTs. A possible explanation is that PTs reported spending more time at work than OTs, which would increase their risk of contracting the coronavirus and consequently increase their level of anxiety. Pniak et al. (48) and Yang et al. (41) concluded that physical therapists experienced significant rise in occupational burnout and anxiety during the pandemic due to increase workload, and they suggested a possible emerging risk in mental health conditions. Also, the background knowledge of OTs in psychosocial sciences, mental health, and adaptation theory may also explain their reduced anxiety levels in comparison to PTs. In addition, therapists in the neurology field experienced more anxiety than therapists working in pediatric or orthopedic areas. A possible explanation may be that therapists working in the neurological setting might worry about COVID-19 infection due to dealing with patients with low immune systems, especially those in the intensive care or neuro-surgery units (49, 50).

According to results of the mPHQ-15, the majority of respondents experienced moderate to severe somatic symptoms. Also, a moderate positive correlation was found between GAD-7 and mPHQ-15 results indicating a simultaneous increase in somatic symptoms and anxiety during COVID-19 pandemic. These findings are reflective of pre- and post-COVID-19 research which shows that a relationship exists between anxiety and somatic symptoms (8, 14, 18, 51). Anxiety and somatic symptoms are common in the general population and can lead to anxiety disorders (8). Neuroimaging studies have provided greater insight into the understanding of anxiety and somatic symptoms, revealing how the amygdala, anterior cingulate cortex, and insula play key roles in the development and maintenance of anxiety symptoms (52, 53).

Healthcare professionals should be cautious when treating patients with somatic symptoms during the COVID-19 pandemic or other catastrophic events, since somatic symptoms may have psychological roots. Psychological targets for intervention can then be identified alongside basic biological mechanisms for anxiety (8). Therapists with somatic symptoms should take time off from work to lessen their symptoms, however, this would further stretch thin the number healthcare professionals available for patient care. Therefore, continuous psychological counseling for healthcare professionals might be necessary during these prolonged events of psychological distress.

Implications and Future Studies

The majority of therapists indicated that the quality of rehabilitation services was negatively impacted by the COVID-19 pandemic. In addition, some therapists reported that their rehabilitation interventions were ineffective. Similarly, Hoel et al. (54) and Chimento-Díaz et al. (55) indicated that the majority of occupational therapists reported that their services were less effective and with lower quality during the pandemic. Due to precautionary procedures and measures, a number of rehabilitation services and activities were temporary discontinued during the pandemic, and home exercise programs were increased to reduce contact with patients. We recommend that healthcare education programs and future conferences and seminars should focus on the use of technology for communication and medical intervention. For example, telerehabilitation can be expanded which includes the use of videoconferencing, phones, email, and apps for individual or group remote therapy sessions. Kreider et al. (56) highlighted that telerehabilitation improved the patients' health and rehabilitation experience in addition to providing convenience, privacy, and comfort. They pointed out that telerehabilitation developed greater active participation and empowerment of the patients to carry out the rehabilitation programs. Also, virtual reality therapy, which is a computer program that creates an artificial environment to give the patient a simulated experience, can allow patients to continue their treatment at home and at the same time it has the benefit of significantly decreasing direct therapist-patient contact. Ilyas et al. (57), who examined patients' visits to the rehabilitation services during the pandemic, recommended improving rehabilitation programs through the

use of patient-centered approach. Thus, technology can help in maintaining rehabilitation services, reducing contact between therapists and patients, slowing the spread of the virus, and protecting vulnerable populations.

Based on our findings, we recommend that psychological counseling should be required for frontline healthcare providers during pandemics and catastrophic events. Also, it is imperative that healthcare workers engage in continuous training and preparation for future events. They must learn coping strategies that support the management of anxiety and psychological distress that is inevitably encountered during such experiences. Organizations and institutions should be required to offer positive support, to promote resilience, and to educate employees in adaptation/coping strategies (20, 58, 59). Doing so would reduce encountered stress and psychological distress and lead to better healthcare delivery (47).

Future studies are needed to examine the effectiveness of courses, training strategies, and technologies that target preventative measures for healthcare professionals in order to ensure a higher level of readiness for tackling pandemics. As different variants of COVID-19 arise, level of stress among healthcare professionals increases due to uncertainty of consequences, rapidity of spread, contiguousness, and strict precautionary measures (58). Therefore, public health officials must be prepared with ready guidelines, updated information, and recommendations to deal with emerging new variants. Such measures can help to support healthcare professionals to minimize their anxiety and fear, and consequently improve their confidence in dealing with pandemic related issues (58, 60). Administrators must be retrained and given greater responsibilities to monitor the status of healthcare workers during pandemics in order to achieve healthier working environments and support desired therapeutic outcomes for different patient populations. Moreover, more research is needed to optimize strategies for reducing anxiety levels and associated somatic symptoms during such events. Finally, healthcare protocols must detail the guidelines to protect the good health, prevent spread of illness, and maintain quality of care and services.

LIMITATIONS

This study had some limitations. The sample of OTs and PTs included a great imbalance between males and females. Therefore, we were unable to study gender differences on anxiety. The research study had a small number of participants. Although, 98 participants provided enough data to reveal trends, a larger number would show more robust results. In addition, our

findings might have limited generalizability to all healthcare professions. However, our findings were similar to the findings of other research studies with different populations in various countries. In addition, our online survey was subject to response bias as respondents with a notion of psychological distress might have been more likely to complete the survey.

CONCLUSION

The COVID-19 pandemic caused a significant impact on mental health of healthcare professionals such as occupational and physical therapists. This study provided important results for the association between anxiety and somatic symptoms. The majority of study participants experienced moderate to severe anxiety and associated somatic symptoms. During crisis events such as the COVID-19 pandemic, ongoing psychological counseling of healthcare professionals is required to maintain positive mental health and to minimize associated somatic symptoms. Interventions are needed to support healthcare professionals by focusing on both the psychological manifestations and physical symptoms.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Health Sciences Center, Kuwait University and Kuwait Ministry of Health. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MA, NA, MN, FM, and HA: conceptualization, methodology, and resources. MA and HA: validation. MA, NA, MN, and FM: formal analysis. MA: writing—original draft preparation. NA, MN, FM, and HA: reviewing and editing. All authors have read and agreed to the published final version of the manuscript.

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Machine Learning-Based Prediction Models for Depression Symptoms Among Chinese Healthcare Workers During the Early COVID-19 Outbreak in 2020: A Cross-Sectional Study

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Edited by:

Mohammadreza Shalbafan,
Iran University of Medical
Sciences, Iran

Reviewed by:

Amir Mosavi,
Dresden University of
Technology, Germany
Sina Ardabili,
University of Mohaghegh Ardabili, Iran
Della Virga,
West University of Timișoara, Romania
Seyed-Ali Sadegh-Zadeh,
Staffordshire University,
United Kingdom

*Correspondence:

Bing Xiang Yang
00009312@whu.edu.cn
Zhongchun Liu
zcliu6@whu.edu.cn

[†]These authors have contributed
equally to this work

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Zhaohu Zhou^{1†}, Dan Luo^{2,3†}, Bing Xiang Yang^{2,3,4*} and Zhongchun Liu^{4*}

¹ School of Basic Medical Sciences, Chengdu University, Chengdu, China, ² School of Nursing, Wuhan University, Wuhan, China, ³ Population and Health Research Center, Wuhan University, Wuhan, China, ⁴ Department of Psychiatry, Renmin Hospital of Wuhan University, Wuhan, China

Background: The 2019 novel coronavirus (COVID-19)-related depression symptoms of healthcare workers have received worldwide recognition. Although many studies identified risk exposures associated with depression symptoms among healthcare workers, few have focused on a predictive model using machine learning methods. As a society, governments, and organizations are concerned about the need for immediate interventions and alert systems for healthcare workers who are mentally at-risk. This study aims to develop and validate machine learning-based models for predicting depression symptoms using survey data collected during the COVID-19 outbreak in China.

Method: Surveys were conducted of 2,574 healthcare workers in hospitals designated to care for COVID-19 patients between 20 January and 11 February 2020. The patient health questionnaire (PHQ)-9 was used to measure the depression symptoms and quantify the severity, a score of ≥ 5 on the PHQ-9 represented depression symptoms positive, respectively. Four machine learning approaches were trained (75% of data) and tested (25% of data). Cross-validation with 100 repetitions was applied to the training dataset for hyperparameter tuning. Finally, all models were compared to evaluate their predictive performances and screening utility: decision tree, logistics regression with least absolute shrinkage and selection operator (LASSO), random forest, and gradient-boosting tree.

Results: Important risk predictors identified and ranked by the machine learning models were highly consistent: self-perceived health status factors always occupied the top five most important predictors, followed by worried about infection, working on the frontline, a very high level of uncertainty, having received any form of psychological support material and having COVID-19-like symptoms. The area under the curve [95% CI] of machine learning models were as follows: LASSO model, 0.824 [0.792–0.856]; random forest, 0.828 [0.797–0.859]; gradient-boosting tree, 0.829 [0.798–0.861]; and decision tree, 0.785 [0.752–0.819]. The calibration plot indicated that the LASSO model, random

forest, and gradient-boosting tree fit the data well. Decision curve analysis showed that all models obtained net benefits for predicting depression symptoms.

Conclusions: This study shows that machine learning prediction models are suitable for making predictions about mentally at-risk healthcare workers predictions in a public health emergency setting. The application of multidimensional machine learning models could support hospitals' and healthcare workers' decision-making on possible psychological interventions and proper mental health management.

Keywords: depression, machine learning, COVID-19, health personnel, predictive value of tests

INTRODUCTION

Since the first confirmed 2019 novel coronavirus (COVID-19) infection case, the COVID-19 pandemic has brought tremendous challenges to the global healthcare system (1). Facing this global pandemic, healthcare workers bear the brunt of this aggravating healthcare burden. Healthcare workers, especially doctors and nurses who directly care for COVID-19 patients, are at great risk of developing mental health illnesses (2). COVID-19-related mental health problems for healthcare workers have received high attention in academia (3–5). Recent meta-studies found depression is the most common mental health outcome among healthcare workers due to the impact of COVID-19, with a prevalence rate of 20–30% worldwide (6–9).

The theory of crisis used as a theoretical framework guided this study. According to James and Gilliland, “crisis” is a broad and subjective term used to describe a situation that affects an individual excruciatingly due to various life, environmental, and psychological stressors. In addition, substantial evidence from the previous studies of epidemics on the impact of psychological health has shown psychosocial consequences in the affected individuals and the general population. In this study, COVID-19 is considered a crisis that leads to intense psychosocial issues and comprises mental health marking a secondary health concern worldwide. The research findings helped us to cultivate risk factors associated with depression symptoms among healthcare workers, namely, disease-related exposures (10), worried about infection (10), working on the frontline (11, 12), gender differences (11, 13, 14), type of hospital (11), technical title (11), location (14), lacking social support (15), and uncertainty toward the pandemic (16).

While most studies focused on understanding the exposure-outcome association of depression symptoms, research on identifying signs that predict depression symptoms were limited. The WHO recommended “psychological first aid” (17), which promotes immediate help and support to field workers who are experiencing mental disorders due to a recent crisis. Furthermore, machine learning, an innovative approach, has extensive applications in prediction to identify patients at high risk, their death rate, and other abnormalities during the pandemic of COVID-19 (18, 19). In a previous study,

machine learning functioned as a valuable technique to suppress interferences out of unlabeled input datasets, which can be applied to analyze the unlabeled data as an input resource for COVID-19 (20). Machine learning techniques provide accurate and useful features rather than a traditional explicitly calculation-based method (21). It is also beneficial to predict the risk in healthcare during this COVID-19 crisis and analyze the risk factors as per age, social habits, location, and climate (22). However, in mental health prediction, the application of machine learning is still in preliminary status. If machine learning models can predict depression symptoms in a timely manner and are available in a clinical setting following a short survey, they can serve as a self-screening mechanism to alert healthcare management about employees who are at risk of depression. The unique variable importance feature of machine learning models can be used to help develop immediate interventions for healthcare workers in preparation for the next public health emergency. To the best of our knowledge, machine learning models were rarely used to predict COVID-19-related mental health outcomes of healthcare workers.

To address this gap, the goal of this cross-sectional study is to develop machine learning models using quantified questionnaire data that can efficiently predict depression symptoms in healthcare workers using the following machine learning techniques: decision tree, logistic regression with least absolute shrinkage and selection operator (LASSO), random forest, and gradient-boosting trees. In addition, the models can help determine psychological and behavioral factors that place healthcare workers at-risk for alterations in mental health and to access the needs of healthcare workers during a public health emergency. The predictive performance and screening utility among these models are also compared and assessed.

METHODS

Participants and Data Collection

This national survey was conducted in Chinese using the WeChat-based online survey platform “Wenjuanxing” between 20 January and 11 February 2020. The survey was distributed in WeChat, a widely used social communication application. Staff from the COVID-19 designated hospitals were contacted by the researcher and asked to invite healthcare workers in their facility to complete this online survey. The eligibility criteria of participants were: licensed healthcare personnel and working

Abbreviations: COVID-19, 2019 novel coronavirus; PHQ-9, 9-item patient health questionnaire; LASSO, Least absolute shrinkage and selection operator; ROC, Receiver operating characteristic; AUC, Area under the curve.

in a hospital designated to care for COVID-19 patients. This survey was accessed by a large population of healthcare workers. All participants were asked to complete an online informed consent before completing the survey. A total of 2,574 healthcare workers completed the survey. Ethical approval for this study was received from the Institutional Review Board at Renmin Hospital of Wuhan University (No. WDRY2020-K004).

Variables and Measurements

The questionnaire includes sociodemographic characteristics and other items regarding mental health outcomes, COVID-19 exposures, use of psychological services, information channels, perception of the pandemic, and self-perceived health status total of 8 segments and 23 potential exposures.

Sociodemographic Characteristics

Includes information on frontline work (Yes/No), gender, education level, marital status, geographic location, living arrangements, and age groups.

COVID-19 Exposure

Questions include: Have you or your family members been diagnosed with COVID-19? Have you had a COVID-19-like symptom (fever, dry cough, fatigue, etc.)? Do you worry about being infected? Have your colleagues been diagnosed with COVID-19? Have your friends been diagnosed with COVID-19? Have people in your neighborhood been diagnosed with COVID-19?

Psychological Services

Questions are related to access to psychological help: Have you received any form of psychotherapy, both one-to-one and group-based? Have you received any form of psychological support material, both paper-based and media-based? Have you received any other psychological help?

Media Usage

Questions focus on the type of media used and the amount of time spent obtaining information on COVID-19: Do you get COVID-19 information talking/chatting with others? Do you get COVID-19 information from television? Do you get COVID-19 information through new media like WeChat, TikTok, Weibo, etc.? On average, how long did you spend each day seeking COVID-19 information?

Perception of Pandemic

The question focused on personal views on resolving the pandemic: What is your belief about whether the pandemic can be controlled: very strong, strong, normal, and none.

Self-Perceived Health Status

The final segment asks healthcare workers to self-report their health status: describe your current health status. What is your current health status now compared to your health status before the outbreak?

Mental Health Outcomes

Depression was evaluated using the Chinese version of the patient health questionnaire (PHQ-9) (23), which has nine items measuring self-assessed depressive symptoms experienced during the previous 2 weeks. It uses a 4-point Likert-type scale (0 = never, 1 = sometimes, 2 = more than once a week, and 3 = almost every day). The total score ranges from 0 to 27, and higher scores indicate more depressive symptoms. Scores of 10 and 15 represent cutpoints for moderate and moderately severe depression, respectively. The Chinese version of the PHQ-9 has shown good psychometric properties with reported Cronbach's α of 0.86 (24).

Statistical Analysis

The primary outcome of the study is a depression event, defined as a score on the PHQ-9 ≥ 5 . Descriptive statistics include the frequency and percentage of depression symptoms under each potential predictor. This aims to provide characteristics for the entire population.

Based on the predictive performances of previous depression-related mental health or COVID-19-related predictions (25–31), four machine learning techniques were developed: decision tree (28, 30), logistics regression with least LASSO (25, 26), random forest (28–30), and gradient-boosting tree (27, 28, 31). Although details of these machine learning techniques are well documented, brief descriptions for each model and hyperparameter are carried out below.

Logistic Regression With LASSO

Logistic regression with LASSO chooses relative important predictors out of all possible predictors by not only minimizing the residual sum of square (RSS) of the coefficient, just like the ordinary least square regression method, but adding a penalty to the RSS equal to the sum of the absolute value as well (it shrinks some coefficient estimates toward zero) (32–34). The hyperparameter “lambda” controls the penalty to the residual sum of a square and was optimized during the cross-validation process. The hyperparameter “alpha” is for the elastic net mixing parameter, hence we set alpha equal to 1 in LASSO regression.

Decision Tree

A decision tree recursively splits a parent node using a finite number of potential predictors stopped by reaching the minimum cost complexity (this process is also called pruning), which results in outcome classification (35). The cost complexity is measured by the number of leaves in the tree (size of the tree) and the error rate of the tree (misclassification rate). The hyperparameter “complexity parameter” refers to the amount by which splitting a node improved the relative error. In other words, the decision tree tries to have the smallest tree with the smallest cross-validation error and its complexity parameter is the trade-off threshold between the size of the tree and the misclassification rate to help prevent overfitting.

Random Forest

Random forest is an ensemble learning method that constructs many independent decision trees without pruning and produces

a single estimate by combining every tree's predictions (36). The permutation method in the random forest is used to assess the importance of predictors by comparing prediction accuracy differences between the results from permuting variables in out-of-bag samples and the result without permutation. Instead of doing an exhaustive search over all potential predictors, random forest randomly sampled "mtry" variables as candidate predictors when forming each split in a tree. The hyperparameter "mtry" was optimized during the cross-validation process. To make ensemble tree methods comparable to each other, the researchers set the other hyperparameter, the number of the tree built, to the fixed 1,000 trees.

Gradient-Boosting Tree

In contrast, a gradient-boosting tree constructs one tree sequentially that aims to improve the shortcomings of the previous tree at each iteration. Importance is determined by the relative influence of each predictor: whether that predictor was selected to split on and how much the squared error improved (37–39). To prevent overfitting, the complexity of the tree at each iteration was controlled by three hyperparameters: the minimum number of observations in the terminal nodes, max tree depth, and shrinkage. To make ensemble tree methods comparable to each other, the researchers set the other hyperparameter, the number of the tree built, to the fixed 1,000 trees.

Except for reporting the beta coefficient of the LASSO method, the researchers scaled each tree-based variable importance unit by the maximum value of 100 to give a straightforward understanding of the sense of variable importance.

Model Training

During the training, the data were randomly split into a 75% training dataset and a 25% test dataset. The training dataset was used to train and validate each of the four models. For each type of model, the hyperparameters were optimized using 100 repetitions of grid search and evaluating the results using three-fold cross-validation. Once the optimal hyperparameters were determined, each model was fitted again on the entire training dataset. The optimal hyperparameters are reported in **Supplementary Table 1**. All training was supervised, meaning the depression outcomes were provided during the training.

Performance Measurement

The test dataset was used to test and compare each of the four models' performances from the perspective of prediction accuracy and screening utility. Receiver operating characteristic (ROC) was used as the main measure (40) of prediction accuracy along with the nonparametric DeLong test to compare the area under the curve (AUC) among the models (41). To assess the model fit, calibrations were plotted to observe the consistency between model-produced probabilities and observed probabilities of depression events. Finally, screening utility was assessed by calculating net-benefit values (42, 43), the differences between the proportion of true positive counts (benefit) and weighted proportion of false-positive counts (harm) at each probability threshold of a depression event; the decision curves were plotted as well.

All computations were performed using R (version 3.5.0); R package "haven" was employed for importing data. The R package "caret" was used for tuning hyperparameters during the model training. The R package "rpart" was employed for performing a decision tree. The R package "glmnet" was used for performing LASSO. The R package "randomForest" was employed for performing random forest. The R package "gbm" was used for performing a gradient-boosting decision tree. The R package "pROC" was employed for performing ROC analysis. All tests were two-sided and considered statistically significant if the *p*-value was <0.05.

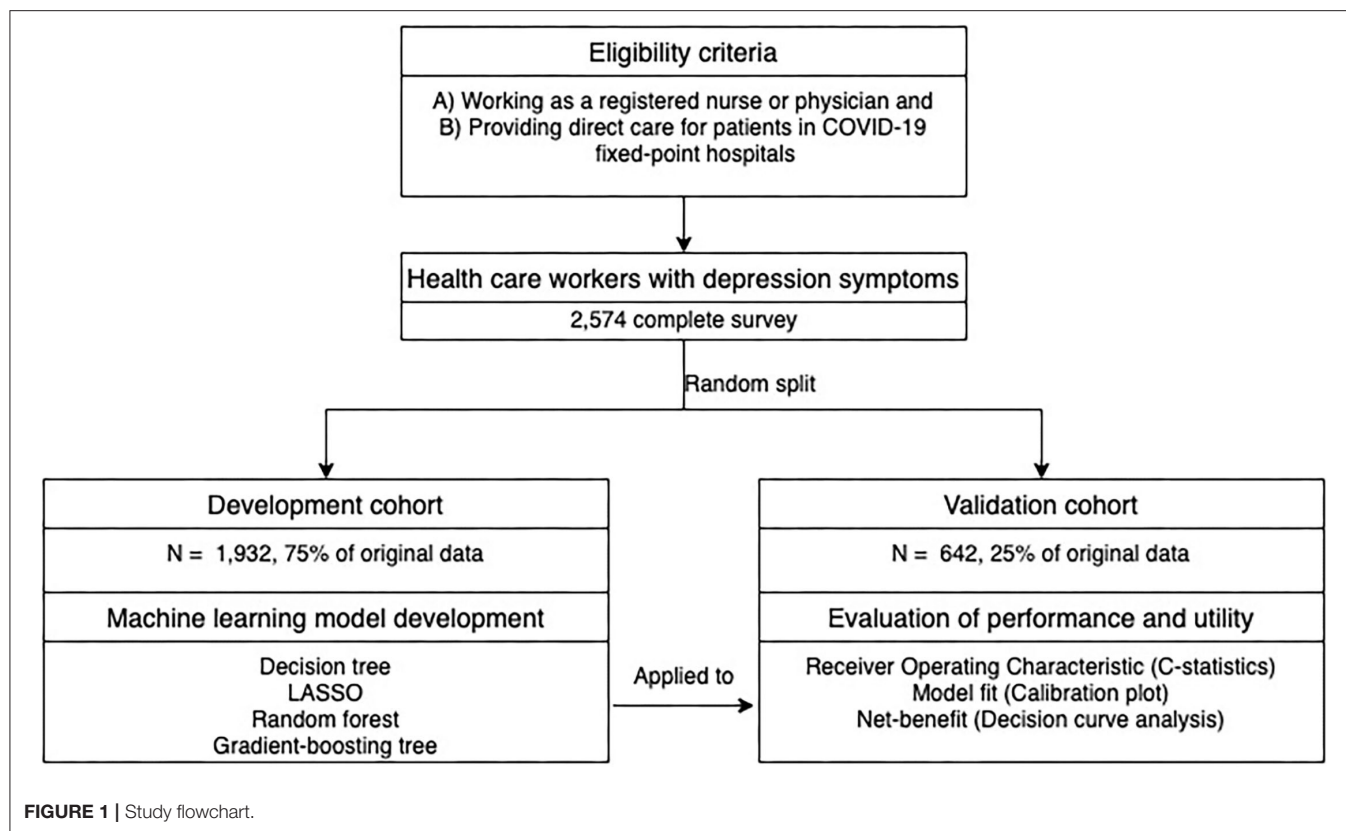
RESULTS

Participants Characteristics

The study flowchart and participants' characteristics are summarized in **Figure 1** and **Table 1**, respectively. In total, questionnaires from 2,574 healthcare workers were analyzed; this includes 1,187 participants (46.11%) with depression symptoms. The participants were randomly split into the training dataset ($N = 1,932$) and the test dataset ($N = 642$). The participants' characteristics were as follows: participants were predominantly female, holding an undergraduate degree or below, worried about infection, without COVID-19-like symptoms, getting information through new media, most of them did not receive any professional psychological therapy, health status getting worse, and without infection exposure (self and others); the majority were married, living with family, spending 1–2 h daily seeking COVID-19 information. The rest of the characteristics generally were evenly distributed within each question item.

Model Development

The final logistic regression with LASSO selected 10 risk predictors and five protective predictors out of 36 potential predictors. The logistic model showed that self-perceived poor health [odds ratio (OR): 3.25 ref: self-perceived good health], self-perceived normal health (OR: 3.70 ref: self-perceived good health), self-perceived health status were much worse than before (OR: 2.47 ref: self-perceived health worse than before), worried about infection (OR: 2.00), very strong level of uncertainty regarding COVID-19 control (OR: 1.57 ref: normal level of uncertainty toward COVID-19 control), and working on the frontline (OR: 1.41) were the top five risk predictors. The model also identified two protective predictors: resided in Hubei province (OR: 0.78 ref: resided in Wuhan city) and received any form of psychological support material (OR: 0.80). Among all predictors identified by tree-based learning methods, self-perceived health status factors always occupied the top five most important predictors, followed by worried about infection, working on the frontline, a very strong level of uncertainty about control of the pandemic, receiving any form of psychological support material, and COVID-like symptoms ranked predictors' importance from tree-based methods generally matched the logistic with the LASSO model. These items also had high estimated ORs that were reflected by the LASSO model. Features and predictor contributions are presented in **Figure 2**.



Model Performance and Evaluation

As for prediction accuracy, the AUC [95% CI] of these machine learning models were as follows: logistic regression with LASSO, 0.824 [0.792–0.856]; random forest, 0.828 [0.797–0.859]; gradient-boosting tree, 0.829 [0.798–0.861]; and decision tree, 0.785 [0.752–0.819]. Based on the ROC analyses, there were significant differences in the AUC between the decision tree and the other three models (see **Supplementary Table 2**). The gradient-boosting tree showed higher overall accuracy with a slight advantage over the random forest and the LASSO model. The ROC curves for each model are shown in **Figure 3A**. To visualize the model fit, a calibration plot was carried out in **Figure 3B**. Overall all four models were underestimated after a predicted probability excess of 40%, considering all calibration lines were below the diagonal. The LASSO model, gradient-boosting tree, and random forest were calibrated very well although there were some fluctuations at predicted probability around 40–50%. The decision tree fitted poorly, which was overestimated and underestimated in predicting depression symptoms.

Clinical Significance and Utility

The decision curve analysis in **Figure 4** showed that all models are clinically significant because the net-benefit values of the models were much higher than all-treatment and non-strategy. Again, the decision tree model had the lowest clinical value, which was expected due to its predictive performance. It

is difficult to tell the difference in the net-benefit values among the rest of the three machine learning models, but it looks like ensemble tree-based learning methods (gradient-boosting tree and random forest) were slightly higher than the LASSO model.

DISCUSSION

This study successfully applied machine learning techniques to predict depression symptoms with reasonable accuracy and net benefit. In addition to the identified risk exposures that were already confirmed in previous studies [e.g., working on the frontline (11), worry about infection (12), and location of residence (11)], several hidden predictors associated with the mental health outcomes were uncovered which could be meaningful in constructing interventions. The decision curve analysis further suggested utility in mental screening implications.

As for the practice of “psychological first aid,” machine learning models identified several potential predictors that implied some possible mental interventions for healthcare workers. Information overload refers to the amount of news received that exceeds the limit of an individual’s information processing capacity (44) and has been frequently studied in its association with the mental wellbeing of the general public during the COVID-19 pandemic (45–47). This study supported the existence of such an association between

TABLE 1 | Demographic and variable characteristics.

Variables		Training dataset		Test dataset	
		No depression symptoms (<i>n</i> = 1,041)	Have depression symptoms (<i>n</i> = 891)	No depression symptoms (<i>n</i> = 346)	Have depression symptoms (<i>n</i> = 296)
Gender					
	Female	783 (75.2%)	746 (83.7%)	266 (76.9%)	241 (81.4%)
	Male	258 (24.8%)	145 (16.3%)	80 (23.1)	55 (18.6%)
Frontline worker					
	Yes	279 (26.8%)	406 (45.6%)	98(28.3%)	132(44.6%)
	No	762 (73.2%)	485 (54.4%)	248(71.7%)	164(55.4%)
Married					
	Yes	715 (68.7%)	548 (61.5%)	238 (68.8%)	197 (66.6%)
	No	326 (31.3%)	343 (38.5%)	108 (31.2%)	99 (33.4%)
Education					
	Graduate degree or higher	177 (17.0%)	154 (17.3%)	66(19.1%)	51(17.2%)
	Undergraduate degree or lower	864 (83.0%)	737 (82.7%)	280(80.9%)	245(82.8%)
COVID-19-like symptom (fever, dry cough, fatigue etc.)					
	Yes	126 (12.1%)	194 (21.8%)	37 (10.7%)	68 (23.0%)
	No	915 (87.9%)	697 (78.2%)	309 (89.3%)	228 (77.0%)
Worry about infection					
	Yes	740 (71.1%)	819 (91.9%)	228 (65.9%)	268 (90.5%)
	No	301 (28.9%)	72 (8.1%)	118 (34.1%)	28 (9.5%)
Getting COVID-19 information via talking/chatting					
	Yes	572 (54.9%)	562 (63.1%)	204 (59.0%)	195 (65.9%)
	No	469 (45.1%)	329 (36.9%)	142 (41.0%)	101 (34.1%)
Getting COVID-19 information through new media (WeChat, TikTok, Weibo, etc.)					
	Yes	997 (95.8%)	861 (96.6%)	329 (95.1%)	283 (95.6%)
	No	44 (4.2%)	30 (3.4%)	17 (4.9%)	13 (4.4%)
Getting COVID-19 information from television					
	Yes	574 (55.1%)	429 (48.1%)	202 (58.4%)	148 (50.0%)
	No	467 (44.9%)	462 (51.9%)	144 (41.6%)	148 (50.0%)
Received any form of psychotherapy					
	Yes	141 (13.5%)	125 (14.0%)	52 (15.0%)	48 (16.2%)
	No	900 (86.5%)	766 (86.0%)	294 (85.0%)	248 (83.8%)
Received any form of psychological support material					
	Yes	672 (64.6%)	451 (50.6%)	228 (65.9%)	149 (50.3%)
	No	369 (35.4%)	440 (49.4%)	118 (34.1%)	147 (49.7%)
Received other psychological help					
	Yes	42 (4.0%)	45 (5.1%)	23 (6.6%)	11 (3.7%)
	No	999 (96.0%)	846 (94.9%)	323 (93.4%)	285 (96.3%)
Living arrangement					
	Live with family	712 (68.4%)	484 (54.3%)	249 (72.0%)	170 (57.4%)
	Live alone	214 (20.6%)	221 (24.8%)	63 (18.2%)	72 (24.3%)
	Live with friends	108 (10.4%)	168 (18.9%)	33 (9.5%)	51 (17.2%)
	Live with others	7 (0.7%)	18 (2.0%)	1 (0.3%)	3 (1.0%)
Location of residence					
	Wuhan city	377 (36.2%)	459 (51.5%)	112 (32.4%)	154 (52.0%)
	Hubei province	297 (28.5%)	172 (19.3%)	103 (29.8%)	68 (23.0%)
	Other province	367 (35.3%)	260 (29.2%)	131 (37.9%)	74 (25.0%)
Time spent seeking COVID-19 information					
	<1 h	206 (19.8%)	144 (16.2%)	58 (16.8%)	34 (11.5%)
	1–2 h	473 (45.4%)	336 (37.7%)	166 (48.0%)	121 (40.9%)

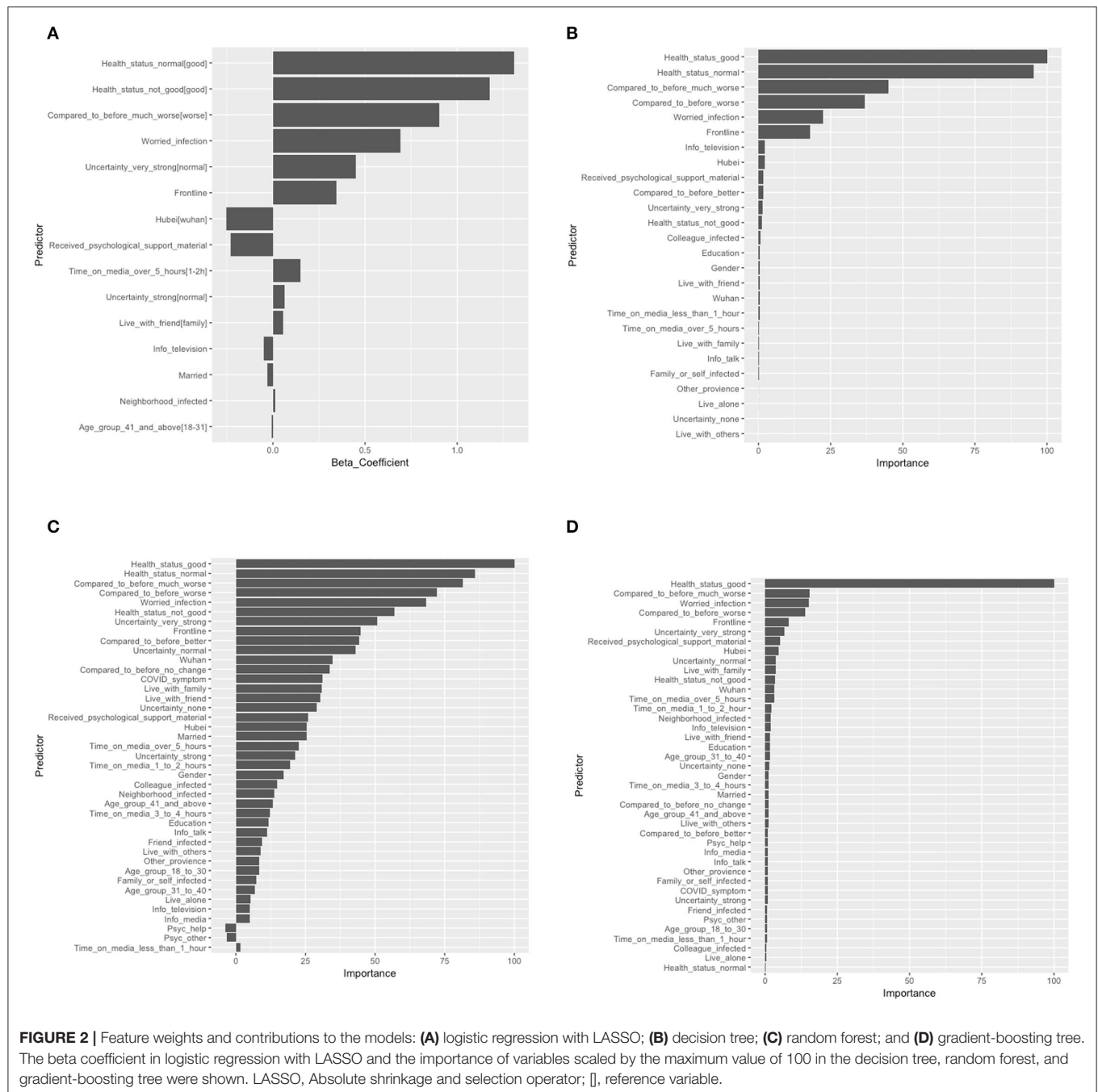
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TABLE 1 | Continued

Variables		Training dataset		Test dataset	
		No depression symptoms (n = 1,041)	Have depression symptoms (n = 891)	No depression symptoms (n = 346)	Have depression symptoms (n = 296)
Perception on pandemic control	3–4 h	226 (21.7%)	218 (24.5%)	68 (19.7%)	83 (28.0%)
	Over 5 h	136 (13.1%)	193 (21.7%)	54 (15.6%)	58 (19.6%)
	Very strong	117 (11.2%)	237 (26.6%)	39 (11.3%)	69 (23.3%)
	Strong	338 (32.5%)	339 (38.0%)	119 (34.4%)	127 (42.9%)
	Normal	538 (51.7%)	306 (34.3%)	178 (51.4%)	97 (32.8%)
	None	48 (4.6%)	9 (1.0%)	10 (2.9%)	3 (1.0%)
Self-perceived health status compered to before COVID-19 outbreak					
	Much worse	91 (8.7%)	312 (35.0%)	22 (6.4%)	110 (37.2%)
	Worse	867 (83.3%)	499 (56.0%)	288 (83.2%)	162 (54.7%)
	Unchanged	76 (7.3%)	33 (3.7%)	34 (9.8%)	7 (2.4%)
	Better	7 (0.7%)	47 (5.3%)	2 (0.6%)	17 (5.7%)142
Infected/family infected					
	Yes	17 (1.6%)	34 (3.8%)	1 (0.3%)	13 (4.4%)
	No	1,024 (98.4%)	857 (96.2%)	345 (99.7%)	283 (95.6%)
Colleague infected					
	Yes	235 (22.6%)	299 (33.6%)	59 (17.1%)	119 (40.2%)
	No	806 (77.4%)	592 (66.4%)	287 (82.9%)	177 (59.8%)
Friend infected					
	Yes	80 (7.7%)	113 (12.7%)	20 (5.8%)	35 (11.8%)
	No	961 (92.3%)	778 (87.3%)	326 (94.2%)	261 (88.2%)
Neighborhood infected					
	Yes	141 (13.5%)	184 (20.7%)	34 (9.8%)	58 (19.6%)
	No	900 (86.5%)	707 (79.3%)	312 (90.2%)	238 (80.4%)
Age group (in years)					
	18–30	450 (43.2%)	433 (48.6%)	142 (41.0%)	137 (46.3%)
	31–40	323 (31.0%)	294 (33.0%)	102 (29.5%)	89 (30.1%)
	41 and above	268 (25.7%)	164 (18.4%)	102 (29.5%)	70 (23.6%)
Self-perceived current health status					
	Not good	3 (0.3%)	53 (5.9%)	2 (0.6%)	15 (5.1%)
	Normal	300 (28.8%)	612 (68.7%)	82 (23.7%)	202 (68.2%)
	Good	738 (70.9%)	226 (25.4%)	262 (75.7%)	79 (26.7%)

information overload and depression among healthcare workers and recognized several possible information overload thresholds. The LASSO model identified that an individual who spends over 5 h seeking COVID-19 information has higher odds of developing depression symptoms compared to those spending 1–2 h in obtaining COVID-19 information. Tree-based variable selection methods also identified spending 1–2 h obtaining COVID-19 information and spending over 5 h are paired predictors for depression symptoms. Moreover, all methods identified that receiving any form of psychological support material (both paper-based and media-based) can serve as important self-help therapy against depression. As several studies urged self-help strategies and social/mental health supports for healthcare workers during the pandemic (48–50), offering psychological support material can potentially be

one feasible self-help solution. There are many advantages to offering psychological support material as a self-help intervention during the COVID-19 pandemic. Due to the high contagion of the virus and strict quarantine policy, traditional face-to-face psychotherapy is difficult to implement. Offering self-help psychological support material is an immediate intervention with minimum psychological therapist contact and increases the cost-effectiveness of the treatment. Plus, self-help interventions appeared to be the preferred option against depression over antidepressant medications (51). For healthcare workers who are worried about medication side effects or unwilling to show signs of mental hardship during employment, providing mental health/wellness pamphlets to all healthcare workers would be an appropriate resource for everyone.



Strengths and Implications

This study has some major strengths compared with other COVID-related mental health studies. As far as we know, this is the first study to apply machine learning prediction models focusing on depression symptoms in healthcare workers during the COVID-19 outbreak. A sample size of 2,574 with 1,187 events allows for multifold cross-validation to prevent model overfitting and uses a separate test dataset to evaluate predictive performance.

Tree-based machine learning methods have advantages of modeling variable to variable interactions (52, 53), complex data (54), and nonparametric data (55). For example, complex categorical variables (in this study: self-perceived health factors, media factors, and psychological services factors) were usually ignored or excluded from previous COVID-19 mental health survey studies (11–13). This is because conventional statistical approaches (such as univariate or multivariate logistic regression) that were commonly adopted either are impossible to model hundreds of interactions among variables or have to follow

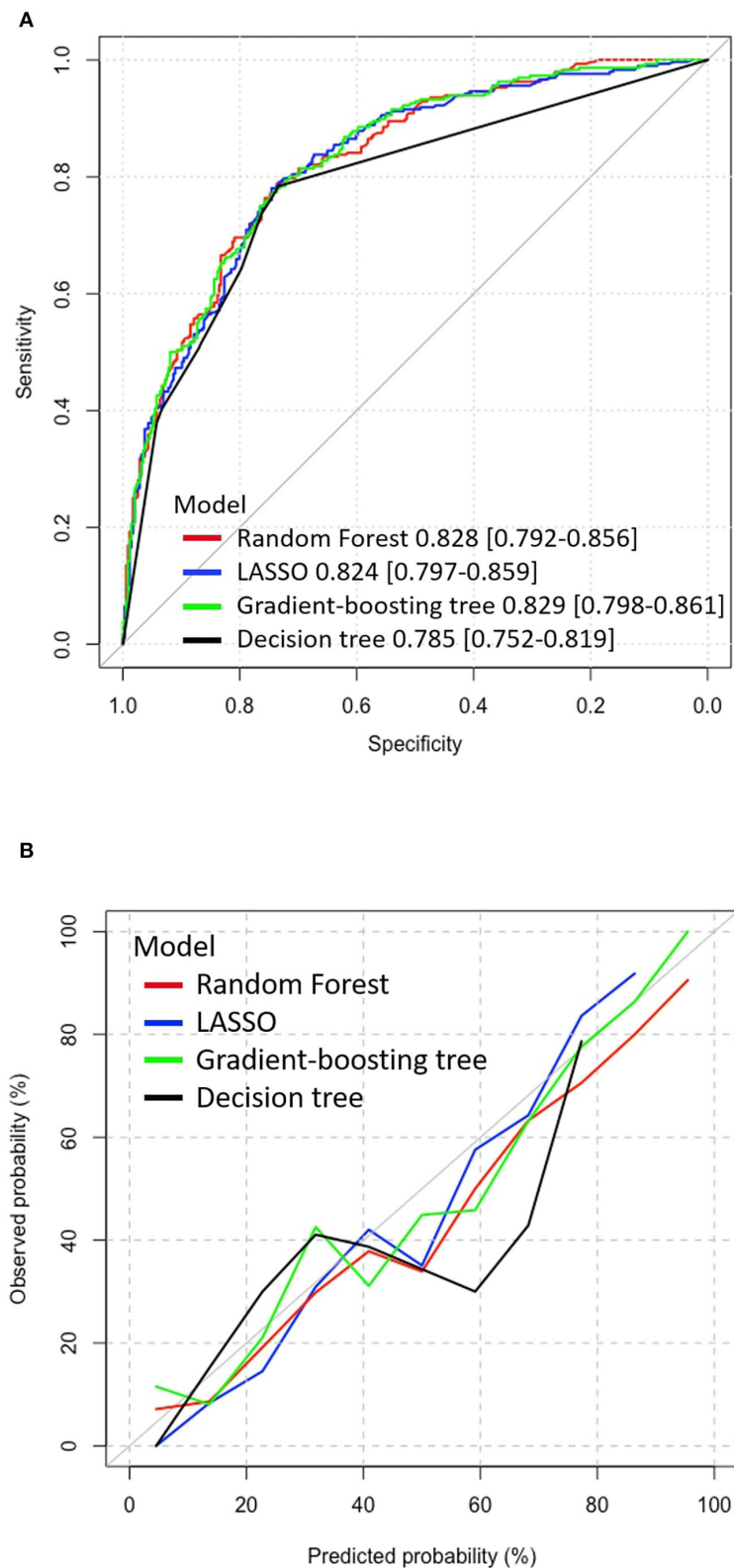
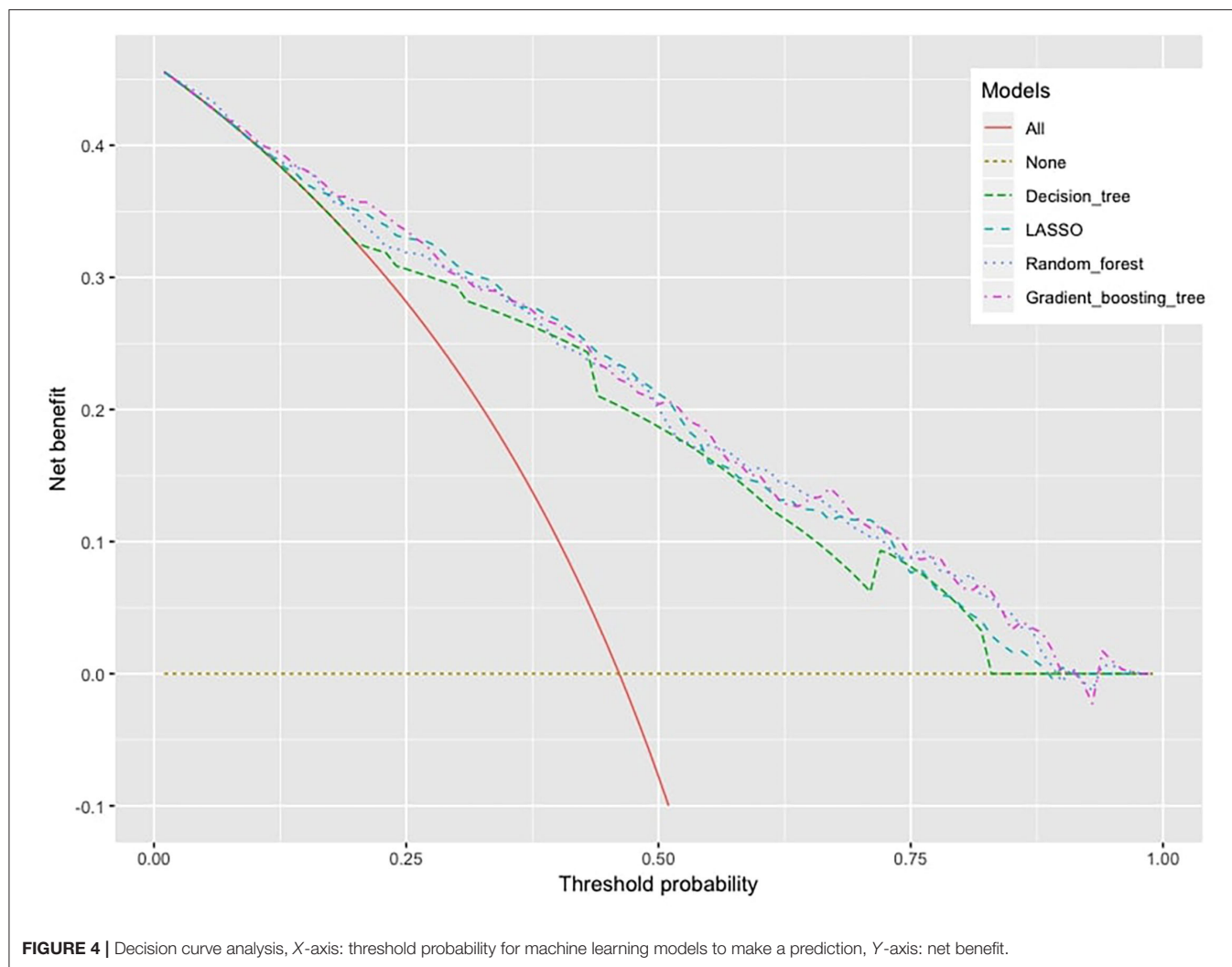


FIGURE 3 | ROC curve and calibration plot of models in the test dataset. **(A)** The ROC curve of the models, X-axis: specificity, Y-axis: sensitivity. The AUC [95% CI] of the models; random forest: 0.828 [0.792–0.856], logistic regression with LASSO: 0.824 [0.797–0.859], gradient-boosting tree: 0.829 [0.798–0.861], and decision tree: 0.785 [0.752–0.819]. **(B)** Calibration plot, X-axis: probabilities estimated by machine learning models, Y-axis: observed probabilities of outcome. ROC, Receiver operating characteristic; AUC, Area under the curve; LASSO, Absolute shrinkage and selection operator.



strict data distribution assumptions. Hence, tree-based machine learning models not only provide more accurate predictions but also provide a different angle by looking at survey data using a data-driven approach instead of a traditional hypothesis-driven approach.

As for the screening implication, the researchers believe this machine learning-based prediction model would play a crucial role as an efficient early screening tool and report information to hospitals about healthcare workers' mental status. Especially when background knowledge of depression caused by the outbreak is lacking, machine learning models could make predictions by using easily acquired information such as demographic data, work-related factors, outbreak factors, or self-perceived factors. They may enable hospitals to quickly collect depression statistics and accurately identify individual at-risk workers for targeted interventions and proper management. The other advantage is that giving actual probabilities of depression symptoms is more informative to healthcare workers than Yes/No answers. Healthcare workers can self-evaluate their current mental status through the depression probabilities and

then decide whether they need professional mental health support. These machine learning techniques can be easily implemented in software such as the WeChat mini program and Weibo. Further to enhance the use, allowing some programs to extract healthcare workers' basic demographic data would be necessary. Although there are several well-established depression screening tools (24, 56, 57), none of them is designed for use during a pandemic situation. Taking a step back, even if machine learning models do not show superior performance over conventional screening tools, combined use with conventional tools could still be very beneficial because they may provide more diagnostic information specifically in a public health emergency setting.

Limitations

This study has several major limitations which could point the direction for future research. First, large sample size and ethnic diversity of participants are always required for cross-site validating of model performance. It is often difficult to obtain a large sample at one geographic location, and even more

difficult to contain participants from ethnic minorities or other races globally. In our survey, 1,102 (42.81%) healthcare workers were from Wuhan city with predominantly Han Chinese. To address this problem, integrating data from international sites would be essential for future work to conduct cross-site model validations. Machine learning models can be trained at one or several independent sites in one country and tested at different sites abroad. The advantage of such cross-site validation is it can correct overfitting problems arising at a single geographic location. Cross-site validation technique had been successfully applied to the classification of mental disorders such as schizophrenia classification using MRI data and showed promising performance. Rozycki et al. (58) used data from 941 participants from 5 sites (location: China, United States, and Germany) to build a linear support vector machine that discovered important neuroanatomical biomarkers of patients with schizophrenia and find robust generalizability of these biomarkers across different sites. Zeng et al. (59) cross-validated deep learning models from 7 sites located in both China and the United States; and found reliable connectome patterns of schizophrenia across independent sites. The above studies did both pooling classification and leave-site-out validation and obtained high classification accuracy (AUC around 0.8). These cross-site validation methods may transfer to the field of depression disorders to construct predictive models and increase the generalizability of the predictive model across the world.

The study is also lacking longitudinal follow-up because the epidemic in China from the outbreak to the control happened quickly. As the global epidemic is prolonged, depression predictions that focus on the longitudinal progression patterns among healthcare workers are worth exploring. Hence, more longitudinal survey “waves” should be carried out to capture time-series information on potential risk predictors. Su et al. (60) did 5 waves of the same survey that aimed to develop machine learning predictive models on depression symptoms among elderly people. The survey contains the exact same categories of questions such as demographics and health-related risk factors. The long short-term memory model was used to predict the values of predictors in the next 2 years, then 6 machine learning models were applied to make depression symptoms predictions. The novelty of longitudinal survey study is it allows machine learning models to merge and characterize the complex interaction between time patterns and predictors. Such successful capture of correlation between static data (predictors) and dynamic data (time) can extend the prediction scope from real-time outcome prediction to outcome’s future tendency prediction. If the same longitudinal survey could be done for healthcare workers, it will give researchers opportunities to learn about future depression tendencies influenced by COVID-19 and the progression mechanism between important predictors and depression symptoms in the flow of time.

Last but not the least, future application of machine learning models in predicting depression symptoms in general diagnostic settings remains unclear. Doctors may still prefer making diagnostic decisions based on more traditional criteria. The “black box” nature of machine learning algorithms is sometimes difficult to interpret irrelevant psychological factors. It should

also be recognized that the rule played by the machine learning-based predictions model is the decision support system. Machine learning-based predictions model can capture valuable predictors out of high dimensional information provided to psychiatrists and doctors at the outbreak of public health emergency.

CONCLUSION

This study shows that machine learning prediction models are suitable for making mentally at-risk healthcare worker predictions in a public health emergency setting. As the COVID-19 pandemic change the way people live and work: minimal contact, strict working condition, and growing media influences; the “psychological first aid” can be focused on preparing immediate noncontact psychological consulting material (both paper-based and media-based); and controlling media consumption time avoiding information overload. The application of machine learning models could support hospitals’ and healthcare workers’ decision-making on early psychological interventions and proper mental health management. Further study of machine learning models predicting high-risk depression symptoms among healthcare workers in cross-site validation is warranted.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

All study participants provided informed consent, and the study design was approved by the Institutional Review Board at Renmin Hospital of Wuhan University (No. WDRY2020-K004). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

BXY and ZL have full access to all the data in the study, take data analysis, and supervision. ZZ and DL: conceptualization, methodology, and writing-original draft. ZZ: software and validation. DL, BXY, and ZL: writing-reviewing and editing. All authors approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2022.876995/full#supplementary-material>

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COVID-19 Worry and Mental Health Among the Economically Active Population in Guangdong, China

Xin Yong¹ and Li Zhang^{2*}

¹ School of Public Administration, Xiangtan University, Xiangtan, China, ² School of Economics and Trade, Hunan University, Changsha, China

Background: The rapid spread of the coronavirus disease 2019 (COVID-19) pandemic has caused people to worry, which has affected their mental health. This study aimed to access the impact of COVID-19 worry on the mental health of the economically active population (EAP) in a province of China.

Methods: An online cross-sectional survey study was conducted during an outbreak of COVID-19 in Guangdong, China. The survey used the 12-item General Health Questionnaire (GHQ-12) to evaluate participants' mental health status and was completed by 1,584 of the 1,708 participants (a response rate of 92.74%). Ordinary least squares (OLS) regression models were used to identify the correlation between COVID-19 worry and mental health.

Results: Approximately 42.05% of participants reported that they were very worried or extremely worried about the COVID-19 pandemic. COVID-19 worry was negatively correlated with mental health ($p < 0.01$) and exhibited a stronger influence on the mental health of participants who were male, younger (aged 16–45), or unemployed than on the mental health of participants who were women, older (aged over 45), or employed.

Conclusion: The findings suggest that COVID-19 worry has generated new inequalities in mental health among the EAP of China. The government should provide more public reassurance and psychological support to the EAP to mitigate the effects of COVID-19 worry and prevent mental health disorders.

Keywords: COVID-19 pandemic, worry, mental health, economically active population, GHQ-12

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*Correspondence:

Li Zhang
lizhangeco@hnu.edu.cn

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INTRODUCTION

Coronavirus disease 2019 (COVID-19), which is caused by a serious infection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), originated in Wuhan, China, at the end of December 2019, and rapidly spread to become a nationwide epidemic and thereafter a global pandemic. The Chinese government has adopted a “zero tolerance” policy in efforts to contain the pandemic, including the use of severe measures, such as abrupt lockdowns of cities and strict home quarantine. For example, Wuhan implemented a strict travel ban, and its 11 million residents were locked down on January 23, 2020, for more than 2 months. These measures have been effective in keeping rates of infection and mortality at a low level. As of 30 August 2020, mainland China had reported 85,048 confirmed cases and 4,634 deaths.¹

¹ China National Health Commission. The latest situation of COVID-19 as of 24:00 on August 30 [in Chinese]. August 31, 2020, available at http://www.gov.cn/xinwen/2020-08/31/content_5538643.htm

However, these stringent pandemic-control rules have had a major adverse impact on the economy and individuals' daily lives. In the first half of 2020, the gross domestic product (GDP) of China shrank by 1.6%,² which was the first contraction since the end of the Cultural Revolution in 1976. In addition, many people in China have experienced employment problems, such as (threats of) job loss, a reduction in their incomes, and/or working hours, and less regular work patterns. In this context, despite the incidence of COVID-19 being relatively low in China, it is possible that the shock to the economy and people's livelihoods may have created a general state of COVID-19 worry in many people.

Worry is defined as a series of uncontrolled thoughts that elicit negative feelings and a high level of anxiety and distress, which are linked to the fear of uncertain and probably undesirable outcomes (1). Several studies have found that COVID-19 worry has been a key cause of psychological distress during the pandemic, and a higher level of worry has been linked to a higher likelihood of mental health problems (2–6). According to a nationwide survey in the United States in late March 2020, ~45% of respondents reported that COVID-19 worry had a negative effect on their mental health (7). Similarly, in the United Kingdom, COVID-19 worry was found to be significantly associated with psychological distress (6). An online study on Russian-speaking healthcare workers also found that the increase in anxiety concerns about COVID-19 was associated with an increase in psychological distress (8). Moreover, it has been determined that even in regions with low rates of SARS-CoV-2 infection, COVID-19 worry significantly contributes to a general population's worsened mental health (9–11). As an illustration, a recent study in Hong Kong showed that compared to individuals who were less worried about COVID-19, those who were more worried about COVID-19 were more likely to have mental health problems (10). Similarly, Chan et al. (11) found that worries about being infected with SARS-CoV-2, and about the economy, their livelihoods, and their families' financial situation, had strong negative effects on the mental health of individuals in Hong Kong during the pandemic (11).

Furthermore, previous studies have reported that the effect of COVID-19 worry on mental health might vary between social groups with different demographic characteristics and economic statuses. In particular, sex, age, and socioeconomic status have been determined to be key factors mediating the impact of COVID-19 worry on mental health (2, 9, 12, 13). First, some studies have shown that women are more likely than men to suffer mental health problems due to COVID-19 worry (2, 14). For instance, a recent study in Norway found that COVID-19 worry can partially explain why women reported experiencing more psychological distress than men during the pandemic (2). A similar finding emerged from a survey of university students in Germany: that the mental well-being of female students was more adversely affected than that of male students' by concerns about the future in the pandemic (14). Second, there is evidence

that the effect of COVID-19 worry on mental health is more significant among younger people than older people (13, 15–17). For example, based on a nationwide survey in the United States, Wilson et al. (13) found that COVID-19 worry was significantly positively associated with psychological distress in younger adults (aged 18–49), but not significantly associated with psychological distress in older adults (aged 50 and older) (13). Additionally, a study in Canada found that compared to older people (aged over 35), younger people (aged 15–34) reported more COVID-19 worries and had more maladaptive health habits, and therefore had a lower level of mental well-being (17). Third, the mental health of individuals with low socioeconomic status is more likely to be negatively affected by COVID-19 worry than that of those with higher socioeconomic status (6, 9). This is explained by the fact that compared to socioeconomically advantaged individuals, socioeconomically disadvantaged individuals (such as unemployed people) have less access to resources (such as financial resources and social support) (2), and therefore are more vulnerable to negative effects of the pandemic on the economy, their daily lives, and their physical/mental health (9).

Although many studies have analyzed the correlations between COVID-19 worry and mental health, most have focused on the general population and healthcare workers (e.g., 2–6) rather than on the economically active population (EAP). The study of Chan et al. (11) was an exception, as their online survey in Hong Kong revealed that compared to the economically inactive population, the mental health of the EAP was more likely to be negatively affected by COVID-19 worry (11). However, they did not further examine the heterogeneity of the effect, and thus did not examine whether COVID-19 worry has varying effects on the mental health of different groups within the EAP.

Based on the above findings, we posit that although China has effectively controlled the spread of SARS-CoV-2, COVID-19 worry may nevertheless indirectly affect the mental health of the EAP. Moreover, the pandemic has diverse effects on individuals' employment, and income is divergent. For example, although the COVID-19 pandemic and the government's response to it have harmed China's economy in general, they have boosted platform economy development by increasing demands for online services (18). Therefore, while some groups within the EAP have faced the problems of job loss, or reductions in working hours and income, platform workers have generally experienced increased employment opportunities and incomes. There is therefore an urgent need to explore the varied impacts of COVID-19 worry on the mental health of various groups within the EAP.

This study examines the correlations between COVID-19 worry and the mental health of the EAP in Guangdong province, China. The EAP comprises employed, self-employed, and unemployed people who are seeking employment, and not the economically inactive population, such as students, retired persons, and homemakers. Specifically, this study aims to determine the validity of the following hypotheses.

H1. COVID-19 worry has an adverse effect on the mental health of the EAP.

H2. Sex mediates the effect of COVID-19 worry on the mental health of the EAP: COVID-19 worry has a more adverse effect on the mental health of women than on that of men.

²National Bureau of Statistics of China. *The semi-annual report on China's economy in 2020* [in Chinese]. July 16, 2020, available at <http://www.gov.cn/zhuanti/2020zgjjbnnb/index.htm>

H3. Age mediates the effect of COVID-19 worry on the mental health of the EAP: COVID-19 worry has a more adverse effect on the mental health of younger age groups

H4. Economic activity status mediates the effect of COVID-19 worry on the mental health of the EAP: COVID-19 worry has a more adverse effect on the mental health of unemployed individuals than on that of (self-)employed individuals.

H5. Occupation type mediates the effect of COVID-19 worry on the mental health of the EAP: COVID-19 worry has a less adverse effect on the mental health of platform workers than on that of other employees.

METHODS

Participants and Procedure

A cross-sectional study was conducted among the EAP in Guangdong province from 1 August to 30 September 30, 2020. Guangdong is the most flourishing and wealthy province in China and had a population of ~126 million in 2020.³ The first confirmed case of COVID-19 in Guangdong province was announced on 19 January 2020. As of 23 August 2020, Guangdong province had reported a total of 1,727 confirmed cases of COVID-19.⁴ Although rates of SARS-CoV-2 infection have been relatively low compared to some Western countries, the strict pandemic control rules have significantly affected the economy. In the first half of 2020, the GDP of Guangdong fell by 2.5% year-on-year.⁵

The eligibility criteria were (1) currently living in Guangdong, (2) aged 16 or older, and (3) employed, self-employed, or unemployed but seeking employment. An anonymous online questionnaire was distributed, and ~1,708 were completed by participants. After deleting incomplete responses, we obtained a total of 1,584 valid questionnaires (a response rate of 92.74%).

The respondents comprised 851 (53.72%) men and 733 (46.28%) women. In total 1,067 (67.36%) were aged 16–35, 267 (16.86%) were aged 36–45, and 250 (15.78%) were aged 46–70. Most of the respondents (59.09%) held rural *hukou* (household registration),⁶ and 53.03% were unmarried. The majority of participants (60.41%) reported that they were healthy. Moreover, 967 (61.04%) were employees (other than platform workers), 193 (12.18%) were platform workers, 254 (16.04%) were self-employed, and 170 (10.73%) were unemployed. The average

per capital monthly family income was 2,536.68 RMB (~402.54 USD). The average income of the respondents constituted 43.92% of their total household income.

Measurements

Worry About COVID-19

Because of the repeated COVID-19 outbreaks at a time when no vaccines or effective medicines were available, there was a widespread worry that the effects of the COVID-19 pandemic would be long-lasting and uncontrollable (19). Given this context, COVID-19 worry was measured by asking “How worried are you that the COVID-19 pandemic cannot be contained?” Responses ranged from 1 (*not at all worried*) to 5 (*extremely worried*).

Mental Health

Participants’ mental health, the focal-dependent variable of this study, was measured using the Chinese 12-item General Health Questionnaire (GHQ-12), which is commonly used to screen for mental health problems (20–22). The questionnaire comprised of 12 items that assess respondents’ anxiety and depression symptoms (e.g., “I have lost much sleep due to worry” and “I always feel stressed”), social dysfunction (e.g., “I am able to concentrate when doing things” [reverse coded]), and loss of confidence (e.g., “I have been thinking I am a worthless person”) (23). Each item was graded on a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*much more/less than usual*). We used the “0-0-1-1” scoring method to sum the item scores (24) into a score scale ranging from 0 to 12. A higher score on the GHQ-12 indicates poorer mental health (24).

Sociodemographic Factors

We collected the participants’ basic sociodemographic information, such as age, sex, marital status, number of children, years of education, *hukou* status, per capita monthly household income, and the proportion of their income in total household income. We also recorded the participants’ current economic activity status, such as employees (other than a platform worker), platform worker, self-employed, and unemployed but seeking employment.

Lifestyle Factors

We collected information on health-related aspects of the participants’ lifestyles, namely the frequencies of drinking alcohol and smoking. In addition, we recorded participants’ perceived health status and whether or not the participant was living alone (Yes = 0, No = 1).

Statistical Analyses

First, descriptive statistics were generated for the sample. Second, we ran ordinary least squares (OLS) regression models to account for covariates. Third, we examined the heterogeneity of the effect of COVID-19 worry on the mental health of our sample of the EAP.

³Nanfang Daily. *The resident population of Guangdong reached 126 million, with an increase of 21.71 million in 10 years* [in Chinese]. May 12, 2021, available at http://www.gd.gov.cn/gdywdt/bmdt/content/post_3279829.html

⁴Guangdong Provincial Health Commission. *COVID-19 situation in Guangdong province on August 24, 2020* [in Chinese]. August 24, 2020, available at: http://www.gd.gov.cn/gdywdt/zwzt/yqfk/qktb/content/post_3070994.html

⁵Guangdong Provincial Bureau of Statistics. *The economy of Guangdong in the first half of 2020* [in Chinese]. July 20, 2020, available at: http://www.gd.gov.cn/zwgk/sjfb/sjxk/content/post_3047584.html

⁶*Hukou* is a household registration system used in mainland China. It records a person’s residency as agricultural (rural *hukou*) or non-agricultural (urban *hukou*). The *hukou* system has been a major source of social inequality; for example, employees holding urban *hukou* have generally received more labor protection and social welfare (such as pensions and health care) than their counterparts holding rural *hukou*. In this study, the *hukou* variable was coded as a dummy (rural = 0, urban = 1). As shown in **Table 1**, the mean *hukou* was 0.409, which means that 40.9% of respondents held urban *hukou* and 59.1% held rural *hukou*.

TABLE 1 | Statistics of the variables.

Variables	Obs.	Mean	Std. Dev.	Min	Max
Mental health	1,584	1.441	1.912	0	10
COVID-19 worry	1,584	3.262	1.170	1	5
Sex	1,584	0.463	0.499	0	1
Age	1,584	32.203	10.622	16	70
Hukou	1,584	0.409	0.492	0	1
Years of education	1,584	12.310	3.130	0	19
Number of children	1,584	0.833	1.056	0	5
Per capita monthly household income	1,584	2,536.676	2,196.731	83.333	8,333.333
Proportion of respondent's income in total household income	1,584	43.917	25.360	0	100
Economic activity status	1,584	1.726	1.043	1	4
Drinking alcohol	1,584	1.259	0.499	1	3
Smoking	1,584	1.525	0.965	1	4
Living alone	1,584	0.770	0.421	0	1
Perceived health	1,584	1.466	0.624	1	3

MODEL SPECIFICATION

The empirical model presented here examines the correlations between COVID-19 worry and the mental health of our EAP sample. In the model, the GHQ-12 mental health score is the explained variable, and COVID-19 worry is the key explanatory variable. Sociodemographic and lifestyle characteristics are included as control variables. The equation is as follows:

$$\text{mental health}_i = \alpha + \beta \text{worry}_i + \gamma V_{id} + \delta V_{il} + \varepsilon_i$$

where the subscript i refers to individuals within the EAP, V_{id} are sociodemographic variables, V_{il} are lifestyle variables, and ε is a random error term. The summary statistics for the variables are presented in Table 1.

RESULTS

Descriptive Data on GHQ-12 Score and COVID-19 Worry of the Participants

Table 2 reports the means and standard deviations (SDs) of the GHQ-12 mental health scores for each sociodemographic category. In the total sample, the average GHQ-12 score was 1.44. Regarding COVID-19 worry, only 6.75% of participants reported that they were “not at all worried” about the containment of the pandemic; 20.39% reported they were “not very worried,” 30.81% reported they were “moderately worried,” 23.99% reported they were “very worried,” and 18.06% reported they were “extremely worried.” Therefore, COVID-19 worry was widespread among our sample of the EAP in Guangdong province. Furthermore, the descriptive statistics show that participants who were “very worried” or “extremely worried” had higher GHQ-12 mental health scores (see Table 2).

Correlation Between COVID-19 Worry and Mental Health of the Participants

Table 3 presents the factors influencing the participants' mental health. Model 1 includes the variables of COVID-19 worry and mental health. Models 2 and 3 also include sociodemographic or lifestyle variables, respectively. In Model 1, a significant association between COVID-19 worry and GHQ-12 mental health score was observed. Moreover, the coefficients and significance levels of the COVID-19 worry variable were similar in Models 2 and 3. Specifically, the coefficients of COVID-19 worry were 0.251, 0.224, and 0.221 in Models 1, 2, and 3, respectively (all $p < 0.01$). Therefore, the regression results support H1, that is, COVID-19 worry has an adverse effect on the mental health of the EAP.

Other Factors Associated With the Participants' Mental Health

As shown in Table 3, age, family economic burden (the percentage of total family income that is an individual's income), current economic activity status, number of children, frequency of drinking alcohol, and self-perceived health status were strongly correlated with mental health. First, the coefficient of age was -0.020 ($p < 0.01$), indicating that age had a significant positive association with mental health. Second, as expected, the family economic burden had a negative relationship with mental health ($p < 0.001$). That is to say, if a family economy is highly dependent on the income of the respondent, the respondent is more likely to have mental health problems during the pandemic. Third, the mental health of participants who were employees was significantly worse than that of participants who were self-employed ($p < 0.05$) but better than that of participants who were unemployed persons ($p < 0.05$). Fourth, having more children was positively correlated with mental health. Fifth, those who consumed alcohol at least twice a day were more likely to have

TABLE 2 | The GHQ-12 mental health scores for each sociodemographic category.

	Sample size	Mean	Std. Dev.
Total	1,584	1.441	1.911
COVID-19 Worry			
Not worried at all	107	1.327	2.086
Not very worried	323	1.108	1.667
Moderately worried	488	1.264	1.820
Very worried	380	1.444	1.834
Extremely worried	286	2.157	2.166
Sex			
Male	851	1.461	1.886
Female	733	1.417	1.941
Age			
16–35	1,067	1.644	2.021
36–45	267	1.262	1.740
46–70	250	0.764	1.351
Hukou			
Rural hukou	936	1.362	1.841
Urban hukou	648	1.555	2.004
Educational level			
Junior high school or below	423	1.184	1.705
Senior high school	543	1.383	1.844
College/university degrees or above	618	1.668	2.072
Number of children			
Unmarried	840	1.677	2.044
Zero or one	268	1.485	1.914
Two or more	476	1.000	1.561
Frequency of drinking			
Less than once a month	1,219	1.408	1.880
Once a month to twice a day	320	1.462	1.918
More than twice a day	45	2.177	2.507
Smoking			
Do not smoke.	1,190	1.447	1.913
Started smoking in the past year.	60	1.800	1.981
Have smoked for more than 1 year.	231	1.259	1.794
Had quit smoking.	103	1.572	2.084
Perceived health status			
Very healthy	957	1.289	1.850
Moderately healthy	516	1.529	1.886
Not healthy	111	2.342	2.258
Economic activity status			
Employees (other than platform workers)	967	1.462	1.955
Platform workers	193	1.450	1.811
Self-employed	254	1.102	1.541
Unemployed but seeking employment	170	1.817	2.185

psychological distress than those who consumed alcohol less than once a month ($p < 0.05$). Finally, compared to participants who perceived themselves as healthy, those who perceived themselves as not healthy were more likely to have poorer mental health ($p < 0.01$).

Group Comparison

To examine the heterogeneity of the effect of COVID-19 worry on the mental health of the EAP, we divided the entire sample into subgroups by sex, age, and economic activity status. **Table 4** reports the regression results by sex. COVID-19 worry was strongly correlated with both men's and women's mental health (both $p < 0.01$). Contrary to our expectations, however, we found the coefficient of the COVID-19 worry variable was larger for male (0.264) than for female (0.173) participants, indicating that COVID-19 worry had a more adverse effect on the mental health of men than on that of women. Therefore, H2 was rejected.

Table 5 presents regression results of the subgroups of participants who were aged 16–35, 36–45, and 46–70. COVID-19 worry was strongly correlated with mental health in the 16–35-year-old group ($p < 0.01$) and the 36–45-year-old group ($p < 0.05$) but was not correlated with mental health in the 46–70-year-old group ($p > 0.1$). This result supports H3. Consistent with previous studies, we found that COVID-19 worry had a significantly adverse effect on the mental health of the younger age-groups but not on that of the older group.

Table 6 shows the regression results of the subsamples of participants who were employees (other than platform workers), platform workers, self-employed, or unemployed. COVID-19 worry was strongly correlated with the mental health of participants who were employees ($p < 0.01$) or unemployed ($p < 0.05$), with coefficients of 0.277 and 0.324, respectively. This implies that COVID-19 worry had a more adverse effect on the mental health of participants who were unemployed than on that of those who were employees. Hence, the results support H4. We also found that COVID-19 worry was not correlated with the mental health of participants who were platform workers, which supports H5.

DISCUSSION

This study examined how COVID-19 worry affected the mental health of a sample of the EAP in Guangdong province, China. We found that there was widespread worry about the containment of COVID-19 during the pandemic. Approximately 42.05% of the participants reported being “very worried” or “extremely worried” about the pandemic. The overall level of COVID-19 worry in the present study was similar to some previous findings in Greater China. For example, an online survey in Taiwan found that 51.7% of respondents reported high levels of worry about COVID-19 in April 2020 (25). Additionally, a survey in Hong Kong from late April to early May 2020 showed that 57.6% of respondents reported they are worried about the COVID-19 pandemic (9). During the early stage of the pandemic, effective vaccines were absent, and new outbreaks may occur at any time, which contributed to the high level of worry related to COVID-19. Moreover, as predicted, we found that compared to participants who were less worried about the containment of the pandemic, those who were more worried about the containment of the pandemic had higher GHQ-12 mental health scores, suggesting that COVID-19 worry was negatively correlated with mental health. This finding reveals that even in countries with

TABLE 3 | Effect of COVID-19 worry on the mental health of EAP.

Variables	Model 1		Model 2		Model 3	
	β (SE)	t	β (SE)	t	β (SE)	t
COVID-19 worry	0.251** (0.041)	6.173	0.224** (0.041)	5.499	0.221** (0.040)	5.457
Female (Male = 0)			0.008 (0.100)	0.079	−0.054 (0.111)	−0.476
Age			−0.020** (0.007)	−2.908	−0.020** (0.007)	−2.911
Urban Hukou (Rural Hukou = 0)			0.119 (0.097)	1.221	0.151 (0.097)	1.556
Years of education			0.002 (0.019)	0.125	0.003 (0.019)	0.186
Number of children			−0.173* (0.068)	−2.565	−0.144* (0.068)	−2.130
ln(per capita monthly household income)			−0.071 (0.056)	−1.273	−0.123 (0.064)	−1.926
Percentage of the respondent's income in total household income			0.008** (0.002)	4.072	0.008** (0.002)	3.925
Self-employed			−0.259 (0.134)	−1.929	−0.280* (0.134)	−2.092
Platform workers			0.059 (0.151)	0.392	0.065 (0.149)	0.432
Unemployed			0.401* (0.159)	2.521	0.343* (0.158)	1.807
Drinking alcohol (less than once a month = 0)						
Once a month to twice a day					0.137 (0.126)	1.086
More than twice a day					0.649* (0.285)	2.277
Smoking (do not smoke=0)						
Started smoking in the past year					0.109 (0.254)	0.431
Have smoked for more than 1 year					−0.039 (0.158)	−0.247
Had quit smoking					0.216 (0.200)	1.081
Not living alone (Living alone = 0)					−0.153 (0.135)	−1.139
Perceived health (Healthy=0)						
Moderately healthy					0.165 (0.102)	1.623
Not healthy					0.981** (0.186)	5.285
Constant	0.624** (0.141)	4.434	1.564** (0.552)	2.835	1.902** (0.631)	3.014
Observations		1,584		1,584		1,584
R-squared		0.024		0.068		0.091

Significance level, ** $p < 0.01$, * $p < 0.05$.

very low infection rates, the COVID-19 pandemic may still negatively affect the mental health of EAPs *via* worry. Echoing prior studies (6, 26), this study shows that COVID-19 worry placed an additional psychological burden on the EAP.

This study further reveals that the correlation between COVID-19 worry and mental health was heterogeneous across different demographic groups. For example, although COVID-19

worry had a significantly adverse effect on the mental health of both men and women, this adverse effect was greater in men. This finding is not consistent with previous studies of sex differences in Norway and Germany, which have found that women were more affected by COVID-19 worry (2, 14). This inconsistency may be attributable to the more traditional roles of the sexes in China, where there has been a resurgence of the

Confucian patriarchal tradition (27). In Chinese society, men are supposed to shoulder most of the responsibility to support their families and secure family-wage employment (28). Thus, in the context of economic uncertainty, worrying that the COVID-19 pandemic would not be controlled might have created more of a psychological burden for men than for women. In addition, this study shows that COVID-19 worry was significantly associated with worse mental health in younger people (aged 16–45) but was not significantly associated with worse mental health in older people (aged 46–70). This finding echoes most of the literature data, which has shown that compared to younger people, older people are more experienced in regulating their emotions (29) and using more effective adaptive strategies (16), and are thus less likely to be negatively affected by worry about the consequences of COVID-19 (13, 17, 30).

TABLE 4 | Effect of COVID-19 worry on mental health, by gender.

Variables	Men		Women	
	β (SE)	t	β (SE)	t
COVID-19 worry	0.264** (0.056)	4.728	0.173** (0.059)	2.925
Constant	1.261 (0.857)	1.472	2.393* (0.960)	2.493
Observations	851		733	
R-squared	0.118		0.097	

Significance level, ** $p < 0.01$, * $p < 0.05$.

TABLE 5 | Effect of COVID-19 worry on mental health, by age.

Variables	16–35		36–45		46–70	
	β (SE)	t	β (SE)	t	β (SE)	t
COVID-19 worry	0.280** (0.053)	5.319	0.183* (0.091)	2.016	0.041 (0.079)	0.516
Constant	0.413 (0.788)	0.524	4.494** (1.514)	2.968	1.241 (1.110)	1.118
Observations	1,067		267		250	
R-squared	0.081		0.126		0.130	

Significance level, ** $p < 0.01$, * $p < 0.05$.

TABLE 6 | Effect of COVID-19 worry on mental health, by employment status.

Variables	Employees		Platform workers		Self-employed		Unemployed	
	β (SE)	t	β (SE)	t	β (SE)	t	β (SE)	t
COVID-19 worry	0.277** (0.054)	5.105	0.088 (0.110)	0.799	0.149 (0.081)	1.851	0.324* (0.137)	2.357
Constant	0.904 (0.822)	1.101	1.545 (1.585)	0.975	1.953 (1.214)	1.609	2.400 (2.125)	1.129
Observations	967		193		254		170	
R-squared	0.083		0.105		0.121		0.230	

Significance level, ** $p < 0.01$, * $p < 0.05$.

By comparing groups with different economic activity statuses, this study also reveals that there was heterogeneity in the effect of COVID-19 worry on the mental health of the EAP. As hypothesized, COVID-19 worry was more strongly associated with worse mental health in participants who were unemployed than in those who were employed or self-employed. This is consistent with the fact that compared to employed people, unemployed people generally face more financial hardship and livelihood insecurity and are thus more vulnerable to the negative consequences of COVID-19 worry. This result is in line with previous findings in South Africa, Bangladesh, and the United States, which showed that adults who kept their paid employment during the COVID-19 pandemic are less likely to have mental health problems than those who lost their jobs (31–33). In addition, although the COVID-19 worry was negatively correlated with the mental health of self-employed persons, the correlation was not statistically significant ($p > 0.05$). This finding may be attributable to the fact that self-employed people in China usually own certain means of production, such as small shops or a piece of farmland, which gives them a relatively higher capacity than employees to sustain their livelihoods under economic uncertainty. Interestingly, we found that COVID-19 worry did not have a significant effect on the mental health of platform workers. This finding is reasonable because with the burgeoning of the platform economy during the pandemic, the employment and incomes of platform workers were generally stable or improved, which may have buffered the negative effect of COVID-19 worry on their mental health. Therefore, we argue that COVID-19 worry created new inequalities in mental health among the EAP.

CONCLUSION

Based on an online survey in Guangdong province, this study found that despite the low rates of SARS-CoV-2 infection in mainland China, there was widespread worry among the EAP about the containment of the COVID-19 pandemic, and that this worry negatively influenced their mental health. The adverse effect of COVID-19 worry on mental health was greater among men, younger individuals (aged 18–45), and unemployed persons. One key policy implication of the present study is that in addition to material support, governments should

provide more public reassurance and psychological support to the EAP (especially younger people, men, and unemployed persons) to help them cope with COVID-19 worry, as this will diminish the negative impacts of the pandemic on their mental well-being.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Committee of the South China Normal University. Written informed consent for participation

was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

XY conceptualized the study, interpreted the data, and wrote the initial draft of the manuscript. LZ contributed to the study design, data analysis and interpretation, and the drafting of the manuscript. Both authors have critically revised and approved the final draft of the manuscript.

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The COVID-19 Impact and Culture Nexus in Japan: Insights for the Global Community

Cornelius B. Pratt^{1,2*} and Ronald Lee Carr³

¹ Communication Psychology and Application Research Center, Northwest University of Politics and Law, Xi'an, China, ² Lew Klein College of Media and Communication, Temple University, Philadelphia, PA, United States, ³ Department of Communication Studies, Temple University Japan, Tokyo, Japan

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INTRODUCTION

This opinion column identifies and reflects on the defining moments in Japan's sprint toward acquiring herd immunity by the end of 2021. As of this writing, COVID-19 conversations across the globe are becoming less and less concerning, as wealthy nations ramp up testing and triple-vaccinate their citizens, as COVID-19-related infection and hospitalization rates fall significantly, or, as is the case of the less developed countries of the Global South, concerted efforts are being made to have a sizable number of residents tested for COVID-19 and inoculated with their first shot. In developed economies, the pendulum of healthcare uneasiness is pivoting toward a simple issue—endemicity—as governments ease or phase out COVID-19 restrictions, as the disease is increasingly being viewed through the lens of, say, the seasonal flu, and as agitation against COVID-19 mandates leads to protests in countries such as the Netherlands, France and Canada. The world will get by, the argument goes, by coexisting with COVID-19 as it does with a host of other diseases, including the seasonal influenza, dengue, and malaria. But applying such a view now to the pandemic may be inadvisable, as Tedros Adhanom Ghebreyesus, director general of the World Health Organization, asserts:

"We're concerned that a narrative has taken hold in some countries that because of vaccines, and because of Omicron's high transmissibility and lower severity, preventing transmission is no longer possible and no longer necessary. Nothing could be further from the truth. More transmission means more disease (1)."

But the world need not have been so ravaged by the pandemic only if it had looked around to remind itself about commonsensical steps that could have been considered in response.

REFLECTIONS ON DEFINING OUTCOMES

In this opinion, we reflect on some of the defining actions that steered the island nation toward managing effectively its own response to COVID-19. To do so, we consider insights into tactical and sociocultural perspectives on that question. We consider factors that can serve as an eye-opener to the international community in its battle against a global scourge. But, first, a backdrop on some of the key issues that have bedeviled the public-health community.

As of March 31, 2022, worldwide, there were more than 485 million cases of COVID-19 and more than 6.14 million deaths from it, making it a major global health issue. In Japan, the effects of COVID-19 are not limited to clinical settings; the disease has had clear implications for the country's political outcomes. Yoshihide Suga, Japan's former prime minister, left office in just 1 year, following criticisms leveled at his government for its initially slow rollout of

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Iran University of Medical
Sciences, Iran

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*Correspondence:

Cornelius B. Pratt
cbpratt@temple.edu

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COVID-19 vaccines, the resulting spikes in COVID-19 infections, and the fallout from his government's refusal to approve compensation for economic injury suffered by furloughed workers because of a slump in the business sector. In national elections held early in October 2021, his successor, Fumio Kishida, of the same Liberal Democratic Party, won a clear majority in Japan's lower, more powerful parliamentary chamber, signaling a refreshing resolve by Japan to reduce significantly chances for any uptick in the spread of the coronavirus, thus placing the country firmly on a trajectory toward achieving herd immunity.

Japan was mired in disputes over hosting the summer 2020 Olympic Games. The cost of hosting the rescheduled games, estimated at nearly \$14 billion, loomed large on the minds of both the Japanese public, who were excluded from all spectator stands at the games, and of the organizers. About 1 week to kickoff, 78% of respondents in Japan thought COVID-19 concerns justified postponing the games at the very least (2), even as additional questions were raised on what the new COVID-19 precautions, the 1-year postponement of the games, and the atmospheric-ocean dynamics in Tokyo in summer 2021 will “mean for preparedness efforts for the athletes, coaches, clinicians, and volunteers (3).” Months before the start of the games, Japan had such low caseloads of COVID-19 infections that some European countries looked languid in their strategic responses to the virus.

As of this writing, with more than 75% of its population having received the second dose of COVID-19 vaccine, and with more than 33% having received a booster shot, the 45,112 average daily new infection cases are still among the lowest among industrialized nations, justifying concluding that Japan now has herd immunity, which occurs when a large enough segment of a population becomes immune to a disease, making its spread less likely.

COVID-19 deaths per capita, by country, show Japan has the lowest rate among industrialized countries, except New Zealand, whose modest casualty statistics—28 deaths and 5.69 deaths per million inhabitants (2, 4)—offer the global community some reassurance of the possibility of nixing a vexing health issue. As of February 2022, Japan had more than 3.3 million confirmed cases, 19,341 deaths, 144.5 deaths per million inhabitants (or 14.47 per 100,000). Statistics from the Ministry of Health, Labor and Welfare show that while Japan's number of newly confirmed daily cases has risen to an average of 89.489 in February 2022, the number of severe cases has dropped by half compared to the number in September 2021 (5). Another reassuring trend is in the comparison of the age of positive cases with that of severe cases and morbidity: As of February 2022, the highest age range for new COVID-19 cases for males and females was 20–29 years, yet, the highest number of severe cases and mortality was among males older than 70 years. Among Japanese children, the trends have also been encouraging: During the Delta wave (August–September 2021), the number of children (1.4% of COVID-19 admissions to intensive care units) treated for COVID-19 infections was 14 times higher than was the case before the Delta surge between October 2020 and May 2021 (6). During periods before and

after the Delta wave, there were no reported deaths among infected children.

In comparison, the United States has much higher rates of severe cases and mortality among children. During 2 weeks, January 27, 2022, through February 10, 2022, there was an 8.2% increase in the cumulative number of child COVID-19 cases since the beginning of the pandemic, and that in states reporting, between 0.00% and 0.01% of all child COVID-19 cases resulted in death (7). Comparatively, Japan has actively managed the impact of the coronavirus on children and young adults.

Early in the pandemic, Japan used a cluster-focused approach based on its understanding of the transmission of the virus. This approach revealed “that in most cases a majority of patients did not infect others, but that a limited number of cases caused more than five secondary cases, forming clusters (8).” The government used those clusters to learn more about environmental risk factors and behaviors, to track down unidentified cases, to issue public warnings about transmissions, and to justify publicly its campaign slogan against gatherings—that is, urging the public to eschew “closed, crowded spaces with close-contact (the three Cs).”

That strategy to mitigate viral transmission in the population seemed effective. However, a concerning reality of COVID-19 has been the fragility of public-health systems, particularly those in developed economies, even as their resilience has never been in doubt. At the peak of the incidence of COVID-19 in Japan, for instance, it lagged most other developed nations in terms of the percentage of its citizens who had received at least one shot of any vaccine against the virus. Underpinning that vaccination drive is the uneven global access to vaccines, a situation the World Health Organization described in September 2021 as unacceptable.

FIVE CONTRIBUTORY FACTORS

In this column, we reflect on five factors that have contributed to pivoting the country on a trajectory toward accomplishing the much-desired herd immunity to the disease—indicating a bold attempt by Japan to nudge itself back on track, following a few missteps, toward acquiring herd immunity.

One of the challenges of global efforts toward reaching herd immunity in the battle against COVID-19 is encouraging—if not persuading—the public to take a significant, yet a simple, step: get inoculated. Reflecting on the role of five factors in Japanese society can help public-health experts demystify the undercurrents of Japan's successful race to herd immunity. The first of such forces is the government's clear, consistent, forthright public announcements on an antidote to the health crisis. (To ensure consistency in COVID-19 messaging, only the national government, through the Ministry of Health, Labor and Welfare, makes countrywide announcements on the virus). For example, on June 8, 2021, Taro Kono, Japan's minister charged with managing COVID-19, delivered to the nation a 2 min, 21 s speech in which he said: “While side reactions, including localized pain and fever do occur, the government recommends that people get vaccinated because the

benefits of having the vaccine outweigh the drawbacks of side effects (9)."

Other national-government talking points, crafted to "provide the information clearly and precisely," use consistently the same two-word grammatical subject italicized here:

- *COVID-19 vaccines* are effective in reducing your risk of developing symptoms.
- *COVID-19 vaccines* will benefit you, as they are essential to reducing the burdens on medical institutions.
- *COVID-19 vaccines* will be available free of charge.
- *The Government* recommends that people get vaccinated because the benefits of vaccination are greater than the risk of side effects. (Minister Kono also used this talking point in his national broadcast on June 8, 2021.)
- *The Government* will continually confirm the safety of the vaccines and provide safety-related information.
- *The Government* is working in an all-out manner to expedite vaccinations.

In the United States, however, there is some inconsistency in COVID-19-related messages disseminated by the Centers for Disease Control and Prevention (CDC) (10). So much public concern had been expressed on the abstruseness of the U.S. federal government's COVID-related announcements that Ned Lamont, governor of Connecticut, said on national television on November 18, 2021: The "*CDC speaks Latin. I can't figure out who is eligible [for a booster shot], who's not eligible* (11)." As Simona Georgescu, a crisis communication expert, said, "... *the White House and CDC could have avoided what is now widely considered mixed messages and constantly changing recommendations that impacted public trust and potentially damaged public adherence to new guidelines and recommendations* (12)."

The second is the absence of media reportage of divisive misinformation and antithetical actions from publicly avowed anti-vaccine protesters. That absence at the media, audience and agitator levels may be a response to the absence of ukases and mandates—for example, on lockdowns and on vaccine inoculation—that have plagued several nations in both the Global North and the Global South. Moreover, it is plausible to conclude that such absence presents optics of cohesive, non-distractive messages about the efficacy of COVID-19 vaccines and why the public can benefit immensely from them.

The third reflects the enormous influence of Japanese organizational management patterns on its ability to sprint toward acquiring herd immunity. Japan's management style contributes to its organizational success. Open, primarily face-to-face communication minimizes communication barriers whereas interdepartmental cooperation and dependency guide action toward accomplishing goals, paving the way for operational effectiveness (13). As Fukuhara notes, the "Japanese people have a high group cohesiveness and tacit consensus with one another" (14), a norm that offers employees a sense of belonging to an organization; of superiors trusting and empowering employees to make decisions; and of management, including that in public administration, encouraging employees to act flexibly.

Thus, implementing a strategic plan can draw upon the resources ensconced in employee innovation. Regarding COVID-19 management tactics, on the one hand, the national government canceled public events and issued several states of emergency, but it did not have any strict lockdowns. On the other, its initial laissez-faire viral-control measures on domestic variants fueled local transmission and its "*reckless relaxation of the border... not only allowed powerful variants from abroad to enter the country but also led to the transfer of variants* (15)."

The fourth, which resonates with the preceding factor, is a combination of social harmony, cooperation and conformity, which, in Japan, is an important cultural virtue that may explain the country's overwhelming public support for, and compliance with, its COVID-19 vaccination program. Citizens are willing to sacrifice self-autonomy for the national good.

Even in countries with a widespread availability of vaccines, there has been a massive resistance to getting the jab. Japan is an exception, but not because of its collectivistic attribute. It must be noted here that, on the one hand, the common view that Japan is a collectivistic society whereas the United States is individualistic has not been empirically substantiated (16). On the other, consistent with modernization theory—which posits the rise of individualism in both Japan and the United States because of economic growth and modernization—collectivism, which subordinates individual goals to family, tribal, organizational or national goals, persists in highly developed East Asian societies such as modern Japan, posing a challenge to modernization theory (17). In response to the inconclusiveness of research findings on that sociocultural binary, Vignoles argues that, because that widely accepted binary culture seems oversimplified and is of limited value, emphasis should be placed on, say, defining concepts more precisely and expanding investigations of cultural identities and stereotypes (18).

The fifth is the public demonstration of how the national interest takes precedence over individual or tribal interest. As a matter of habit, the Japanese wear face masks during flu season to reduce their chances of infecting others rather than becoming infected. This act of preventing infections to others exemplifies the selfless behaviors of the Japanese, contributing to the low number of COVID-19 cases and related fatalities. Japan's approach to catastrophes such as the March 11, 2011, triple-disaster reflected a cultural policy of a cohesive, united front among the Diet, municipalities, and ward offices across Tokyo and northern Japan. Shortly after March 11, the Tokyo Metropolitan Government imposed conservation limits for energy use throughout Tokyo. As a result, ward offices across Tokyo closed their pools, limited the routine use of electricity, and shut down elevators and escalators across the city. Not only did Tokyo wards meet the limits, they also exceeded them.

At bottom, all five factors reflect, to a significant degree, the Japanese culture of monochromatism in compliance with institutional mandates, and that of societal uneasiness with the public behaviors of non-Japanese nationals.

CONCLUSION

The summer 2020 Olympic Games tested Japan's resolve in ensuring the safety of athletes, of visitors, of residents. That was accomplished. Extraordinary measures—for example, excluding most spectators from events and constantly monitoring athletes' health—kept the citywide COVID-19 infection rate low. For residents, however, the coalescence of the strategic and the sociocultural explains Japan's effective management of the impact of COVID-19, even as its missteps served as a road map for a better control of the pandemic within its borders.

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Both authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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The Contributions of Pandemic Severity, Government Stringency, Cultural Values and Internet Usage to Post-traumatic Stress Disorder During the COVID-19 Pandemic: An Analysis of Data From 35 Countries

Ravi Philip Rajkumar*

Department of Psychiatry, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India

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Edited by:

Samer El Hayek,
University of Miami Health System,
United States

Reviewed by:

Samuli Kangaslampi,
Tampere University, Finland
Vincenzo Auriemma,
University of Salerno, Italy

*Correspondence:

Ravi Philip Rajkumar
ravi.psych@gmail.com

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Emergent symptoms of post-traumatic stress disorder (PTSD) have been frequently reported in the context of the COVID-19 pandemic, and may affect up to 17–18% of individuals. There is preliminary evidence that pandemic severity, cultural values, restrictions imposed by governments, and Internet usage may all influence the emergence of PTSD symptomatology. In this study, possible linear- and non-linear associations between these factors and the prevalence of PTSD symptoms across 35 countries were examined based on data from existing research. Evidence was found for a positive logarithmic relationship between the COVID-19 case-fatality ratio and PTSD ($p = 0.046$), a positive logarithmic relationship between power distance and PTSD ($p = 0.047$), and a trend toward a negative quadratic association with Internet usage ($p = 0.051$). No significant cross-national effect was observed for government restrictiveness. These findings suggest that strategies aimed at minimizing COVID-19 deaths, and at ensuring equitable access to essential resources, may be of use in reducing the emergence of PTSD symptoms at a population level during this pandemic.

Keywords: COVID-19, post-traumatic stress disorder, cultural collectivism, prevalence, mortality rate, case-fatality ratio, government stringency

INTRODUCTION

The COVID-19 pandemic has been associated with emergent symptoms of psychological distress on an unprecedented scale (Zhang and Chen, 2021). Though some researchers have attempted to group these symptoms under the umbrella of a “COVID stress syndrome” (Taylor, 2021; Taylor et al., 2021), most studies in this field have attempted to measure the frequency and severity of symptoms of “classical” psychiatric syndromes, such as anxiety and depression, using standardized measurement tools (Nochaiwong et al., 2021). A recent global analysis estimated that 33% of individuals developed symptoms of anxiety, 28% symptoms of depression and 30% insomnia related to the pandemic (Liu et al., 2021), suggesting that up to one-third of individuals may have experienced significant psychological distress over the course of the COVID-19 pandemic.

One particular form of psychological distress that has attracted significant attention during the pandemic is post-traumatic stress disorder (PTSD). PTSD is a complex syndrome characterized by persistent symptoms of re-experiencing, avoidance/numbing, and hyperarousal, occurring after exposure to a traumatic event which was associated with feelings of helplessness or fear (Friedman et al., 2011). A “traumatic event” is defined as one that involves actual or threatened death or injury, or a threat to physical integrity, directed at the self or at others (Bryant, 2019). Exposure to such events has been common and widespread during the COVID-19 pandemic (Dutheil et al., 2021). According to the most recently published meta-analysis at the time of writing, the estimated prevalence of significant PTSD symptomatology during the COVID-19 pandemic is 17.5%. However, this estimate included studies of general population samples as well as groups perceived to be at a higher risk of PTSD, such as survivors of severe COVID-19 and healthcare or other frontline workers (Yunitri et al., 2022).

Certain factors have been found to predict the development of symptoms of PTSD during the pandemic. These include demographic factors such as age, geographical location and employment (e.g., nursing staff or other healthcare workers), and methodological factors such as the choice of instrument used to screen for PTSD or the specific group being studied (e.g., patients with COVID-19, staff working in COVID-19 units); however, the differences that could be attributed to these factors were modest (Cénat et al., 2021; Yunitri et al., 2022). However, certain other factors that were found to contribute to psychological distress during the pandemic have not been specifically studied in the context of PTSD. These include the local severity of the pandemic (COVID-19 Mental Disorders Collaborators., 2021), the severity of restrictions on human mobility (COVID-19 Mental Disorders Collaborators., 2021; Jin et al., 2021), and the prevailing cultural values in a given country, particularly the cultural dimension of individualism vs. collectivism (Shekriladze et al., 2021; Xiao, 2021).

Though these factors have not been fully studied in relation to PTSD during the pandemic, there is translational and empirical evidence of their relevance. For example, quarantine or isolation has been found to contribute to PTSD during earlier outbreaks of infectious disease (Reynolds et al., 2008; Henssler et al., 2021); forced quarantine may be more traumatic than voluntary quarantine (TMGH-Global COVID-19 Collaborative., 2021); emergent PTSD has been noted at higher rates in regions with a higher COVID-19 incidence rate (Carmassi et al., 2022); and sudden death of a loved one due to COVID-19, or enforced separation from them prior to death due to infection control measures, can contribute to traumatic grief (Masiero et al., 2020; Djelantik et al., 2021). It has also been observed that cultural values such as collectivism shape the appraisal of trauma and influence both the emergence and persistence of PTSD symptoms (Jobson, 2009). Culture can also influence the level of social support provided to those exposed to pandemic-related traumatic stress (Messner, 2021), and this can protect against the emergence of post-traumatic stress (Gentry et al., 2022). Finally, several dimensions of culture are associated with the transmission of SARS-CoV-2, and this might exert an indirect

effect on PTSD through the traumatic effects of quarantine, hospitalization, or bereavement (Chen and Biswas, 2022; Duarte et al., 2022).

The COVID-19 pandemic has also been characterized by high rates of online and social media usage, amplified by restrictions on in-person social contact. There is some evidence of a link between higher social media usage and PTSD symptomatology. This may be due to the “sensitizing” effect of repeated exposure to pandemic-related images and stories on vulnerable individuals exposed to pandemic-related traumatic stressors (Ikizer et al., 2021; Price et al., 2022).

In the light of the above findings, the current study attempted to examine the relative contributions of COVID-19 severity indicators, the stringency of governmental responses to the pandemic, the national level of cultural collectivism, and national Internet usage on cross-national variations in the prevalence of significant symptoms of PTSD.

METHODOLOGY

In this study, cross-national variations in the prevalence of PTSD symptoms were examined in relation to three indices of COVID-19 severity (prevalence, crude mortality rate and case-fatality ratio), a culturally neutral index of individualism-collectivism (the Global Collectivism Index), a standardized measure of the restrictiveness of governmental measures to control the pandemic (the COVID-19 Government Stringency Index), and a proxy measure of national internet usage (the percentage of individuals using the Internet in each country), while correcting for methodological factors that could independently affect the prevalence of PTSD symptoms, such as age and gender distributions of study samples or the nature of the screening tool used. For the purpose of this study, “prevalence of PTSD symptoms” was defined as the percentage of individuals scoring above a specified cut-off for clinical concern on a standardized screening instrument for PTSD. This figure denotes the proportion of individuals who screened positive in a given study, and should not be understood as a measure of the prevalence of syndromal PTSD.

Data Sources

PTSD Prevalence and Methodological Factors

A literature search of the PubMed, Scopus and ProQuest databases was carried out using the search terms (“COVID-19”, “COVID”, “SARS-CoV-2”, either alone or joined to “pandemic”) AND (“PTSD”, “post-traumatic stress disorder”, “post-traumatic stress”, “post-traumatic stress symptoms”). After screening a total of 1,051 citations, 20 relevant studies covering 35 countries were included in the analysis. Studies were included only if they (a) involved subjects from general population samples, (b) provided a quantitative estimate of the frequency of PTSD at a specific point in time, and (c) used a standardized and validated screening tool or instrument for the identification of clinically significant PTSD symptomatology. General population studies were selected for analysis to minimize the number of potential confounders that might arise if “high-risk” populations, such as frontline healthcare workers and COVID-19 survivors, were sampled. All

studies included in this paper were based on data collected during the year 2020. The estimated prevalence of PTSD symptoms (PTSD-Prev), expressed as a percentage, was the dependent variable in the current study.

For each study, the following methodological variables were also extracted: (a) nature of the screening instrument used, (b) sample size, (c) time between the onset of the pandemic in the concerned country and the collection of data, measured in months, (d) mean age of the study sample, and (e) gender distribution, expressed as percentage of female participants in the sample. These factors were selected based on observations that they might influence estimates of the frequency of PTSD symptoms in earlier reviews and meta-analyses.

When designing this study, a comparison of studies measuring the prevalence of PTSD symptoms in 2020, 2021 and 2022 was envisaged. However, a comprehensive review of literature revealed that though there were studies published in 2021 and 2022, most of these either: (a) reported data from 2020, (b) did not provide a percentage of the number of individuals who screened positive, or (c) were focused on specific high-risk populations, such as healthcare workers, individuals hospitalized for severe COVID-19, or people with a pre-existing mental illness. As these studies could not be compared to those conducted in general population samples, this part of the study could not be carried out.

COVID-19 Severity Indices

Three indices of the severity of the COVID-19 pandemic were examined for each country. The estimated prevalence (C19-Prev) is defined as the number of confirmed COVID-19 cases per 1 million population, while the crude mortality rate (CMR) is defined as the number of confirmed deaths due to COVID-19 per 1 million population, and the case-fatality ratio (CFR) is the ratio of deaths to total cases of COVID-19, expressed as a percentage. Though these measures have certain inherent limitations due to variations in testing, reporting and death certification practices, they have been widely used to quantify the severity of the pandemic at a cross-national level (Favas et al., 2022). Information on these variables was obtained from the Johns Hopkins University's global COVID-19 data aggregator. For each study, data on COVID-19 severity was collected and entered for the time at which the individual study was conducted (Johns Hopkins Coronavirus Resource Center., 2022).

Global Collectivism Index (GCI)

Though several measures of cultural individualism-collectivism have been described in the literature, their validity is open to question as they are mostly based on data obtained from Western, industrialized countries with a democratic form of government. To address this, the GCI was developed to provide a truly global estimate of cultural collectivism, based on data from 188 nations, including several Asian and African countries that were excluded in earlier analyses (Pelham et al., 2022). A positive GCI indicates a collectivist culture (the highest being Somalia, with a GCI of 1.92), while a negative GCI indicates a more individualist culture (the lowest being Monaco, with a GCI of -1.85). The CGI shows

moderate to high positive correlations with all prior measures of cultural collectivism.

Other Cultural Dimensions (Hofstede)

A review of the existing literature found that, besides individualism-collectivism, three cultural dimensions appeared to correlate with COVID-19 transmission. These dimensions were power distance, masculinity-femininity and uncertainty avoidance. Power distance reflects the extent to which a society follows a strict hierarchy and accepts inequalities; this parameter was associated with adherence to government restrictions (Messner, 2021) and reduced numbers of hospital or ICU admissions (Duarte et al., 2022). Masculinity-femininity measures the extent to which a society is oriented toward achievement, assertiveness and competition, as opposed to cooperation and nurturing; high masculinity scores are associated with the number of COVID-19 cases and deaths at a national level (Chen and Biswas, 2022). Uncertainty avoidance indicates the extent to which a society is able to tolerate ambiguous or uncertain situations, with high scores indicating lower tolerance; high uncertainty avoidance is also associated with increased COVID-19 prevalence and mortality (Chen and Biswas, 2022). Therefore, these three cultural dimensions were also included in the analysis. Data on these variables was obtained from the Hofstede Insights database (Hofstede Insights, 2022).

Government Stringency Index (GSI)

Governments across the world have varied in the extent, severity and duration of the restrictions imposed on their subjects during the COVID-19 pandemic. The GSI, computed by the Oxford Coronavirus Government Response Tracker (OxCGRT) provides a composite measure of all these restrictions, including school and work closures, restrictions on public events and gatherings, quarantine measures and restrictions on internal and external travel. The GSI can take on any value from 0 to 100, with 0 indicating the least stringent response and 100 indicating the most stringent response (Hale et al., 2021; Our World In Data., 2022). For the purpose of this study, the estimated GSI for the time at which each individual study was conducted was included in this analysis. For example, if a study of pandemic-related PTSD was conducted in May 2020, the GSI as of May 31, 2020 was entered in the corresponding row for that study.

Internet Usage

As there is no reliable, large-scale estimate of social media usage at a cross-national level, the percentage of Internet users per country was utilized as a proxy measure for time spent consuming online or social media. Information on this variable was obtained from the World Bank's database and is based on aggregated data from telecommunication unions (World Bank, 2022).

Data Analysis

Data analysis was carried out using the Statistical Package for Social Sciences, version 20.0 (SPSS version 20.0, SPSS Inc.) All study variables were tested for normality prior to data

analysis. Three key study variables—CMR, CFR and GCI—did not conform to a normal distribution ($p < 0.01$, Shapiro-Wilk test).

In the first step of the analysis, the association between the five methodological variables listed above and the estimated prevalence of PTSD symptoms in each study was examined as follows: For continuous variables such as sample size and mean sample age and time, bivariate correlations (Pearson's and Spearman's) were computed to assess the possibility of a linear or monotonic association between these variables and PTSD symptoms. To assess the effect of the screening tool used, a one-way analysis of variance (ANOVA) was carried out, followed by a *post-hoc* Bonferroni test, to examine whether PTSD symptom prevalence differed significantly across studies using different tools.

In the second step, bivariate correlations between PTSD-Prev and the independent variables of interest were examined using Pearson's and Spearman's correlation analyses. Both methods were used in parallel in view of the possible non-normal distribution of the aforementioned variables. Finally, attempts were made to test for non-linear relationships between PTSD-Prev and the independent variables using the curve estimation function for logarithmic and quadratic models if the visual inspection of scatter plots suggested such a relationship, and/or if the monotonic model suggested a trend toward an association. These plots are provided in the **Supplementary Material**. All statistical tests were two-tailed, and a significance level of $p < 0.05$ was considered significant. In view of the exploratory nature of this study and its small sample size, correction for multiple comparisons was not undertaken.

RESULTS

Data on PTSD-Prev could be retrieved for a total of 35 countries, based on 23 published studies. A complete description of these studies and their methodological characteristics is provided in the **Supplementary Material**. The estimated prevalence of PTSD symptoms ranged from a minimum of 11.7% in a Vietnamese sample to 49.6% in an Iranian sample, with a mean prevalence of $29.8 \pm 10.2\%$.

Analyses of Methodological Factors

There were significant variations in sample size, time of sampling, age, and gender distribution across the included studies. Moreover, a variety of instruments were used to estimate PTSD symptom severity. The most commonly used instrument was the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5, 13 countries) followed by the PTSD Checklist for DSM-5 (PCL-5, 12 countries), the Impact of Event Scale-Revised (IES-R, 5 countries), the International Trauma Questionnaire (ITQ, 3 countries), the Startle, Physiological Arousal, Anger and Numbness screening instrument (SPAN, one country) and the Screen for Post-Traumatic Stress Symptoms Tool for DSM-IV (SPTSS, one country). No significant correlation could be identified between the prevalence of PTSD symptoms and either sample size ($r = -0.17$, $p = 0.324$), time gap between the imposition of pandemic measures and sample evaluation ($r =$

TABLE 1 | Linear and non-linear relationships between COVID-19 severity indices and the estimated prevalence of PTSD symptoms by country.

Variable	Linear correlation (r)	Monotonic correlation (ρ)	Evidence for non-linear correlation in scatter plot or trend	Non-linear association, if applicable
C19-Prev	-0.23 (0.186)	-0.19 (0.279)	None	N/A
CMR	-0.01 (0.979)	0.16 (0.375)	None	N/A
CFR	0.23 (0.191)	0.28 (0.105)	Yes	Logarithmic $r = 0.34^*$ $p = 0.046$

C19-Prev, estimated national prevalence of COVID-19; CMR, estimated COVID-19 crude mortality rate; CFR, COVID-19 case-fatality ratio; r , Pearson's correlation coefficient; ρ , Spearman's correlation coefficient; N/A, not applicable.

*Significant at $p < 0.05$.

-0.05 , $p = 0.947$), mean age of the study sample ($r = -0.20$, $p = 0.242$) or gender distribution ($r = -0.19$, $p = 0.288$). No multicollinearity could be identified between any of the methodological variables themselves ($r < 0.5$ for all correlations). There was a significant effect of the choice of study instrument on PTSD-Prev ($F = 3.4$, $p = 0.021$). On *post-hoc* analysis, the only significant inter-instrument difference noted was between studies using the ITQ and studies using the SPAN or SPTSS ($p = 0.028$, Bonferroni *post-hoc* test), with a similar trend between the ITQ and PCL-5 ($p = 0.087$, Bonferroni *post-hoc* test). No significant difference could be identified between any of the other instruments. From this analysis, it was evident that only the ITQ appeared to significantly influence variations in PTSD symptom estimates. To account for this, subsequent analyses were conducted both with the entire sample ($n = 35$) and after excluding studies which had used the ITQ ($n = 32$).

Analyses of Pandemic Severity Indices

Correlations between the three indices of COVID-19 severity (prevalence, crude mortality rate, and case fatality rate) are presented in **Table 1**. It can be seen from these results that none of these variables showed a significant linear or monotonic correlation with PTSD-Prev. However, there was a significant and positive correlation between the prevalence of PTSD symptoms and the logarithm of the COVID-19 case fatality rate ($r = 0.34$, $R^2 = 0.12$, $p = 0.046$). No significant association could be identified for any of the other COVID-19 severity indices. There was no significant multicollinearity between any of the COVID-19 indices themselves ($r < 0.6$ for all correlations). When these analyses were repeated with the subset of studies not using the ITQ, these results were not altered substantially.

Analysis of Cultural Variables, Stringency, and Internet Usage

Correlations between PTSD-Prev, CGI and CGI scores, and percentage of Internet users are presented in **Table 2**. Linear analyses revealed trend-level associations of a positive nature for power distance ($r = 0.30$, $p = 0.084$) and of a negative nature for Internet usage ($r = -0.33$, $p = 0.052$). Non-linear models found a

TABLE 2 | Linear and non-linear associations between cultural dimensions, government stringency, internet usage and the estimated prevalence of PTSD symptoms by country.

Variable	Linear correlation (<i>r</i>)	Monotonic correlation (ρ)	Evidence for non-linear correlation in scatter plot or trend	Non-linear association (best fit), if applicable
Individualism-collectivism	0.22 (0.208)	0.22 (0.209)	None	N/A
Power distance	0.30 (0.084)	0.33 (0.051)	Yes	Logarithmic $r = 0.34$ $p = 0.047$
Masculinity-femininity	0.22 (0.208)	0.15 (0.392)	None	N/A
Uncertainty avoidance	0.25 (0.149)	0.25 (0.15)	None	N/A
Government stringency	0.04 (0.814)	0.09 (0.598)	None	N/A
Internet usage	-0.33 (0.052)	-0.33 (0.056)	Yes	Quadratic $R^2 = 0.11$ $p = 0.051$

Abbreviations: N/A, not applicable.

significant positive association between the natural logarithm of power distance and PTSD-Prev ($r = 0.34$, $p = 0.047$); however, the association with Internet usage remained at a trend level. No significant linear or non-linear correlation between other cultural dimensions or government stringency and PTSD-Prev could be identified.

Intercorrelations Between Cultural and Other Variables

As an additional measure, correlations between cultural dimensions and the other independent variables of interest (COVID-19 indices, government stringency, and Internet usage) were examined. Cultural collectivism was positively correlated with both stringency ($r = 0.61$, $p < 0.01$) and C19-CFR ($r = 0.51$, $p < 0.01$) and negatively correlated with C19-Prev ($r = -0.68$, $p < 0.01$) and Internet usage ($r = -0.68$, $p < 0.01$). An identical pattern of correlations was obtained for power distance (stringency: $r = 0.41$, $p = 0.014$; C19-CFR: $r = 0.45$, $p < 0.01$; C19-Prev, $r = -0.61$, $p < 0.01$; Internet usage, $r = -0.58$, $p < 0.01$). Masculinity was positively correlated with stringency ($r = 0.36$, $p = 0.034$), while uncertainty avoidance was positively correlated with C19-CMR ($r = 0.45$, $p < 0.01$).

Partial Correlation Analyses

As C19-CFR appeared to be independently associated with PTSD prevalence and with the cultural dimensions of collectivism and power distance, partial correlation analyses between these two dimensions and PTSD prevalence were conducted with C19-CFR held constant. However, neither of these associations were statistically significant (power distance x PTSD: $r = 0.22$, $p = 0.203$; collectivism x PTSD: $r = 0.12$, $p = 0.489$).

In view of the lack of significant bivariate linear analyses, multivariate linear regression was not attempted.

DISCUSSION

Post-traumatic stress disorder during the COVID-19 pandemic has been the focus of intense debate and research. While some researchers have warned of a “second pandemic” of PTSD in the wake of the damage caused by this pandemic (Dutheil et al., 2021), others have highlighted the heterogeneity of psychological responses to COVID-19, as evidenced by both cross-national variations in the prevalence of psychological distress (Shevlin et al., 2021) and the phenomena of post-traumatic growth and resilience which mitigate against the persistence of PTSD symptoms (Killgore et al., 2020; Gonda and Tarazi, 2022). The current study suggests that the “heterogeneity” view may be closer to reality than the “tsunami” view, as a wide range of reported rates of PTSD symptoms was observed across the studies analyzed in this paper. However, even the lowest reported rate included in this study (11.5%) is comparable to the estimate of 17–18% reported in meta-analyses, suggesting that a significant minority of the general population experiences PTSD symptoms in response to the pandemic. There is insufficient evidence to comment on what proportion of these individuals will continue to experience chronic PTSD; past evidence (Mak et al., 2009; Wang et al., 2020) suggests that these symptoms may diminish or resolve over time in some cases, while current studies have yielded equivocal results (Benfante et al., 2022; Kalaitzaki et al., 2022).

In this study, we identified a possible association between the prevalence of PTSD symptoms and the COVID-19 case-fatality ratio. This finding is significant in the light of the debate surrounding the nature of traumatic stressors during the COVID-19 pandemic. While some authors have argued for a rigorous definition which would include only severe events (involving personal or occupational exposure to death or the risk of death) as “traumatic stress”, others have suggested considering “pandemic exposure”, or events such as being placed in quarantine or subjected to movement restrictions, as traumatic events *per se* (Norrholm et al., 2021). This debate is an extension of ongoing discussions of whether the spectrum of “traumatic events” is being unduly broadened (Jones, 2021). The current results, though subject to certain important limitations, suggest that the “narrower” definition of traumatic stress may be accurate, as the case-fatality ratio is a reflection of the risk of death in an infected individual, as opposed to measures such as prevalence (which includes mild and asymptomatic cases).

Among cultural dimensions, power distance showed a tentative positive association with the prevalence of PTSD symptoms. Societies with high power distance are characterized by institutionalized inequality. In the context of the COVID-19 pandemic, unequal distribution of healthcare and other resources may have contributed to traumatic stress in the general population. Power distance was associated with an increased COVID-19 case fatality ratio in this study, which could have contributed to traumatic grief. It is possible that other

sociocultural factors, which were not analyzed in this study may also influence the emergence of post-traumatic stress symptoms (Ohta et al., 2021). It is also possible that these factors exert a greater influence on other forms of psychological distress, such as depression and anxiety, than on PTSD.

Though a negative association between Internet usage and PTSD symptoms was observed in this analysis, this finding was just below the threshold for statistical significance. While certain aspects of Internet usage, such as consumption of pandemic-related media (“doomscrolling”) have been associated with PTSD (Price et al., 2022), the Internet may also be used for social connection, communication of vital information, purchase of essentials and even healthcare (“telemedicine”) during periods of confinement or isolation (Farsi et al., 2022). The role of the Internet in shaping positive or negative psychological responses to COVID-19 is complex, and requires further elucidation along multiple vectors in diverse populations.

As discussed earlier, the planned comparison of studies from 2020, 2021 and 2022 could not be carried out due to the low number of studies sampling subjects in 2021 and 2022. In a study of four countries (Germany, Israel, Poland and Slovenia), both government stringency and the percentage of subjects “at risk” of PTSD fell by around 5% between February and June 2021; however, the authors did not test for a significant association between these variables (Benatov et al., 2022). In contrast, a study of the Italian general population found a non-significant increase in PTSD symptomatology from April 2020 (19%) to January 2021 (21%); no specific demographic variables were associated with changes in PTSD symptoms at the individual level (Benfante et al., 2022). In contrast, a study from Greece comparing the frequency of PTSD symptoms during two successive lockdowns (March–May 2020 and November 2020–May 2021) found a significant increase in symptoms (36% vs. 26%) during the second lockdown (Kalaitzaki et al., 2022). The variability of these results highlights the need for further multi-country longitudinal research in this field, with an analysis of both individual and broader social and cultural factors.

This study is subject to certain important limitations. It is based on data derived from various studies, and this may lead to variations due to methodological factors, despite the efforts made to address these in the current study. It is largely derived from data obtained during the first “wave” of the COVID-19 pandemic, and these findings may not generalize to PTSD emerging at a later stage of this pandemic. It is cross-sectional and correlational in nature, meaning that no firm conclusions regarding causality can be drawn. It is based on data from a limited number of countries, meaning that information from certain geographical areas, such as sub-Saharan Africa and Oceania, was not available. Though certain significant findings were obtained, these require replication and

may not survive more rigorous forms of statistical correction. As they were based on national-level data, these findings are not directly applicable to individuals. Other factors that may significantly influence the emergence of pandemic-related PTSD, such as prior physical and mental health status, or increases in intimate partner violence, could not be assessed (Thibaut and van Wijngaarden-Cremers, 2020). The dependence of the study findings on published data imply that they are sensitive to publication bias. No correction was made for multiple comparisons in the correlation analyses, raising the possibility of false-positive findings. Finally, as this study was based on a secondary analysis of earlier research, it could not be registered in a database of prospective observational, interventional or meta-analytic studies.

CONCLUSION

Despite the above limitations, this study suggests that significant relationship may exist between the COVID-19 case fatality rate and the emergence of PTSD symptoms in the context of the pandemic. Provisional evidence of a positive association with cultural power distance and a negative association with Internet usage were also observed. These findings suggest that interventions aimed at improving COVID-19 survival (such as high-risk prevention strategies and prompt treatment of severely ill patients) may foster resilience and reduce the emergence of PTSD at the level of the general population. It is also possible that attempts to ensure equitable access to essential resources may also reduce this risk in societies with high levels of inequality (Condon et al., 2020), but this recommendation should be considered tentative.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsoc.2022.881928/full#supplementary-material>

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Mental Health, Burnout, and Job Stressors Among Healthcare Workers During the COVID-19 Pandemic in Iran: A Cross-Sectional Survey

Ahmad Hajebe¹, Maryam Abbasinejad², Masoud Zafar³, Amirali Hajebe⁴ and Farhad Tareman^{5*}

¹ Psychiatric Department, Research Center for Addiction and Risky Behaviors, Iran University of Medical Sciences, Tehran, Iran, ² Department for Mental Health and Substance Abuse, Ministry of Health and Medical Education, Tehran, Iran, ³ University Counselling Center, Shahed University, Tehran, Iran, ⁴ Non-communicable Diseases Research Center, Endocrinology and Metabolism Research Institute, Tehran University of Medical Sciences, Tehran, Iran, ⁵ Department of Clinical Psychology, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

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*Correspondence:

Farhad Tareman
fa.tareman@uswr.ac.ir

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Introduction: The COVID-19 pandemic has caused increasing levels of mental health problems such as anxiety and depression among doctors, nurses and other healthcare workers in hospitals or health centers. The main objective of this study was to assess the mental health, job stressors, and burnout among healthcare workers in Iran.

Materials and Methods: A cross-sectional study was performed in the primary healthcare centers and hospitals affiliated with six of the medical universities in Iran. The selection of participants was done using multi-center convenient sampling. The Patient Health Questionnaire-9, Generalized Anxiety Disorder-7, and Copenhagen Burnout Inventory were used for gathering data through an online platform. Data related to job stressors were obtained using a validated checklist. Data analysis was performed using Chi-square and multiple regression tests and the phi coefficient.

Results: The results of our study showed that 53% of the healthcare workers of the hospitals and primary healthcare centers enrolled in our study either had generalized anxiety disorder or major depressive disorder or both disorders. Moderate and high levels of burnout were seen among 48.9% of the study participants. The prevalence of mental disorders and burnout were significantly higher among the female healthcare workers compared to the male ($p = 0.0001$) and a higher rate of mental disorder and burnout was also seen among healthcare workers of hospitals compared to those working in primary healthcare centers ($p = 0.024$). "Worry about children and old members of family," "family worries for my health condition" and "lack of specific effective treatment for COVID-19" were found to be predictive of mental disorder and burnout. The most prevalent job stressor among the total sample was "low payment or income during the COVID-19 period".

Conclusion: The results of our study revealed high psychological distress and burnout among healthcare workers of the hospitals during the fourth peak of the COVID-19

pandemic in Iran. This study highlights the need for health officials to pay attention to the job stressors of healthcare workers and obliges them to perform effective interventions to address their needs and concerns.

Keywords: mental health, burnout, job stressors, COVID-19, healthcare workers, Iran

INTRODUCTION

The World Health Organization (WHO) declared the SARS-CoV-2 outbreak as a pandemic on March 11th 2020 (1). Until March 2022, which is the time of inscribing this article, the COVID-19 cases worldwide have surpassed 445 million and there have been more than 6 million COVID-19 reported deaths confirmed globally (2). The uncontrollable nature of COVID-19 has posed remarkable challenges to the health care systems in most of the nations affected (3). Some countries have reported temporary shortage of health care providers and/or health equipment and supply in the midst of the peaks of the pandemic (4). Other than that, the current pandemic has caused increasing levels of mental health problems such as anxiety and depression among doctors, nurses and other healthcare workers in hospitals or health centers (5). As reported, many health personnel have lost their lives due to COVID-19 and many of them have been infected with the virus or transferred the illness to their family members (6).

Pandemics such as the COVID-19 provoke fear and anxiety, which is common among healthcare workers who are directly involved in the management of ill patients. The healthcare workers' exposure to patients' suffering and deaths (7) also increases their fear and anxiety. Unattended anxiety negatively impacts work performance and job satisfaction of health personnel, leading to frequent absenteeism and eventual turnover (8). Available data suggest that the prevalence of anxiety and depression among health care workers during the COVID-19 pandemic ranged from 22.6% (9) to 47% (10) and 22.8% (7) to 50.4% (11) respectively. The prevalence of burnout among healthcare workers in the COVID-19 has also been frequently studied in different regions and countries and high-level burnout rates of 49.3% (12) and 50% (13), to more than 60% (14) and even 67% (15) have been reported among healthcare workers in the COVID-19 pandemic. Studies have also shown high rates of anxiety and depression among Iranian healthcare workers in the COVID-19 pandemic (16–18), especially among the female (19). Iranian studies have shown negative psychological experiences caused by COVID-19 in healthcare workers, such as fatigue, discomfort, and helplessness due to high-intensity work, anxiety, and worry about family members (20). An Iranian study performed by Jalili et al. (21) have reported high levels of burnout among 53% of the healthcare workers in the COVID-19 pandemic.

Studies have defined variable psychosocial stressors that the COVID-19 pandemic has brought about and led to exceeding levels of psychological distress (22), mental health problems such as anxiety and depression (23), and burnout (5, 24–26) among healthcare personnel worldwide.

Throughout the COVID-19 pandemic, frontline healthcare workers have been facing the fear of infection of themselves

or their families and dealt with considerable initial uncertainty about disease standard treatment regimens (27). They have also been faced with complex ethical issues in practice, and frustrated by moral conflicts (28). Excessive workloads, long working hours, lack of enough time for recovery, insufficient personal protective equipment at the beginning of the pandemic, not being able to tell their manager if they are not coping (29), and inadequate hospital facilities for the patients are all important factors that have put them under persistent pressure and sometimes affected the quality of patient care (10).

Several psychosocial and demographic variables like gender, age, profession, place of work, family income (30), and risk factors such as poor social support, low senses of self-efficacy, and experiencing stigma (22) are associated with increased stress, anxiety and depressive symptoms and burnout (31) among healthcare workers during the COVID-19 pandemic (32). For instance, some studies convey that being a woman (33), having a younger age, being the parents of dependent children (34), and working in high-risk areas may have more negative psychological health outcomes (11). This reality is even more negative in the case of nurses due to the high emotional burden of continued contact with patients' suffering and pain (35).

The main objective of this study was to assess the prevalence of depression, anxiety and burnout among Iranian healthcare workers of the PHC system and hospitals in the COVID-19 pandemic. This is the first large-scale multi-provincial study performed for assessing burnout and adverse mental health effects of the COVID-19 pandemic on a heterogeneous group of healthcare workers in Iran.

MATERIALS AND METHODS

Study Design and Settings

A cross-sectional study was performed in the primary healthcare centers and hospitals affiliated with six medical universities located in the provinces of Tehran, Tabriz, Gilan, Ahvaz, Ghom, and Kurdistan of Iran. The medical universities were selected based on their geographical diversity and the capacity of their primary healthcare centers for providing services. In each university, one hospital and five primary healthcare centers were chosen for performing the study.

Study Participants

The target population in this study included physicians, nurses, dentists, mental health workers, environmental and occupational health workers, community health workers, medical technicians, and staff members working in hospitals and primary healthcare centers. The samples size was calculated to be 1,055. We considered a sample size which was 10% larger to cover possible drop-out of participants and ultimately came up with

an approximate number of 1,170 participant. According to probability-proportional-to-size sampling (36), 120 individuals were selected from each hospital, making a total of 720 participants from the hospital setting and 15 individuals were selected for each PHC center, making a total of 450 participants from primary healthcare centers to cover different job categories. The selection of participants was done using multi-center convenient sampling. Any healthcare worker working at hospitals or PHC centers at the time of the study, working at least between 44 and 50 h a week was recognized eligible to receive the questionnaire link and was asked to respond to all of the questions in the time period announced, and therefore was initially enrolled in the study. Only one reminder was performed 2 weeks after the initial call for participation. At the end of the data gathering process, 37 participants who had missing demographic data or had not filled out one or more of the questionnaires were excluded from the study and 1,133 participants remained.

Study Instruments

Demographic data were obtained in the beginning of the questionnaire. Data related to job stressors were obtained using a checklist which was developed after thorough literature and desk review and finalized after performing individual deep interviews with experts and focus group discussions (FGD) with members of each of the target groups. We initially came up with a job stress checklist of 80 items. Content validity of all items was measured with the consultation of 10 experts and items with a CVR of lower than 0.75 (37) and an I-CVI of lower than 0.78 (38) were excluded from the checklist, and so the final checklist consisted of 65 items. For identifying the top ten stressor as selected by the participants, all of the 65 stressors were presented to the participants in the online questionnaire and participants were asked to score the importance of each stressor on a 5-point Likert scale.

Data related to the study variables, burnout, and mental health status were obtained using online validated questionnaires, as follows:

Patient Health Questionnaire-9

The PHQ-9 (39) is a nine-item instrument designed for detecting major depressive disorder (MDD) based on the fourth version of the Diagnostic and Statistical Manual of Mental disorders (DSM-IV) (40). The internal reliability of the PHQ-9 was excellent, with a Cronbach's α of 0.89 in the PHQ Primary Care Study (39). Scores are calculated based on how frequently a person experiences the mentioned feelings. In scoring, each "not at all" response is scored as 0; each "several days" response is 1; each "more than half the days" response is 2; and each "nearly every day" response is 3 (39). Therefore, scores range from 0 to 27 with higher scores indicating more severe MDD symptoms. The PHQ-9 has been validated for use among the Iranian population with a Cronbach's α of 0.856 (41) and a cut-off score of 13 which provided an optimal balance between sensitivity and specificity (42).

Generalized Anxiety Disorder-7

The GAD-7 (43) is a seven-item self-report scale developed for the diagnosis of generalized anxiety disorder (GAD) according to the DSM-IV. The GAD-7 score is calculated by assigning scores of 0, 1, 2, and 3, to the response categories of "not at all," "several days," "more than half the days," and "nearly every day". Scores range from 0 to 21 with higher scores indicating more severe GAD symptoms (43). The GAD-7 has been validated to use among the Iranian population with an α Cronbach value of 0.88 and a cut-off point of 10 for diagnosing GAD (44).

Copenhagen Burnout Inventory

The CBI (45) was used to measure the fatigue and exhaustion as core constructs of burnout among participants. This 19-item questionnaire measures three burnout sub-dimensions: personal burnout (6 items), work-related burnout (7 items), and client-related burnout (6 items). Each item is scored by the participant on a 5-point Likert scale. Scores fall into the four categories of "no burnout" (0–25), "mild burnout" (25.1–50), "moderate burnout" (50.1–75), "high burnout" (75.1–99). Separate scores can be reported for each sub-dimension and the total score of the test is the mean score of all three sub-dimensions (46). The original version of the instrument had presented a good internal consistency for all three subscales: personal burnout ($\alpha = 0.87$), work related burnout ($\alpha = 0.87$), and client-related burnout ($\alpha = 0.85$). The internal consistency of the Persian version ranged from a Cronbach's α of 0.82 to 0.90 and the test-retest reliability was excellent with the ICC ranging from 0.85 to 0.95 (47).

Procedure

In each university, the director of the mental health department was the coordinator of the project. Project managers were appointed for each of the hospitals for coordination and monitoring of the process of data collection. The project coordinators and managers were trained through a 1-day training session and were instructed on the sampling method, research design and assessment tools. A detailed guideline on the aim of the study and the methodology including number of participants needed for each job category were also sent to them via electronic mail. Participants were chosen by the project coordinator and project managers by convenient sampling. The PORS-LINE platform was used for gathering data. The link of the questionnaire was sent to each participant and they were asked to fill out the questionnaire from June 23rd 2021 to July 18th 2021. It is worth mentioning that this study was performed in the fourth peak of COVID-19 in Iran which was simultaneous with the peaks in India and Brazil (48).

Data Analysis

Data entry and analysis was performed with the SPSS V.23 software. We used descriptive analysis using one and two-variable frequency tables for displaying numbers, percentages and frequencies. Chi-square tests were used for qualitative variables, and the phi coefficient was used for two-state variables and multiple regression tests were used for continuous quantitative variables.

TABLE 1 | Demographic data of the study sample ($n = 1,133$).

Variable		Frequency (percent)
Gender	Male	378 (33.4)
	Female	755 (66.6)
Marital status	Single	276 (24.4)
	Married	830 (73.3)
	Widowed	5 (0.4)
	Divorced	22 (1.9)
Age	20–30	301 (26.6)
	31–40	452 (39.9)
	41–50	287 (25.2)
	51–60	90 (7.9)
	61 <	3 (0.3)
Occupation type	Physicians	244 (21.9)
	Nurses	463 (40.9)
	Medical technicians	107 (9.4)
	Administrative staff	96 (8.5)
	Service staff	108 (9.5)
	Dentists	28 (2.5)
	Mental health workers	44 (3.9)
	Environmental and occupational health workers	43 (3.8)
	Total	1,133 (100)

RESULTS

Demographic Data

At the end of the deadline of data gathering, 37 questionnaires were excluded from the study because the participant had not filled out some of the questionnaires, and we ultimately had 1,133 completed questionnaires from 1,133 participants. Among these, 755 (66.6%) were female. The majority (66.5%) of the participants were aged 20 to 40 and were married (73.3%). Participants were consisted of physicians, nurses and other workers and staff members from which 715 (63.1%) of them worked at hospitals. The largest group regarding occupation were the nurses with 41 percent of the participants (see **Table 1**).

Job Stressors

The most prevalent job stressor among the total sample was “low payment or income during the COVID-19 period,” and “worry about family members being infected by COVID-19,” “worry about my transmitting COVID-19 to family members,” and “worry about children and old members of the family” came afterwards (see **Table 2**).

Mental Disorder

The presence of generalized anxiety disorder (GAD) and major depressive disorder (MDD) among study participants was assessed with the PHQ-9 and GAD-7 tools respectively. According to the results, among the male participants, 35.7 and 30.2% and among the female participants, 53.1 and 38.9% had GAD and MDD respectively. Considering both genders, among

TABLE 2 | Top 10 ranks of reported stressors among total sample ($n = 1,133$).

Stressors	Total rank
Low payment and income in these days	1
Worry about family members being infected by COVID-19	2
Worry about my transmitting COVID-19 to family members	3
Worry about children and old members of the family	4
Lack of special payment or low payment for the COVID-19 period	5
The Ministry of Health not keeping their promises	6
No payments for overtimes	7
Family worries for my health condition	8
Low support of authorities of the Ministry of Health	9
Lack of a specific effective treatment for COVID-19	10

TABLE 3 | Frequency and percentage of any mental disorder by gender ($n = 1,133$).

Gender	Mental health		Total
	No mental disorder <i>N</i> (%)	Any mental disorder <i>N</i> (%)	
Male	217 (57.4)	161 (42.6)	378 (100)
Female	316 (41.8)	439 (58.2)	755 (100)
Total	533 (47)	600 (53)	1,133 (100)

$\Phi = 0.147$ ($p = 0.0001$).

the 1,133 participants, a total of 536 (47.3%) participants had GAD and 408 (36%) had MDD, and a total of 600 (53%) of the participants had either GAD or MDD or both of the disorders, which is referred to as “any mental disorder.” Among those with any mental disorder, 344 (30.36%) had both MDD and GAD, 192 (16.9%) had only GAD and 64 (5.6%) had only MDD. Study results showed that 58.2% of the female and 42.6% of the male participants had any mental disorder. A higher rate of mental disorder among the female compared to the male participants was statistically significant ($p = 0.0001$) (see **Table 3**).

Regarding workplace, a total of 397 participants (55.5%) of those working in hospitals and 203 (48.6%) of those working in PHC centers had any mental disorder. The higher rate of mental disorders of the healthcare workers in the hospitals was statistically significant ($p = 0.024$).

Burnout

According to the results, among the 1,133 participants, a total of 554 (48.9%) participants had moderate and high level burnout (36%). Also, study results showed that 381 (50.5%) of the female and 173 (45.8%) of the male participants had moderate and high level burnout. A higher rate of burnout among the female compared to the male participants was statistically significant ($p = 0.001$) (see **Table 4**). The mean score of burnout among individuals was 61.1 in the participants with any mental disorder

TABLE 4 | Frequency and percentage of burnout by gender ($n = 1,133$).

Gender	Burnout				Total
	No burnout (CBI: 0–25)	Low level burnout (CBI: 26–50)	Moderate level burnout (CBI: 51–75)	High level burnout (CBI: 76–100)	
	N (%)	N (%)	N (%)	N (%)	N (%)
Male	80 (21.2)	125 (33.1)	119 (31.5)	54 (14.3)	378 (100)
Female	92 (12.2)	282 (37.4)	255 (33.8)	126 (16.7)	755 (100)
Total	172 (15.2)	407 (35.9)	374 (33)	180 (15.9)	1,133 (100)

Pearson Chi-Square = 15.97 (p -value = 0.001).

and 37.7 in the participants without any mental disorder. This means that there is a significant relationship between the presence of anxiety and depression with burnout ($p < 0.0001$, $t = 21.054$).

Regarding workplace, a total of 375 participants (52.4%) of those working in hospitals and 179 (42.8%) of those working in PHC centers had moderate to high levels of burnout. The higher rate of burnout of the healthcare workers in the hospitals in comparison to the PHC centers was statistically significant ($p = 0.011$). Our findings showed a significant correlation between burnout and MDD ($R = 0.64$, $p = 0.0001$) and also between burnout and GAD ($R = 0.58$, $p = 0.0001$).

Predictors of Mental Disorder and Burnout

The regression performed for predicting any mental disorder based on the ten top-ranking stressors showed that the regression coefficient is equal to 0.374 and the determination coefficient (R^2) is equal to 0.14. In other words, the ten stressors predicted 14 percent of any mental disorder. The F is equal to 18.27 and confirms the significance of the regression model with a 0.01 error (see **Table 5**).

The regression model shows that “worry about children and old members of family,” “family worries for my health condition,” “lack of specific effective treatment for COVID-19” could significantly predict the outcome of any mental disorder.

The regression performed for predicting burnout based on the ten top-rank stressors showed that the regression coefficient (R) was 0.437 and the determination coefficient was (R^2) 0.19. Therefore, the top ten stressors were able to predict 19 percent of the outcome of burnout. The F value is equal to 26.55 and it confirms the significance of the regression model with an error of 0.01 (see **Table 6**).

The regression model shows that among the ten top-ranking stressors, “low payment and income,” “worry about children and old members of the family,” “lack of special payment or low payment for COVID-19 days,” “the MOH not keeping their promises,” “family worries for the individuals’ health condition,” and “the lack of specific effective treatment for COVID-19” could predict burnout significantly.

For summarizing the results of the multiple regression models performed for assessing the relationship between the top ten stressors with the outcomes of any mental disorder and burnout, **Table 7** is presented. In this table, the job stressors which could

TABLE 5 | Multiple regression model for predicting any mental disorder among the study sample.

	B (Beta)	Std. error	t (P v)
(Constant)	−0.479	0.084	−5.679 (0.0001)
Low payment and income in these days	0.022 (0.046)	0.018	1.208 (0.227)
Worry about family members getting COVID-19	−0.003 (−0.006)	0.015	−0.189 (0.85)
Worry about my family members getting COVID-19 by me	0.013 (0.033)	0.014	0.990 (0.32)
Worry about children and old members of family	0.068 (0.148)	0.017	4.137 (0.0001)
Lack of special payment or low payment for COVID-19 days	0.015 (0.034)	0.018	0.845 (0.398)
Not keeping promises given by Ministry of Health	0.000 (−0.001)	0.017	−0.014 (0.99)
No payments for overtimes	0.001 (0.001)	0.015	0.039 (0.97)
Family worries for my health condition	0.039 (0.089)	0.014	2.781 (0.006)
Low support of authorities of Ministry of Health	0.027 (0.069)	0.016	1.736 (0.083)
Lack of specific effective treatment for COVID-19 disease	0.052 (0.129)	0.015	3.568 (0.0001)

Dependent variable: Any mental disorders. The bold values indicate significantly predict the dependent variables.

significantly predict the outcomes are bolded. As is seen, “worry about children and old members of family,” “family worries for my health condition” and “lack of specific effective treatment for COVID-19” are the three job stressors that could significantly predict both of the two outcomes of mental disorder and burnout (see **Table 7**).

DISCUSSION

Our study shows a higher than 50% prevalence of mental disorders among healthcare workers of hospitals and PHC centers in the midst of one of the deadliest COVID-19 pandemic peaks in Iran. This reported prevalence is higher than that of the general population which has been reported to be 29.7% in the same time period (49). This finding is similar to a number of

TABLE 6 | Multiple regression model for predicting burnout among the study sample.

	B (Beta)	SE	t (P v)
(Constant)	-2.736	3.633	-0.753 (0.452)
Low payment and income in these days	1.490 (0.071)	0.778	1.915 (0.056)
Worry about family members getting COVID-19	0.438 (0.023)	0.640	0.684 (0.494)
Worry about my family members getting COVID-19 by me	-0.426 (-0.024)	0.585	-0.729 (0.466)
Worry about children and old members of family	2.258 (0.110)	0.712	3.173 (0.002)
Lack of special payment or low payment for COVID-19 days	1.436 (0.073)	0.758	1.894 (0.059)
Not keeping promises given by Ministry of Health	1.566 (0.085)	0.735	2.131 (0.033)
No payments for overtimes	-0.062 (-0.003)	0.648	-0.095 (0.924)
Family worries for my health condition	1.841 (0.096)	0.596	3.087 (0.002)
Low support of authorities of Ministry of Health	1.071 (0.062)	0.673	1.590 (0.112)
Lack of specific effective treatment for COVID-19 disease	2.632 (0.147)	0.626	4.206 (0.0001)

Dependent variable: Burnout. The bold values indicate significantly predict the dependent variables.

international (7, 9–11) and national (16–20) studies conducted at the time of the COVID-19 pandemic for assessing psychological distress and mental health problems among healthcare workers which have reported a high prevalence of anxiety and depression. One similar study performed a year earlier among healthcare workers from twelve different cities in India revealed that 52.9% of the participants had the risk of psychological distress that needed further evaluation (50). The higher prevalence of mental disorders among female healthcare workers found in our study has also been replicated in many studies (51–55). Results also showed a raised prevalence ratio of female/male regarding GAD and a decreased prevalence ratio of female/male regarding MDD among the healthcare workers compared to previous population studies (56).

Moderate to severe levels of burnout have been seen among nearly half of our study participants, mostly reported in healthcare workers of hospitals. Our findings are similar to findings of other studies assessing burnout levels among health care workers in the COVID-19 pandemic (12–14), one study even showing a burnout prevalence of 67% (15). Alrawashdeh et al. (33) showed in their study which was performed among physicians that several significant factors were positively associated with burnout, including female gender, working at highly loaded hospitals, working for long hours, doing night shifts, and lack of sufficient access to personal protective equipment. Regarding the fact that the further mentioned risk factors for burnout are usually mostly relevant to hospitals and not outpatient centers, we can perhaps conclude that the higher

TABLE 7 | Summary of multiple regression analysis for top ten stressors predicting dependent variables.

Top ten stressors	Dependent variables	
	Burnout	Mental disorder
Low payment and income in these days	•	
Worry about family members getting COVID-19		
Worry about my family members getting COVID-19 by me		
Worry about children and old members of family	•	•
Lack of special payment or low payment for COVID-19 days	•	
Not keeping promises given by Ministry of Health	•	
No payments for overtimes		
Family worries for my health condition	•	•
Low support of authorities of Ministry of Health		
Lack of specific effective treatment for COVID-19 disease	•	•

The bold values indicate significantly predict the dependent variables.

prevalence of burnout in hospitals found in our study can be rationalized. Results of one study showed a significant association of depression, anxiety and stress with cumulative psychological burnout, consistent with our study results (57).

The most prevalent job stressor reported by the participants of our study was low payment and income in the COVID-19 days. Concerning the role of the sufficiency of the income for family needs, Tarcan et al. (58) suggest that higher income tended to be related with better health status and with lower burnout levels, both for general physicians and nurses. Several authors have identified a relationship between better payment or income earned and higher job satisfaction, which in turn decreases burnout level (59–61). Despite this general view, one study (62) did not find such relation between payment and burnout syndrome and Linzer et al. (63) even concluded that the relevant factor for physicians was rather the relationship with patients than the monetary compensation.

Our study findings have shown that the three factors of “worry about children and old members of the family,” “family worries for my health condition,” and “lack of a specific effective treatment for COVID-19” can significantly predict the severity of the two outcomes of mental disorder and burnout. Concerns about personal and family health (64) and fear for personal and family safety had (65) also been reported among healthcare workers throughout different epidemics such as the SARS and MERS. Worry about children among the healthcare workers in the COVID-19 pandemic has been stated in other studies, especially among nurses who have been distanced from their children for a while (66). One study in the United States also showed that it was most stressful for healthcare workers to think they could transmit the disease to their family and friends (67).

This finding has also been replicated in many other studies (8, 10, 23). Results of other studies have also revealed more psychological stress among married healthcare workers and those having children (68, 69), possibly resembling the concern these individuals have about the health of their family members.

Conducting this study during the ongoing outbreak of COVID-19 and in the midst of one of the worst pandemic peaks in Iran imposed methodological limitations for our study. The main one was that an online platform was selected for gathering data from the participants in order to minimize human encountering. This prevented the researchers to select a specific time, place and circumstance for meeting the participants and filling out the questionnaires, which could have enhanced the quality of the data gathering. Convenient sampling also limits the generalizability of our results due to possible underrepresentation of the study sample as a whole.

One of the main strength points of this study is that the researchers managed to reach out to a great number of healthcare workers in six provinces in different geographical zones in the country. Another strength point was that a holistic approach was adopted and different types of healthcare workers and health staff who worked in hospitals and PHC centers were selected for enrollment in the study. Standard tools have been used for assessing mental disorders and burnout among the participants in this study which enables comparison with the results of other studies of this kind.

CONCLUSION

The results of our study revealed high psychological distress and burnout among healthcare workers of the hospitals during the fourth peak of the COVID-19 pandemic in Iran. Higher levels of distress among female healthcare workers and those

working in hospitals as seen in many other studies should be an area of special consideration and special interventions should be conducted in this regard. Burnout among healthcare workers may lead to lower quality of care for the patients and increase the probability of medical mismanagement, which is a critical issue regarding the fact that the health system is faced with shortage of human resources and high workload due to the COVID-19 pandemic. This study highlights the need for health officials to pay attention to the stressing effect of low payment and also the fear and concerns of healthcare workers about personal and family safety in the COVID-19 pandemic and obliges them to perform effective interventions to address their needs and concerns.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethical Committee of Iran University of Medical Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AhH and FT have contributed in conducting the research. MZ has performed the data analysis. AhH, MA, FT, AmH, and MZ have contributed to inscribing the main body of the article. All authors contributed to the article and approved the submitted version.

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COVID-19 and Youth Psychopathological Distress in Umbria, Central Italy: A 2-Year Observational Study in a Real-World Setting

Giulia Menculini^{1†}, Giorgio Pomili^{1†}, Francesca Brufani¹, Agnese Minuti¹, Niccolò Mancini¹, Martina D'Angelo², Sonia Biscontini³, Enrico Mancini⁴, Andrea Savini⁴, Laura Orsolini⁵, Umberto Volpe⁵, Alfonso Tortorella¹ and Luca Steardo Jr.^{2*}

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University of Genoa, Italy
Alessandro Rovetta,
R&C Research, Italy
Jennifer Severe,
University of Michigan, United States

*Correspondence:

Luca Steardo Jr.
steardo@unicz.it

[†] These authors have contributed
equally to this work and share first
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¹ Section of Psychiatry, Department of Medicine and Surgery, University of Perugia, Perugia, Italy, ² Psychiatric Unit, Department of Health Sciences, University Magna Graecia of Catanzaro, Catanzaro, Italy, ³ Mental Health Department, Azienda Unità Sanitaria Locale (AUSL) Umbria 2, Terni, Italy, ⁴ Comunità "La Tenda" Cooperativa Sociale, Foligno, Italy, ⁵ Unit of Clinical Psychiatry, Department of Clinical Neurosciences/DIMSC, School of Medicine, Polytechnic University of Marche, Ancona, Italy

Introduction: Adolescents and young adults represent a vulnerable population in the context of the Coronavirus disease 2019 (COVID-19) pandemic. The present retrospective study aims to investigate the pandemic's psychological impact on adolescents and young adults by analyzing data from an outpatient mental health service dedicated to youths in Umbria, central Italy.

Materials and Methods: The clinical charts of subjects aged 14–24 who first accessed the service in the timeframe between March 1st, 2019, and February 28th, 2021, were reviewed. Subjects were divided into two subgroups according to the period of time when they accessed the service (pre-COVID-19 vs. during- COVID-19 outbreak). Bivariate analyses were performed using the Chi-square test and the Welch's *t*-test. A secondary analysis was performed considering only subjects suffering from psychiatric disorders. Furthermore, data concerning individuals who were already followed by the service before the pandemic were analyzed by the McNemar's test and the *t*-paired test to assess changes in treatment features.

Results: The number of new accesses during the pandemic period remained stable. After the emergency onset, youths accessing the service showed a higher prevalence of anxiety disorders ($p = 0.022$). During the COVID-19 period, services were more frequently delivered by using a digital mental health approach ($p = 0.001$). Psychopharmacological treatment was more frequently prescribed among subjects that were referred to the service after the pandemic onset ($p = 0.033$). As for substance use, a highly significant reduction in opioid use was observed ($p = 0.003$). Family therapy was delivered less frequently in the during-COVID-19 subgroup, especially in the subpopulation of subjects suffering from psychiatric disorders ($p = 0.013$). When considering subjects referred to the service in the pre-COVID-19 period, the number

of interventions provided to this population increased after the pandemic outbreak ($p = 0.038$).

Conclusion: In the context of the COVID-19-related public health crisis, youths represent an at-risk population for which pathways to care should be reinforced, and targeted interventions, including psychosocial treatments, should be implemented.

Keywords: adolescents, COVID-19, psychopathological distress, psychiatric disorders, young adults, youth mental health

INTRODUCTION

The Coronavirus disease 2019 (COVID-19) pandemic represents an unprecedented health emergency affecting healthcare systems worldwide, with serious socioeconomic consequences (1). In the complex scenario that arose from the infection spread, mental health was prioritized because of the high psychological distress caused by social distancing and isolation (2, 3). Indeed, an increasing prevalence of anxiety, depression, irritability, and insomnia has been documented among the general population after the COVID-19 outbreak (4). The COVID-19 pandemic hit Italy consistently, and data from the epidemiological register of the Umbria region, in the center of the country, also reported a dramatic increase in the curve since the beginning of the pandemic spread (5). The rise in contagions forced the regional council to adopt severe restrictive measures to preserve the proper functioning of the hospital and healthcare network, with high psychopathological distress for the population. Indeed, previous reports underlined that the mental health of the general population in central Italy was significantly impacted by the pandemic, as also demonstrated by the increase of psychiatric consultations in emergency services (6).

However, the risk of developing COVID-19-related psychological distress was particularly high in vulnerable populations, such as in subjects aged 16–24 years old, who represented one of the groups most affected by the pandemic emergency (7–10). Lockdown measures had an unfavorable impact on adolescents and young adults, and a large amount of literature highlighted a greater risk for the occurrence of psychiatric symptoms due to a change in their lifestyles and habits (11) as well as lower levels of post-traumatic growth (12). For instance, the closure of schools has imposed distance learning as an alternative to maintain continuity in the education of children and adolescents (13). The subsequent prolonged social isolation threatened the psycho-physical wellbeing of youths, worsening or unmasking psychopathology (14). During the pandemic, there has been a widespread increase in depression, anxiety, irritability among children, and adolescents, and suicidal behaviors (8, 15, 16). Studies conducted in Italy already demonstrated a high prevalence of moderate or severe anxiety among youths (17), as well as a higher risk for developing problematic internet use in this population during the pandemic (18).

Furthermore, limitations due to infection imposed an adaptation in the availability of psychiatric and psychosocial interventions in dedicated settings, which were pointed out as critical needs for this population (19–21). For this reason,

implementing telepsychiatry and integrating interventions to maintain regular and emergency child and adolescent psychiatric treatment during the pandemic was identified as a significant challenge that could be necessary for limiting long-term consequences on mental health (22). In fact, integrated intervention programs (medical intervention, psychotherapy, psychoeducation to family members, social intervention) seem to have a considerably better impact than treatment-as-usual in the youth population, especially at disease onset (23).

Several countries had already allocated tailored funding for the mental health of adolescents and young adults before the pandemic (24) and conducted specific campaigns to address children and young people's mental health in the COVID-19 era (25). To this end, the European Year of Youth 2022 presents an opportunity for countries and organizations to enhance health promotion initiatives and focus on mitigating mental health problems in this population (26).

Within this scenario, the Italian Umbria region had already decided to allocate specific funds to widen the possibility of mental health departments supporting youths with psychopathological distress. The Addiction Service (SerD) of Local Mental Health 2 (USL Umbria 2) in Foligno agreed with the Umbria region to expand its curative offer by implementing an outpatient service dedicated to adolescents and young adults who present psychological distress.

Based on these premises, the present study aimed to investigate the pandemic's impact on adolescents and young adults, analyzing data from the abovementioned outpatient youth mental health service. Notably, changes in access to mental health care, clinical and treatment features of patients in charge of the service before the pandemic were furtherly analyzed. A secondary analysis was performed to evaluate access to care and changes in clinical and treatment features of subjects suffering from psychiatric disorders. Particularly, we expect to detect significant changes in diagnostic and treatment (both psychopharmacological and psychosocial) features after the COVID-19 outbreak, possibly reflecting differences in pathways to care and patterns of care for this population.

MATERIALS AND METHODS

Study Procedures

The present study was performed by carrying out a retrospective chart review analysis of clinical data collected during the time period between March 1st, 2019 and February 28th, 2021, at

the Addiction Service (SerD) of Local Mental Health 2 (USL Umbria 2) in Foligno, Umbria, Italy. Clinical charts of subjects aged 14–24 who first accessed the service between March 1st, 2019, and February 28th, 2021, were retrospectively reviewed. In the study, we included both subjects who had a personal history of substance use disorders (SUD) and subjects who reported no history of SUD. Indeed, SUD can also be considered an early sign of psychological distress in youths and may represent a “red flag” for the later development of clear-cut psychiatric symptoms (27).

Information concerning the personal and clinical history of the included subjects was extracted from the electronic medical charts achieved from the online platform PoInT GeDi (28). Data were inserted in two electronic datasets created *ad hoc* for the current project. In the first dataset, subjects who first accessed the service between March 1st, 2019, and February 28th, 2021, were entered. This population was then divided in two subgroups, namely subjects who had accessed the service for the first time in the period March 1st, 2019, and February 28th, 2020 (pre-COVID-19 period) and those who referred to the service for the first time in the period March 1st, 2020 and February 28th, 2021 (during-COVID-19 period). Indeed, the national lockdown was established in Italy on March 9th, 2020, which also concerned the Umbria region. Furthermore, the first case of COVID-19 was confirmed in Italy at the end of February 2020, and an increase in COVID-19 cases and related hospitalizations registered in Umbria at the beginning of March (29). This dataset was used to compare socio-demographic, clinical, and treatment characteristics among the two populations to evaluate significant differences between subjects who accessed the service before and after the pandemic outbreak and between the treatments provided in the two populations in the two different periods. Socio-demographic data collected for the included subjects were age, gender, nationality, marital status, scholarship, working status, and living status. As for clinical information, data concerning medical comorbidities, SUD (alcohol, amphetamines, cannabinoids, cocaine, and heroin), psychiatric diagnosis, suicide attempts, and non-suicidal self-injurious behavior was collected. Moreover, we extracted the following treatment-related features: current psychopharmacological treatment (antidepressants, antipsychotics, benzodiazepines, mood stabilizers), replacement treatment for addiction, other pharmacological treatments, psychosocial interventions (individual psychotherapy, family therapy, social, and educational interventions), and treatment in a residential facility.

Only subjects who first accessed the service in the pre-COVID-19 period were considered in the second dataset. Information concerning treatments provided before and after the pandemic was collected to analyze significant changes in treatment features possibly related to the COVID-19 pandemic. Data concerning clinical characteristics and treatment features (see above) was collected for both pre- and during-pandemic periods.

To address the secondary aim of the study, a further analysis was performed on a subsample of subjects suffering from psychiatric disorders. The following nosographic entities were considered: schizophrenia spectrum disorders, depressive disorders, bipolar disorders, anxiety disorders, impulse control

disorders, neurodevelopmental disorders, substance-related disorders, personality disorders, and adjustment disorders. Trained psychiatrists and psychologists with specific expertise on youth mental health carried out the diagnostic evaluation by using the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) (30). Subjects affected by neurocognitive disorders or medical illnesses that might significantly influence mental health status were excluded. The analysis was then repeated following the aforementioned procedure, focusing on this subsample.

According to the study's observational nature, all the included subjects underwent treatment as usual. The study was conducted in accordance with Declaration of Helsinki and followed the Good Clinical Practice Guidelines. All the included subjects signed their informed consent for having their data used for research purposes. In the case of minors, informed consent was also obtained by parents or those who exercised parental authority. The study protocol was approved by the Ethics Committee of Umbria Region (protocol N° 23369/21/ON).

Study Setting

The facility where the study was carried out is a multidisciplinary service aimed at providing health promotion, prevention, and treatment of people with problems of addiction to legal or illegal psychoactive substances (drugs, alcohol, smoking), or addiction without the use of substances (e.g., gambling and video addiction). The service is equipped with specific facilities dedicated to youth suffering from psychological distress, with separate pathways for those who report SUD, including alcohol, and those who do not. Indeed, despite the service itself being dedicated to addiction problems, the growing number of youths reporting mental health problems led to the institution of a specific project addressed to young people with psychological distress without SUD comorbidity. This path of care is part of two specific projects, named “Girovento” and “Giovani 2.0.” These projects attempt to address the need for new clinical-organizational responses concerning increasingly complex requests coming from youths in the fourteen–twenty-four age group; all these treatment pathways operate in close integration with the services of child and adolescent psychiatry, inpatient, and outpatient community mental health services for adults, and with the school psychologists consulting service, as well as with social services.

The multidisciplinary team discusses weekly the clinical cases of subjects who access these projects, identifying and elaborating individualized therapeutic projects, e.g., individual psychotherapy, family therapy, social and educational interventions, peer groups and support groups addressed to parents. Psychiatric evaluation and treatment are also provided whenever needed.

Statistical Analysis

A descriptive analysis of socio-demographic, clinical, diagnostic, and treatment features was performed to evaluate the distributional properties of the variables in the study sample. Categorical variables were expressed as frequencies, while continuous variables were expressed as mean and

standard deviation (SD) or median and interquartile range (IQR) according to the normality of the distribution. The normality of continuous variables was verified by using the Kolmogorov-Smirnov test.

Bivariate analyses were carried out to compare the subgroups of subjects who accessed the service before and after the pandemic outbreak. We performed the Chi-Square test for categorical variables since levels of the variables were mutually exclusive and the compared groups were independent. All tests were performed for 2×2 cross tabs. The assumption according to which the expected cell count should be ≥ 5 in at least 80% of the cells was verified for all tests, and when this assumption was not met the Fisher's exact test was carried out (31, 32). The Welch's *t*-test was used for continuous variables due to the presence of outliers. The analysis was conducted using a parametric test due to the sensitivity of this technique, which guarantees sufficient robustness in case of normality assumption violation in sample sizes like the one we considered (33–35). In order to assess differences concerning the pre- and during-COVID-19 period for subjects who first accessed the service before the pandemic break, the Mc Nemar's test was used for categorical variables since we attempted to find statistically significant differences in paired variables categorized as dichotomous. The sample consisted of all youths accessing the service, and since no restrictions in access to the service were established (e.g., presentation modalities, area of residence), the sample could be considered as representative of the population of interest (youths accessing to care in the Umbria region). The Student's *t*-test for paired samples was employed for continuous variables. We chose not to apply a *p*-value correction (e.g., Bonferroni correction) to avoid type II errors. Indeed, we conducted exploratory analyses for testing a hypothesis mainly concerning two groups of variables, namely diagnostic and treatment features, and thus did not want to miss possible significant association worthy of being further explored (36). All *p*-values were two-tailed. Since the reporting of results according to a continuous approach rather than to a fixed threshold (e.g., $p < 0.05$) has been largely advocated (37, 38), findings from the present study will be presented in terms of high ($p < 0.01$), medium ($p < 0.05$ and ≥ 0.01), and low ($p < 0.1$ and ≥ 0.05) significance. All analyses were performed using the Statistical Package for Social Sciences (SPSS) version 26 for Windows Inc. (Chicago, IL, United States).

RESULTS

Description of Sample Characteristics

The overall study population consisted of 110 subjects, with a higher prevalence of male gender ($n = 77$, 70%) and a median age of $19 \pm$ years old (IQR 5, range 14–24). Most subjects in the sample were Italian ($n = 97$, 88.2%). None of the included subjects was married, and the majority lived with their family of origin ($n = 77$, 70%). As for working status, 56 (50.9%) were current students, whilst 19 (17.3%) did not study or work. In the sample, 57 (51.8%) youths were referred to the service before the COVID-19 pandemic outbreak and 53 (48.2%) had their first contact after the pandemic spread. The most frequently reported

addictive behavior was alcohol use ($n = 35$, 31.8%), followed by cannabis use ($n = 31$, 28.2%).

Subjects suffering from a psychiatric disorder were 79 (71.8%), among which 48 (60.8%) were males. The median age in the sample was 18 (IQR 4) years old, ranging from 14 to 24. When analyzing the period when youths referred to the service, 42 (53.2%) accessed the outpatient facility before the COVID-19 outbreak. Most subjects in this subsample lived with their family of origin ($n = 65$, 82.3%), while a minority of them lived in residential facilities ($n = 7$, 8.9%) or on their own ($n = 6$, 7.6%). At the time of clinical assessment, 53 subjects (67.1%) were students, while 14 (17.7%) did not study or work. In this subsample, the most common psychiatric disorders were represented by anxiety disorders ($n = 37$, 46.8%) and adjustment disorders ($n = 22$, 27.8%). Concerning addictive behaviors, most subjects reported cannabis use ($n = 29$, 36.7%) (see **Tables 1, 2**). Six (7.6%) subjects presented self-aggressive behaviors, and one attempted suicide. Psychopharmacological treatment was prescribed in 21 (19.9%) subjects in the overall sample. Particularly, antipsychotics were prescribed to 10 (9.1%) subjects, while five (4.5%) received antidepressants, 10 (9.1%) took mood stabilizers, and seven (6.4%) underwent anxiolytics prescription. As for psychosocial interventions, individual psychotherapy was delivered to 72 (65.5%) subjects, and family therapy was provided in 17 (15.5%) cases. Moreover, 49 (44.5%) and 20 (18.2%) subjects underwent social-educational interventions.

Socio-Demographic and Clinical Characteristics of Subjects Accessing the Service Before and During the COVID-19 Pandemic

When comparing subjects accessing the service before ($n = 57$, 51.8%) and during the COVID-19 pandemic ($n = 53$, 48.2%), no differences in socio-demographic characteristics were found regarding gender and occupation. Subjects accessing the service after the pandemic started were older than those referred before the COVID-19 outbreak (mean age 19.77 ± 2.63 vs. 18.53 ± 2.82), and more often lived with their family of origin (79.2% vs. 61.4%), respectively with a medium ($p = 0.018$) and low ($p = 0.067$) significance.

When assessing addictive behaviors in the two subgroups, no differences were detected between subjects accessing the service before and during the COVID-19 pandemic except for opioid use, which was highly more prevalent in the pre-pandemic sample (22.8% vs. 1.9%, $p = 0.003$). Furthermore, youths accessing the service after the emergency onset showed a higher prevalence of anxiety disorders (45.3% vs. 22.8%, $p = 0.022$).

The two subgroups did not differ in the number of psychiatric visits and psychosocial interventions supplied. After the COVID-19 outbreak, services were more frequently delivered using a digital mental health approach (28.3% vs. 3.5%), with a high significance of the result ($p = 0.001$). No significant differences were detected in terms of drop-out rates.

A medium significance was found for differences in the prescription of psychopharmacological treatment, which was more frequently prescribed among subjects that were referred to

TABLE 1 | Comparison of socio-demographic and clinical characteristics of subjects accessing the service before (pre-COVID-19; $n = 57$, 51.8%) and after the COVID-19 pandemic outbreak (during-COVID-19; $n = 53$, 48.2%).

Socio-demographic and clinical characteristics					
	Pre-COVID-19 (n,%)	During-COVID-19 (n,%)	χ ²	p	OR (95% CI)
Female gender	19 (33.3)	14 (26.4)	0.340	0.560	0.718 (0.315–1.634)
Italian nationality	50 (87.7)	47 (88.7)	0.000	1.000	1.097 (0.343–3.501)
Unemployed	9 (15.8)	10 (18.9)	0.030	0.862	1.240 (0.461–3.338)
Living with family of origin	35 (61.4)	42 (79.2)	3.357	0.067	2.400 (1.024–5.624)
Living alone	5 (8.8)	2 (3.8)	0.465	0.495	0.408 (0.076–2.199)
Living in a residential facility	13 (35.1)	7 (13.7)	0.000	1.000	0.849 (0.215–3.346)
Referral to a residential facility	3 (5.3)	0 (0)	1.227	0.244	0.505 (0.418–0.609)
NSSI	4 (7)	2 (3.8)	0.108	0.680	0.520 (0.091–2.961)
Drop-out	17 (29.8)	15 (28.3)	0.000	1.000	0.929 (0.407–2.118)
	Pre-COVID-19 (mean, SD)	During-COVID-19 (mean, SD)	Welch's t-test		p
Age	18.53 (2.82)	19.77 (2.63)	5.758		0.018
Number of interventions	30.89 (37.63)	22.89 (33.66)	1.596		0.209
Diagnostic features					
	Pre-COVID-19 (n,%)	During-COVID-19 (n,%)	χ ²	p	OR (95% CI)
Psychiatric comorbidity	37 (64.9)	42 (79.2)	2.124	0.145	2.064 (0.875–4.869)
Adjustment disorders	12 (21.1)	10 (18.9)	0.002	0.962	0.872 (0.342–2.227)
Anxiety disorders	13 (22.8)	24 (45.3)	5.249	0.022	2.801 (1.231–6.371)
Bipolar disorders	0 (0)	0 (0)	–	–	–
Depressive disorders	6 (10.5)	6 (11.3)	0.000	1.000	1.085 (0.327–3.599)
Impulse control disorders	8 (14)	13 (24.5)	1.337	0.248	1.991 (0.751–5.276)
Neurodevelopmental disorders	3 (5.3)	3 (5.7)	0.000	1.000	1.080 (0.208–5.600)
Personality disorders	8 (14)	8 (15.1)	0.000	1.000	1.089 (0.377–3.144)
PTSD	2 (3.5)	1 (1.9)	0.000	1.000	0.529 (0.047–6.008)
Schizophrenia spectrum disorders	3 (5.3)	0 (0)	1.227	0.244	0.505 (0.418–0.609)
More than one psychiatric disorder	14 (24.6)	17 (32.1)	0.440	0.507	1.450 (0.630–3.341)
SUD	36 (63.2)	33 (62.3)	0.066	0.797	0.840 (0.393–1.795)
Alcohol use disorders	18 (31.6)	17 (32.1)	0.000	1.000	1.023 (0.458–2.284)
Cannabis use disorders	13 (22.8)	18 (34)	1.182	0.277	1.741 (0.751–4.033)
Cocaine use disorders	4 (7)	5 (9.4)	0.013	0.736	1.380 (0.350–5.440)
Opioid use disorders	13 (22.8)	1 (1.9)	9.020	0.003	0.065 (0.008–0.517)
More than one SUD	7 (12.3)	6 (11.3)	0.000	1.000	0.912 (0.286–2.911)
Treatment features					
Psychopharmacological treatment	6 (10.5)	15 (28.3)	4.526	0.033	3.355 (1.191–9.452)
Antidepressants	0 (0)	5 (9.4)	3.669	0.023	0.457 (0.371–0.563)
Antipsychotics	4 (7)	6 (11.3)	0.205	0.517	1.691 (0.450–6.362)
Benzodiazepines	3 (5.3)	4 (7.5)	0.010	0.709	1.469 (0.313–6.896)
Mood stabilizers	2 (3.5)	8 (15.1)	3.169	0.047	4.889 (0.988–24.185)
Alcohol substitution therapy	1 (1.8)	1 (1.9)	0.000	1.000	1.077 (0.066–17.663)
Opioid substitution therapy	10 (17.5)	1 (1.9)	5.942	0.016	0.090 (0.011–0.733)
Educational interventions	9 (15.8)	11 (20.8)	0.183	0.669	1.397 (0.528–3.697)
Family therapy	13 (22.8)	4 (7.5)	3.796	0.051	0.276 (0.084–0.910)
Individual psychotherapy	36 (63.2)	36 (67.9)	0.105	0.745	1.235 (0.561–2.719)
Social interventions	28 (49.1)	21 (39.6)	0.656	0.418	0.680 (0.319–1.449)
Digital interventions	2 (3.5)	15 (28.3)	11.092	0.001	10.855 (2.345–50.244)

NSSI, Non-suicidal self-injury; PTSD, Post-traumatic stress disorder; SUD, Substance use disorder. For all categorical variables, “yes” are listed. High ($p < 0.01$) and medium significance ($p < 0.05$ and ≥ 0.01) is reported in bold and italics, low significance ($p < 0.1$ and ≥ 0.05) is reported in italics. Data concerning the whole sample of youths referring to the service in the two considered periods are reported in this table.

TABLE 2 | Comparison of socio-demographic and clinical characteristics of subjects accessing the service before (PSY-pre-COVID-19; $n = 37$, 46.8%) and after the COVID-19 pandemic outbreak (PSY-during-COVID-19; $n = 42$, 53.2%).

Socio-demographic and clinical characteristics					
	PSY-pre-COVID-19 (n,%)	PSY-during-COVID-19 (n,%)	χ ²	p	OR (95% CI)
Female gender	17 (45.9)	14 (33.3)	0.837	0.360	0.588 (0.237–1.463)
Italian nationality	34 (91.9)	37 (88.1)	0.034	0.717	0.653 (0.145–2.941)
Unemployed	6 (16.2)	8 (19)	0.001	0.973	1.216 (0.379–3.898)
Living with family of origin	32 (86.5)	33 (78.6)	0.390	0.533	0.573 (0.173–1.895)
Living alone	4 (8.8)	2 (4.8)	0.345	0.411	0.413 (0.071–2.395)
Living in a residential facility	3 (8.1)	4 (9.5)	0.000	1.000	1.193 (0.249–5.716)
Referral to a residential facility	3 (8.1)	0 (0)	1.668	0.098	0.447 (0.348–0.574)
NSSI	4 (10.8)	2 (4.8)	0.345	0.411	0.413 (0.071–2.395)
Drop-out	5 (13.5)	10 (23.8)	0.769	0.381	2.000 (0.615–6.509)
	PSY-pre-COVID-19 (mean, SD)	PSY-during-COVID-19 (mean, SD)	Welch's t-test	p	
Age	17.35 (2.47)	19.29 (2.62)	11.353	0.001	
Number of interventions	33.43 (34.45)	27.55 (36.40)	0.755	0.388	
Treatment features					
	PSY-pre-COVID-19 (n,%)	PSY-during-COVID-19 (n,%)	χ ²	p	OR (95% CI)
Psychopharmacological treatment	6 (16.2)	15 (35.7)	2.898	0.074	2.870 (0.977–8.437)
Antidepressants	0 (0)	5 (11.9)	2.909	0.057	0.500 (0.398–0.628)
Antipsychotics	4 (10.8)	6 (14.3)	0.015	0.743	1.375 (0.356–5.306)
Benzodiazepines	3 (8.1)	4 (9.5)	0.000	1.000	1.193 (0.249–5.716)
Mood stabilizers	2 (5.4)	8 (19)	2.192	0.094	4.118 (0.815–20.802)
Alcohol substitution therapy	1 (1.8)	1 (1.9)	0.000	1.000	0.878 (0.053–14.551)
Opioid substitution therapy	10 (17.5)	1 (1.9)	5.942	0.044	0.440 (0.341–0.568)
Educational interventions	8 (21.6)	10 (23.8)	0.000	1.000	1.133 (0.394–3.259)
Family therapy	13 (35.1)	4 (9.5)	6.100	0.013	0.194 (0.057–0.666)
Individual psychotherapy	34 (91.9)	36 (85.7)	0.258	0.490	0.529 (0.123–2.287)
Social interventions	24 (64.9)	20 (47.6)	1.724	0.189	0.492 (0.199–1.219)
Digital interventions	1 (2.7)	15 (35.7)	11.307	0.001	20.000 (2.487–160.865)

NSSI, Non-suicidal self-injury. For all categorical variables, "yes" are listed. High ($p < 0.01$) and medium significance ($p < 0.05$ and ≥ 0.01) is reported in bold and italics, low significance ($p < 0.1$ and ≥ 0.05) is reported in italics. Data concerning youths suffering from a psychiatric disorder as diagnosed according to the DSM-5 criteria periods are reported in this table.

the service after the pandemic (28.3% vs. 10.5%, $p = 0.033$). Particularly, antidepressant and mood stabilizer prescription rates were higher after the COVID-19 outbreak (9.4% vs. 0%, $p = 0.023$; 15.1% vs. 3.5%, $p = 0.047$). When assessing changes in the delivery of psychosocial interventions, we evidenced a reduction in family therapy in the during-COVID-19 group (7.5% vs. 22.8%), with a low significance ($p = 0.051$). For comparison between subjects accessing the service before and after the pandemic spread, see **Table 1**.

When analyzing the secondary outcome of the study, by comparing subjects affected by psychiatric disorders referring to the service before ($n = 37$, 46.8%) and during ($n = 42$, 53.2%) the COVID-19 pandemic (see **Table 2**), the only socio-demographic characteristic that differed among the two subgroups with a high significance was the age. Indeed, subjects accessing psychiatric services after the pandemic were older than those who were referred to the service before the infection outbreak (19.29 ± 2.62 vs. 17.35 ± 2.47 , $p = 0.001$). Diagnostic features did not

differ between the two subgroups, nor did the other clinical characteristics investigated in the present study.

Digital social and educational interventions and telepsychiatry interventions were significantly more frequent in the during-COVID-19 subgroup (35.7% vs. 2.7%, $p = 0.001$). Treatment prescription varied among the two populations with a low significance. Particularly, higher psychopharmacological prescription rates (35.7% vs. 16.2%, $p = 0.074$), especially for what concerned antidepressants (11.9% vs. 0%, $p = 0.057$) and mood stabilizers (19% vs. 5.4%, $p = 0.094$), were highlighted in the during-COVID-19 population.

Family therapies were less frequently administered to subjects who accessed the service after the pandemic spread when evaluating psychosocial interventions (9.5% vs. 35.1%), with a medium significance ($p = 0.013$). Moreover, none of the subjects accessing the service after the COVID-19 outbreak was referred to residential facilities, with a low significance when compared to those accessing the service before (0% vs. 8.1%, $p = 0.098$).

Differences in Treatment Features During the COVID-19 Pandemic

Among subjects referred to the service before the pandemic, 18 (31%) dropped out of the therapeutic program before the COVID-19 spread. Only subjects who did not drop-out before the pandemic outbreak were considered for this sub-analysis ($n = 39$).

Medium significance was found in the difference between the number of interventions supplied before and during the COVID-19 pandemic (70.80 ± 107.117 vs. 34.55 ± 39.08 , $p = 0.038$). Digital mental health services demonstrated a highly significant increase in the considered population (5.1% vs. 56.4%, $p < 0.001$). The rates of psychosocial interventions did not differ when comparing the period before and after the pandemic spread, and neither did psychopharmacological treatment features.

DISCUSSION

After the COVID-19 outbreak, there was a significant increase in the number of interventions supplied to subjects who first accessed the service in the “pre-COVID-19” period. We found an increase in the mean age of subjects who accessed the service in the “during-COVID-19” period, a higher prevalence of anxiety disorders, and an increase in the use of anxiolytics and mood stabilizers. A reduction in the prevalence of opioids use disorder and in the use of substitution therapy for opioid dependence was also observed. Furthermore, we observed a highly significant increase in digital mental health interventions in the “during-COVID-19” period, as well as a decrease in family therapies, both provided by digital tools and in-person, with a high significance of the difference in the subpopulation of subjects suffering from psychiatric disorders. Treatment features of people who were already followed by the service before the COVID-19 outbreak did not significantly change, except for the number of supplied interventions and the already mentioned increase of digital interventions.

New accesses to the service after the COVID-19 outbreak were stable, which is in line with the literature on the topic. Indeed, previous studies highlighted that the number of admissions to psychiatric care facilities showed trends similar to the pre-COVID-19 outbreak period (39). This result could be due to an adaptation of mental services to give help during the pandemic, especially implementing digital mental health services (40), while it is in contrast with other findings, e.g., those concerning the decrease of new accesses to psychiatric emergency units (41–43). Based on the stated above, access to care during the COVID-19 emergency should be further investigated since it represents a complex issue that relies on several possible determinants (44). Future research on the topic should thus consider these determinants, such as socio-economic factors (45, 46).

Our study also observed a significant increase in the number of follow-up interventions of subjects that were already being treated in the “pre-COVID-19” period. This has been made possible by the highly significant increase of digital mental health interventions (47–51). Indeed, digital mental health

interventions, such as those delivered *via* mobile and web-based platforms, offer the potential to improve access to care while avoiding many existing barriers to receiving face-to-face intervention, including stigma and time (52–54). The evidence base for digital mental health interventions in the general population is rapidly accumulating (55, 56), and many studies on the topic reported that such interventions were either effective or partially effective in producing beneficial changes in the main psychological outcome variables, also among youngsters (50, 57, 58).

Dropouts from the therapeutic project did not face a statistically significant increase and were similar to those detected in studies conducted on similar populations before the pandemic spread (59). Despite this, an increasing trend in dropouts was evidenced after the COVID-19 outbreak and a positive, strong association was highlighted in the psychiatric disorders' subgroup. To our best knowledge, literature concerning drop-out rates from outpatient psychiatric services during the pandemic is scant, especially for the youth population. Data from the present research are thus expected to be further clarified by future prospective studies, since adequate access to care represents a crucial issue in the field of early intervention (60).

The results have shown an increase of medium significance in the mean age of subjects accessing the service in the “during-COVID-19” period. We hypothesized that this finding could be due to better social support given by belonging to a group, such as schoolmates for adolescents, representing a protective factor against loneliness that can lead to anxiety and depressive symptomatology (61). Therefore, having finished school, with a consequent reduction in the sense of belongingness, may have a synergistic effect with the isolation linked to the pandemic and lockdown measures themselves. Many studies reported that loneliness threatens mental health (7, 62), leading to sleep disturbances and increased inactivity (63, 64). Greater severity of depressive symptomatology may also had been caused by loneliness, along with poor self-perceived overall health quality, impaired functional status, and a perceived negative change in the quality of life (65).

Concerning people who first sought help to the service after the COVID-19 outbreak, we found a higher prevalence of anxiety disorders in this population when compared to those referred before the pandemic spread. An increase in prescriptions of antidepressants and mood stabilizers was also highlighted, both for subjects suffering from psychiatric disorders and those who did not. Interestingly, the significance of the phenomenon was higher in the second group. Several studies confirmed our findings by detecting the increase in the prevalence of anxiety and depressive disorders in young adults during the COVID-19 pandemic (66, 67). Scientific papers that have evaluated the differences in the prescriptions of psychopharmacological treatments during the pandemic are scant. However, some studies showed an increasing trend (68). It should also be noted that the choice of pharmacological treatments in youth populations represents a critical issue, as demonstrated by the high prescription rates of off-label treatments in this population (69). In our sample, when a clear-cut diagnosis according to the DSM-5 criteria was not possible to be performed,

pharmacological treatments were based on symptom dimensions. Indeed, the absence of a full-blown diagnosis does not necessarily mean the absence of an at-risk state, namely a totipotent condition that could hesitate in different exit syndromes (70–72). This could also explain higher rates of mood stabilizer prescription in the sample, even though the diagnosis of bipolar disorders did not significantly change. To this extent, it should be noted that the emergence of SUD or anxiety symptoms during youth may be the expression of a bipolar diathesis in young people, and this may partially explain the higher mood stabilizer prescription rate (73). Furthermore, we should consider that adjustment disorders may also manifest with disturbed conduct, which may more frequently benefit from mood stabilizers or antipsychotics in youths (74, 75). Due to the risk of dependence associated with benzodiazepines assumption, especially in a population of subjects accessing an addiction service, low-dose atypical antipsychotics and mood stabilizers were preferred for anxiety symptoms or anxiety disorders (76, 77).

As demonstrated by some reviews (10, 78), the COVID-19 pandemic and the lockdown measures may have negatively impacted youths' mental health. First, school closure may have significantly impacted children and adolescents, particularly those aged between 5 and 18 (79). Lack of regular contact with friends may more frequently result in loneliness during adolescence and is not necessarily mitigated using phones or other communication forms (80). This context predisposes adolescents to psychopathological vulnerability, leading to an increasing trend in diagnoses of depressive and anxiety disorders (81). Accordingly, the prevalence of depression in young people across studies conducted in this period ranged from 22.6% to 43.7%, according to previous studies (66, 67), and an increase in the severity of pre-existing depression was detected (82). A survey conducted in China among 8,079 adolescents aged 12–18 revealed a high prevalence of symptoms of depression (43%), anxiety (37%), and combined depression and anxiety (31%) during the COVID-19 pandemic (83). Several risk factors, such as relatives suffering from COVID-19, were identified for the development of affective symptoms (84). These findings are considerable since youths suffering from psychiatric disorders represent an extremely vulnerable population, among which significant consequences could also emerge after the pandemic outbreak (85).

As expected, we observed a highly significant increase in telepsychiatry interventions in line with a large amount of literature. Several papers highlighted an increase in the prevalence of digital mental health interventions in young adults during the COVID-19 pandemic, and different psychological interventions were adapted to the online form (86, 87). We highlighted a decreasing trend in family therapies, with higher significance in the subgroup of subjects suffering from psychiatric disorders. Family therapies are psychotherapy interventions provided by a trained mental health professional (in our service, usually a psychologist) and oriented toward communication improvement and conflict solution in familiar contexts. This data is relevant since scientific literature demonstrated how the pandemic impacted the whole familiar system. Indeed, previous reports underlined that quarantine measures might influence

depressive symptom severity among students and their family members (88). Studies focusing on the mental health of children, young adults and their parents showed considerable stressors that these populations perceived during the pandemic period. Children and adolescents were mainly stressed by the disruption of social life and important activities/events, whereas their parents were stressed by the uncertainty of the pandemic and the disease itself (89). These changes in habits suggest that specific risk factors for the development of psychological distress should be identified for both youths and their families in order to act on potentially modifiable stressors. Despite this, the readaptation of family therapy models to digital mental health settings, which was needed due to physical distancing protocols, required a huge effort, and several challenges were faced by both professionals and users (90). Indeed, the lack of adequate technology could represent a concern for families already coping with socio-economic problems before the pandemic due to the worsening of such problems in most cases (91).

Furthermore, the engagement with the therapist could become a concern for families that were not already in contact with the service in the “pre-COVID-19” period. This issue could explain the decrease in such interventions, possibly due to one or more members' difficulties trusting the therapist and establishing a therapeutic alliance (92). A decreasing trend was not evidenced for social and educational interventions, usually requiring one-to-one relationships between social workers/professional educators and the user. This relationship does not happen in the context of a therapeutic process and does not undergo the rules of a psychotherapeutic setting, making it easier to adapt the intervention for a digital setting.

These considerations reinforce the need for integrated interventions in adolescents showing the onset of psychiatric symptoms during the pandemic (93). Integrated psychosocial interventions could avoid the detriments of more extended home-schooling periods, the loss of opportunities to meet peers, and the disruption of familiar daily routines (89). Accordingly, the finding concerning the reduction in access to residential facilities should be considered, even though the significance was low. This could be interpreted in consideration of significant challenges faced in youth residential care, where social distancing measures and the interruption of contacts with families of origin critically affected the possibility of providing integrative care (94).

Regarding substance use, in our study, we observed a reduction in opioid use in the “during-COVID-19” period of medium significance and, consequently, a reduction in the use of substitution therapy for drug addiction. This evidence could be related to the limitations produced by the lockdown measures during the pandemic period and confirms data from previous studies (95, 96).

However, our sample's decrease in opioid consumption should be considered a part of a more complex, multi-facet situation. Indeed, due to reduced access to treatment and replacement pharmacology therapies and the lack of continuity in the intake of opioids, emergencies occurred more frequently in the pandemic period, as demonstrated by the increase in cases of opioid overdose (97).

Our study has limitations: first, the relatively small sample size may limit the generalizability of the findings. The issue is also due to the choice of a real-world setting relying on data from one service, since outpatient facilities dedicated to adolescents and young adults suffering from mental health problems are limited in our region. The sample size also hindered the possibility to perform further sub-analyses, e.g., stratifying subjects based on psychiatric diagnoses. Furthermore, it should be considered that data concerning the “during-COVID-19” period were collected during different pandemic phases, without, e.g., specifying whether new accesses happened during lockdown periods or not. To note, we could not analyze any increasing trends in the considered variables during the years preceding the COVID-19 outbreak, and the comparison between the pre-COVID-19 and the during-COVID-19 period assumed no increasing trends in the variables of interest.

Moreover, a specific psychopathological assessment was not systematically administered, and data collected in the usual clinical practice were instead used. This issue may limit the possibility to evaluate treatment response in the considered population. To this end, further studies should evaluate the outcomes of the administered interventions in youths suffering from psychological distress, particularly focusing on telepsychiatry and psychosocial treatments.

CONCLUSION

Data from the present study suggest that health professionals should accurately screen youths for the presence of psychological distress, both those that already suffered from a psychiatric disorder and those manifesting such distress for the first time. Youths represent a high-risk population for the development of mental disorders, and these were demonstrated to increase during the COVID-19 pandemic and could be expected to rise in the post-pandemic era. The increase of specific psychopathological features in this vulnerable group after the COVID-19 outbreak suggests that pathways to care should be reinforced, and targeted interventions should be

proposed to improve the mental health of adolescents and young adults. Particularly, clinicians should further promote the adaptation of mental health services to the emerging historical and social context, e.g., extensively rethinking services under a digital mental health perspective. Furthermore, the proposed interventions should include tailored pharmacological treatments that could help achieve symptomatologic remission and psychosocial interventions that would progressively lead youths toward a full-functional recovery.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Umbria Region (protocol N° 23369/21/ON). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

GM and GP conceived the idea and designed the study. GP and AS collected the data. GM performed the statistical analysis. GM, GP, FB, AM, NM, and MD'A wrote the original draft. SB, EM, LO, UV, and AT revised the whole manuscript. LS supervised the study during all its phases. All authors contributed to the article and approved the submitted version.

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Correlation Between Schizophrenia and Coronavirus Disease in North Sumatera, Indonesia: A Correlative Analytical Study

Mustafa M. Amin*, Richie Futrawan and Muhammad Surya Husada

Department of Psychiatry, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

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*Correspondence:

Mustafa M. Amin
mustafa.mahmud@usu.ac.id

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Between Schizophrenia and
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Background: In the first quarter of 2020, two cases of coronavirus disease (COVID-19) were reported in Indonesia, approximately 4 months after the first case was reported in China. The numbers continued to increase following the introduction of many variants of the virus. The pandemic may have an impact on the community's mental health, particularly on those with mental illnesses. Therefore, this study aimed to determine the correlation between schizophrenia and COVID-19 based on demographic characteristics.

Methods: This nominal-nominal and numerical-nominal correlative analytical study used a cross-sectional approach and was conducted at a psychiatric hospital in North Sumatera. The sample population consisted of 48 patients and 48 healthy controls, who were selected using a non-probability consecutive sampling method.

Results: The analysis showed that there were correlations between schizophrenia and COVID-19 ($r = 0.417$, $p < 0.001$) and between the age of patients with schizophrenia and COVID-19 with ($r = 0.544$).

Conclusions: COVID-19 is correlated with schizophrenia and the age of patients with schizophrenia. We recommend that patients with schizophrenia follow the same health guidelines as the clinical high-risk group for COVID-19 and receive the same treatment. Physicians that treat patients with COVID-19 should pay close attention to those with schizophrenia because they may underestimate their condition.

Keywords: schizophrenia, age, coronavirus disease, COVID-19, Indonesia

INTRODUCTION

In Indonesia, two cases of coronavirus disease (COVID-19) were announced on March 2, 2020, approximately 4 months after it was first identified in China. Subsequently, two other confirmed patients were discovered on March 6, 2020, and the numbers have continued to increase (1). At the end of March 2022, there were approximately 6 million confirmed cases of COVID-19 in Indonesia (2).

This situation has led to the development of several studies on the effects of the pandemic on the mental health of the general community, especially in patients with mental disorders (3). During the pandemic in Indonesia, two studies were conducted on mental health. The first study by Kaligis et al. (4) concluded that anxiety symptoms were the most reported symptoms of the

participants. A similar result was reported by Izzatika et al. (5), who found that 34.6% of the study population experienced anxiety. Previous studies have shown that the stress associated with the virus and its preventive measures have a negative effect on mental health, particularly among people with schizophrenia. Furthermore, viral infection can worsen the symptoms experienced in schizophrenia because it is associated with psychotic symptoms through immune mechanisms (6), particularly cytokines. Schizophrenia is linked to disruption of the cytokine milieu and a tendency for the development of pro-inflammatory cytokines (7). The pandemic has had an unprecedented impact on several countries worldwide, and preventive efforts have been disproportionately burdened by the presence of schizophrenia and other disorders (8).

Mechanisms related to the association between coronavirus infection and mental disorders have revealed the involvement of neuroimmune networks. Furthermore, elevated cytokine levels have been observed in some psychiatric disorders as a sign of immunity, which is also common in patients with COVID-19. Dissolved cytokines in the brain or their corresponding local alteration levels can affect the synthesis, release, and reuptake of several neurotransmitters, including monoamines, such as dopamine, norepinephrine, and serotonin. Alterations in metabolism are also involved in the pathophysiology of various psychiatric disorders. Changes in cytokine levels cause disturbances in metabolism, which trigger behavioral deficits. Therefore, the immune system can be assumed to be the link between COVID-19 infection and mental health disorders (9). There are limited studies on the correlation between schizophrenia and the coronavirus pandemic; hence, this study is expected to provide information for clinicians, patients, families, and the community. This study aimed to investigate the implications of the global pandemic related to the increased risk of infection and poor outcomes among patients with schizophrenia, as well as the anticipated adverse mental health consequences of the disorder.

METHODS

Ethics Statements

All participants provided written informed consent after they were given a detailed and clear explanation of the study process. This study was approved by the Research Ethics Committee of the Universitas Sumatera Utara (Reference Number: 838/KEP/USU/2021).

Study Design and Population

This was a correlative analytical study with a cross-sectional approach that assessed the correlation between people with schizophrenia and COVID-19. The independent variables were age, sex, and schizophrenia, whereas the dependent variable was COVID-19. Furthermore, the study was conducted at the Psychiatric Hospital of North Sumatera Province, Medan for 5 months, i.e., between September 2021 and January 2022.

The number of confirmed cases was the lowest according to the COVID-19 National Taskforce during these months. The study was conducted during a pandemic; however, the

government never implemented a lockdown policy. They only had a regulation to restrict activity for the community.

The sample population consisted of patients with schizophrenia and healthy controls living around the research location, who were selected using a consecutive sampling method. The inclusion criteria for the schizophrenia group were people with schizophrenia regardless of the duration of their illness based on the International Classification of Disease and Related Health Problems Tenth edition; those with a Positive and Negative Syndrome Scale score of 80/20 that was measured when they first came to the hospital; those aged 18–45 years; and those who were cooperative and willing to be interviewed. The exclusion criteria were a history of other psychiatric disorders, neurological diseases, endocrine disorders, autoimmune diseases, alcohol use, and other addictive substance use (except nicotine and caffeine). The healthy control group comprised people aged 18–45 years with no psychiatric disorders after screening based on the Mini-International Neuropsychiatric Interview and those who were cooperative and willing to be interviewed. A history of family psychiatric disorders, neurological diseases, autoimmune diseases, endocrine disorders, and alcohol and other addictive substance use were also exclusion criteria for this group.

Data Collection

A nasal swab specimen was collected from each sample, after which laboratory tests were performed. The antigen rapid diagnostic test (Ag-RDT) examination technique, which involves specimen collection and examination, was performed by trained health personnel as well as a laboratory analyst at the North Sumatera Psychiatric Hospital. They strictly adhered to standard procedures based on the type of Ag-RDT used, which can be in the form of a nasal swab. Universal precautions to prevent disease transmission were followed before the specimens were collected.

Sample Size Calculation

The population size required was calculated using the equation below (10):

$$n = \left\{ \frac{Z\alpha + Z\beta}{0.5 \ln \left[\frac{(1+r)}{(1-r)} \right]} \right\}^2 + 3$$

n = minimum sample size

α = type I error, set at 5%

$Z\alpha$ = alpha standard value (1.96), two-way hypothesis

β = type II error, set at 20%

$Z\beta$ = beta standard value (0.84)

r = the minimum correlation that is considered significant was determined (0.4)

Subsequently, a value of 47.49 was obtained, which was rounded to 48; hence, the sample population consisted of 48 patients with schizophrenia and 48 healthy controls.

Data and Statistical Analyses

After collecting all data from patients with schizophrenia and the controls, i.e., age, sex, and COVID-19 status, data processing was performed in several stages: (1) editing, a step to examine

TABLE 1 | Demographic characteristics of patients with schizophrenia and the controls.

Variable (n1 + n2 = 48)	Median (min–max) n (%)
Patients with schizophrenia, age	25 (18–41)
Controls, age	28.50 (25–38)
Patients with schizophrenia, sex	
-Male	30 (62.5)
-Female	18 (37.5)
Controls, sex	
-Male	30 (62.5)
-Female	18 (37.5)
Patients with schizophrenia	
-Positive for COVID-19	34 (70.8)
-Negative for COVID-19	14 (29.2)
Controls	
-Positive for COVID-19	12 (25)
-Negative for COVID-19	36 (75)

COVID-19, coronavirus disease; min, minimum; max, maximum.

the completeness of the data obtained through interviews; (2) coding, classifying the answers based on their type; (3) tabulation, entering the data into a table based on the variables studied; and 4) data analysis. Categorical data are presented as number (*n*) and percentage (%), while numerical variables are presented as mean and standard deviation. No normality test was conducted before the data were analyzed using correlation tests. The nominal-nominal correlation test is the contingency coefficient test, whereas the numerical-nominal correlation test is the eta test. When data were normally distributed, the Shapiro–Wilk test was used to determine the median because the number of samples was <50 ($p < 0.05$). Data processing and analysis were performed using the Statistical Package for Social Sciences (SPSS) software, version 24 (IBM Corp.).

RESULTS

The age, sex, and COVID-19 status of participants in the schizophrenia and control groups are shown in **Table 1**. Each group had 30 men, accounting for 62.5% of the total population. Thirty-four patients in the schizophrenia group (70.8%) were positive for COVID-19, whereas 36 of participants in the control group did not have COVID-19. The schizophrenia group had a median age of 25 (range, 18–41) years, while the control group had a median age of 28.50 (range, 25–38) years. The result of the eta test revealed an *r*-value of 0.544.

Table 2 shows that there was a correlation between the age of patients with schizophrenia and COVID-19 ($r = 0.544$). Consequently, another eta correlation test was performed to determine the relationship between the age of the control group and COVID-19, an *r*-value of 0.243 was recorded along with a type 1 error or an error value of 0.05.

Table 3 shows the relationship between the sex of patients with schizophrenia and COVID-19; 22 men and 12 women tested positive for the virus. This indicated that there was no correlation

TABLE 2 | Correlation of the age of the patients with schizophrenia and the controls with COVID-19.

Variable	Median (min–max)	<i>n</i>	<i>r</i> -value
Patients with schizophrenia			
Age	25 (18–41)		0.544*
COVID-19			
Positive		34	
Negative		14	
Controls			
Age	28.50 (25–38)		0.243*
COVID-19			
Positive		12	
Negative		36	

*Eta correlation test.

COVID-19, coronavirus disease; min, minimum; max, maximum.

TABLE 3 | Correlation of the sex of the patients with schizophrenia and the controls with COVID-19.

Variable	Positive for COVID-19 (<i>n</i>)	Negative for COVID-19 (<i>n</i>)	<i>r</i> -value	<i>p</i> -value
Patients with schizophrenia				
Sex				
Male	22	8	0.071	0.623*
Female	12	6		
Controls				
Sex				
Male	10	20	0.241	0.085
Female	2	16		

*Contingency coefficient test.

COVID-19, coronavirus disease.

TABLE 4 | Correlation of schizophrenia and non-schizophrenia with COVID-19.

Variable	Positive for COVID-19	Negative for COVID-19	<i>r</i> -value	<i>p</i> -value
Schizophrenia	34	14	0.417	$<0.001^*$
Controls	12	36		

*Contingency coefficient test.

COVID-19, coronavirus disease.

between the two variables ($r = 0.071$, $p = 0.623$). A similar result was found in the control group, where 20 men and 16 women tested negative for the virus. This indicated that there was no correlation between the two variables ($r = 0.241$, $p = 0.085$).

Table 4 shows the relationship between schizophrenia and COVID-19; 34 patients with schizophrenia tested positive for the virus, whereas 36 control samples were negative. Furthermore, the statistical test revealed a correlation between schizophrenia and COVID-19 ($r = 0.417$, $p < 0.001$).

DISCUSSION

We discovered a correlation between the age of patients with schizophrenia and COVID-19. This finding is in line with the result of a study from 2020 performed by Hu et al. in China that compared 13,783 data points recorded in January 2020. Their study revealed that COVID-19 increased the risk of schizophrenia among people within the age range of 29 to 50 years at the first onset of psychosis during the pandemic. They thought it was due to older people being more prone to COVID-19, which could increase the risk of schizophrenia. The emergence of COVID-19 could make older adults emotionally vulnerable, and too much information could put strain on each person's nerves. It may also increase the risk of severe mental illnesses, such as schizophrenia (11). Age is related to mental health status, including schizophrenia, and old age affects the incidence of and morbidity and mortality due to COVID-19. Previous studies have shown that patients with COVID-10 had a more robust host innate response to viral infection than others without COVID-19 of the same age. They also showed increased differential expression of genes associated with inflammation, while that of beta-interferon I was reduced. Furthermore, age-dependent defects in T- and B-cell function, as well as overproduction of type 2 cytokines, could lead to a deficiency in controlling viral replication. These conditions can also cause a prolonged pro-inflammatory response, leading to poor outcomes (12).

We found that COVID-19 was not correlated with the sex of the patients with schizophrenia and the controls. This finding is contradicted by Wang et al. (13), who analyzed secondary data from 360 hospitals and 317,000 providers in the United States. Their study revealed that compared to their male counterparts, female patients with schizophrenia are at a higher risk of experiencing COVID-19, after their age, ethnicity, and medical comorbidities were analyzed (13). Physical distancing can worsen female patients' symptoms, and they felt that their lives were more stressful than male patients' lives during the pandemic (14); the latter could induce symptoms of schizophrenia. Moyser postulated that women might be doing unpaid family work that their households would have previously outsourced to the paid economy or with which their households would have previously received help from extended family or friends due to the closure of daycare, schools, and businesses, such as restaurants and dry cleaners (14). These situations may lead to stressful events that can precipitate mental illness.

Furthermore, there was a correlation between schizophrenia and COVID-19. This result is in line with the findings of Wang et al. (13), who reported that patients with schizophrenia were more susceptible to viral infection. A possible mechanism for the correlation between COVID-19 infection and mental health outcomes is involvement of the neuroimmune network. This finding suggests that elevated levels of various cytokines can be observed in some psychiatric disorders, which also serve as immune markers for COVID-19. The presence of dissolved cytokines in the brain or their corresponding local alteration levels can affect the synthesis, release, and reuptake of several neurotransmitters, including monoamines, such as

dopamine, norepinephrine, and serotonin (15). Changes in their levels can cause disturbances in metabolism, thereby triggering behavioral deficits. Therefore, the immune system can be used as a link between COVID-19 and mental health disorders. Several studies have shown that cytokines play essential roles in learning and memory. Moreover, under healthy conditions, increased expressions of interleukin (IL)-1 β , IL-1, IL-6, and IL-18 receptor antagonists occur in the hippocampus during long-term potentiation (LTP), which is believed to underlie certain forms of brain function (16–18). It is thought that IL-1 β is associated with LTP maintenance, learning acquisition, and memory consolidation, which indicates that IL-6 has the opposite effect. Peripheral and central diseases are characterized by elevated levels of cerebral IL-1 β and IL-6 levels, which inhibit synaptic plasticity, learning, and memory (19). High levels of IL-6 are often found in the blood of patients infected with COVID-19. It is also present in the central nervous system of cytokeratin 18 promoter (K18-hACE2) transgenic mice infected with coronavirus (20, 21).

Signs of a peripheral inflammatory response in schizophrenia are indicated by elevated serum/plasma levels of certain pro-inflammatory factors, including prostaglandin E2 and C-reactive protein, as well as some pro-inflammatory cytokines, such as IL-1 β , IL-6, IL-8, and tumor necrosis factor- α . Additionally, the peripheral inflammatory response in patients with schizophrenia involves aberrant monocytes, which are a primary source of these molecules. A previous study reported a significant increase in the absolute or relative numbers of monocytes and white blood cells in patients with this disorder (22). Subsequently, there is an imbalance between pro-inflammatory and anti-inflammatory cytokines associated with psychiatric disorders, such as schizophrenia. Data from a previous immunological study revealed elevated levels of peripheral inflammatory markers in patients with schizophrenia (23).

Political and health authorities must pay attention to the mental health of infected and uninfected individuals during a pandemic. In addition, several preventive and treatment strategies must be developed. Some strategies that were developed were as follows: (1) investing in media campaigns, i.e., federal and state leaders must invest in public health campaigns that normalize discomfort, destigmatize mental health issues, especially schizophrenia, promote self-care, convey effective preventative and treatment measures, and make mental health services more accessible (24). In Indonesia, mental health promotion is still not comprehensive; many promotions were done by the Indonesian Psychiatric Association or by the psychiatrists themselves. This issue needs to be taken seriously to reduce the stigma of mental illnesses, especially schizophrenia. However, the availability of psychotropic medication is limited in primary care services, so patients with schizophrenia still need to come to the hospital to receive treatment. (2) Increasing the number of people who are screened for mental illness and schizophrenia. Given the prevalence of psychological distress during the pandemic, widespread mental health screenings should be implemented. Vaccine administration provides an excellent universal context, and mental health screening should be initiated as part of return-to-work and return-to-school

programs. Specific high-risk professions should also be screened, i.e., frontline workers, those with poor incomes, and those who are more socially isolated, who are disproportionately affected by the mental health implications of COVID-19 (24). Mental health screening in Indonesia, especially for detecting schizophrenia, is rare. This is due to the lack of physicians who have been trained to use a questionnaire for screening mental illnesses and the high number of patients visiting the primary care unit; as a result, physicians do not have time to perform screening. (3) Focus on the most critical interventions, i.e., establish population-level measures to minimize distress, promote resilience, and provide specialized services for people at highest risk of distress (24). Psychiatrist is not well distributed in Indonesia, and many of them stay in urban areas rather than rural areas. If the distribution problem can be solved, intervention for people with mental illnesses, especially schizophrenia, will be easier. (4) Expanding capacity, i.e., prior to the epidemic, the mental health treatment system was already struggling to satisfy the mental health requirements of many countries. Now is the time to invest in the workforce of social workers, psychiatric nurse practitioners, psychologists, master's-level therapists, psychiatrists, and peer counselors (24). As aforementioned, the number of professionals dealing with mental health issues in Indonesia is limited. Psychiatry is not a popular choice compared with internal medicine, surgery, child health, and obstetrics/gynecology. There are not many psychologists, psychiatric nurse practitioners, or peer counselors available, even in urban areas. In the future, the Indonesian government should pay more attention to providing scholarships or incentives to people who want to study in this field of service. (5) Make mental health surveillance and research a top priority; this pandemic is unlike any other, and it is unclear how the mental health consequences will play out over time. Real-time population mental health monitoring and the collection of high-quality longitudinal and representative data must be emphasized to identify risks and understand longer-term trajectories of distress and resilience. At the population and individual levels, ongoing research should examine communication initiatives, screening programs, systems of care workforce development, and new and existing interventions. These data, especially on the integration of mental and physical healthcare during and after the epidemic, must guide our responses to future crises (24). Psychiatric research is still not a top priority in Indonesia, and the top national research priority is still food and energy. Health research is still focusing on stunting and reducing the number of deaths of babies and mothers during delivery. Things to look forward to in the future include approaching the government to increase awareness of the importance of mental health and significantly increasing research funds for psychiatry, especially for schizophrenia.

Poor mental health is associated with a reduced life span and higher economic burden. In addition to the urgent and fundamental task of saving lives during the COVID-19 pandemic, psychiatric care needs to be provided on time. Several protocols must be implemented to minimize mental problems that occur during infection and after hospitalization. Moreover, a study evaluating the impact of isolation on mental health during

the pandemic is essential because it can serve as a guide for the development of new strategies in other critical situations (25). The approach used for psychoneuroimmunology in COVID-19 needs to complement that of social science because it provides a better understanding of how to overcome the disease. Future studies should test the hypotheses outlined, as this is expected to help reduce the impact of COVID-19 on mental health. Some strategies can be implemented to prevent COVID-19 in the schizophrenia population; for example, schizophrenia patients should follow the same health guidelines as clinical high-risk groups for COVID-19 and receive the same treatment; patients with schizophrenia should receive additional attention from the general practitioners treating COVID-19 patients since they may underestimate or have trouble describing respiratory symptoms; and antipsychotic medication adherence should be promoted and monitored by professionals and families (26).

As far as we are concerned, the strength of this study is that there are no studies with similar methods and measuring tools that were conducted in Medan and Indonesia in general. This study is the first to explore the correlation between schizophrenia and COVID-19. However, it has several limitations, such as the small sample size owing to the level 3 and 4 regulations for the implementation of community activity restrictions by the government. This study was also performed at one health center because of limited human resources; hence, the results do not represent the national population. We recommend that (1) future research should repeat the study using a larger sample size, (2) samples should be collected from private hospitals too, and (3) data from other Asian nations should be combined.

CONCLUSIONS

The COVID-19 pandemic, which has affected several countries, has revealed that people with schizophrenia are more susceptible to the virus. This result is in line with findings from several studies showing that patients with schizophrenia have lower immunity than healthy people. There is also the impression that such patients often receive less attention from the government regarding their physical health due to stigmatization. Therefore, special regulations must be implemented to ensure that people with schizophrenia receive vaccines first to increase their immunity.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethical Committee of Universitas Sumatera Utara. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Prevalence and Associated Factors of Diabetes Distress, Depression and Anxiety Among Primary Care Patients With Type 2 Diabetes During the COVID-19 Pandemic in Egypt: A Cross-Sectional Study

Hazem A. Sayed Ahmed^{1†}, Ahmed Mahmoud Fouad^{2†}, Sally Fawzy Elotla^{2†}, Anwar I. Joudeh^{3,4}, Mona Mostafa⁵, Asghar Shah⁶, Jaffer Shah^{7*} and Samar F. Mohamed¹

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Samer El Hayek,
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United States

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Jean Westenberg,
University of British Columbia, Canada

*Correspondence:

Jaffer Shah
jaffer.shah@kateb.edu.af

[†]These authors have contributed
equally to this work and share first
authorship

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¹ Department of Family Medicine, Faculty of Medicine, Suez Canal University, Ismailia, Egypt, ² Department of Public Health, Occupational and Environmental Medicine, Faculty of Medicine, Suez Canal University, Ismailia, Egypt, ³ Department of Internal Medicine, Hamad Medical Corporation, Doha, Qatar, ⁴ Department of Internal Medicine, Faculty of Medicine, University of Jordan, Amman, Jordan, ⁵ Department of Internal Medicine, Faculty of Medicine, Suez Canal University, Ismailia, Egypt, ⁶ Division of Biology and Medicine, Brown University, Providence, RI, United States, ⁷ Medical Research Center, Kateb University, Kabul, Afghanistan

The prevalence of type 2 diabetes mellitus (T2DM) is growing worldwide. T2DM is often complicated by a range of psychological disorders that interfere with glycemic control and self-care. Previous studies have reported diabetes distress, depression, and anxiety among patients with T2DM; however, little is known about the burden of these comorbid mental disorders in primary care patients with T2DM treated in Egypt during the COVID-19 era. Participants were selected by convenient sampling from eight rural primary healthcare facilities from Ismailia in Egypt. Symptoms of diabetes distress, depression and anxiety were assessed by using the Arabic version of the 20-item Problem Areas in Diabetes (PAID), Patient Health Questionnaire 9, and Generalized Anxiety Disorder Scales, respectively. Multiple hierarchical logistic regression models were used to estimate the significant factors associated with diabetes distress, depression, and anxiety. A total of 403 individuals with T2DM were interviewed. The prevalence of severe diabetes distress was 13.4% (95% CI: 10.1–16.7), while prevalence of depressive and anxiety symptoms was 9.2% (95% CI: 6.4–12.0%), and 4.0% (95% CI: 2.1–5.9), respectively. In a series of hierarchical logistic regression models, significant predictors for diabetes distress were being married, illiterate, not-working, living with insufficient income, and having multi-comorbidities. Likewise, the significant predictors for depression and anxiety were elevated glycated hemoglobin level and the higher PAID total score, while having multi-comorbidities was a significant predictor for anxiety only. Diabetes distress was more prevalent than depressive and anxiety symptoms in this study population. Several sociodemographic and clinical characteristics were identified to be related with psychological problems among patients with T2DM, which necessitate a multidisciplinary team-based approach for optimal screening and management.

Keywords: anxiety, COVID-19, depression, diabetes distress, primary healthcare, type 2 diabetes

HIGHLIGHTS

- Diabetes distress was more prevalent than depression and anxiety symptoms among patients with type 2 diabetes at rural primary healthcare facilities.
- The significant predictors for diabetes distress were being married, illiterate, not working, living with insufficient income, and having multi-comorbidities.
- The significant predictors for depression and anxiety symptoms were elevated HbA1c level and the higher PAID score, while having multi-comorbidities was a significant predictor for anxiety symptoms only.

INTRODUCTION

Diabetes mellitus (DM) is a widespread global health problem. Egypt has the 10th highest age-adjusted diabetes prevalence globally, with a comparative diabetes prevalence of 20.9% in people aged 20–79 years. T2DM is the most common form of DM, accounting for 90% of all cases of DM worldwide. T2DM can lead to premature death, a wide range of psychological disorders and decreased quality of life. Additionally, T2DM poses an economic burden on patients, families, and countries (1). DM increases the risk of contracting COVID-19 infection, the risk for hospitalization or intensive care unit admission, and the risk for death (2–4).

The management of patients with T2DM is often complicated by a breadth of psychological disorders including diabetes distress (DD), depression, and anxiety which might negatively impact diabetic patients' quality of life and coping mechanisms with their disease (5, 6). The era of COVID-19 represents a special situation where external stressors, economic burden, risk of acquiring the infection or limited access to healthcare could endanger the mental health of patients with chronic illnesses including those with diabetes (7). A cross-sectional study on 120 patients with type 1 and type 2 diabetes mellitus in Brazil during the COVID-19 pandemic found that more than 90% of the participants had features of ongoing mental suffering and around 40% had significant psychological distress with a higher tendency in patients with T2DM (8).

DD is the emotional burden associated with DM and its management over time (9, 10). A previous meta-analysis demonstrated that the overall prevalence of DD globally was 36% (11). The prevalence of DD in primary healthcare (PHC) patients with T2DM has been reported less than the prevalence among those treated in secondary care (12). Its prevalence among PHC patients with T2DM at primary care level varied across countries; it was 1.2% in Germany, 4% in the Netherlands, 8.9% in Thailand, 9.3–21% in the United States, 22.3% in Saudi, and

24.4% in Greece (12–18). Higher levels of DD are linked with lower quality of life, elevated glycated hemoglobin level (HbA1c), and decreased glycemic control among T2DM patients (19–21).

Depressive symptoms are important indicators in individuals with T2DM. DD and depression are correlated and partly overlapping constructs but are not interchangeable (22). One meta-analysis demonstrated that the prevalence estimates of depression among individuals with T2DM in low and middle-income countries ranged from 25 to 45% with an average of 35.7%. These estimates were significantly higher than estimates in high-income countries, which had a 25% prevalence of comorbid depression (23). The prevalence rates of depression among individuals with T2DM managing in PHC settings were 11.5 to 26.6% in Malaysia (24, 25), 17% in the United Arab Emirates (26), 20 to 37.9% in Saudi Arabia (17, 27–29), 40.2% in Palestine (30), 20.03 to 29.2% in Spain (31, 32), 30.3% in Germany (33), and 67.9% among socially disadvantaged people in the United States (34). The prevalence of depressive disorders in diabetics is approximately 2-fold higher than the prevalence of depression in non-diabetics. Co-morbidity significantly worsens the prognosis of both illnesses and raises their mortality (6). Depression among individuals with DM is related with an increased risk of incident microvascular and macrovascular complications. A bidirectional relationship between depression and complications resulting from diabetes has been reported (35). Diabetic PHC patients with depression tended to have more severe physical symptoms, poorer self-care, and were demonstrated suboptimal adherence to prescribed care regimens (36).

Anxiety is an emotion with important implications in patients with T2DM. Elevated anxiety symptoms were found in 40% of diabetic patients (37). The prevalence rates of anxiety symptoms in PHC patients with T2DM were 30.5 to 40% in Malaysia (24, 25), and 38.3% in Saudi Arabia (29). The relationship between DM and anxiety has been reported to be bi-directional. A meta-analysis revealed that DM is associated with both elevated anxiety symptoms and anxiety disorders (38). Another meta-analysis found an association between baseline anxiety and incident DM (39). Lifetime anxiety symptoms have been shown to increase risk of hyperglycemia, contribute to more severe psychological symptoms, and sub-optimal self-management behavior among individuals with T2DM (40).

The American Diabetes Association notes that primary health care providers should consider evaluation for symptoms of DD, depression, and anxiety among PHC patients with T2DM using appropriate standardized and validated tools at their first visit, at periodic intervals, and when there is a change in illness, management, or life circumstance (41). Assessment of the complex psychological and emotional needs of people living with DM should be approached in a culture-sensitive method. Therefore, we used screening tools that were validated for use in Arabic-speaking countries and for PHC patients (42, 43).

The present study is motivated by the paucity of current research on the prevalence of DD, depression, and anxiety symptoms within the T2DM population of Egypt considering the COVID-19 context. As such, the primary goal of our study is to assess the prevalence and associated factors of DD, depression,

Abbreviations: –2LL, –2 Log Likelihood; BMI, Body Mass Index; df, degree of freedom; CI, Confidence interval; DD, Diabetes distress; DM, Diabetes mellitus; GAD-7, Generalized Anxiety Disorder Scale 7; HbA1c, Glycated hemoglobin; HDL, High-density lipoprotein; IQR, Interquartile range; LDL, Low-density lipoprotein; OR, Odds ratio; PAID, Problem Areas in Diabetes; PHC, Primary healthcare; PHQ-9, Patient Health Questionnaire 9; Rho, Spearman's Rank-Order Correlation; SD, Standard deviation; SPSS, Statistical Package for the Social Sciences; T2DM, Type 2 diabetes mellitus; WHO, World Health Organization.

and anxiety symptoms. We also investigate the relationship between symptoms of DD, depression, and anxiety among PHC patients with T2DM during the COVID-19 pandemic in Egypt. We hypothesized that T2DM patients experienced high levels of DD, depression, and anxiety symptoms during the COVID-19 pandemic; symptoms of DD have a statistically significant positive relationship with depressive and anxiety symptoms; depressive symptoms have a statistically significant positive relationship with anxiety symptoms; and a certain set of demographic and clinical characteristics of patients with T2DM are related to symptoms of DD, depression, and anxiety.

METHODS

Design, Sampling, and Setting

Using a cross-sectional design, this study was carried out in eight rural primary care facilities at the Ismailia governorate, Egypt during the COVID-19 pandemic (between September 2020 and June 2021). A sample size of 369 was calculated using Epi InfoTM StatCalc version 7.2.4.0 (Centers for Disease Control and Prevention, Atlanta, GA, USA), given the data derived from a pilot study ($n = 25$). Calculation was based on the least prevalence obtained from our pilot study (4% for anxiety symptoms), 2% margin of error, and 95% level of confidence. The calculated sample size was further increased by 10% to compensate for the non-response. A convenience sampling of 406 patients with T2DM who met the eligibility criteria were interviewed during the study period. Patients were eligible if they were 18 years or older, had been diagnosed with T2DM for at least 1 year, and gave a written informed consent to participate. Three patients were excluded who had gestational diabetes or were not able to give their consent due to a serious mental illness or cognitive impairment. So, 403 participants were included in our study.

We obtained the ethical approval of this study from the Research Ethics Committee at the Faculty of Medicine, Suez Canal University, Ismailia, Egypt (Ref No. 4277/2020). All patients gave their written informed consent prior to their participation in this study.

Tools and Measurements

Data collection was performed using face-to-face interviews with selected patients. Questionnaire included questions about sociodemographic, lifestyle and clinical characteristics: age, gender, marital status, occupation, family income, duration of diabetes, treatment for diabetes, diabetes-related long-term complications (e.g., cardiovascular, cerebrovascular, retinopathy, nephropathy, neuropathy, or peripheral vascular complications), smoking, alcohol drinking, and physical activity. Patients were also asked about history of COVID-19 (confirmed or suspected). Furthermore, the PAID was used to assess DD (9, 42, 44, 45), while the Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder Scale (GAD-7) were used to evaluate symptoms of depression and anxiety, respectively (46, 47).

The PAID scale consisted of 20 items, with a total score ranged from 0 to 100. Each item scored on a 5-point Likert scale

ranging from 0 to 4, where 0 = not a problem, and 4 = serious problem. PAID total score was calculated by summing all items and multiplying it by 1.25. A higher score indicating greater DD, with a score of ≥ 40 indicating severe emotional distress (37–39). The Arabic version of the PAID has recently demonstrated to be a reliable and valid tool to screen DD in an Egyptian sample (42).

The PHQ-9 was used to evaluate the depressive symptoms where each item took a score from 0 to 3 (“not at all” to “nearly every day,” respectively). The total PHQ9 score was calculated as the sum of all items’ scores, with a maximum score of 27. A total PHQ-9 score ≥ 10 showed a high sensitivity and specificity for major depression (46). The PHQ-9 was translated to Arabic with of a satisfactory validity and reliability (43).

The GAD-7 was used to evaluate the anxiety symptoms with each item taking a score from 0 to 3 (“not at all” to “nearly every day,” respectively). The sum of all items’ score comprised a total GAD-7 score ranging from 0 to 21. A total GAD-7 score of 10 or higher was satisfactory sensitive and specific for GAD (47). An Arabic translation of GAD-7 is available with a satisfactory validity and reliability (43).

Body mass index (BMI) was calculated as the body weight (in kg) divided by the squared root of height (in meters), where patients were considered overweight if they had a BMI between 25 and 29.9, and obese if BMI ≥ 30 . The world health organization has defined regular physical activity for adult people with chronic illness as engaging in at least 150 min or more of moderate-intensity aerobic activity per week; or at least 75 min or more of vigorous-intensity aerobic activity per week; or an equivalent combination of moderate- and vigorous-intensity activity weekly (48).

The most recent HbA1c values (< 8 weeks prior to, or 12 weeks after interviewing the patient) and lipid profile [i.e., total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides] were obtained from patients’ medical records. Good glycemic control was identified if HbA1c values were $< 7\%$ in adult, or $< 7.5\%$ in adults older than 65 years (41).

Statistical Analysis

All procedures of data management and analyses were performed with the Statistical Package for the Social Sciences (SPSS) for Windows, version 25.0 (IBM Corporation, NY, USA). A significance level was set at 0.05 for all statistical analyses. Categorical variables were described as frequencies and percentages (%), while numeric variables were summarized as mean and standard deviation. Associations between categorical variables were investigated for statistical significance with Chi-square test or Fischer’s exact test as indicated. Graphs were created with GraphPad Prism (version 8.0.0 for Windows, GraphPad Software, San Diego, California USA, www.graphpad.com). Multiple hierarchical logistic regression models were used to identify the predictors of DD, depression, and anxiety symptoms among the studied patients. Independent variables were entered in the model as blocks. Three blocks were identified: the first block involved sociodemographic variables, second block included lifestyle and general health variables, while the third block included diabetes-related variables.

Improvement in the predictive power of the consecutive models was identified by calculating the change in -2 log likelihood ($-2LL$) and was tested for statistical significance using the chi-square distribution (where the degree of freedom was the difference in the number of parameters in each model). Also, the change in the R-square and the predictive accuracy were reported for each model. Odds ratio (OR) and 95% confidence interval (CI) was reported for each independent variable in the models.

RESULTS

This study involved 403 patients with T2DM with a mean age of 46 years (± 11.5 ; range: 19–80 years), and 59.1% were female. Demographic, lifestyle, and health-related characteristics are presented in **Tables 1, 2**. **Figure 1** shows

that 13.4% (95% CI: 10.1–16.7) of diabetic patients had a PAID score indicating severe DD, while 9.2% (95% CI: 6.4–12.0%) had a PHQ-9 score suggestive of major depression. Only 4.0% (95% CI: 2.1–5.9) of diabetic patients had a GAD-7 score suggestive for generalized anxiety. Furthermore, female patients comprised the majority of patients who had symptoms of DD, depression, and anxiety (70.4, 83.8, and 87.5%, respectively).

Table 1 shows that most of the diabetic patients were married, had completed their secondary or higher education, not working (including housewives and retired), and had sufficient family income (76.2, 74.7, 57.6, and 76.7%, respectively). Symptoms of depression and anxiety were significantly associated with all demographic variables while DD was significantly associated with all demographic characteristics except for gender. DD, depression, and anxiety symptoms were frequent among older

TABLE 1 | Distribution of diabetic patients according to their sociodemographic characteristics ($N = 403$).

Characteristics	All Participants No. (Column %) N = 403	No. (Row %)					
		Diabetes Distress n = 54	p-value	Depression n = 37	p-value	Anxiety n = 16	p-value
Age (years)							
Less than 40 years	103 (25.6%)	6 (5.8%)	<0.001*	2 (1.9%)	<0.001*	2 (1.9%)	<0.001*
40–59	222 (55.1%)	16 (7.2%)		13 (5.9%)		3 (1.4%)	
60+	78 (19.4%)	32 (41.0%)		22 (28.2%)		11 (14.1%)	
Gender							
Male	165 (40.9%)	16 (9.7%)	0.069	6 (3.6%)	0.002*	2 (1.2%)	0.018*
Female	238 (59.1%)	38 (16.0%)		31 (13.0%)		14 (5.9%)	
Marital status							
Single	19 (4.7%)	0	<0.001*	0	<0.001*	0	0.002* ^F
Married	307 (76.2%)	31 (10.1%)		18 (5.9%)		7 (2.3%)	
Divorced/widow	77 (19.1%)	23 (29.9%)		19 (24.7%)		9 (11.7%)	
Education level							
Illiterate	87 (21.6%)	35 (40.2%)	<0.001*	28 (32.2%)	<0.001*	13 (14.9%)	<0.001* ^F
Less than secondary	15 (3.7%)	1 (6.7%)		1 (6.7%)		2 (13.3%)	
Secondary	239 (59.3%)	17 (7.1%)		7 (2.9%)		1 (0.4%)	
University and above	62 (15.4%)	1 (1.6%)		1 (1.6%)		0	
Occupation							
None	232 (57.6%)	50 (21.6%)	0.000* ^F	36 (15.5%)	<0.001*	16 (6.9%)	0.020* ^F
Manual work and sales	72 (17.9%)	4 (5.6%)		0		0	
Clerical or administrative work	29 (7.2%)	0		1 (3.4%)		0	
Professionals and their associates	58 (14.4%)	0		0		0	
Business owners and freelancers	12 (3.0%)	0		0		0	
Family income							
Insufficient	94 (23.3%)	33 (35.1%)	<0.001*	25 (26.6%)	<0.001*	10 (10.6%)	<0.001* ^F
Sufficient	309 (76.7%)	21 (6.8%)		12 (3.9%)		6 (1.9%)	

*Statistically significant p -value at $p < 0.05$.

^F Fisher's exact test.

Bold value indicates the significant findings.

The table shows only the groups positive for diabetes distress, depression, and anxiety symptoms. All statistical significances were tested by comparing groups positive for the study outcomes (i.e., diabetes distress, depression and anxiety symptoms) to those who were negative for these outcomes.

TABLE 2 | Patients' lifestyle and health-related characteristics (*N* = 403).

Characteristics	All Participants No. (Column %) <i>N</i> = 403	No. (Row %)					
		Diabetes Distress <i>n</i> = 54	<i>p</i> -value	Depression <i>n</i> = 37	<i>p</i> -value	Anxiety <i>n</i> = 16	<i>p</i> -value
Body Mass Index (kg/m ²), Mean (SD)	403 (100.0%)	29.6 (8.0)	0.613 ^M	30.6 (9.1)	0.326 ^M	34.0 (11.5)	0.113 ^M
Normal	99 (24.6%)	17 (17.2%)	0.023*	12 (12.1%)	0.036*	5 (5.1%)	0.041*^F
Overweight	166 (41.2%)	13 (7.8%)		8 (4.8%)		2 (1.2%)	
Obese	138 (34.2%)	24 (17.4%)		17 (12.3%)		9 (6.5%)	
Sex-specific waist circumference (cm)							
Men, mean (SD)	91.6 (13.1)	89.9 (19.4)	0.219 ^M	75.2 (8.7)	0.001*^M	70.0 (7.1)	0.019*^M
Women, mean (SD)	92.2 (17.1)	94.3 (18.1)	0.373 ^M	100.8 (18.9)	0.002*^M	107.6 (21.1)	0.004*^M
Overall, mean (SD)	91.9 (15.5)	93.0 (18.4)	0.282 ^M	96.7 (20.0)	0.089 ^M	102.9 (23.6)	0.041*^M
Life-style characteristics							
Ever cigarette smoking	130 (32.3%)	14 (10.8%)	0.285	6 (4.6%)	0.028*	2 (1.5%)	0.084
Alcohol drinking	2 (0.5%)	0	1.000 ^F	0	1.000 ^F	0	1.000 ^F
Physical inactivity	103 (25.6%)	34 (33.3%)	<0.001*	27 (26.2%)	<0.001*	13 (12.6%)	<0.001*^F
Duration of diabetes							
Less than 5 years	143 (35.5%)	6 (4.2%)	<0.001*	3 (2.1%)	<0.001*	0	<0.001*
5–10 years	161 (40.0%)	17 (10.6%)		10 (6.2%)		5 (3.1%)	
More than 10 years	99 (24.6%)	31 (31.3%)		24 (24.2%)		11 (11.1%)	
Type of antidiabetic medications							
Oral hypoglycemics	272 (67.5%)	20 (7.4%)	<0.001*	13 (4.8%)	<0.001*	4 (1.5%)	<0.001*
Insulin-containing regimens	131 (32.5%)	34 (26.0%)		24 (18.3%)		12 (9.2%)	
Number of diabetic complications							
None	139 (34.5%)	6 (4.3%)	<0.001*	1 (0.7%)	<0.001*	0	0.002*
Single	101 (25.1%)	7 (6.9%)		6 (5.9%)		3 (3.0%)	
Two or more	163 (40.4%)	41 (25.2%)		30 (18.4%)		13 (8.0%)	
Type of complications							
Retinopathy	155 (38.5%)	40 (25.8%)	<0.001*	29 (18.7%)	<0.001*	13 (8.4%)	<0.001*
Nephropathy	95 (23.6%)	38 (40.0%)	<0.001*	29 (30.5%)	<0.001*	13 (13.7%)	<0.001*^F
Peripheral neuropathy	208 (51.6%)	46 (22.1%)	<0.001*	32 (15.4%)	<0.001*	15 (7.2%)	0.001*
Autonomic neuropathy	4 (1.0%)	0	1.000 ^F	0	1.000 ^F	0	1.000 ^F
Coronary or cerebrovascular	2 (0.5%)	1 (50.0%)	0.250 ^F	1 (50.0%)	0.175 ^F	1 (50.0%)	0.078 ^F
Peripheral vascular	126 (31.3%)	37 (29.4%)	<0.001*^F	29 (23.0%)	<0.001*	13 (10.3%)	<0.001*
Number of chronic comorbidities							
None	300 (74.5%)	17 (5.7%)	<0.001*	11 (3.7%)	<0.001*	2 (0.7%)	<0.001*^F
Single	65 (16.1%)	17 (26.2%)		9 (13.8%)		2 (3.1%)	
Two or more	38 (9.4%)	20 (52.6%)		17 (44.7%)		12 (31.6%)	
Type of chronic comorbidities							
Hypertension	89 (22.1%)	34 (38.2%)	<0.001*	24 (27.0%)	<0.001*	13 (14.6%)	<0.001*^F
Dyslipidemia	36 (8.9%)	19 (52.8%)	<0.001*^F	14 (38.9%)	<0.001*^F	10 (27.8%)	<0.001*^F
Others ^a	23 (5.5%)	7 (31.8%)	0.018*^F	9 (40.9%)	<0.001*^F	6 (27.3%)	<0.001*^F
HbA1C%, mean ± SD	7.8 ± 0.7	8.7 ± 1.2	<0.001*	8.9 ± 0.8	<0.001*	8.2 ± 0.7	<0.001*
Glycemic control							
Controlled	30 (7.4%)	2 (6.7%)	0.204 ^F	1 (3.3%)	0.341 ^F	0	0.621 ^F
Uncontrolled	373 (92.6%)	52 (13.9%)		36 (9.7%)		16 (4.3%)	
Lipid Profile, mean ± SD							
Total cholesterol	196.5 ± 16.7	204.8 ± 19.8	0.001*	209.7 ± 27.2	0.004*	208.4 ± 33.5	0.005*
HDL	63.6 ± 9.2	62.0 ± 8.7	0.189		0.091	61.6 ± 11.5	0.399

(Continued)

TABLE 2 | Continued

Characteristics	All Participants No. (Column %) N = 403	No. (Row %)					
		Diabetes Distress n = 54	p-value	Depression n = 37	p-value	Anxiety n = 16	p-value
LDL	67.1 ± 18.7	79.8 ± 23.8	<0.001*	61.1 ± 9.2	<0.001*	92.6 ± 20.6	<0.001*
Triglycerides	93.4 ± 37.9	119.0 ± 39.5	<0.001*	87.6 ± 27.3 135.9 ± 69.2	<0.001*	124.2 ± 41.3	0.001*
Family history of diabetes							
No	92 (22.8%)	6 (6.5%)	0.027*	6 (6.5%)	0.315 ^F	2 (2.2%)	0.542 ^F
Yes	311 (77.2%)	48 (15.4%)		31 (10.0%)		14 (4.5%)	
History of COVID-19							
PCR-confirmed diagnosis	14 (3.5%)	2 (14.3%)	1.000 ^F	0	0.628 ^F	0	1.000 ^F
Clinically-suggestive diagnosis	15 (3.7%)	2 (13.3%)	1.000 ^F	2 (13.3%)	0.638 ^F	2 (13.3%)	0.115 ^F

^aOther chronic diseases included 11 patients with gastrointestinal & Liver, six patients with peripheral venous, one patient with end-stage-renal disease (ESRD), one patient with a neurological disease, and three patients with musculoskeletal diseases.

^FFisher's exact test; ^MMann-Whitney test.

*Statistically significant p-value at $p < 0.05$.

SD, standard deviation; HDL, High-density lipoprotein; LDL, Low-density lipoprotein.

Bold value indicates the significant findings.

The table shows only the groups positive for diabetes distress, depression, and anxiety symptoms. All statistical significances were tested by comparing groups positive for the study outcomes (i.e., diabetes distress, depression and anxiety symptoms) to those who were negative for these outcomes.

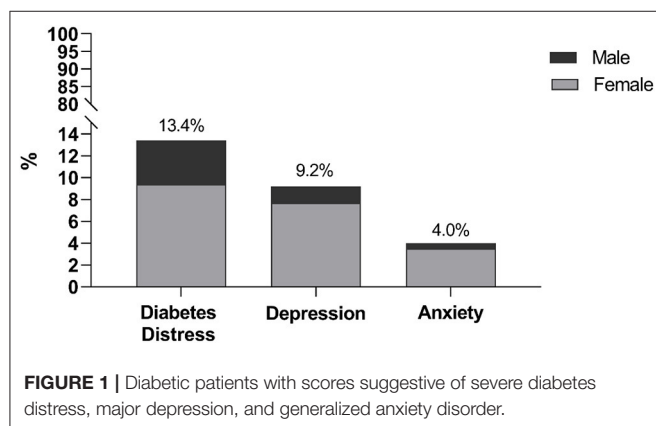


FIGURE 1 | Diabetic patients with scores suggestive of severe diabetes distress, major depression, and generalized anxiety disorder.

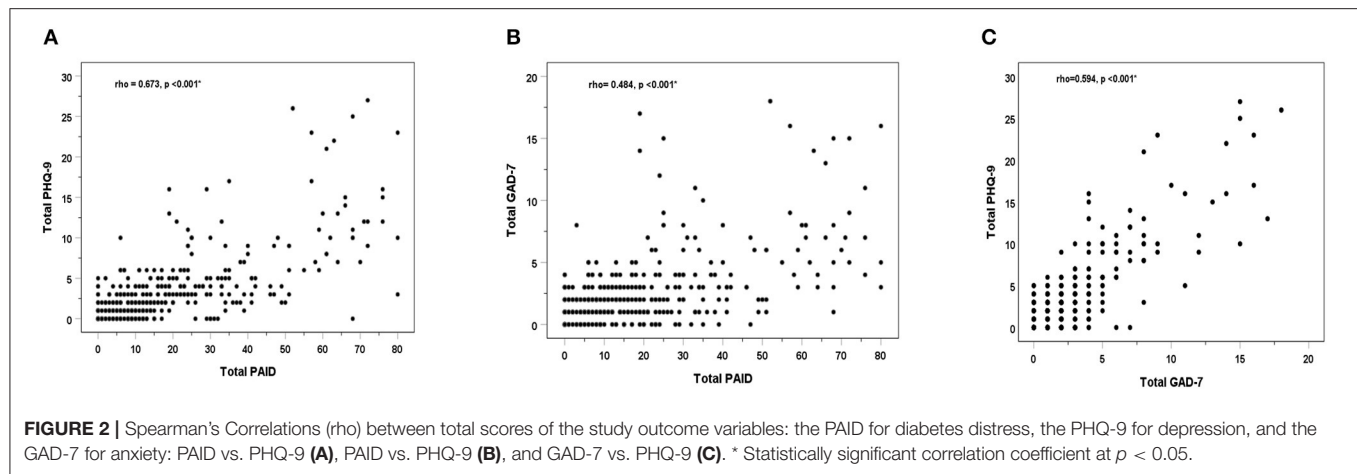
patients (≥ 60 years), female, unmarried (single, divorced or widowed), illiterate, not working (including housewives and retired) and patients with insufficient family income.

Table 2 shows that DD associated significantly with overweight and obesity, physical inactivity, longer duration of diabetes (> 10 years), insulin-containing medications, multiple diabetic complications (particularly retinopathy, nephropathy, peripheral neuropathy, and peripheral vascular diseases), multiple chronic comorbidities, the higher levels of HbA1c, total cholesterol, LDL and triglycerides, and the existence of family history of DM. Likewise, depressive and anxiety symptoms concurred in having significant associations with overweight and obesity, sex-specific waist circumference, physical inactivity, longer duration of diabetes, insulin-containing medications, multiple diabetic complications, multiple chronic comorbidities, and the higher levels of HbA1c, total cholesterol, LDL, and

triglycerides. However, the history of COVID-19 and the glycemic control did not show significant association with any of the study outcomes (i.e., symptoms of DD, depression, or anxiety).

Figure 2 shows that the total PAID score for symptoms of DD were positively correlated with both the total PHQ-9 score for depressive symptoms and the total GAD-7 score for anxiety symptoms (ρ : 0.673 and 0.484, respectively, $p < 0.001$). Likewise, the PHQ-9 and the GAD-7 showed a significant, moderate, and positive correlation (ρ : 0.594, $p < 0.001$).

Table 3 displays results of the hierarchical logistic regression analyses for symptoms of DD, depression, and anxiety. Model 1 included only the potential sociodemographic predictors (i.e., block 1) and showed a statistically significant change in the $-2LL$ from the baseline model (containing only the constant). Model 1 accounted for 37.5, 36.5, and 27% of the variation in symptoms of diabetic distress, depression, and anxiety, respectively. By adding the block 2 (i.e., the life-style and general health variables), the predictive power of the DD, depression and anxiety models was improved as indicated by the significant change in the model $-2LL$ and the increasing R-square. Likewise, adding the block 3 (i.e., the diabetes-related variables) significant improved the predictive power of each model and increased the model R-square. In the last model for DD (model 3), the only significant predictors were being married, illiterate, not working, living with insufficient income, and having multi-comorbidities. However, the last model for depressive symptoms showed that the higher HbA1c levels and the PAID score were the only significant predictors, and the last model for anxiety revealed that multi-comorbidities, the elevated HbA1c levels and the PAID score were the only significant predictors. The odds ratios of significant predictors and its 95% confidence intervals are presented in Table 3.



DISCUSSION

According to the study findings, approximately one in seven, one in 10 and one in 25 primary care patients with T2DM in the rural area of Ismailia governorate in Egypt were suffering from symptoms of severe DD, major depression and anxiety, respectively. Several sociodemographic and clinical characteristics were identified to be associated with these findings at a different degree.

The prevalence of DD in the current study was higher than what was reported in a meta-analysis by Perrin et al. (11) and in primary care patients in Netherland, USA, Germany, and Thailand (12, 13, 15, 16), but less than the prevalence in Saudi Arabia and Greece (17, 18). These marked discrepancies between different study findings could be attributed to many reasons including cultural, social, demographic, and health-related characteristics of the study populations as well as tools of DD assessment. Moreover, Perrin et al. meta-analysis had an extremely high level of heterogeneity and asymmetrical funnel plot suggesting larger representation of studies with more prevalent DD. It is also important to note that the American, Dutch, Germany and Thai studies were carried out before COVID-19 era (12, 13, 15, 16).

Just <10% of our study sample had symptoms of major depression (PHQ-9 ≥ 10). Prevalence rates of comorbid depression in diabetes was variably reported with a range of 2–88% with a world-pooled prevalence of 28% (49). According to Lloyd et al., social and cultural factors influence depression occurrence leading to different prevalence rates of depression-related conditions among individual countries and within different communities and ethnicities in the same country (50). Furthermore, cultural meaning of depression could be expressed differently between different populations. For example, a focus group interview of patients with T2DM living in the United Kingdom found that patients with T2DM who were from Bangladeshi and Pakistani background often expressed symptoms of depression in a somatic way (51). In fact, it is increasingly recognized that primary care patients throughout the world express depression with somatic manifestations

irrespective of their cultural background (52). Therefore, a qualitative assessment of depression burden in our population is needed to complement the study findings.

The least reported comorbid psychiatric problem in patients with T2DM in this study was anxiety symptoms with only 4% of the study sample having a minimum score of 10 on the GAD questionnaire. Previous literature also showed higher rates of anxiety disorders among patients with T2DM ranging between 30 and 40%. However, these studies used different tools for anxiety assessment which makes direct comparison to our study findings difficult (24, 25, 32, 37). Nevertheless, Smith et al. concluded that DM is weakly and positively associated with anxiety symptoms and anxiety disorders with a pooled OR of 1.25 (CI: 1.10–1.39) with low levels of statistical heterogeneity (38).

Complex interactions between DM and social as well as cultural dynamics are likely to affect the way patients experience illness and health (50). Our study did not find an association between gender and higher risk for developing DD which is consistent with Kamrul-Hasan et al. findings (53). However, bivariate analysis showed that females had higher risk for developing depression and anxiety although that was not confirmed with subsequent multivariate analysis. Previous studies demonstrated an association between female gender and DD (11, 13, 17, 19, 54, 55), and female gender and comorbid depression and anxiety with T2DM (19, 54). It is postulated that socio-cultural and biological factors may be implicated for this gender difference increasing female patients' vulnerability to life events and affecting their coping skills (56). On the other hand, males appear less likely to seek medical advice or express distress leading to spuriously lower prevalence rates of emotional difficulties (57).

Regarding age, bivariate analysis of this study suggested that symptoms of DD, depression, and anxiety occurred more frequently with increasing age. However, multivariate analysis did not find an association between age with either DD, depression or anxiety symptoms. Similarly, a Malaysian cross-sectional study on PHC patients with T2DM did not find a statistical association between age and prevalence of depressive

TABLE 3 | Hierarchical logistic regression models for prediction of diabetes distress, depression, and anxiety symptoms among diabetic patients (N = 403).

Predictors	Diabetes Distress, n = 54			Depression n = 37			Anxiety, n = 16		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Block 1: Sociodemographic variables									
Age ≥60 years	2.79 (0.98–7.92)	2.16 (0.65–7.17)	2.09 (0.60–7.23)	1.48 (0.46–4.73)	0.98 (0.26–3.68)	0.28 (0.05–1.62)	2.98 (0.60–14.7)	1.10 (0.15–7.93)	0.39 (0.03–5.20)
Female	0.82 (0.30–2.27)	1.41 (0.31–6.49)	1.37 (0.29–6.51)	1.68 (0.51–5.59)	2.45 (0.41–14.6)	6.76 (0.36–127.0)	3.77 (0.74–19.1)	3.48 (0.28–43.7)	10.1 (0.32–325.5)
Married	2.14 (0.79–5.79)	3.19 (1.03–9.90)*	3.63 (1.12–11.7)*	1.06 (0.36–3.08)	1.28 (0.38–4.29)	0.46 (0.09–2.24)	1.29 (0.30–5.64)	1.17 (0.21–6.65)	0.56 (0.06–5.37)
Illiterate	3.90 (1.66–9.19)*	3.60 (1.44–9.01)*	3.63 (1.37–9.62)*	4.85 (1.70–13.9)*	4.04 (1.33–12.2)*	1.70 (0.33–8.75)	7.85 (1.54–40.1)*	5.50 (1.00–30.3)*	7.31 (0.55–97.1)
Not working	5.74 (1.45–22.7)*	6.09 (1.44–25.7)*	5.91 (1.34–26.1)*	8.36 (0.89–78.3)	7.86 (0.82–75.1)	2.03 (0.13–30.9)	— ^a	— ^a	— ^a
Insufficient income	2.86 (1.34–8.07)*	2.76 (1.26–6.05)*	2.47 (1.09–5.64)*	2.90 (1.17–7.20)*	2.72 (1.05–7.04)*	1.29 (0.37–4.49)	1.32 (0.37–4.69)	1.04 (0.25–4.26)	0.42 (0.07–2.52)
Block 2: Life-style and general health									
Overweight/ obese		0.51 (0.22–1.20)	0.51 (0.21–1.21)		0.67 (0.25–1.83)	0.86 (0.21–3.49)		1.24 (0.28–5.43)	2.52 (0.27–23.7)
Cigarette smoker		2.09 (0.51–8.62)	2.11 (0.49–9.20)		1.61 (0.28–9.12)	1.52 (0.08–29.8)		1.18 (0.09–15.07)	2.61 (0.07–97.3)
Physically inactive		1.41 (0.56–3.59)	1.42 (0.52–3.86)		1.42 (0.45–4.43)	1.16 (0.24–5.65)		1.23 (0.17–8.91)	1.79 (0.14–23.3)
Multiple comorbidities (≥2)		3.03 (1.16–7.87)*	2.90 (1.04–8.08)*		3.72 (1.36–10.1)*	1.08 (0.26–4.47)		15.5 (3.42–69.9)*	8.22 (1.16–58.3)*
Block 3: Diabetes-related variables									
Duration of diabetes ≥10 years			0.95 (0.33–2.65)			1.67 (0.37–7.54)			0.48 (0.06–4.01)
Insulin-containing medications			1.58 (0.64–3.95)			1.47 (0.37–5.87)			3.00 (0.43–20.7)
Multiple diabetic complications (≥2)			1.04 (0.41–2.62)			2.33 (0.42–13.0)			1.42 (0.10–20.2)
HA1C %			1.21 (0.71–2.05)			4.85 (1.95–12.1)*			7.34 (2.22–24.2)*
Total cholesterol (mg/dl)			0.99 (0.97–1.02)			0.99 (0.95–1.02)			0.97 (0.93–1.01)
Triglycerides (mg/dl)			1.00 (0.99–1.01)			0.99 (0.98–1.02)			0.98 (0.96–1.00)
PAID-20			—			1.09 (1.06–1.13)*			1.07 (1.02–1.11)*
Δ–2LL (df, p-value)	91.75 (6, <0.001*)	11.90 (4, 0.018*)	1.63 (6, 0.951)	71.33 (6, 0.000*)	10.43 (4, 0.034*)	58.99 (7, 0.000*)	30.71 (5, 0.000*)	17.50 (4, 0.002*)	22.98 (7, 0.002*)
Nagelkerke R-Square	0.375	0.417	0.423	0.365	0.413	0.663	0.27	0.415	0.596
Δ R-Square	0.375	0.042	0.006	0.365	0.048	0.25	0.27	0.145	0.181
Predictive accuracy %	87.8%	89.8%	89.5%	96.3%	91.5%	94.8%	96.3%	96.3%	97.3%

–2LL, –2 Log Likelihood; df, degree of freedom.

*Statistically significant p-value at p < 0.05.

Reference categories for categorical variables, respectively as appeared in the table: age <60 years, male, not-married (including single, widow, or divorced), working, normal BMI, non-smoker, physically active, less than two comorbidities, duration of diabetes <10 years, oral hypoglycemics, and less than two diabetic complications.

^aVariable excluded due to insufficient responses in patients with anxiety.

Bold value indicates the significant findings.

and anxiety symptoms (24). on the contrary, another two studies in Saudi Arabia and Australia reported slightly lower rates of psychological disorders in older patients with DM compared to patients with younger age (29, 55). These differences could reflect unmet needs of older patients with T2DM in our population and should be followed by further research to identify the underlying causes of this outcome.

The current study's bivariate analysis showed that illiteracy, insufficient family income, unemployment, and being divorced or widowed were associated with higher prevalence of DD, depression, and anxiety symptoms. Study findings from other countries also showed similar association although not all associations were statistically significant (53, 58). Consequently, optimizing management of patients with DM does not only require a multidisciplinary team of healthcare workers, but it also involves synergistic multi-dimensional care plan of the surrounding environment.

Lifestyle factors like physical inactivity and obesity were associated with higher rates of diabetes associated mental health disorders in our study. This association was also confirmed in a longitudinal study that found that persistent depressive symptoms at 5 years were significantly associated with worse compliance with dietary and physical activity recommendations compared to patients with diabetes without depressive symptoms (59). Moreover, increased depression scores overtime predicted lesser adherence rates to dietary and exercise recommendations (60). Therefore, addressing psychological needs of patients with DM could help to improve patients' self-care and quality of life.

COVID-19 pandemic exerted a tremendous pressure on both patients and healthcare providers with unknown long-term consequences. Although we did not find a significant association between history of COVID-19 infection and the prevalence of mental health disorders among diabetic patients in our study, an earlier longitudinal study in Australia found that COVID-19 lockdown restrictions had negative impact on patients with T2DM quality of life and physical activity levels without affecting generalized anxiety and depressive symptoms prevalence (61). Therefore, ensuring access to mental health services for vulnerable patients during this unprecedented time cannot be overrated.

In the current study, diabetes duration, complications and treatment regimen were all associated with increased risks for comorbid DD, depression, and anxiety symptoms, which is consistent with previous studies (53, 55, 58). However, it is difficult to interpret potential risk factors for mental health disorders in T2DM as these factors often coexist and interact with each other. Although using insulin was associated with increased rate of diabetes-related psychological disorders (in bivariate analysis), this might be confounded by the fact patients with T2DM receiving insulin-based regimens might have had diabetes for a longer period and/or have higher rate of comorbid diseases or diabetes-related complications.

By using multiple logistic regression, we found that the only predictors for DD were social factors (namely being married, illiterate, having insufficient income) and having multiple co-morbidities. Nevertheless, DD itself as well as HbA1c level were predictors for depressive and anxiety symptoms in

patients with T2DM. The intercorrelation between social factors, health-related variables, DD, depression, and anxiety seem to go into a continuous cycle with complex interactions that necessitate a holistic patient-centered approach in order to break this cycle.

Our study provided some of the early evidence on the burden of three important psychological disorders in people with T2DM who are managed in the PHC centers in the rural area of Ismailia in Egypt. However, this observational study is subjected to limitations. First, due to the cross-sectional nature of the study, it is not possible to identify causality between variables. Therefore, a further longitudinal study is needed to reveal the strength and direction of any potential association. Second, as we did not have baseline data on the burden on mental health disorders among patients with T2DM in our population, we could not assess the impact of COVID-19 pandemic on our study participants. Third, lack of randomization limited the ability to generalize the results. Fourth, the use of western methods to identify psychological disorders in non-western countries could be questionable. However, all the scales that we used (the PAID, the PHQ-9, and the GAD-7) were validated for use in Arabic language. Nevertheless, developing culturally sensitive screening tools could help in better assessment of psychological disorders in non-English speaking patients with DM.

CONCLUSIONS

Our study found DD is more prevalent than depressive and anxiety symptoms in adults with T2DM managed in the PHC facilities in the rural area of Ismailia in Egypt during the COVID-19 pandemic. DD and HbA1c level were associated with depressive and anxiety symptoms in this population of patients. Although psychosocial assessment is important for all patients with T2DM, our study findings suggest that PHC providers should pay closer attention to females, elderly, patients suffering from DM for a longer time, those with multiple comorbidities and/or chronic diabetes complications. As multiple sociodemographic and clinical factors were identified to be linked with psychological conditions in patients with T2DM, it is important to utilize multidisciplinary teams to achieve holistic patient-centered care. Further studies are necessary to better understand the long-term psychological consequences of the COVID-19 pandemic on patients with T2DM.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s on reasonable request.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee at the Faculty of Medicine, Suez Canal University, Ismailia, Egypt (Ref No.

4277/2020). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HS commenced the idea of this research. HS, AF, AJ, JS, and AS drafted this manuscript. SM collected the data of this research. AF and SE analyzed these data. SE, MM, JS, and SM

critically reviewed this manuscript. SM and HS supervised this research. All authors designed this research and approved the final manuscript.

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The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The Impact of COVID-19 Vaccination on the Social Participation of Immunocompromised Persons – Results of a Multicenter Observational Study

Gloria Heesen^{1*}, Dominik Schröder¹, Frank Müller¹, Eva Hummers¹, Frank Klawonn^{2,3}, Marie Mikuteit⁴, Jacqueline Niewolik⁴, Sandra Steffens⁴, Anne Cossmann⁴, Georg Behrens⁴, Alexandra Dopfer-Jablonka^{4,5} and Stephanie Heinemann¹

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Samer El Hayek,
University of Miami Health System,
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Reviewed by:

Gabriele Righi,
Careggi University Hospital, Italy
Mohamed Mekhemar,
University of Kiel, Germany

*Correspondence:

Gloria Heesen
gloria.heesen@stud.uni-goettingen.de

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¹ Department of General Practice, University Medical Center, Göttingen, Germany, ² Department of Computer Science, Ostfalia University of Applied Sciences, Wolfenbüttel, Germany, ³ Biostatistics Group, Helmholtz Centre for Infection Research, Braunschweig, Germany, ⁴ Department of Rheumatology and Immunology, Hannover Medical School, Germany, ⁵ German Center for Infection Research (DZIF), Partner Site Hannover-Braunschweig, Heidelberg, Germany

Immunocompromised persons are at an increased risk for a severe SARS-CoV-2 infection and their safety behaviors may influence their social participation. Vaccinated persons have a lower incidence of infection and severe disease when infected compared to non-vaccinated persons. Therefore, their behavior may change and their social participation may increase after a complete vaccination. The aim of this study was to explore social participation of immunocompromised persons before and after complete COVID-19 vaccination. Between March and September 2021, 274 immunocompromised participants were recruited. Survey data were collected at baseline and follow-up from 194 participants including the Index for the Assessment of Health Impairments [IMET], Patient Health Questionnaire-4 [PHQ-4], subjective health status and quality of life. At baseline, participants were not yet completely vaccinated. Complete vaccination was achieved prior to the follow-up questionnaire. IMET scores decreased significantly at follow-up, indicating a higher social participation after complete vaccination. PHQ-4, subjective health status and quality of life did not differ between baseline and follow-up. There were no significant differences across sociodemographic factors. Significant PHQ-4 differences were observed regarding the population size of the participants' home community. Social participation of immunocompromised persons in our study increased after COVID-19 vaccination. Therefore, social participation should be explored further, especially with regards to the impact of vaccination on groups with a high health risk.

Keywords: social participation, observational study, COVID-19 vaccination, immunocompromised, pandemic (COVID-19)

INTRODUCTION

The global pandemic caused by SARS-CoV-2 is affecting daily life in various ways. Several “lockdowns” restricting social interactions to slow the spread of infection were adopted in Germany. This caused a fundamental change in daily social life e.g., social gatherings in spare time or at work were restricted by law. Before the release of the first vaccine in December 2020, the only proven protection against an infection were distance, masks, and hygiene measures.

Li et al. (1) proposed a positive association between the perceived severity and uncontrollability of COVID-19 with negative emotions and cautious behavior. It stands to reason that people at particularly high risk for a serious SARS-CoV-2 infection adopted risk-limiting behaviors that were more restrictive than the legal regulations implemented to protect the entire population (2). Furthermore, it is conceivable that such persons’ family and friends learned to keep their distance because they feared infecting them unwillingly. Persons with immune dysfunction and concomitant immunosuppressive treatment for rheumatic and other autoimmune conditions are one group at particularly high risk (3).

Social participation is a broad concept and can be defined as involvement or being included in a community life situation (4, 5). In order to maintain and achieve personal autonomy and well-being, social participation is necessary (6, 7). Studies have already associated social participation with health outcomes (8). Immunocompromised persons are associated with a reduced social participation compared to healthy individuals (8). The pandemic situation presents an additional burden for social participation and mental health, even for healthy individuals (9–12).

Basic immunization is regarded a key effective protective measure against COVID-19, whereby the knowledge and recommendations about the number and timing of vaccinations is continuously changing throughout the pandemic. The definition of basic immunization against COVID-19 had to be repeatedly adapted to the current state of research in the course of the pandemic.

At the beginning of the survey (end of March 2021), a basic immunization was defined as 14 days after two doses of Comirnaty, Spikevax or Vaxzevria, or 14 days after one dose of COVID-19 Vaccine Janssen. According to the official recommendation in Germany, valid from December 2021, three vaccinations are needed for basic immunization of persons receiving an immunosuppressive medication such as Methotrexate or Cyclophosphamide and a booster vaccination after 6 months is also advised (13). At the start of the German vaccination campaign in December 2020, complete vaccination was thought to allow for relaxation of social restrictions even if the effectiveness of the vaccination for immunocompromised people was not entirely clear. Currently, breakthrough infections are occurring throughout Europe and beyond. Therefore, in contrast to original expectations, in German guidelines a

complete relaxation of social restrictions is not recommended even after complete vaccination (14, 15).

More recently, the uncertainty and insecurity regarding individual vaccine effectiveness affects not only immunocompromised individuals, but all people due to viral variants of concern such as the omicron variant (16, 17).

The above-mentioned factors underline the need to understand the impact of vaccination upon social participation and quality of life. Therefore, this study aims to investigate if a complete COVID-19 vaccination influences social participation in a prospective, multicenter study with immunocompromised persons.

MATERIALS AND METHODS

Research Design and Participants

The COVID-19 Contact Immune Study [CoCo study] is a prospective, longitudinal, observational study at two large university hospitals in Northern Germany that, besides others, included participants with immunosuppressive drug therapy. Recruitment took place between March 2021 and September 2021. Persons with an ongoing immunosuppressive medication who were 18 years or older and capable of giving consent were included in the CoCo Immune Study. No further inclusion or exclusion criteria were applied.

The recruitment strategy consisted of newspaper advertisements, posters in vaccination centers, in university hospitals and in doctors’ offices specialized in rheumatologic diseases. We set up a study telephone hotline and an e-mail address where interested participants could contact study personnel directly.

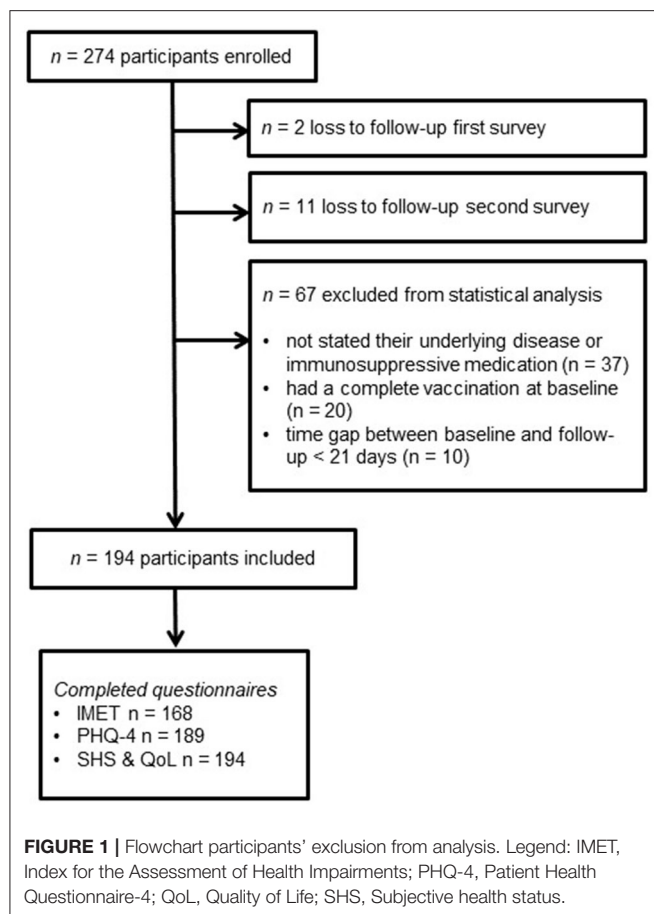
Due to the pandemic situation and the particularly vulnerable, immunosuppressed participant group, we conducted the study in a minimized-contact manner. Enrollment in the study and obtaining consent from participants could be done by video or phone call or in person, depending on participants’ preference. Study materials were shipped by mail to the participants. Study materials were returned by mail. All participants were informed that all possible preventive measures should be taken and all regulations should be observed. Further information can be gathered in the study protocol (18).

Measures

Index for the Assessment of Health Impairments (IMET)

The primary outcome is the IMET [Index for the Assessment of Health Impairments], which is a self-administered questionnaire to measure social participation based on the International Classification of Functioning, Disability and Health (19). It was initially developed to assess participation and involvement in persons with different chronic diseases and validated in a large cohort. The main field of application is rehabilitation research. The IMET is unidimensional and consists of nine items with a 11 (0–10) level Likert scale where higher scores indicate lower social participation consistently across all items. The sum of all nine items can be used to determine the overall social participation with a high internal reliability (Cronbach’s alpha

Abbreviations: GAD, Generalized Anxiety Disorder Scale; IMET, Index for the Assessment of Health Impairments; PHQ Patient Health Questionnaire.



0.90). The IMET asks if the participants have any impairments at the moment. It does not measure the actual social behavior of the participants. The IMET was used by Mergel & Schützwohl to assess social participation before and after the COVID-19 lockdown in participants with a mental disorder and in the general population (20).

PHQ-4

The PHQ-4 [Patient Health Questionnaire-4] is a brief, validated, high reliability (α 0.85) measure of anxiety and depression symptoms (21). This scale consists of two subscales PHQ-2 [Patient Health Questionnaire-2] measuring depression symptoms and GAD-2 [Generalized Anxiety Disorder Scale-2] measuring anxiety symptoms, consisting of two four-point Likert-type items (0–3) for each subscale. It produces an overall psychological distress sum score ranging from 0–12, where higher scores indicate a worse psychological well-being. Validated against the Brief Symptom Inventory, the PHQ-4 has a specificity of 94.5% and sensitivity of 51.6% (22).

Further Questions

In addition to the validated questionnaires (IMET and PHQ-4), the health-related quality of life and subjective health status of the last 2 weeks for each participant were each assessed with a

TABLE 1 | Baseline characteristics.

	<i>n</i> (%) or mean (sd)
Gender	
Male	57 (29.5)
Female	136 (70.5)
Age, years (mean (sd))	51.3 (13.8)
<40	44 (22.8)
40–65	115 (59.6)
>65	34 (17.6)
School education¹	
Low	16 (8.6)
Middle	54 (28.9)
High	113 (60.4)
Not specified	4 (2.1)
City resident size	
<5,000	77 (41.0)
5,000–20,000	36 (19.1)
20,000–100,000	24 (12.8)
>100,000	51 (27.1)
Household*	
Parenting	47 (24.2)
Single parent	2 (1.0)
Living alone	38 (19.6)
Care of relatives	22 (11.3)
Underlying disease*	
Rheumatological disease	82 (42.3)
Inflammatory bowel disease	39 (20.1)
Psoriasis	27 (13.9)
Multiple sclerosis	21 (10.8)
Transplant	14 (7.2)
Other	22 (11.3)
Comorbidities*	
Hypertension	76 (39.2)
Heart failure	2 (1.0)
Diabetes type 2	8 (4.1)
COPD	2 (1.0)
Degree of impairment (%)²	
No impairment (0)	71 (36.8)
Low impairment (20–49)	39 (20.2)
Moderate impairment (50–74)	63 (32.6)
Severe impairment (75–100)	20 (10.4)
Therapy paused for COVID vaccination (yes)	48 (24.7)
Immunosuppression medication*	
Prednisolone	68 (35.1)
Metothrexate	52 (26.8)
TNF inhibitor	43 (22.2)
Azathioprine	13 (6.7)
Tacrolimus & Everolimus	12 (6.2)
Others	51 (26.3)
Number of taken immunosuppressants	
1	115 (59.3)

(Continued)

TABLE 1 | Continued

	<i>n</i> (%) or mean (sd)
2	60 (30.9)
3 or more	19 (9.8)
Vaccination type	
mRNA	146 (77.7)
Vector-based	14 (7.4)
Cross vaccinated ³	28 (14.9)

¹based on German secondary school education, ²based on the German social law measuring physical, mental and social impairment ³Multiple selection possible; COPD: chronic obstructive pulmonary disease ³consisting of one dose mRNA vaccination and one dose vector-based vaccination.

single item on a seven-point Likert-scale. Higher scores on the Likert-scale indicate a poorer health status or lower quality of life.

Measured Covariates

We obtained additional items in our questionnaire about sociodemographic variables including age (numeric and categorized), school education, gender, size of residential place and variables describing the living situation of the participants (e.g., single parent). School education was classified as low (no or low secondary school diploma), medium (intermediate secondary school diploma) or high (college preparatory) based on the German secondary school graduation. In addition, the questionnaire was used to obtain information about medical conditions/treatments, such as the underlying disease of the immunosuppressed participants, the degree of disability according to German Social Law (categorized) and if the person paused his/her immunosuppressive medication prior to receiving the COVID-19 vaccine.

Time Points

The baseline questionnaire, including sociodemographic and medical data, was administered at enrolment. The IMET, PHQ-4, health-related quality of life and health status questions were repeated in a follow-up questionnaire 1 month after the participant's second COVID-19 vaccination shot.

Statistical Analysis

For the statistical analysis, recruited participants were excluded if they (a) did not state their immunosuppressive medication or underlying disease, (b) had a complete COVID-19 immunization at baseline (14 days after two vaccinations or after one in case the COVID-19 Vaccine Janssen was used) or (c) baseline and follow-up questionnaire were filled out with a time gap <21 days.

Characteristics of the sample were reported descriptively. Reliability of the included questionnaires were assessed calculating Cronbach's alpha. Cronbach's alpha values ≥ 0.7 were interpreted as acceptable (23). Mean scores and differences between baseline scores and follow-up scores (1 month after COVID-19 vaccination) were reported and compared using a paired *t*-test. Differences were calculated subtracting the follow-up scores from the baseline scores. Thus, higher scores indicate

worsening and lower scores an improvement of the outcome. All examined outcomes were approximately normally distributed.

The effect size Hedges g^* adjusted for small sample size was calculated. Values of 0.2, 0.5, and 0.8 are interpreted as a small, medium, and large effect size, respectively (24). The PHQ-4 measures overall psychological distress as well as anxiety and depression symptoms in two subscales of the instrument (21, 25). A sum score of ≥ 3 on either subscale or ≥ 6 on the whole scale is considered the cutoff point for identifying possible symptoms of clinical anxiety or depression. According to this instrument, each patient was classified as "clinically unremarkable" or having "possible anxiety," "possible depression" or "possible mental health concerns" at baseline. At follow-up, the same instrument was used to detect and classify possible abnormalities concerning anxiety, depression and overall mental health. Any changes in the PHQ-4 classifications between baseline and follow-up were tested with the McNemar-test. An alpha level of 0.05 or less was considered to be statistically significant. We adjusted the alpha using the Bonferroni correction when subscales of the questionnaires were individually tested.

Participants that did not complete both the baseline and follow-up questionnaires were excluded from the analysis. Bivariate analysis was conducted between sociodemographic variables and the paired IMET differences, while reporting the mean difference of the baseline and follow-up IMET scores and the 95% confidence interval [CI] using *t*-distribution. Pearson correlation coefficients between the IMET and the different questionnaires were calculated. According to Cohen (26), a correlation coefficient of 0.1, 0.3, and 0.5 is interpreted as a small, moderate, and strong association between two variables. All statistical analyses were carried out using SPSS Version 28 (IBM, Armonk, NY) while R (ggplot2 package) was used to illustrate the results in figures.

RESULTS

Sample Description

The baseline questionnaire was filled out between March 30 and May 21, 2021. Between May 17, 2021, and August 30, 2021, the follow-up questionnaire was completed. The mean interval between the completion dates was 79.9 days (SD: 23.5, min: 23, max: 143). After loss-to-follow up and further exclusion of the participants based on the inclusion and exclusion criteria, a total of 194 participants were included in the analysis (see **Figure 1**). No participant completed the survey during the period of the national lockdown in Germany. The participants were on average 51.3 years old and mostly female (70.5%). The majority of our sample had a high school education (60.4%) and lived either in rural areas (<5.000 residents) or big cities (>100.000 residents). The most frequent diagnosis groups of the underlying immunosuppressive therapy were rheumatic diseases ($n = 82$, 42.3%), inflammatory bowel diseases ($n = 39$, 20.1%), and/or psoriasis ($n = 27$, 13.9%). About one third of the participants suffer from hypertension ($n = 76$, 39.2%). Further comorbidities are diabetes type 2 ($n = 8$, 4.1%), heart failure ($n = 2$, 1.0%) and COPD ($n = 2$, 1.0%). One quarter of all participants paused their immunosuppression medication due to the COVID-19 vaccine

TABLE 2 | Mean characteristics of the measures and the effect size.

	Baseline Mean (sd)	Follow-up Mean (sd)	Difference Mean (sd)	Hedges g* Hedges G (95% CI)
IMET Score T0-T1 (all completed cases n = 168)	31.7 (16.7)	27.2 (18.3)	4.6 (15.7)	0.3 (0.1; 0.4)
Usual activities of daily life (n = 194) ⁵	1.3 (2.0)	1.5 (2.2)	−0.2 (1.8)	−0.1 (−0.2; 0.0)
Family and domestic responsibilities (n = 191) ⁶	2.1 (2.3)	2.3 (2.5)	−0.2 (2.0)	−0.1 (−0.2; 0.0)
Getting thing done outside of home (n = 192) ⁴	3.1 (3.0)	2.6 (2.7)	0.5 (2.9)	0.2 (0.0; 0.3)
Daily tasks and obligations (n = 191) ⁸	2.8 (2.8)	2.6 (2.5)	0.2 (2.8)	0.1 (−0.1; 0.2)
Recreation and leisure (n = 187)⁹	5.5 (3.4)	4.0 (3.1)	1.4 (3.6)	0.4 (0.2; 0.5)
Social activities (n = 188)⁹	7.1 (3.4)	4.8 (3.2)	2.2 (3.8)	0.6 (0.4; 0.7)
Close personal relationships (n = 194)⁷	3.6 (3.2)	2.9 (2.9)	0.7 (3.1)	0.2 (0.1; 0.4)
Sex life (n = 185) ⁷	3.2 (3.2)	3.6 (3.5)	−0.4 (3.0)	−0.2 (−0.3; 0.0)
Stress and extraordinary strain (n = 194) ²	3.5 (2.8)	3.3 (2.8)	0.2 (2.7)	−0.1 (−0.1; 0.2)
PHQ-4 (n = 189)	2.9 (2.6)	2.8 (2.4)	0.1 (2.3)	0.0 (−0.1; 0.2)
PHQ-2 (n = 189)	1.6 (1.4)	1.5 (1.3)	0.1 (1.3)	0.1 (−0.0; 0.2)
GAD-2 (n = 191)	1.3 (1.5)	1.4 (1.4)	−0.0 (1.4)	−0.0 (−0.2; 0.1)
Subjective health status (n = 194)	3.2 (1.1)	3.2 (1.3)	0.0 (1.2)	0.0 (−0.1; 0.2)
Quality of Life (n = 194)	3.2 (1.3)	3.0 (1.2)	0.2 (1.3)	0.1 (−0.0; 0.3)

Bold: significant change between baseline and follow-up between using a paired t-test ($p < 0.05$ or adjusted after Bonferroni while testing subscales); Hedges g* bias corrected for small sample size; sd: standard deviation; IMET, Index for the Assessment of Health Impairments; PHQ-4, Patient Health Questionnaire-4; PHQ-2, Patient Health Questionnaire-2; GAD-2, Generalized Anxiety Disorder Scale-2; ^{superscript} indicating targeted ICF domain.

TABLE 3 | Correlation between the IMET differences and other subscales.

Scale	Correlation (95% CI)
PHQ-4	0.34 (0.20–0.47)
GAD-2	0.11 (−0.05–0.26)
PHQ-2	0.26 (0.11–0.40)
Subjective health status	0.13 (−0.02–0.27)
Quality of life	0.29 (0.14–0.42)

Bold: significant (Bonferroni-adjusted); PHQ-4, Patient Health Questionnaire-4; PHQ-2, Patient Health Questionnaire-2; GAD-2, Generalized Anxiety Disorder Scale-2.

(Table 1). The IMET was completely covered at both time points by 168, PHQ-4 by 189 and quality of life and health status by all 194 participants, respectively. The reliability of the baseline and follow-up IMET and PHQ-4 questionnaires indicates a high internal consistency (Cronbach's $\alpha \geq 0.8$).

Change of Social Participation and Mental Health Over Time

At baseline, immunosuppressed participants had a mean IMET score of 31.7 compared to 27.2 at follow-up ($t_{167} = 3.75$, $p < 0.001$). Three out of nine domains of the IMET showed a significant change: (1) recreation and leisure, (2) social activities and (3) close personal relationships. The scores decreased between baseline and follow-up by 1.4 (recreation), 2.2 (social activities) and 0.7 (personal relationships), respectively (Table 2). The PHQ-4 with its subscales as well as the subjective health status and the quality of life showed no significant change between the two time points with effect sizes (Table 2).

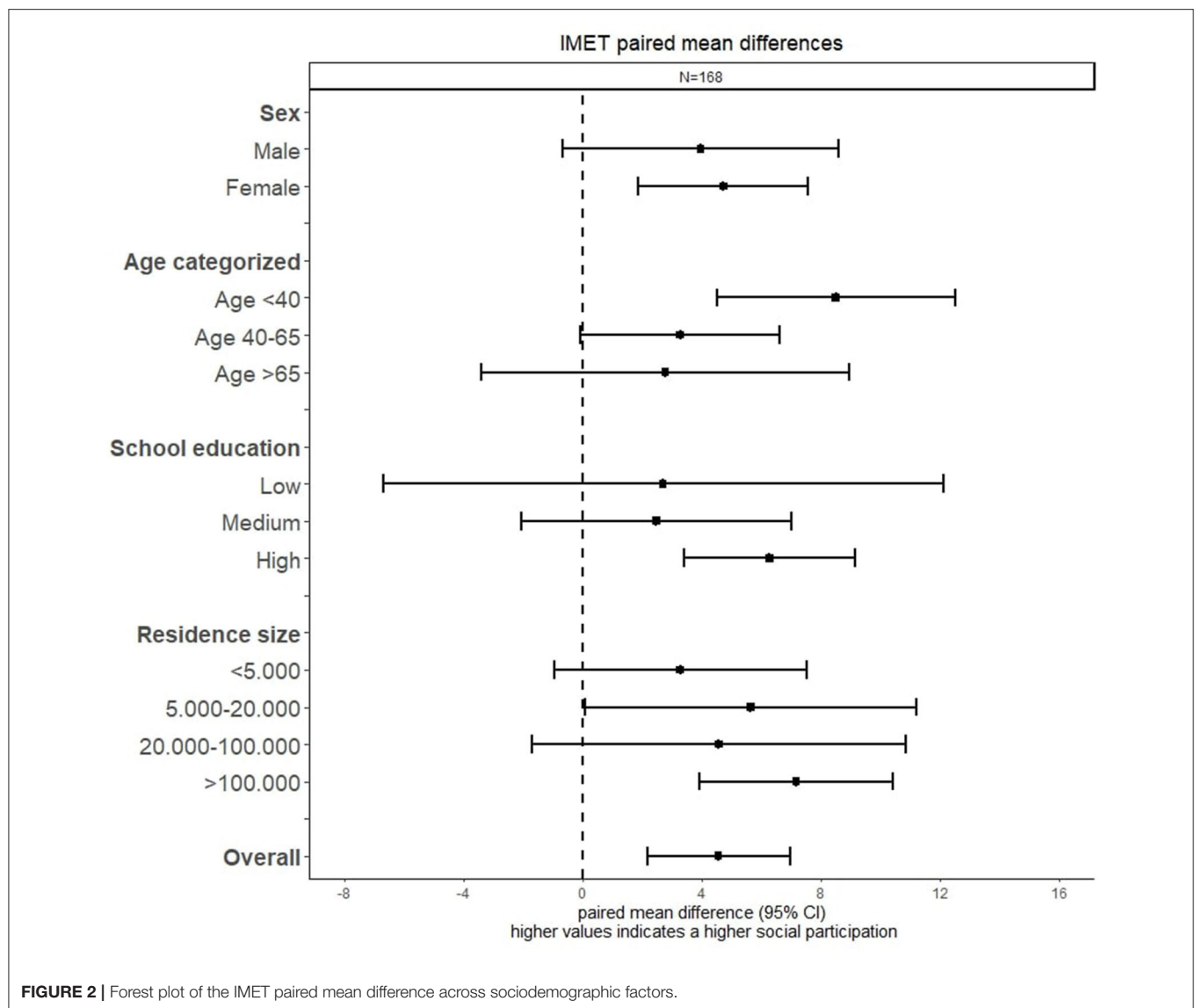
The proportion of participants with questionnaire scores indicating mental health problems showed a slight but non-significant decrease between baseline and follow-up.

Correlation Between Change in Social Participation and Other Measures

The difference between baseline and follow-up of the IMET showed a significant correlation with the difference of the PHQ-4, whereby the subscale PHQ-2 showed a small significant correlation and the correlation with the GAD-2 was not significant. A small significant correlation was also found between the self-rated quality of life and the IMET (Table 3). There was no difference regarding the type of vaccination (mRNA, vector-based vaccination and cross vaccination) between those participants whose social participation improved and those whose social participation stayed consistent or worsened.

Bivariate Analysis of Social Participation and Mental Health Across Sociodemographic Factors

Bivariate analysis of the IMET differences examined across social demographic variables shows overlapping 95% CI across all variables which indicates no significant differences using the t-distribution (Figure 2). Female participants (4.0, 95% CI [−0.7–8.6]) show a higher IMET difference compared to male participants (4.7, 95% CI [1.9–7.6]). With increasing age, a lower IMET difference can be observed. Participants with a low (2.7, 95% CI [−6.7–12.5]) or medium (2.5, 95% CI [−2.1–7.0]) school education had a nearly identical IMET score difference between baseline and follow-up, where participants with a high



school education are associated with higher mean difference (6.3, 95% CI [3.4–8.9]). With increasing residential size, no clear pattern could be observed. However, participants living in larger cities with 100,000+ residents showed the highest IMET score difference (7.2, 95% CI [3.9–10.4]) between the two measured time points.

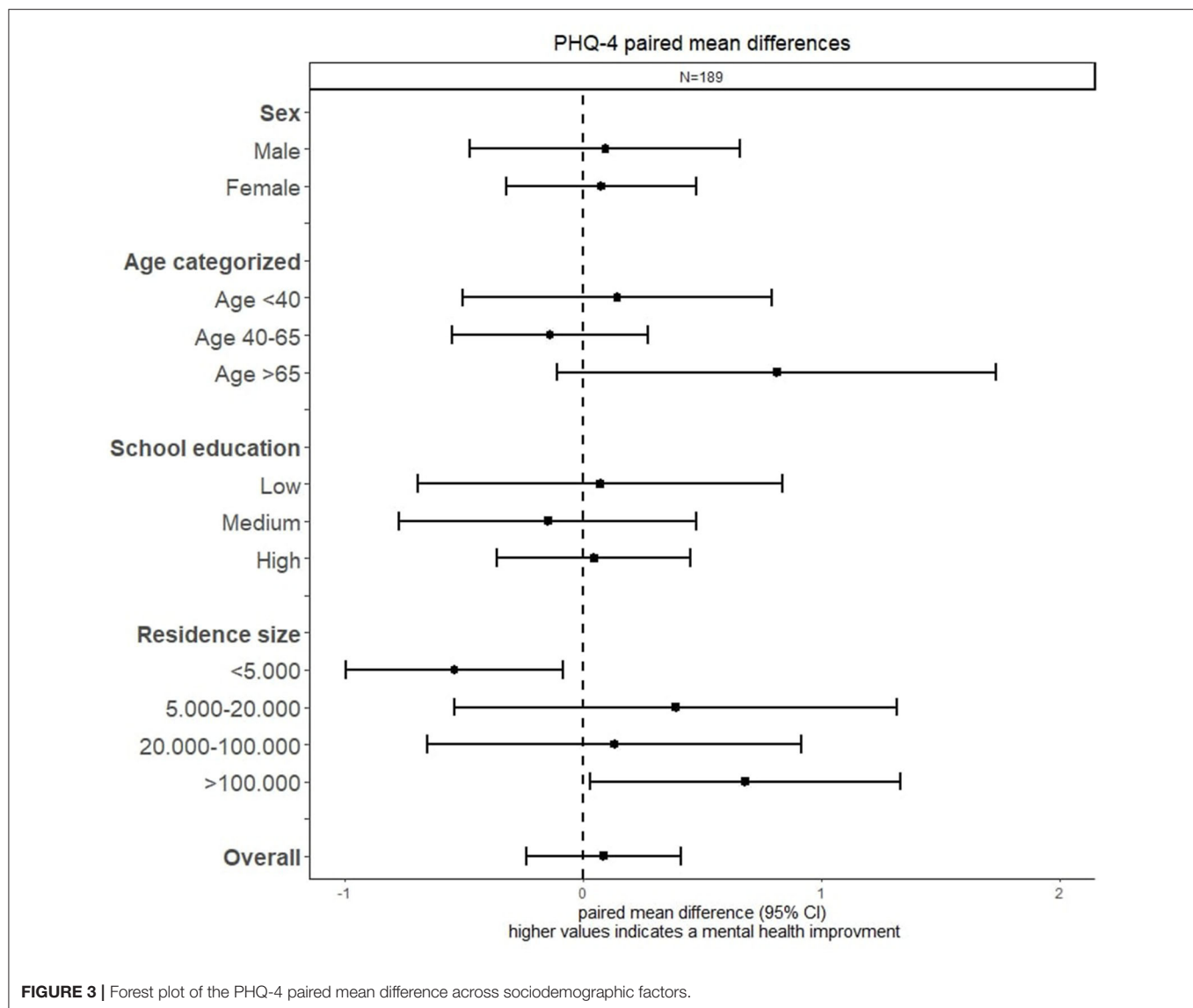
While the mental status measured by PHQ-4 did not change significantly in the overall cohort, there was a significant difference between residents of villages and residents of large cities. For the first, the PHQ-4 scores worsened significantly (-0.5 , 95% CI [-1.0 – -0.1]), while for residents of large cities the score improved considerably (0.7 , 95% CI [0.0 – 1.3]) (Figure 3).

DISCUSSION

This study shows that social participation increased after complete COVID-19 vaccination. Three subscales “recreation

and leisure,” “social activities” and “close relationships” were responsible for the change in the overall IMET score, while other aspects like “usual activity of daily life” remained the same. COVID-19 vaccination did not have an influence on mental health, subjective health status and quality of life. A positive and significant correlation was found between social participation and mental health status and between social participation and quality of life. No change of social participation was observed when stratified according to sociodemographic factors. Mental health did not differ significantly between baseline and follow-up, however, the subgroups of participants residing in small cities or villages (<5,000 residents) had a significant decrease of their mental health at follow-up and participants from big cities (>100,000 residents) showed a significant increase.

Even though the IMET was not initially developed to measure social participation during a pandemic, it was already used by Mergel & Schützwohl for this purpose (2021). They used the IMET to measure the social participation before and after the



national lockdown during the COVID-19 pandemic. The study included participants from the general population as well as participants who suffered from a chronic mental disorder or participants who received active mental disorder treatment (20). The first observation point was before the pandemic began in August 2019 followed by March 2020 and July 2020. Similar to our results, a lower social participation in all groups in the subdomains recreation and leisure, social activities and close personal relationships was observed at follow-up. These domains were presumably mostly directly affected by public health measures implemented to contain the pandemic.

The change of the IMET can be compared with already existing literature using norm data, pre-post changes and intergroup pre-post changes from rehabilitation research. Deck et al. (8) gathered norm data for the IMET in the German population in 2014. A mean IMET score of 16.65 for women and 15.6 for men aged between 50 and 59 years was described. People with chronic inflammatory bowel disease had an IMET

score about 18.7. Our sample, with a mean age of 51.3 years, had considerably higher mean IMET scores of 31.7 at baseline and 27.2 at follow-up, indicating less social participation. However, the pandemic situation and an underlying disease that requires immunosuppressive medication were key differences between the norm data and our sample. Furthermore the baseline characteristics also differed from the German average population, especially the comparatively high level of education in our sample as well as the higher proportion of female participants (8). Hueppe et al. (27) compared in a randomized controlled trial the effect of a rehabilitation intervention in participants with inflammatory bowel disease. The control group and the intervention group showed IMET scores of 32.8 and 34.7, respectively. The IMET score decreased by 7.3 and 2.9 points in the intervention and control groups, respectively, after 12 months. These changes from baseline to follow-up resulted in an effect size between the study arms of 0.23. In our sample, with 20% diagnosed inflammatory bowel disease, vaccination of

immunosuppressed participants resulted in an even higher effect size (0.29). A similar effect size of 0.36 was found by Nübling et al. studying a rehabilitation intervention using secondary data of participants with a mean age of 51.7 years (28). Comparing the effect sizes of our study with rehabilitation interventions, we found the effect of the complete COVID-19 vaccination and the effect of a rehabilitation intervention to be comparable.

In contrast to our finding of no significant change of mental health between the two time points, a study among hospital workers found a significant difference in the rate of change in vaccinated persons compared to non-vaccinated persons implying better mental health after the COVID-19 vaccination (29). The correlation between increasing IMET and increasing PHQ-2 scores leads to the assumption that a high level of depressions goes along with less social participation. The absence of a correlation between the change in IMET and GAD-2 between baseline and follow-up shows no dependency between social participation and anxiety levels in our sample. Further studies confirm the association between social participation and depressive symptoms. For example Noguchi et al. could show that effect as well during the COVID-19 pandemic (12, 30). The difference in mental health between participants living in small cities or villages and big cities may be explained due to lower mental health care resources in rural areas compared to big cities (31). This finding needs to be investigated further in a multivariable model adjusted for various confounders with a larger sample size and over a longer period of time. The vaccination type showed no association to the change of social participation. It has to be considered that about 75% of our cohort were vaccinated with a mRNA vaccination.

The German National Institute for Public Health (“Robert Koch-Institut”) reports a reduced immune response and suggests a reduced effectiveness for immunocompromised persons (25). Even for healthy individuals, the effectiveness of vaccination cannot be assessed with certainty with regard to the virus variants of concern (32). Official recommendations for high-risk groups recommend severe and more far-reaching restrictions regarding lifestyle and protection measures compared to statutory restrictions (33). Further evidence regarding the immune response, efficacy and duration of protection of the COVID-19 vaccination for immunocompromised persons could have negative effect upon the social participation of these persons, even after the initial improvement.

There has never been a pandemic in the recent history of time. Existing scientific concepts, e.g., for measuring participation, cannot cover the dimensions of impairment. The IMET used as a primary outcome in the study is based on the International Classification of Functioning, Disability and Health and developed to measure the effect of rehabilitation interventions and may not reflect the social participation completely during a pandemic. The data from this study could be used for sample size calculation in further research. Based on the IMET score change of 4.6 and a standard deviation of 15.6 after a complete vaccination a sample size of 94 would be sufficient to detect such an effect with a power of 80% and alpha 0.05 using a paired *t*-test.

Various factors beside the vaccination status could confound our results. Possible confounders could be changes regarding the pandemic situation, disease progression and medical therapy. In particular, the incidence of SARS-CoV-2 infections varies over time, with a trend toward higher incidence at colder outdoor temperatures. SARS-CoV-2 incidence and the proportion of intensive care unit beds occupied by COVID-19 patients to the total number of intensive care unit beds were used as the main reference values for regulatory restrictions to minimize the spread of SARS-CoV-2 (34). A further limitation of the study is that the results may be influenced by changes in the season (from spring to summer), which may have an effect upon a respondent's perception of reduced social participation. Further studies should compare social participation during the different seasons of the year in immunocompromised persons. They are more vulnerable for any kind of contagious disease, not just COVID-19, and seasonal waves of illness may have an effect upon social participation.

The sample of our study may not be representative for all immunocompromised persons (e.g., mostly female and low comorbidities) due to possible selection bias and loss-to-follow-up bias. Only complete cases for each included scale were analyzed. Therefore, the number of participants varies between included outcomes.

Additionally, only immunocompromised persons who wanted to get vaccinated were recruited. Therefore, the results are based on paired differences between two time points. A study design including a non-vaccinated, immunocompromised control group would have allowed us to estimate the effect of the vaccination on the social participation with more validity. However, a study design requiring immunocompromised persons to remain unvaccinated over the 12-month study period would neither have been feasible nor ethically appropriate.

By offering only questionnaires in German language, we structurally excluded potential participants with limited German language proficiency. The main cause of this was that the IMET questionnaire is only validated in the German language.

Participants could have misunderstood the items of the questionnaire even though they could contact the research team and ask questions about the individual items.

CONCLUSION

The investigation of immunocompromised participants revealed a positive change in social participation after a complete COVID-19 vaccination. The improvement of participation after vaccination corresponds in effect size to that of medical rehabilitation. An increase of social participation was observed in the domains “recreation and leisure,” “social activities” and “close personal relationships.” Social participation was positively associated with mental health and quality of life in our sample. Across different sociodemographic factors, no differences in social participation were observed. The dynamic pandemic situation could influence social participation additionally to vaccination status. The hypothesis that social participation is positively affected by complete COVID-19 vaccination should

be examined in further studies, including a control group where possible to ensure these results.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of the University Medical Center Göttingen (No. 29/3/21). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

Conceptualization: GH and FM. Methodology: DS and GH. Formal Analysis: DS. Investigation: GH, SH, and FM.

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Relationship Between Economic Loss and Anxiety During the Coronavirus Disease 2019 Pandemic: Moderating Effects of Knowledge, Gratitude, and Perceived Stress

Hyerim Jang¹, A-La Park², Yu-Ri Lee³, Seunghyong Ryu⁴, Ju-Yeon Lee⁴, Jae-Min Kim⁴, Sung-Wan Kim^{4,5*} and Young-Shin Kang^{1*}

¹ Department of Psychology, Chonnam National University, Gwangju, South Korea, ² Care Policy and Evaluation Centre, Department of Health Policy, London School of Economics and Political Science, London, United Kingdom, ³ Department of Social Welfare, Nambu University, Gwangju, South Korea, ⁴ Department of Psychiatry, Chonnam National University Medical School, Gwangju, South Korea, ⁵ Mindlink, Gwangju Bukgu Mental Health and Welfare Center, Gwangju, South Korea

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Jaume I University, Spain

*Correspondence:

Sung-Wan Kim
swkim@chonnam.ac.kr
Young-Shin Kang
lavieenrose@chonnam.ac.kr

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Objectives: The prolonged coronavirus disease 2019 (COVID-19) pandemic has caused individuals to suffer economic losses, in particular due to the implementation of intensive quarantine policies. Economic loss can cause anxiety and has a negative psychological impact on individuals, worsening their mental health and satisfaction with life. We examined the protective and risk factors that can influence the relationship between economic loss and anxiety during the COVID-19 pandemic.

Methods: Panel data from 911 participants were collected in April and May 2020 and again 6 months later. We analyzed the relationship between economic loss and anxiety and investigated the moderating effects of knowledge about COVID-19, gratitude, and perceived stress. Moreover, we investigated whether there were any changes in moderating effects over time or in different demographic groups.

Results: In the early stages of the spread of COVID-19, gratitude ($B = -0.0211$, $F = 4.8130$, $p < 0.05$) and perceived stress ($B = 0.0278$, $F = 9.3139$, $p < 0.01$) had moderating effects on the relationship between economic loss and anxiety. However, after 6 months, only perceived stress had a significant moderating effect ($B = 0.0265$, $F = 7.8734$, $p < 0.01$).

Conclusion: In the early stages of COVID-19, lower levels of gratitude and higher perceived stress led to greater anxiety. In later stages of the prolonged pandemic, only perceived stress had a continued moderating effect on the relationship between economic loss and anxiety. This study suggests that psychological interventions to reduce perceived stress are needed to treat the possible adverse effects of the spread of infectious diseases on mental health.

Keywords: COVID-19, anxiety, economic loss, knowledge related COVID-19, gratitude, perceived stress

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a novel infectious disease that has been prevalent worldwide since it was first confirmed in December 2019. Quarantine and isolation are essential to preventing the transmission of COVID-19. Therefore, policies to restrict the public lives of individuals, such as limiting public crowds, have been implemented globally.

Although social distancing is effective for preventing the spread of viruses (1), it brings about great economic loss. According to the Organization for Economic Co-operation and Development (OECD) (2), the real gross domestic product of the world decreased by 4.2% in 2020. Compared to 2019, the number of employed and self-employed individuals in South Korea decreased by 218,000 and 75,000, respectively, in 2020 (3). This indicates an increase in the number of individuals facing economic difficulties following the COVID-19 outbreak. Holmes et al. (4) suggested that the economic difficulties caused by COVID-19 quarantine policies can have serious mental health implications. Studies conducted in South Korea have demonstrated that individuals with reduced income due to COVID-19 have significantly higher anxiety compared to those with no reduction in income (5, 6). The OECD (7) reported that individuals who were unemployed or in unstable occupations in the United Kingdom during the COVID-19 crisis complained of higher levels of mental anguish. According to a review of psychological effects of large-scale epidemics (8), long quarantine periods prevent adequate provision of necessary information and supplies, which causes individuals to experience financial loss. This can add to the stress of fear of infection and may have negative psychological effects, such as anxiety, anger, confusion, and posttraumatic stress.

Anxiety is the most common symptom in unstable situations. Global uncertainty due to COVID-19 spread (9) was a persistent threat that could not be avoided (10). This reduced the overall quality of life during the spread of COVID-19 (11). According to the theory of uncertainty, which is related to generalized anxiety disorder, some individuals poorly tolerate the possibility of occurrence of a negative event, regardless of its probability (12). Therefore, it may be assumed that economic loss due to prolonged COVID-19 would make individuals extremely vulnerable to anxiety. In fact, low tolerance of the uncertainty of COVID-19 partially mediates adjustment disorders and causes generalized anxiety disorder (9). Moreover, studies in Korean (13, 14) and Chinese (15, 16) populations have reported substantial anxiety reactions. According to a Korean big data study (17), anxiety is one of the top keywords related to negative psychological effects of COVID-19, along with prolonged, lethargic, stress, and fear. Therefore, determining the factors that can influence the effects of economic loss due to COVID-19 on anxiety would be helpful for future psychotherapy and counseling interventions.

Fear and anxiety due to uncertainty were characteristic of the early stages of the pandemic, and unverified information propagated easily because there was limited information about the disease (18). In such a situation, false information about transmission, treatment, and prevention can exacerbate

psychological problems (19). Moreover, like a lack of information, excessive information also increases anxiety (16, 20). Evidence suggests that excessive use of social media and consumption of information about COVID-19 can increase anxiety (16, 21, 22). Media may not deliver correct knowledge about COVID-19; rather, it may spread anxiety and fear due to unverified information (23). In contrast, providing adequate and accurate information about infectious diseases may reduce confusion and anxiety (23, 24). A nationwide mental health survey conducted by the Korean Society of Traumatic Stress Studies reported “information related to infectious diseases” as the most important information for the public (25). Therefore, accurate knowledge may regulate negative emotions caused by COVID-19, thereby acting as a protective factor.

Other protective factors that can reduce the effects of the pandemic, such as gratitude, can also be considered. Gratitude is a well-known concept in the field of positive psychology, and people with high levels of gratitude can find positive aspects even in negative situations and reinterpret events (26). Individuals with a lot of gratitude are highly satisfied with their lives, frequently experience optimistic or positive emotions, and have lower levels of depression and stress (27, 28). In studies related to COVID-19, gratitude were positively associated with mental wellbeing during the lockdown in the United Kingdom (29). Individuals with stronger religious beliefs have a greater tendency to be grateful, and religion positively affects psychological wellbeing (30, 31). Religious people are highly likely to use their religious beliefs to deal with uncertainty and alleviate anxiety during the COVID-19 pandemic. In severely stressful situations, such as difficulties with outdoor activities or economic loss due to the spread of an infectious disease, gratitude and religion seem to relieve stress-related anxiety.

Similarly, individual perceptions and subjective judgments of stress levels due to an event can also affect anxiety. In times of stress, individuals perceive their stress level based on their subjective evaluation of an event, their resources, and their capacity to control it instead of objective parameters (32). Anxiety and perceived stress have a bidirectional relationship. People who have anxiety disorders are more affected by stressful events (33). Conversely, stressful events tend to precede anxiety disorders (34). Therefore, individuals who perceive their stress levels to be high during an event may experience more emotional difficulties. A longitudinal study showed that Dutch adults who reported higher levels of perceived stress during the COVID-19 lockdown experienced greater negative emotional changes, such as anxiety and hostility (35).

As COVID-19 is becoming a “social disaster” because of its prolonged global effects, there is a great need for studies examining temporal changes (36, 37). Various studies have reported the actual psychological impact of COVID-19 ranging from anxiety, panic, and fear to more long-term distress such as PTSD, depression, and grief (38, 39) and have warned of the risk for neurological sequelae from headaches, olfactory and gustatory dysfunction, and sleep disturbance to cognition and memory complications (40). It may be important to determine protective and risk factors in terms of time and social demographics for such a long-term disaster. Therefore, we examined the moderating

effects of knowledge about COVID-19, gratitude, and perceived stress on anxiety due to economic loss in the early stages of the pandemic in South Korea and whether these effects changed after 6 months. Moreover, by dichotomizing individual characteristics and analyzing each moderating effect model, we aimed to determine whether the model used in this study could have moderating effects within different groups.

MATERIALS AND METHODS

Participants and Procedures

This study enrolled individuals ages 19–65 years who lived in metropolitan areas, such as Seoul and its surrounding areas, Daegu, and Gwangju, which are representative metropolitan cities. Quota sampling was used to ensure a uniform age and sex distribution within the regional groups. Two online questionnaires were used to assess change over time. The first questionnaire survey was conducted between April 24 and May 5, 2020, 3 months after the COVID-19 outbreak in South Korea; the second questionnaire survey was conducted between November 9 and 23, 2020, 6 months after the first survey. Data collection methods previously described for the general population were used (41). All participants were selected from the panels of an online survey service (Macromill Embrain, South Korea). The first data collection period (April–May 2020) included 1,500 participants. The second survey questionnaire was sent to the 1,500 participants who were sent the first questionnaire, and 60.7% of them responded. A total of 911 participants who answered both questionnaires were included in the final analyses. The study was approved by the Chonnam National University Hospital Institutional Review Board (CNUH-2020-092).

Measurement

Sociodemographic Information

In this study, sex, age, religion, job type, and medical insurance type were considered variables for individual characteristics. The questionnaire presented various religions (e.g., Christianity, Buddhism), including “no religion,” but responses were recoded as only the presence or absence of religion. Job type (regular worker/long-term contract worker, short-term contract worker, or without any regular income) and medical insurance type were analyzed to assess socioeconomic status. As COVID-19 is a medical issue, it was relevant to assess whether an individual had medical insurance. The health insurance system in South Korea provides health insurance to all individuals who have been employed for more than a month, along with their dependents, and to all individuals who run a business (42). Medical aid is provided to the remaining low-income people who have difficulty maintaining a livelihood (42). Therefore, individuals provided with medical aid can be regarded the poorest people in South Korea.

Economic Loss

To measure COVID-19-related economic losses, we used previously described self-report questionnaires (41, 43). Two items for economic problems were selected to measure distress

related to the COVID-19 outbreak: “In the aftermath of COVID-19, I have experienced a loss in income.” and “I am experiencing economic stress (increased economic burden due to less income or more inflation)” All items were assessed on a 5-point Likert scale ranging from “not at all” (1 point) to “very much so” (5 points). Higher scores represented greater difficulties with external activities and economic loss. Cronbach’s alphas were 0.811 and 0.793 for the first and second surveys, respectively.

Anxiety

The Generalized Anxiety Disorder scale (GAD-7; 44) was used to measure anxiety among study participants. This questionnaire, developed by Spitzer et al. (44), consists of seven items. Cronbach’s alphas were 0.925 and 0.922 for the first and second surveys, respectively.

Knowledge About Coronavirus Disease 2019

Knowledge about COVID-19 was assessed with a 6-item researcher-developed questionnaire (23) (Table 1). Higher scores indicated greater knowledge about COVID-19. The Kuder-Richardson Formula 20 for this scale, which corresponds to dichotomous questions (45), was 0.78 and 0.43 for the first and second surveys, respectively.

Gratitude

The Gratitude Questionnaire-6 (GQ-6), developed by McCullough et al. (27) and translated and validated for Koreans by Kwon et al. (46), was used. The GQ-6 is a self-report measure that evaluates the experience and expression of gratitude in daily life. Cronbach’s alphas were 0.894 and 0.892 for the first and second surveys, respectively.

Perceived Stress Level

The Perceived Stress Scale (PSS) was used to measure perceived stress among study participants (47, 48). The PSS measures stress due to negative perception and lack of positive perception for a situation. Cronbach’s alphas were 0.818 and 0.827 for the first and second surveys, respectively.

Media Use

As reported previously, media exposure affects knowledge about COVID-19 and anxiety (23, 49). Therefore, the model for the moderating effects of knowledge about COVID-19 was analyzed with media use as a covariate. Previously described

TABLE 1 | Questionnaire to measure knowledge of COVID-19.

Statements	
Q1.	COVID-19 is spread through the saliva of infected people. (True)
Q2.	To prevent infection with COVID-19, it is necessary to avoid touching your eyes, nose or mouth with your hands. (True)
Q3.	Washing your hands under running water with soap for at least 30 s helps to prevent COVID-19 infection. (True)
Q4.	When coughing or sneezing, it is necessary to cover your mouth with your palm. (False)
Q5.	Windows should be kept closed as much as possible, as the virus can enter while ventilating a room. (False)
Q6.	COVID-19 is a fatal disease causing death in more than 30% of affected general adults. (False)

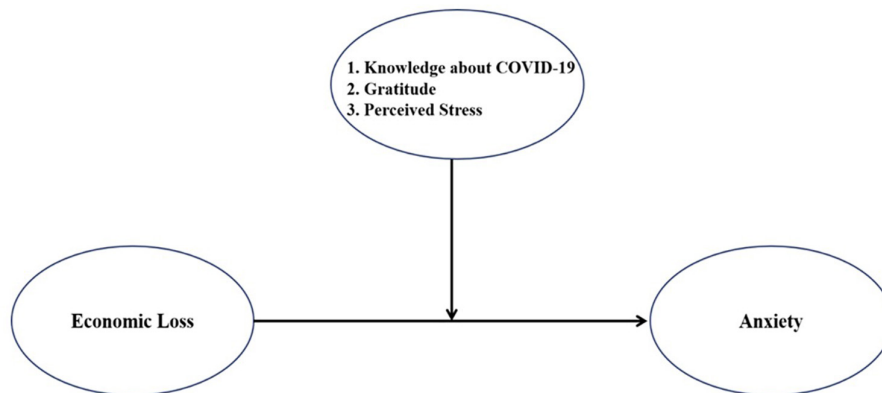


FIGURE 1 | A model of the moderating effect.

questionnaires (23, 49) that measure media and information use and exposure during COVID-19 were used. Cronbach's alphas were 0.732 and 0.762 for the first and second surveys, respectively.

Statistical Analysis

SPSS Statistics 25.0 (IBM) and SPSS PROCESS Macro 3.5 (50) were used for analyses. PROCESS Macro is an analytical modeling tool proposed by Hayes in 2013 that enables the analysis of models, such as moderated, mediated, and adjusted-mediated models, using ordinary least squares and logistic regression (50). Descriptive statistics for individual characteristics and variables are presented as frequencies, percentages, means, and standard deviations. Pearson correlation analyses were used to assess correlations between primary and secondary variables. To examine the moderating effects of knowledge about COVID-19, gratitude, and perceived stress on the relationship between the independent variable (economic loss) and the dependent variable (anxiety), we used SPSS PROCESS Macro 3.5 (model 1: simple moderation model with one moderating variable) to verify the moderation model (50) (**Figure 1**). Johnson-Neyman analyses were conducted to probe trends in the interaction effects. Finally, data were analyzed to determine differences in moderating effects based on individual characteristics, such as sex, socioeconomic status, and religion.

RESULTS

Sociodemographic Data

The 911 study participants included 466 males and 445 females. The average age of the respondents to the first survey was 41.5 years ($SD: \pm 11.7$), 582 (63.9%) were regular workers/long-term contract workers, and 329 (36.1%) were short-term contract workers or those without any regular income (part-time workers, the unemployed, housewives, students, etc.). A total of 871 participants (95.6%) were covered by national health insurance, whereas 40 (4.4%) were recipients of medical aid or near-poverty individuals who earned 50% less than the standard median income. Frequencies, means, and standard deviations of key variables by sociodemographic group are presented in **Table 2**.

Correlation Between Key Variables

First the correlation between the independent variable and the dependent variable was examined. Economic loss and anxiety were positively correlated in the first ($r = 0.253, p < 0.01$) and second ($r = 0.259, p < 0.01$) surveys. Next correlations between the dependent variable and the moderating variables were examined. Knowledge about COVID-19 ($r = -0.251, p < 0.01$) and gratitude ($r = -0.289, p < 0.01$) were negatively correlated with anxiety in the first survey, whereas perceived stress ($r = 0.547, p < 0.01$) was positively correlated. Similarly, knowledge about COVID-19 ($r = -0.245, p < 0.01$) and gratitude ($r = -0.311, p < 0.01$) were negatively correlated with anxiety in the second survey, whereas perceived stress ($r = 0.520, p < 0.01$) was positively correlated. Means, standard deviations, and correlation coefficients of key variables are presented in **Table 3**.

The Relationship Between Economic Loss and Anxiety

We divided the repeatedly measured data into first and second surveys and examined the moderating effects of knowledge about COVID-19 (M11, M12), gratitude (M12, M22), and perceived stress (M13, M23) on the relationship between economic loss (X1, X2) and anxiety (Y1, Y2). In the moderation analyses, all variables were centered at their means.

Moderating Effects of Knowledge About Coronavirus Disease 2019

Knowledge about COVID-19 did not moderate the relationship between economic loss and anxiety due to COVID-19 in the first ($B = 0.0997, p = 0.123$) or second ($B = 0.0494, p = 0.416$) survey (**Table 4**).

Moderating Effects of Gratitude

In the first survey, gratitude moderated the relationship between economic loss and anxiety due to COVID-19 ($B = -0.0211, p < 0.05$). The Johnson-Neyman method was used to probe the interaction and revealed that when the section of gratitude in the first survey was smaller than 11.5254, the coefficient between economic loss and anxiety was statistically significant

TABLE 2 | Frequencies, means, and standard deviations of key variables by sociodemographic group (*N* = 911).

Variable		1st total (%)		M	SD	2nd total (%)		M	SD
Gender	Male	466 (51.1)	Economic loss (X1)	6.60	2.25	Economic loss (X2)		6.50	2.05
			Knowledge about COVID-19 (M11)	4.87	1.07			4.65	1.15
			Media use (Covariate1)	13.25	2.87			12.98	2.96
			Gratitude (M12)	29.42	5.95			28.64	5.66
			Perceived Stress (M13)	19.99	5.18			19.75	4.95
			Anxiety (Y1)	3.97	4.46			3.89	4.20
			X1	6.87	2.16			6.53	2.12
	Female	445 (48.8)	M11	5.05	1.02	X2		4.90	0.98
			Covariate1	14.22	2.66			13.94	2.65
			M12	30.41	5.75			29.96	5.65
			M13	21.69	5.33			21.26	5.32
			Y1	3.97	4.46			4.29	4.25
Age (\pm SD)		41.5 years (\pm 11.7)							
Religion	Presence	358 (39.3)	X1	6.92	2.18	349 (38.3)	X2	6.16	2.10
			M11	4.96	1.03			4.72	1.10
			Covariate1	14.03	2.67			13.64	2.67
			M12	30.82	5.90			29.43	5.61
			M13	20.69	4.93			19.92	5.12
			Y1	3.83	4.34			3.77	4.06
	Absence	553 (60.7)	X1	6.61	1.07	562 (61.7)	X2	7.15	1.91
			M11	4.97	2.22			4.80	1.06
			Covariate1	13.53	2.88			13.33	2.95
			M12	29.31	5.78			29.02	5.82
			M13	20.90	5.56			21.52	5.14
			Y1	4.31	4.41			4.56	4.46
Job type	Regular/ Long-term	582 (63.9)	X1	6.39	2.20	586 (64.3)	X2	6.16	2.10
			M11	4.96	1.05			29.43	5.61
			Covariate1	13.47	2.70			13.35	2.86
			M12	29.90	5.77			4.73	1.07
			M13	20.17	5.10			19.92	5.12
			Y1	3.76	4.18			3.77	4.06
	Short-term contract/ No income	329 (36.1)	X1	7.35	2.10	325 (35.7)	X2	7.15	1.91
			M11	4.97	1.05			4.84	1.08
			Covariate1	14.17	2.94			13.62	2.83
			M12	29.91	6.06			29.02	5.82
			M13	21.96	5.52			21.52	5.14
			Y1	4.75	4.67			4.56	4.46
Socio economic status	Medical insurance	871 (95.6)	X1	6.70	2.22	868 (95.3)	X2	6.50	2.08
			M11	4.98	1.04			4.80	1.06
			Covariate1	13.72	2.81			13.48	2.86
			M12	30.03	5.81			29.40	5.64
			M13	20.78	5.37			20.47	5.17
			Y1	4.04	4.34			4.00	4.18
	Medical aid	40 (4.4)	X1	7.45	1.91	43 (4.7)	X2	6.77	2.20
			M11	4.48	1.22			4.09	1.19
			Covariate1	13.93	2.83			12.91	2.54
			M12	27.25	6.54			26.95	6.16
			M13	21.55	4.04			20.86	5.57
			Y1	5.90	5.10			5.19	4.91

TABLE 3 | The means, standard deviations, and correlation coefficients of the variables included in the moderation models.

	M	SD	1	2	3	4	5	6	7	8	9	10
1. Economic loss (1)	6.73	2.21	1									
2. Economic loss (2)	6.52	2.08	0.676**	1								
3. Knowledge about COVID-19 (1)	4.96	1.05	-0.091**	-0.114**	1							
4. Knowledge about COVID-19 (2)	4.77	1.08	-0.058	-0.088**	0.519**	1						
5. Gratitude (1)	29.90	5.87	-0.042	-0.073*	0.171**	0.178**	1					
6. Gratitude (2)	29.28	5.69	-0.079*	-0.093**	0.175**	0.163**	0.627**	1				
7. Perceived stress (1)	20.82	5.32	0.296**	0.247**	-0.100**	-0.076*	-0.298**	-0.228**	1			
8. Perceived stress (2)	20.49	5.18	0.249**	0.296**	-0.064	-0.059	-0.243**	-0.295**	0.596**	1		
9. Anxiety (1)	4.12	4.39	0.253**	0.231**	-0.251**	-0.246**	-0.289**	-0.272**	0.547**	0.445**	1	
10. Anxiety (2)	4.05	4.22	0.219**	0.259**	-0.191**	-0.245**	-0.222**	-0.311**	0.430**	0.520**	0.599**	1

** $p < 0.01$, * $p < 0.05$.**TABLE 4 |** The moderating effects of knowledge about COVID-19 on the relationship between economic loss and anxiety.

Variables	Anxiety (X1, X2)					
	B	SE	t	p	95% CI	
					LLCI	ULCI
Constant	0.2397	0.7012	0.3418	0.7326	-1.1365	1.6158
Economic loss (X1)	0.3508	0.0640	5.4846	0.0000	0.2253	0.4763
Knowledge about COVID-19 (M11)	-0.9443	0.1317	-7.1708	0.0000	-1.2028	-0.6859
X1 * M11	0.0997	0.0646	1.5435	0.1231	-0.0271	0.2265
Media use (covariate)	0.2841	0.0502	5.6601	0.0000	0.1856	0.3826
$R^2 = 0.1478$, Adjusted $R^2 = 0.0022$, $F_{(4,906)} = 39.2723$, $p < 0.000$						
Constant	0.8404	0.6551	1.2828	0.1999	-0.4454	2.1261
Economic loss (X2)	0.3867	0.0657	5.8866	0.0000	0.2578	0.5156
Knowledge about COVID-19 (M21)	-0.8645	0.1222	-7.0764	0.0000	-1.1043	-0.6248
X2 * M21	0.0494	0.0607	0.8145	0.4156	-0.0697	0.1685
Media use (covariate)	0.2395	0.0477	5.0150	0.0000	0.1457	0.3332
$R^2 = 0.1411$, Adjusted $R^2 = 0.0006$, $F_{(4,906)} = 37.2155$, $p < 0.000$						

SE indicates standard error; LLCI and ULCI indicate confidence intervals; All variables were centered at their means; The models for each survey were tested independently.

(Figure 2). This indicates that lower levels of gratitude were associated with greater effects of economic loss on anxiety in the first survey. However, in the second survey, gratitude was not a significant moderating variable in the relationship between economic loss and anxiety due to COVID-19 ($B = -0.0088$, $p = 0.3921$). Statistics for the main analyses are presented in Table 5.

Moderating Effects of Perceived Stress

In the first survey, perceived stress moderated the relationship between economic loss and anxiety due to COVID-19 ($B = 0.0278$, $p < 0.01$). Using the Johnson-Neyman method to probe the interaction, we found that when the section of perceived stress in the first survey was larger than -3.3860 , the coefficient between economic loss and anxiety was statistically significant (Figure 3A). This indicates that the effect of economic loss on anxiety increased as perceived stress increased. Similarly, in the second survey, perceived stress significantly moderated the relationship between economic loss and anxiety ($B = 0.0265$, $p < 0.01$). When the section of perceived stress was greater than -3.9338 in the second

survey, the coefficient between economic loss and anxiety was statistically significant (Figure 3B). This indicates that the effect of economic loss on anxiety increased as perceived stress increased. Statistics for the main analyses are presented in Table 6.

Summary of Main Analyses

Moderating effects of knowledge about COVID-19, gratitude, and perceived stress on the relationship between economic loss and anxiety due to COVID-19 were verified. In the first survey, knowledge about COVID-19 had no moderating effect on the relationship between economic loss and anxiety due to COVID-19, but both gratitude and perceived stress had moderating effects. Conversely, in the second survey, only perceived stress had moderating effects.

Differences in Moderating Effects by Individual Characteristics

Next we examined whether moderating effects varied by sex, religion, health insurance coverage, or job type. Among males,

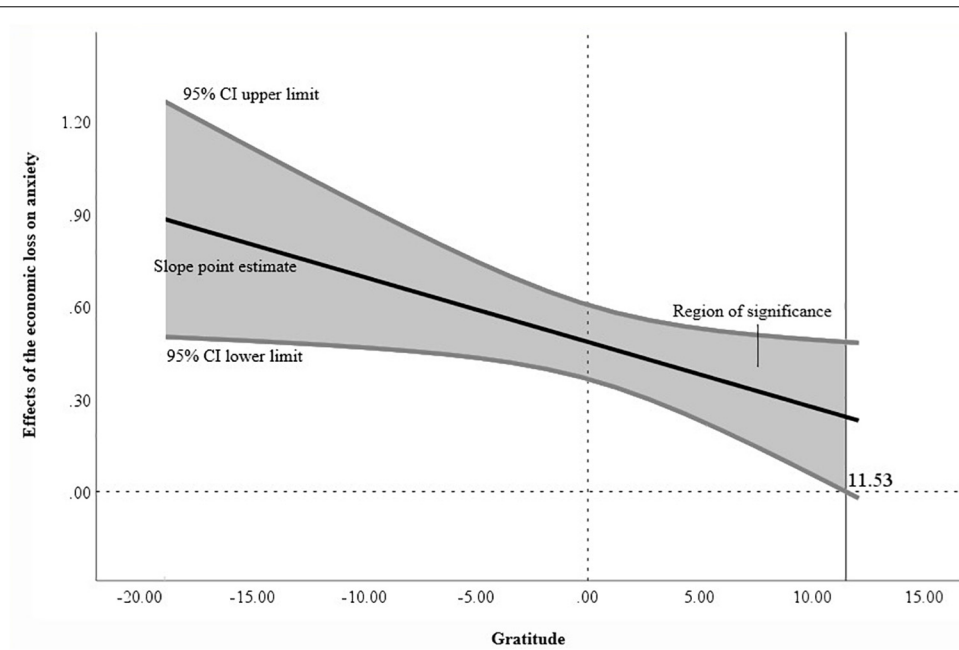


FIGURE 2 | Johnson-Neyman analysis graph of the moderation effect of gratitude in first survey.

TABLE 5 | The moderating effects of gratitude on the relationship between economic loss and anxiety.

Variables	Anxiety (X1, X2)					
	B	SE	t	p	95% CI	
					LLCI	ULCI
Constant	4.1060	0.1346	30.7016	0.0000	3.8419	4.3701
Economic loss (X1)	0.4851	0.0610	7.5713	0.0000	0.3653	0.6048
Gratitude (M12)	-0.2073	0.0229	-7.1696	0.0000	-0.2524	-0.1623
X1 * M12	-0.0211	0.0096	0.6894	0.0285	-0.0399	-0.0022
$R^2 = 0.1462$, Adjusted $R^2 = 0.0045$, $F_{(3,907)} = 51.7785$, $p < 0.000$						
Constant	4.0419	0.1297	31.1751	0.0000	3.7874	4.2963
Economic loss (X2)	0.4752	0.0625	7.6073	0.0000	0.3526	0.5978
Gratitude (M22)	-0.2140	0.0228	-9.3694	0.0000	-0.2588	-0.1692
X2 * M22	-0.0088	0.0103	-0.8562	0.3921	-0.0290	0.0114
$R^2 = 0.1509$, Adjusted $R^2 = 0.0007$, $F_{(3,907)} = 53.7273$, $p < 0.000$						

SE indicates standard error; LLCI and ULCI indicate confidence intervals; All variables were centered at their means; The models for each survey were tested independently.

gratitude ($B = -0.0304$, $p < 0.05$) and perceived stress ($B = 0.0462$, $p < 0.001$) in the first survey and knowledge about COVID-19 ($B = 0.1574$, $p < 0.05$) in the second survey were significant moderating variables. This indicates that lower levels of gratitude and higher perceived stress increased the effect of economic loss on anxiety in the first survey. Meanwhile, greater knowledge about COVID-19 reduced the effect of economic loss on anxiety in the second survey. Among females, none of the three variables had moderating effects in the first survey, but the moderating effect of perceived stress ($B = 0.0320$, $p < 0.05$) was significant in the second survey. This indicates that greater perceived stress increased the effect of economic loss on anxiety in the second survey.

Among participants who reported the presence of religion, gratitude ($B = -0.0316$, $p < 0.001$) was the only variable with a significant moderating effect in the first survey. However, no moderating effect of gratitude was found in the second survey. Meanwhile, perceived stress ($B = 0.0546$, $p < 0.001$) was the only moderating variable in the second survey in this group. In the absence of religion group, the moderating effects of knowledge about COVID-19 ($B = 0.1675$, $p < 0.05$) and perceived stress ($B = 0.0332$, $p < 0.01$) were significant in the first survey, although there were no moderating variables in the second survey.

In terms of job type, the moderating effects of perceived stress in the first ($B = 0.0251$, $p < 0.05$) and second ($B = 0.0421$, $p < 0.001$) surveys were significant for participants who were

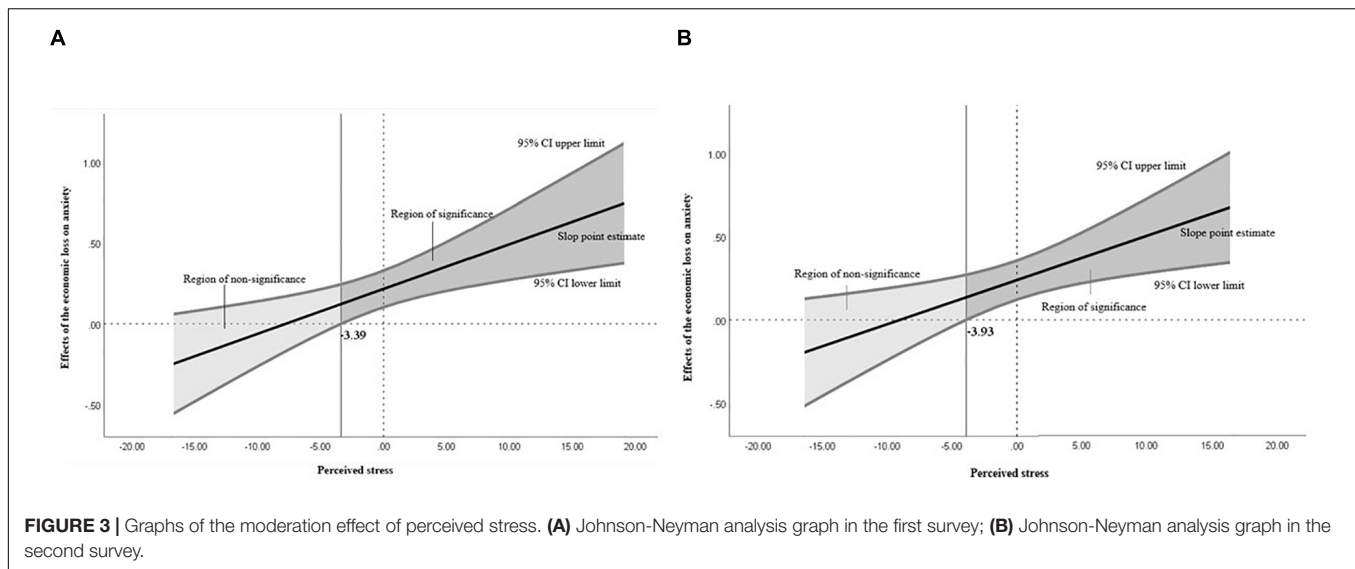


TABLE 6 | The moderating effects of perceived stress on the relationship between economic loss and anxiety.

Variables	Anxiety (X1, X2)					
	B	SE	t	p	95% CI	
					LLCI	ULCI
Constant	4.0419	0.1297	31.1751	0.0000	3.7874	4.2963
Economic loss (X1)	0.2161	0.0574	3.7656	0.0002	0.1035	0.3288
Perceived Stress (M13)	0.4295	0.0237	18.0939	0.0000	0.3829	0.4761
X1 * M13	0.0278	0.0091	3.0519	0.0023	0.0099	0.0456
$R^2 = 0.3149$, Adjusted $R^2 = 0.0070$, $F_{(3,907)} = 138.9434$, $p < 0.000$						
Constant	3.9669	0.1220	32.5198	0.0000	3.7275	4.2063
Economic loss (X2)	0.2397	0.0595	4.0312	0.0001	0.1230	0.3563
Perceived Stress (M23)	0.4011	0.0240	16.7418	0.0000	0.3540	0.4481
X2 * M23	0.0265	0.0094	2.8059	0.0051	0.0080	0.0450
$R^2 = 0.2889$, Adjusted $R^2 = 0.0062$, $F_{(3,907)} = 122.8199$, $p < 0.000$						

SE indicates standard error; LLCI and ULCI indicate confidence intervals; All variables were centered at their means; The models for each survey were tested independently.

regular or long-term contract workers. However, there were no significant moderating variables for non-regular workers or for those who had no regular income.

Among those who were covered by health insurance, the moderating effects of gratitude ($B = -0.0209$, $p < 0.05$) and perceived stress ($B = 0.0278$, $p < 0.01$) were significant in the first survey, although perceived stress ($B = 0.0252$, $p < 0.01$) was the only significant factor in the second survey. There were no significant moderating variables among recipients of medical aid.

DISCUSSION

This study examined the effects of knowledge about COVID-19, gratitude, and perceived stress on COVID-19-related anxiety in the public. We conducted two independent analyses using panel data obtained in April and May 2020 and in November 2020. Gratitude and perceived stress had moderating effects in

the first survey (April and May 2020), but only perceived stress had a moderating effect in the second survey (November 2020). Moreover, analyses were conducted based on sex, religion, and socioeconomic status to determine whether different groups were affected differently by knowledge about COVID-19, gratitude, and perceived stress.

Gratitude and perceived stress showed moderating effects on the relationship between economic loss and anxiety in the first survey. In other words, in the early stages of COVID-19, lower levels of gratitude and higher perceived stress led to greater anxiety. These results are consistent with previous studies that have reported gratitude as a protective factor (29) and perceived stress as a risk factor (35). However, there were no moderating effects in groups with high levels of gratitude or those with low perceived stress. This is because anxiety is closely associated with the predictability and controllability of events. Economic loss can have significant direct and indirect effects on individuals' survival. However, given the unpredictable

nature of the COVID-19 pandemic, perceptions of predictability and controllability were reduced. Therefore, it is possible that gratitude decreased and anxiety increased with an increase in perceived stress.

Only perceived stress had a continued moderating effect on the relationship between economic loss and anxiety in the second survey. We observed an increase in anxiety as perceived stress increased. Given that this study was conducted repeatedly among the same participants, this indicates that gratitude, which was a protective factor in the first survey, had reduced moderating effects over time. This may be because people had different experiences at the time of the first survey, which was 3 months after the onset of COVID-19, corresponding to the honeymoon phase (3–6 months after a disaster) of the emotional phases of disasters, compared to the second survey, which was conducted when 6 months had passed. In the honeymoon phase of a disaster, national and local governments promise damage recovery and support and provide survivors with the hope of resources to rebuild their lives (51, 52). Therefore, the expected provision of resources by the government may have led the participants to be optimistic about economic loss and eventual recovery. However, the prolonged COVID-19 pandemic led to an increase in unemployment and absenteeism (3), thereby gradually increasing the economic deficit experienced by individuals (2, 3). Because of the longevity of the pandemic, individuals continued to experience physical and emotional fatigue. By the end of the honeymoon phase (8 months to 2 years after a disaster), individuals become less hopeful for the restoration and recovery of life and become increasingly distrustful of government support (52). During this phase, positive emotions (such as hope and relief), the predictability of events, and the sense of control felt at the beginning of the pandemic may have decreased (52). However, anxiety did not decrease as the COVID-19 pandemic continued. It is likely that at the time of the second survey, when the pandemic had become prolonged, gratitude, as a spiritual coping method or personality trait, could not act as a protective factor against economic loss or stress. Previous studies have reported a temporal decline in mental health during epidemics (53, 54) that tends to persist even after the epidemic has ended (55, 56). However, there are limitations to what individuals can do to improve their coping skills. Psychological support should go hand in hand with effective systems for taxation, debt, management support, job creation, and so forth. Moreover, it is important to promote mental health at the community level using psychosocial interventions. Therefore, the government and local communities should take measures to provide sustainable help.

It is necessary to look at the economic losses brought about by the spread of COVID-19 in socioeconomic and political contexts. Since the 1997 Asian foreign exchange crisis, concerns about polarization as a side effect of rapid economic growth have been constantly raised in South Korea (57–59). The prolonged spread of COVID-19 has made the low-income class more economically vulnerable, further exacerbating economic inequalities and polarization (60). In the midst of an economic crisis that is hard even for individuals considered persistent to cope with, the unpredictable economic loss and the lack of trust in protective measures by the government can have significant

adverse effects on individuals' mental health (61). In a survey conducted by the Ministry of Health and Welfare in South Korea (62), the majority of people agreed with the effectiveness and need for social distancing but were doubtful about the fairness of its implementation (63) or the sufficiency of the state's financial support. It seems appropriate for future studies to consider the effects of confidence or trust among individuals who have faced economic loss in the pandemic and the mental health support that can be provided by the environment.

It is also interesting that there were no significant moderating effects of knowledge about COVID-19 in our main study, although the group-specific analyses found moderating effects among males and those with an absence of religion. This contrasts with earlier studies (24) that have reported that knowledge about infectious diseases reduces anxiety during pandemics. These findings can be explained by the ambiguity of the variable "acquisition of information." Although appropriate and accurate knowledge reduces anxiety and confusion during a pandemic (23, 24), acquiring knowledge through stimulating media reports increases distorted perceptions along with uncertainty about the pandemic and may further amplify anxiety and fear among individuals (64). Therefore, governments and communities should ensure the prompt availability of accurate information.

In addition, the COVID-19 pandemic is different from previous SARS coronavirus and Middle East Respiratory Syndrome (MERS) epidemics. As new variants continue to emerge, disparities in vaccine rollout procedures across countries and uncertainties about side effects of vaccines can lead to disability and death. The unexpectedness and unpredictability of the current pandemic separates it from previous infectious diseases. It is possible that the protective effects of knowledge about the pandemic and gratitude reported in previous studies were absent in COVID-19. In fact, when stress levels due to COVID-19 among South Koreans were compared to those due to other disasters in Korea, they were 1.5 times those of the MERS outbreak and 1.4 times those of the Gyeongju and Pohang earthquakes (53). Therefore, the emotional distress caused by the COVID-19 pandemic is more severe than that caused by other disasters.

Perceived stress had a moderating effect among males in the first survey; among females in the second survey; among those with full health insurance coverage, regular jobs, and religion in the second survey; and among those with no religion in the first survey. This suggests that, in addition to the strong stressor effects of COVID-19, individual perceptions of the economic situation during COVID-19 are also risk factors that can affect anxiety over time. Among males, moderating effects appeared at the beginning of the pandemic, and greater perceived stress caused higher levels of anxiety. However, the moderating effects disappeared 6 months later when the pandemic had become prolonged. These results may indicate that perceived stress levels may act as a risk factor in the early stage of a disaster among males, but they may be more adaptive to prolonged stress. Conversely, among females, there were no protective factors in the early stages of the pandemic, but perceived stress acted as a risk factor in later stages of the prolonged pandemic (i.e., females may be more vulnerable to long-term disasters). In addition, given that perceived stress

continued to act as a risk factor in groups that were less likely to be affected by catastrophic expenditures for health care services (regular workers and those with health insurance coverage), and in both the religion and non-religion groups, perceived stress appears to be a major health risk for all individuals at all times. Therefore, psychological interventions to reduce perceived stress seem necessary.

The study has some limitations. As this study involved the use of cross-sectional surveys at two different time points, it is difficult to make longitudinal interpretations of patterns of change in variables over time, causal relationships, and interactions between variables. In the future, longitudinal studies are required to use multivariate latent growth modeling to determine the change in variables over time, to verify relationships between these changes, and to analyze individual differences in these changes. Moreover, it may be necessary to obtain data at fixed intervals while considering the duration and severity of the pandemic, government policies, and major events to determine patterns of change and causal relationships. Furthermore, this study focused on generalized anxiety only. Instruments and questionnaires for anxiety other than the GAD-7 may be used to explore and compare specific types of anxiety (social anxiety, health anxiety, agoraphobia, etc.). Although perceived stress was the only consistent moderator at the beginning of the outbreak and afterward, it would be worth exploring the effects of ecological variables, such as government financial support and social distancing policies, as economic problems can be intertwined at the individual and structural levels. We used medical insurance to measure individual socioeconomic status in this study, but there were large differences in sample sizes by insurance group because of the nature of national insurance system in South Korea. According to the National Statistical Portal of South Korea (65), in 2020, a total of 51,344,938 individuals received medical benefits, whereas the number of individuals in low-income and near-poverty groups who received medical aid was 1,526,030, accounting for only 3% of the population. The classification of 4.4% of the population

into the low-income group in this study accurately reflected the population in its own way. However, the sample size in this group was relatively small, and the definition of low income could vary in different countries. Therefore, the findings for the low-income group should be interpreted cautiously.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Chonnam National University Hospital Institutional Review Committee (CNUH-2020-092). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HJ, Y-SK, S-WK, A-LP, Y-RL, SR, J-YL, and J-MK analyzed and interpreted the data. S-WK designed and collected the data. HJ and Y-SK wrote the manuscript. All authors approved the final version of the article.

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COVID-19 in China: A Rapid Review of the Impacts on the Mental Health of Undergraduate Students

Hairong Shi^{1*}, Haixue Zhu² and Yan Ni³

¹ School of Biology and Food Engineering, Chuzhou University, Chuzhou, China, ² School of Educational Science, Chuzhou University, Chuzhou, China, ³ School of Marxism, Nanjing Normal University, Nanjing, China

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Mohammadreza Shalbafan,
Iran University of Medical
Sciences, Iran

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Luis De Rivera,
Institute of Psychotherapy and
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Ruilian Zhang,
The University of
Queensland, Australia

*Correspondence:

Hairong Shi
shihairong99@chzu.edu.cn

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Public health crises pose challenges for governments and health systems, and the coronavirus disease 2019 (COVID-19) has presented major challenges to humans worldwide. In the context of COVID-19 in China, we explore the impacts of the pandemic on the mental health of undergraduate students. We examine pandemic prevention and control measures in Chinese universities through a rapid review and use our findings to explain the difficulties that undergraduate students face. Moreover, our analysis examines the impacts on five aspects of mental health: emotional aspects, personality, interpersonal relationships, learning behavior and employment options. Additionally, we provide implications in four areas based on the application of the study: strengthening psychological intervention, promoting government information disclosure, improving family communication and adjusting self-awareness.

Keywords: COVID-19, mental health, China, strategies, undergraduate

INTRODUCTION

The novel coronavirus was first identified in Wuhan, China, in December 2019 and can cause a respiratory infectious disease called coronavirus disease 2019 (COVID-19) (1). Since the beginning of 2020, COVID-19 has spread rapidly around the world. 2022 is the third year of the global spread of the COVID-19 pandemic, and mutant strains have appeared one after another (2, 3). Large-scale vaccination has continued to be promoted, but the pandemic continued to recur, and the number of infected cases and deaths continued to increase (4). To date, data show that the number of confirmed infections in the world has exceeded 500 million, and the death toll has exceeded 6 million. According to data from Johns Hopkins University 14, the country with the most confirmed cases is the United States, with more than 80 million cases, accounting for nearly one-third of the global total. The United States is also the country with the most deaths, with 1 million deaths thus far. Countries with a relatively high number of confirmed infections also include India, Brazil and France, with 43 million confirmed cases in India, 30 million in Brazil and 28 million in France. Today, there are traces of COVID-19 almost everywhere in the world (4).

Globally, some countries (regions) are still in a state of emergency. Strict pandemic prevention measures are being adopted or maintained to intensify the prevention and control of the COVID-19 pandemic. In some countries (regions), the severity of the COVID-19 pandemic has lessened, and some restrictive measures have been gradually relaxed (4–6).

After the outbreak of the Wuhan pandemic, China quickly introduced various pandemic prevention policies and measures to bring the pandemic under control. The pandemic situation in China has been under control domestically (7). However, recently, due to the influence of the mutated Omicron virus, the local pandemic in China has rebounded. Local diagnoses continue to occur in Guangdong, Shanghai, Jiangsu, Jilin and other provinces. Since March 2022, the overall number of infections in the country has increased sharply (8, 9). From March 1–24, the cumulative number of local infections reported nationwide exceeded 56,000, affecting 28 provinces (**Figure 1**). Among these, Jilin Province still has a high level of infections. From March 1–24, a total of more than 29,000 cases of infection were reported. With more than 1,000 new infections per day for several consecutive days, the pandemic situation in Jilin City and Changchun City is continuing to develop (4). The severity of the pandemic in Shanghai, Hebei Province, Fujian Province, and Liaoning Province has grown rapidly in recent days. The risk of community transmission at each of the outbreak sites persists. The pandemic situation in Qingdao, Weihai, and Zibo in Shandong Province and Shenzhen and Dongguan in Guangdong Province was initially controlled (10–12). The pandemic situation in Beijing, Chongqing, Zhejiang Province and other places has stabilized. In terms of vaccinations, China had reported a total of 3 billion doses of the COVID-19 vaccine by end of May 2022. The total number of people vaccinated reached 1.2 million, and 90% of the country's total population has been fully vaccinated.

In this research, we will explore the impacts of COVID-19 control strategies on the mental health of undergraduate students in China. Four sections follow this introduction. Section pandemic prevention and control strategies in Chinese universities and the difficulties faced by undergraduate students introduces China's COVID-19 control strategies in universities and the difficulties that undergraduate students face. Section the impacts on the mental health of undergraduate students caused by the pandemic states the impacts of the pandemic on the mental health of undergraduate students. Section implications provides implications for different parties to improve the mental health of undergraduate students. Section conclusion concludes the paper.

PANDEMIC PREVENTION AND CONTROL STRATEGIES IN CHINESE UNIVERSITIES AND THE DIFFICULTIES FACED BY UNDERGRADUATE STUDENTS

Pandemic Prevention and Control Measures in Chinese Universities

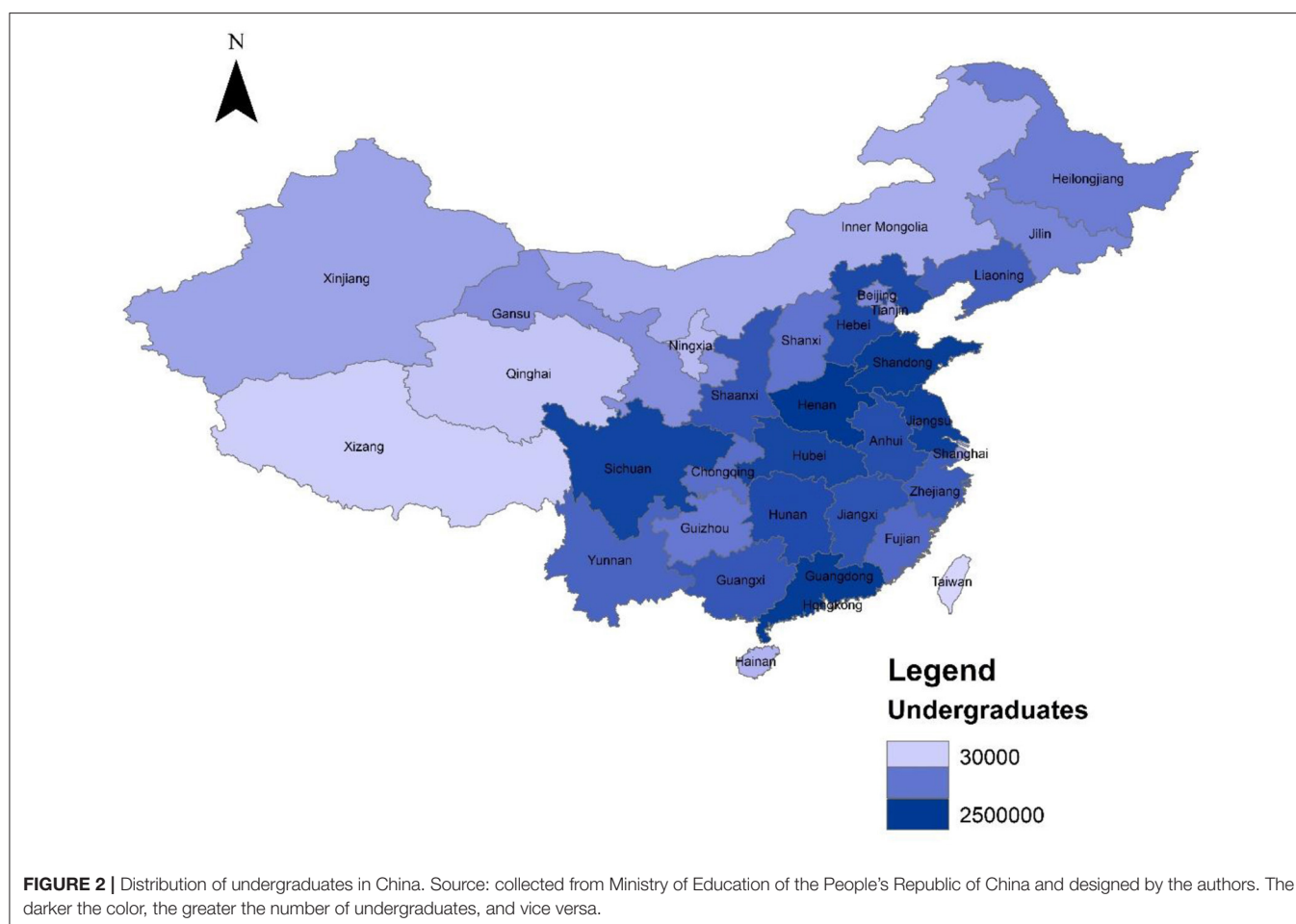
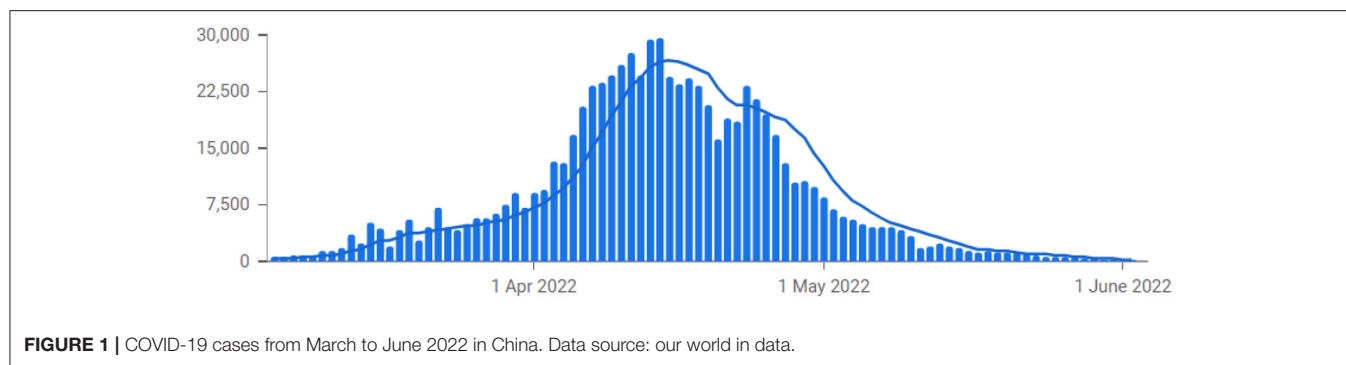
Recently, many places in China have taken a series of measures to curb the spread of the pandemic, such as allowing work from home, prohibiting the cross-regional movement of people, and the closed management of undergraduates and universities (1). With the development of the internet, work tasks for an increasing number of industries can be performed online (2). Therefore, most companies in closed areas adopt the method of letting employees work from home to maintain the normal operation of the company. To reduce the spillover and spread

of the pandemic caused by interprovincial and interregional movement, Jilin Province banned the interprovincial and interregional movement of its own personnel on March 14, 2022. If people have special circumstances that require them to leave the province or region, they need to register at the local police station. After returning, they are quarantined and controlled according to relevant regulations on pandemic prevention and control. If there are any violation of the above provisions, the relevant departments are be held accountable according to law and discipline. Dongguan Pandemic Prevention and Control Headquarters of Guangdong Province issued a notice on March 14, 2022 that Dongguan city would suspend all non-essential movements. In addition to ensuring urban operation and the transportation of goods and goods supplied to Hong Kong, public transportation and subway service in Dongguan have been temporarily suspended. The communities and villages throughout the city are required to implement enclosure management, retain necessary entrances and exits, and set up inspection points. Checkpoints are open 24 h a day, and site codes are required for entry. The city's residents are not allowed to leave Dongguan unless it is necessary (6). Anyone with special needs will leave Dongguan with a 24-h nucleic acid negative certificate. In addition to ordinary high school boarding students who are in their senior year, offline teaching has been paused for students at all levels and types of schools in the city (including children in kindergartens). All kinds of training institutions and custodial childcare institutions have suspended offline training and custodial childcare services 22. Shanghai Fudan University announced that campus closure management will begin at 20:00 on March 13, 2022, and teachers and students will not leave the school. Teachers and students in the school will carry out nucleic acid testing as needed. The campus is located in a separate area behind the school's gate and implements relatively closed management. Teachers and students do not move across.

China has more than 30 million undergraduate students (**Figure 2** and **Table 1**). In the face of the pandemic, the specific prevention and control measures implemented by Chinese universities mainly include (1) daily temperature monitoring, (2) protective measures for dining in canteens and (3) comprehensive online teaching.

Body Temperature Monitoring

Undergraduates and universities have implemented the system of daily temperature reporting and zero reporting and have set up temperature monitoring points at the school entrance (8). All students must have their temperature taken and submit a health code. Only those with normal body temperatures can enter the campus. Students with body temperatures of 37.3°C and above are not allowed to enter the campus (1). Arrangements will be made to isolate students at a temporary isolation point outside the school. The counselors or class cadres in the school conduct temperature checks on the students every morning, midday, and evening. Temperature monitoring posts are also set up in crowded places, such as classroom buildings, libraries, canteens, and dormitories, to monitor the temperature



of those entering (3). During the testing process, if a student's body temperature reaches 37.3°C (inclusive) or above or has symptoms such as dry cough, shortness of breath, muscle aches and weakness, the student counselor will immediately report to the school's leading group for pandemic prevention and control. The emergency plan will be activated, and the students will be quickly sent to the temporary observation places in each building by special personnel wearing masks and then sent to the fever clinic of the designated hospital for further examination (10).

Pandemic Prevention for Dining in Canteens

During the pandemic, most undergraduates and universities have required students to wear masks when entering the canteens. In addition, the staff must show the health code and itinerary code. In the temperature measurement area at the entry, the body temperature will be detected by an automatic infrared thermal imaging thermometer (5–7). Those with abnormal body temperatures will be sent to the outdoor observation and remeasurement area for remeasurement or treatment. Hand sanitizer will be used to disinfect after the temperature

TABLE 1 | Number of regular students for normal and short-cycle courses in higher education.

Province	Undergraduates number	Provincial population	Percentage of provincial population (%)
Henan	2,492,185	99,365,519	2.51
Guangdong	2,400,227	126,012,510	1.90
Shandong	2,291,483	101,527,453	2.26
Jiangsu	2,014,698	84,748,016	2.38
Sichuan	1,800,903	83,674,866	2.15
Hubei	1,616,873	57,752,557	2.80
Hebei	1,604,798	74,610,235	2.15
Hunan	1,510,332	66,444,864	2.27
Anhui	1,368,465	61,027,171	2.24
Jiangxi	1,241,984	45,188,635	2.75
Shaanxi	1,210,048	39,528,999	3.06
Guangxi	1,184,167	50,126,804	2.36
Zhejiang	1,148,737	64,567,588	1.78
Liaoning	1,140,799	42,591,407	2.68
Yunnan	964,205	47,209,277	2.04
Fujian	947,187	41,540,086	2.28
Chongqing	915,556	32,054,159	2.86
Shanxi	841,986	34,915,616	2.41
Guizhou	840,249	38,562,148	2.18
Heilongjiang	825,601	31,850,088	2.59
Jilin	726,957	24,073,453	3.02
Beijing	608,866	21,893,095	2.78
Gansu	581,062	25,019,831	2.32
Tianjin	572,152	13,866,009	4.13
Shanghai	540,693	24,870,895	2.17
Xinjiang	486,680	25,852,345	1.88
Inner Mongolia	486,647	24,049,155	2.02
Hainan	230,062	10,081,232	2.28
Ningxia	146,679	7,202,654	2.04
Qinghai	74,111	5,923,957	1.25
Tibet	38,556	3,648,100	1.06

Data source: collected from Ministry of Education of the People's Republic of China. http://www.moe.gov.cn/jyb_sjzl/moe_560/2020/gedi/202108/t20210831_556496.html.

measurement. The canteen implements single-person, single-seating, with students sitting in the same direction (8). The school encourages students and teachers to eat meals at different times and to eat outside the canteen. If the number of people indoors reaches capacity, the canteen will take temporary measures to restrict the flow. When queuing to pick up meals, people will need to line up along a yellow line on the ground and pick up meals in an orderly manner at the window (13).

Online Teaching Mode

The COVID-19 pandemic continues unabated. To actively respond to the impact of the COVID-19 pandemic on classroom teaching, the Ministry of Education put forward the overall plan for deployment and set requirements to allow students to continue teaching and learning while suspending in-person

school (14, 15). Due to the impact of the COVID-19 pandemic since the beginning of 2020, schools nationwide have postponed the school enrolment date. Undergraduates and universities across the country have begun online teaching on a large scale. A total of 265 million current students have largely switched to online courses (16–18). Data show that during the pandemic, the number of daily active users of multiple online education applications reached more than 10 million. Among them were 22 online course platforms that were launched by the Ministry of Education, offering 24,000 online courses (19). The online course offerings have provided a guarantee for ordinary undergraduates and universities to be able to suspend in-person classes but continue teaching during the pandemic (20). A number of office applications have been used for cross-border online education. Office applications such as DingTalk and Tencent Conference have become online education platforms and are widely used by teachers and students across the country. At the same time, Huawei has also joined the online education industry and has launched online education classrooms or teaching systems. At present, the online teaching environment includes the following three types: First, online teaching resources and platforms, such as Ai Course (Chinese University MOOC). The second is self-service live broadcast platforms that are accessed from home, such as Zoom, Tencent Conference, DingTalk, etc. This kind of platform is simple and easy to operate, and students and teachers can also communicate and provide feedback on their learning progress in real time. This model is very close to the environment of offline classrooms. The third is an online teaching management exchange platform at home. WeChat and QQ can be used for online class management and communication and arrange, supervise and evaluate the self-learning situation of class students. According to relevant surveys (21, 22), most of the undergraduate students expressed their approval for the online teaching carried out by undergraduates and universities. This shows that online learning works well. A total of 21.9% of undergraduate students strongly agreed with the current online teaching method used by teachers and believed that the learning effect was good and that the results were great. A total of 32.99% of students agreed with online teaching and thought that online learning was more effective. A total of 25.33% of students believed that methods used for online teaching were conventional, and the learning effect was similar to offline teaching. However, 18.48% of the students did not agree with the online teaching method currently used by teachers and believed that the learning effect was not as good that provided by offline learning (21–23).

Difficulties That Undergraduate Students Face

Undergraduate students have many different characteristics from other groups that are affected by the pandemic. First, undergraduate students have just entered the stage of early adulthood. Compared with other younger students, undergraduate students already have certain knowledge and abilities (10). They have already reached a certain level in terms of information acquisition and comprehension and the channels

they use for communication. Relative to other age groups, social network media is used the most widely by undergraduate students (24). During the pandemic, undergraduate students have been studying at home, and they spend more time online than usual. In addition, various news items about the pandemic on the internet can be overwhelming because they occupy so much of various social platforms, and it is almost impossible for people to ignore this information. Receiving relevant information from various media reports every day has also led to a great increase in the fear and anxiety of undergraduate students (23).

Second, according to relevant research, at the physiological level, the development of the physiological functions of undergraduate students is basically mature. However, the frontal lobe, the area of the brain responsible for emotion and control, is not yet fully developed (25). Therefore, undergraduate students still have a relatively weak psychological capacity and ability for the resolution of emotions (26). They are emotionally sensitive and unstable. This causes undergraduate students to suffer from greater emotional fluctuations when facing emergencies such as major pandemics, and therefore, they are more likely to cause damage to their social functions (23, 24).

In addition, undergraduate students have considerable abstract thinking ability and have begun to rationally judge and understand things. However, their way of thinking is more subjective and one-sided (27). This conflict in thinking ability can easily lead to extreme thoughts in the face of major pandemics and even to adverse consequences as a result. Therefore, due to confrontation with the novel situation of pandemic prevention and control, the mental health of undergraduate students still faces huge impacts and challenges (28).

THE IMPACTS ON THE MENTAL HEALTH OF UNDERGRADUATE STUDENTS CAUSED BY THE PANDEMIC

The impacts on the mental health of undergraduate students mainly include emotional aspects, personality, interpersonal relationships, learning behaviors and employment options. Below is the detailed review of those five aspects. It's worth to note that all the numbers we use are reported from Chinese previous studies.

Emotional Aspects

Anxiety is an emotional reflection of a person's serious deterioration in the value characteristics of real or future things. This includes anxiety, tension, fear and other elements. It is associated with critical situations and unpredictable and unmanageable events, and anxiety may be relieved after the situation changes. According to a survey during COVID-19 (29), the median scores of undergraduate students' anxiety and depression were 2.00 (1.00, 5.00) and 1.00 (0.00, 4.00), respectively. According to the scoring standard, 2,849 people (73.41%) had no anxiety. The numbers of undergraduate students with mild, moderate and severe anxiety were 900 (23.19%), 105 (2.71%) and 27 (0.70%), respectively (28–30). A total of

3,060 people (78.85%) had no depression, and the number of undergraduate students with mild, moderate and severe depression was 659 (16.98%), 123 (3.17%), and 39 (1.01%), respectively. Spearman rank correlation analysis showed that the correlation coefficient between GAD-7 anxiety scores and PHQ-9 depression scores was 0.56 ($P < 0.00$). This shows that the depression and anxiety of undergraduate students are highly positively correlated under the stress of the COVID-19 pandemic. In order to prevent the escalation of the pandemic, universities have postponed the start of school. Undergraduate students have had to reduce their frequency of going out, which has prevented them from attending school and participating in social activities normally (30). This may affect their learning progress and exacerbate their anxiety and depression. Therefore, the mental health problems of undergraduate students cannot be ignored. Among the 3,881 undergraduate students surveyed, the incidences of anxiety and depression were 26.60 and 21.16%, respectively. It is higher than the survey for undergraduate students under normal circumstances (25, 26). It is evident that under the stress of the COVID-19 pandemic, the incidence of anxiety and depression in undergraduate students has increased significantly. It is urgent to take measures of targeted psychological intervention and provide health education.

Personality

Personality is unique to an individual and different from others (14). Its formation is linked to the external environment and congenital conditions. As a relatively stable psychological factor, it determines an individual's cognition and behavior. It is an important psychological basis for coping with stressors. Personality characteristics such as suspiciousness, sensitivity and timidity affect an individual's cognitive evaluation of things (16, 17). Personality can create unrealistic psychological conflicts, setbacks and other psychological stimuli, preventing people from choosing effective coping methods to eliminate the psychological stress response (31–33). It is mentioned in the social cognitive theory that mental health problems caused by stress are more likely to occur in people who choose to escape psychologically and regard the stressors as a long-term catastrophic threat. Studies have shown that an optimistic personality is conducive to the maintenance of health, and the disease morbidity and mortality are lower in optimistic individuals than in those who have a pessimistic personality. It also has a strong psychological function and helps an individual maintain a good psychological state and positive emotions. Under the pandemic, because most undergraduate students' communication with each other has been limited to social tools and massively multiplayer online games mediated by the internet, there has been a lack of sufficient offline communication (31). At the same time, the frequency of communication between classmates who have no close relationship is almost zero. As a result, the exchange of communication between undergraduate students and their classmates and communication with those who are not closely related is very scarce. Most of the undergraduate students have experienced a gradual change in their personality traits to a certain extent because they have been alone for a long time

or because they have rarely interacted with the outside world, especially with their peers (32).

Interpersonal Relationships

The quarantine has resulted in a reduction in students' social interaction and interaction with classmates, friends, and teachers (33). Long periods of interpersonal alienation can trigger loneliness in students, resulting in psychological and behavioral biases. An unwillingness to express oneself may be a sign of serious psychological problems such as disharmony with others, inattention to study, addiction to the internet, and even lead to a sense of emptiness (34, 35). According to a relevant questionnaire, 27.21% of undergraduate students experienced problems getting along with classmates and friends under the pressure of the pandemic. During the pandemic, undergraduate students could not get along with their classmates and friends as they would normally, and the scope of communication was limited (36). They had lived and studied at home alone for a long time. Due to a lack of interpersonal relationships, they have experienced loss, depression, suspicion, and even self-isolation and loneliness, resulting in psychological obstacles. Additionally, they have experienced challenges to interpersonal sensitivity. The troubles caused by interpersonal sensitivity to students are mainly reflected in the fact that they have been with their families since the beginning of control measures for the pandemic. They have had less and less communication, and conflicts have arisen because of some trivial matters (37, 38). Current undergraduate students were born in the internet age, and mobile phones are the most common medium that they use to make friends, shop, obtain information and spend time on the internet. Therefore, they tend to frequently use their mobile phones to watch news or chat, leading to a lack of positive communication with parents. Faced with this situation, many parents often resort to scolding (39). Students feel that it is difficult for their parents to communicate with them, and there is a gap between them, which leads students to think that their parents cannot understand them. Interpersonal relationships are an important part of undergraduate students' daily study and life. After a public health emergency, establishing good interpersonal relationships with relatives, teachers, friends, and classmates is beneficial to the timely relief of psychological pressure. It could improve the understanding of others and help undergraduate students obtain more social support, thereby minimizing anxiety and the incidence of mental health problems such as fear (40).

Learning Behaviors

During the COVID-19 pandemic, most students have been able to make a study plan and execute it successfully (41). A total of 31.39% of the undergraduate students could make a relatively complete study plan by themselves. A total of 61.09% of the students were able to study using a teacher's plan (42). However, 7.52% of the students still had no study plan. Statistics show that there are gender differences in the study plans and autonomous learning abilities of undergraduate students. A total of 35.51% of the boys said they made a relatively complete study plan, while only 27.55% of the girls said they could study independently according to their own study plan. At the same time, 43.27%

of the girls said that they basically studied according to the teacher's plan, while only 31.61% of the boys studied according to the teacher's plan (24). However, there is little difference in the proportion of boys and girls who do not have a study plan. There are also students who are not comfortable with this form of online teaching. During the pandemic, the time scheduled for work and rest has become arbitrary. Due to the irregularity of life and the lack of external constraints, it has been easy to become addicted to games and blur the concept of time. If this condition persists for a long time, it can lead to changes in behavior such as procrastination and irritability (28–30). In addition, for some students, the degree of self-consciousness of learning is not enough, and the accuracy and proficiency of knowledge mastery are insufficient. During the pandemic, online learning forms have lacked the direct supervision and guidance of teachers, which has further affected students' knowledge mastery. In particular, certain training courses that require specialized equipment cannot be practically operated in an online class, and lack the targeted guidance of teachers. This will have a major impact on many students. Therefore, after the resumption of school, many students may have a sense of fear about tests and examinations, and they may be worried about a decline in grades and the possibility of failing assessments. This can even produce anxiety and various physical and mental problems (35).

Employment Options

According to a survey of graduates on job-seeking behavior (36), when asked if they had started job hunting as a graduating class, among the 1,775 graduates who participated in the survey, 737 had already started job hunting, accounting for 41.52% (25–27). The number of people who had not started job hunting was 1,038, accounting for 58.48% of the graduates. In the process of job hunting, the graduates described their moods (based on 737 people who had started job hunting) with keywords such as nervousness, resignation, etc. (28). For the reasons for not starting a job search (based on 1,038 people who had not yet applied for a job), the graduates selected other keywords, describing reasons such as further education, entrepreneurship, joining the army, preparing for competitions, participating in training, etc. As for the reason they did not want to find a job, some people felt that they could not meet the requirements of the ideal work enterprise. Others thought the job search process was too complicated (32). Some people had not determined what kind of work they wanted to do. Some others stated that it was difficult to find a satisfactory job. In addition, other reasons included choosing between further education and employment, choosing to enter graduate school, being unable to settle down to study, the difficulty of choosing employment, and not yet being mentally prepared (11, 12).

After more than 2 years of the pandemic, the economic growth rate has slowed down, both internationally and domestically (14–16). This has largely affected the overall situation of the Chinese economy. The employment situation of graduates is affected by the impact of the pandemic on the economy, and the employment situation of this year's graduates is extremely severe (6, 7). The pressure on graduates has increased sharply, and many students have chosen to continue their studies to

relieve the pressure of employment, resulting in a sharp increase in the number of applicants for entrance examinations (8). The number of applicants for postgraduate entrance examinations in 2022 was as high as 4.57 million, an increase of 800,000 compared with 2021. The enrolment number is 1.107 million, which means that 3 million people will be dropped from the list and will continue to face pressure (37). According to the latest data from the Ministry of Education, in 2022, the number of graduates at the undergraduate level is expected to reach 10.76 million, a year-on-year increase of 1.67 million (34). This is the first time that the number of graduates at the undergraduate level has exceeded 10 million, and it is also the largest increase of the most recent years. The scale and increment of graduates both hit a record high (29, 30).

IMPLICATIONS

Impacts of COVID-19 on mental health of different group have been explored. The elderly generally experienced significantly lower levels of psychological symptoms including depression, anxiety, and perceived stress. Pregnant women, patients with chronic diseases, and patients with pre-existing severe mental disorders showed mixed results according to each mental health outcome (43). Across countries, the mental health of unemployed people and those experiencing financial insecurity was worse than that of the general population (44). 44.3% of parents with children <18 years living at home reported worse mental health as a result of the COVID-19 pandemic compared with 35.6% of respondents without children <18 living at home (45). Study also indicates that COVID-19 has a considerable impact on the psychological wellbeing of front-line hospital staff. Results suggest that nurses may be at higher risk of adverse mental health outcomes during this pandemic, but no studies compare this group with the primary care workforce (46).

Because the COVID-19 pandemic has not yet ended, the government, universities, and families need to pay close attention to the physical and mental health of undergraduate students. Interpersonal issues, as well as mental symptoms, require appropriate interventions, which may minimize the unavoidable psychological impact of the pandemic (31). It is necessary to carry out health education and provide undergraduate students with relevant information on mental health, physical health, academic skills, fitness and other factors that will improve their lives in a timely manner. To alleviate the psychological problems of undergraduate students, it is recommended to start with measures on the following four levels.

Strengthening Psychological Intervention for Undergraduate Students

Universities should alleviate the psychological problems of undergraduate students through active guidance, psychological intervention and other measures (42). Universities should try to relieve the psychological pressure of undergraduate students, paying special attention to the emergence of vicarious trauma (34). Undergraduate students experience nervousness and anxiety mainly due to their lack of understanding of

the pandemic (24, 25). In the face of panic caused by the unknown, universities should take active measures to guide students to cultivate a correct attitude. First, universities should actively guide students to obtain information through correct and official channels (21). Currently, with the rapid development of online self-media, various sources of information are extensive but cannot be guaranteed to be reliable. Universities need to guide students to obtain information through authoritative channels to reduce the negative impact of rumors. Second, online psychological counseling and intervention should be actively carried out (43). In particular, it is necessary to focus on students who are quarantined and students with confirmed cases of the virus around them. It is important to teach them effective ways to relieve tension and anxiety, and regular telephone interviews and online one-on-one consultations can be adopted to reduce students' psychological fear and resistance (34, 35). Third, publicity and education should be strengthened. During special periods, publicity can be carried out through various channels, such as official accounts and online self-media. This is a good way to guide students to learn about the pathogenesis of the virus, its clinical manifestations and preventive measures for the virus, popularize correct professional knowledge, and reduce students' fear of unknown diseases (36).

Promoting Government Information Disclosure

According to relevant research findings, actively publicizing the country's policies and measures on the COVID-19 pandemic will strengthen undergraduate students' confidence in the country's ability to fight COVID-19 (1, 2). The data show that the stronger the national prevention and control, the more stable the mentality of undergraduate students (44, 45). First, the government should improve its management mechanism for responding to public emergencies. There are always opportunities to improve the government's programs for joint prevention and control, make policy and regulatory information public and improve undergraduate students' cognitive bias toward COVID-19 and reduce the occurrence of excesses (3–5). Second, the government should make full use of various publicity channels to improve the credibility of mainstream media. The relevant government departments can transmit open and neutral information to the outside world through a standardized and orderly communication system, which can effectively alleviate the public's insecurity about crisis events (6). Mainstream media have a considerable degree of authority and credibility, and government departments should use various channels (46). These measures will help maximize the satisfaction of the public's right to know and actively guide the public to treat the COVID-19 pandemic with a calm and rational attitude (47). On the one hand, these measures can combat rumors and prevent the public from panicking (10). On the other hand, they can enhance the credibility of the government and improve the public's confidence in the government's ability to fight the pandemic. In addition, educational departments at all levels should actively respond to relevant policies and issue policy documents to undergraduates and universities in a timely and accurate manner (11).

Improving Family Communication

In general, negative emotions are very contagious. Parents are in a state of tension and panic every day, and some even view the pandemic with hostility and anger (22–25). These negative energies are more likely to cause anxiety among students. Therefore, first, as mainstays of the whole family, parents should try their best to regulate their emotions and set a positive example to children (48). It is helpful for parents to create a warm and harmonious family atmosphere in order to help their families through this difficult time. If there is a serious psychological disorder in the family, it is necessary to obtain professional psychological support and assistance in time (27). Second, timely expression of difficult emotions, effective relief, and active companionship should be implemented. Due to passive isolation, the radius of the distance we travel outside the house has decreased, which especially causes difficulties for lively and active undergraduate students, who are desperately looking forward to returning to school and resuming interpersonal interactions (11, 12). This indefinite bondage and imprisonment causes undergraduate students to have many negative emotions. If the accumulation of negative emotions is not relieved in time, it will form psychological garbage and cause psychological problems. Parents need to pay attention to the emotional changes of their children at all times and give them appropriate comfort (24). They should also take the initiative to help children reduce stress, such as doing sports together and doing housework to improve their moods and help them maintain positive and optimistic attitudes. In addition, parents should fully understand their children, trust them, and communicate rationally with them. The longer they live together under the same roof, the more conflicts there will be between parents and children (22). Parents should have the courage to face up to their children's personality growth and be willing to accept imperfect children. Parents should also give children some space for independent reflection and respect their choice of views and needs. When encountering a problem, parents should not intensify the conflict, wait for both parties to calm down and then communicate positively (19–21).

Adjusting Self-Awareness

Students should adapt themselves to the changing environment through intellectual control and strengthening of will (4). First, we should strengthen the ability to judge information. Attention should be given to authoritative information, scientific understanding should be built, and the ability for information discrimination should be improved (15–17). Faced with a large amount of complex information, undergraduate students should not pay too much attention to it in order to avoid psychological overload. They should only pay attention to news information from official and formal channels (20). They should not believe or spread rumors, keep their minds sober, and not lose their abilities to judge due to the influence of the objective environment (21). Second, it is necessary to strengthen personal hygiene protection, improve the awareness and ability of self-protection, actively respond to policies to achieve active isolation, and avoid cross-infection by avoiding crowded areas (25). Students can take measures such as wearing a mask when going out, disinfecting frequently, etc. Students should also remain vigilant. At this stage,

the country has achieved a staged victory in the treatment of the pandemic (44). Therefore, while maintaining vigilance, we should also remain calm and trust the medical workers who are struggling on the front line. In addition, students should actively learn about psychological matters, and learn to rationally regulate emotions and correctly understand negative emotions. It is normal for individuals to have some negative emotions after a major event (34). A moderate emotional response is a self-protective measure of human beings. When students experience negative emotions such as fear and tension, it is important for them to take the initiative to communicate with others (23). Although restricting travel has caused great trouble to study and life, it is still necessary to maintain optimism and enhance self-immunity to effectively avoid the spread of viruses (49).

CONCLUSION

At present, the global pandemic situation remains severe. The United States, Europe, South America and some countries in South Asia are still seeing a significant increase in new confirmed cases. The death toll is also rising, with anxiety and fear over the outbreak looming over people's minds. Many countries are still unable to escape the suffering caused by the pandemic. The new round of pandemic counterattacks in China is characterized by many points of infection, wide areas and frequent occurrences (25, 49). The pandemic occurred in more than 20 provinces, the number of newly confirmed local cases and asymptomatic infections increased rapidly, and the pandemic has been scattered throughout many places. The scope of the spread has been further expanded. Community transmission in some areas has not been interrupted, spillover cases have been reported, and the pandemic situation is equally severe and complex. The ongoing COVID-19 pandemic has had a huge impact on undergraduate students' study and daily life, disrupting the learning process and daily lives of undergraduate students. At this stage, undergraduate students should make changes to actively cooperate with the strict home prevention and control measures taken by their communities and local governments. It is also necessary for them to work hard to adapt to taking courses at home through live broadcasts. They have many psychological problems in emotion, personality, interpersonal communication, learning behaviors and so on. Emotions such as anxiety and depression have frequently appeared, and there are situations of high anxiety and tension with regards to seeking employment. Faced with this situation, universities need to play an active role to actively guide and help students. Second, the government can play its important role to disseminate relevant information in a timely manner and from a place of scientific authority, which can alleviate psychological problems to a certain extent. In addition, individual students need to enhance their own mental health knowledge. Having good mental health knowledge will enhance the individual's ability to deal with crisis events. Only with the concerted efforts of all parties and the support within our capabilities will undergraduate students successfully persist during them pandemic period and develop a high level of psychological health.

AUTHOR CONTRIBUTIONS

HS, HZ, and YN: conceptualization, writing—original draft, and writing—review and editing. HS: funding acquisition and resources. HZ and YN: project administration and supervision. All authors have read and agreed to the published version of the manuscript.

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A Review Study on the Trends of Psychological Challenges, Coping Ways, and Public Support During the COVID-19 Pandemic in the Vulnerable Populations in the United States

Rakesh Kumar^{1†}, Anand Singh², Rahul Mishra³, Ushasi Saraswati¹, Jaideep Bhalla¹ and Sandeep Pagali^{1*}

¹ Mayo Clinic, Rochester, MN, United States, ² Institute of Human Behaviour and Allied Sciences, University of Delhi, New Delhi, India, ³ Maulana Azad Medical College, University of Delhi, New Delhi, India

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Mohammadreza Shalbafan,
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*Correspondence:

Sandeep Pagali
pagali.sandeep@mayo.edu

†ORCID:

Rakesh Kumar
orcid.org/0000-0002-3916-9263

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Background: The COVID-19 pandemic resulted in significant mortality and morbidity in the United States. The mental health impact during the pandemic was huge and affected all age groups and population types. We reviewed the existing literature to understand the present trends of psychological challenges and different coping strategies documented across different vulnerable sections of the United States population. This rapid review was carried out to investigate the trends in psychological impacts, coping ways, and public support during the COVID-19 pandemic crisis in the United States.

Materials and Methods: We undertook a rapid review of the literature following the COVID-19 pandemic in the United States. We searched PubMed as it is a widely available database for observational and experimental studies that reported the psychological effects, coping ways, and public support on different age groups and healthcare workers (HCWs) during the COVID-19 pandemic.

Results: We included thirty-five studies in our review and reported data predominantly from the vulnerable United States population. Our review findings indicate that COVID-19 has a considerable impact on the psychological wellbeing of various age groups differently, especially in the elderly population and HCWs. Review findings suggest that factors like children, elderly population, female gender, overconcern about family, fear of getting an infection, personality, low spirituality, and lower resilience levels were at a higher risk of adverse mental health outcomes during this pandemic. Systemic support, higher resilience levels, and adequate knowledge were identified as protecting and preventing factors. There is a paucity of similar studies among the general population, and we restricted our review specifically to vulnerable subgroups of the population. All the included studies in our review investigated and surveyed the psychological impacts, coping skills, and public support system during the COVID-19 pandemic.

Conclusion: The evidence to date suggests that female gender, child and elderly population, and racial factors have been affected by a lack of support for psychological wellbeing. Further, research using our hypothesized framework might help any population group to deal with a pandemic-associated mental health crisis, and in that regard, analysis of wider societal structural factors is recommended.

Keywords: COVID-19, psychosocial support systems, mental health, psychological adaptation, culture, society

INTRODUCTION

World Health Organization (WHO) declared the novel coronavirus (2019-nCoV) a public health emergency of international concern (PHEIC) on 30 January 2020, and a pandemic on 11 March 2020 (1). Thereafter, the COVID-19 pandemic has negatively affected the mental health of various population groups. This ongoing undesirable grim has significant mental health implications across all age groups and even for health professionals in the United States, and a mental health crisis has emerged. Initially, the United States Centers for Disease Control and Prevention (CDC) estimated that nearly one-third of the United States adults have anxiety or depression as on June 2020 (2). A major media, Usatoday.com, came up with the headline “Mental illness is epidemic within the coronavirus pandemic,” reflecting the depth of the mental-health crisis in the United States.

There is a dual magnitude of concern uprising mental health (suicidal ideation) and substance use disorders, as well as the onset of new barriers (3, 4). The United States Census Bureau, household pulse survey, reported similar data that 41% of adults reported symptoms of depressive and/or anxiety disorder in January 2021 as compared with January 2019 (5). As the pandemic wears on, necessary and ongoing public health measures exposed many persons to experience situations linked to mental health conditions, such as isolation and job loss. It is very crucial for each country to understand its impact on public health and its effects on the impact of Mental Illness, Culture, and Society. A recent study reported that COVID-19 deaths were underestimated and later on increased the inappropriateness of this pandemic situation in the United States (6). The study projected that COVID-19 had resulted in enormous losses of American lives, and this was highlighted by the national media in Washingtonpost.com, which made headlines stating that *the toll went beyond the number of civil war deaths in past*. The United States government came up with various effective strategies and rigorous attempts for the strict implementation of COVID-19 appropriate behaviors and vaccination, which lead to indispensable public involvement. The massive media coverage increased awareness about the science and pseudoscience of the pandemic combined with uncertainty and evolution of new viral variants that have effectively contributed to the “pandemic fatigue” with the potential of more spread of infection and further taken a toll on mental health issues. In addition, a large community-based study found vaccine hesitancy in 22% of the participants in the United States during the COVID-19 pandemic (7). The current pandemic is significantly impacting the mental health of all over the past 2 years. The vulnerable section of

the population (youth, pregnant women, elderly, and healthcare workers) is particularly impacted during pandemics.

In this review study, we aimed to assess the psychological challenges of specific age groups, working groups, and their possible coping mechanisms. In this study, we conducted a narrative review on the trends of psychological challenges, coping ways, and public support for the groups such as young adults, pregnant ladies, healthcare workers (HCWs), and the elderly population.

AIM OF THE REVIEW

This review aims to identify the psychological impacts, coping mechanisms, and public support during the COVID-19 pandemic in different population groups (child and adolescent, pregnant and postpartum women, minority racial population, elderly population, and healthcare professionals). The second aim was to identify risks and protective factors associated with adverse mental health outcomes. This rapid review and robust gathering of evidence could be used to inform governments/healthcare decision-makers, which will be vital to future policy making.

MATERIALS AND METHODS

Search Strategy

We planned, conducted, and reported this study according to the guidelines for rapid reviews (8), WHO (9), and the recent Cochrane Collaboration’s recommendations for COVID-19 (10).

Data Sources and Searches

Two authors (US and RM) searched across PubMed, a widely available database to capture research from potentially relevant fields, including health, mental health, and health management. The search strategy was executed on 14 February 2022, and again 2 weeks later on 28 February 2022, using a combination of subject headings and keyword searching. The bibliographical database was created with EndNote X9TM.

Search Criteria

The design of the search criteria was intended to draw together research both for this rapid review and to contribute to the design of a digital mental health intervention to enhance the psychological wellbeing of different populations including HCWs. We used keywords such as COVID-19, United States, mental health, psychosocial support systems, and psychological

adaptation for the search of studies. The flowchart for the study is presented in **Figure 1**.

Types of Participants

Participants were restricted to studies based in the United States on different age groups, races, pregnancy-related populations, and HCWs during the COVID-19 pandemic. The findings in each population type, namely, the child, adolescent, and young adult population, elderly adult population, healthcare workers, pregnant and post-partum women, and minority ethnic groups, were studied. Based on these documented observations, we propose a framework for clinicians' consideration to identify the etiology of mental illness during these times and accordingly consider the coping strategies.

Types of Studies Included

Published observational and experimental survey studies that reported the psychological effects, coping skills, and public support during the COVID-19 pandemic were included. The study designs included quantitative and qualitative primary studies. Studies relating to any previous pandemics and other epidemics (such as H1N1, H5N1, SARS, MERS, Zika, Ebola, and West Nile Fever) were excluded. All studies other than United States and published in languages other than English were excluded.

Screening and Selection of Studies

Searches were screened according to the selection criteria by RM. The full text of potentially relevant studies/papers was retrieved for further clarification. Data extraction and quality assessment were done by RM, US, and JB. Relevant data were extracted into structured tables including study, population, age, and psychological symptoms. Common coping methods and main study results were reported, wherever available, and authors extracted protective factors and risk factors.

Tables 1, 2 present an overview of the included studies. RK and SP assessed the quality of studies and assessed their risk of bias using the Evidence Partners appraisal tool. Data synthesis and analysis were conducted. The outcomes were categorized according to the study, population, age, and psychological symptoms/impact of COVID-19.

RESULTS

Study Characteristics

In this review, we included 35 studies, which contain surveys and data from the predominantly United States-based studies.

Psychological Toll and Coping Ways in Children, Adolescent, and Young Adult Population

Various surveys were conducted to assess the effect of COVID-19 on mental health among college students. In a survey by Son et al. (11), participants reported fear/worry about their health, sleep pattern disruptions, difficulty in concentration, and

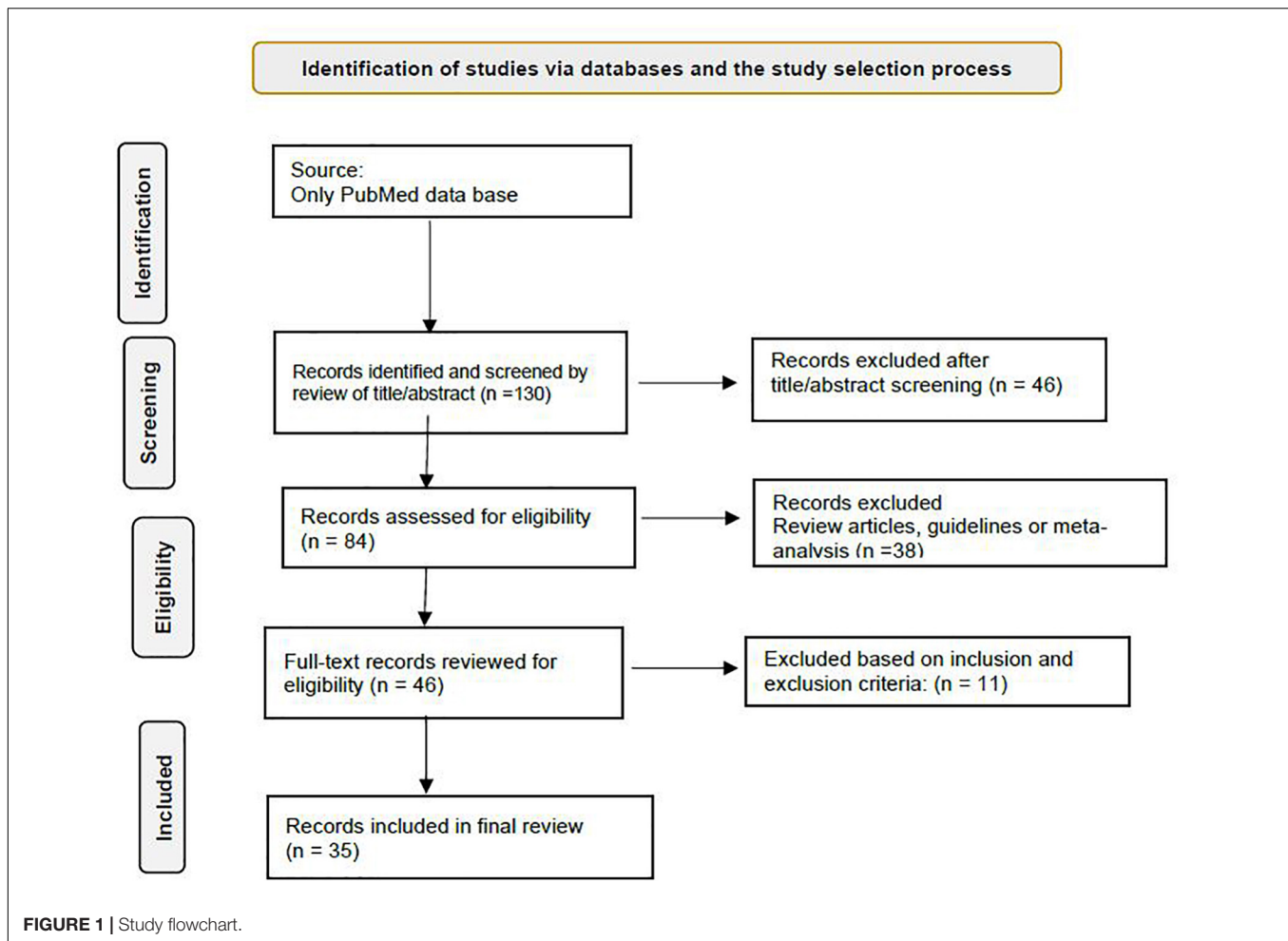
increased concerns about their academic performance, whereas another survey by the same authors showed increments in preexisting anxiety, depression, anxiety, and suicidal thoughts (12). However, 43% of participants could cope adequately with stress. The restrictions in social interaction, uncertain duration, and severity of illness were perhaps the reasons for these alarming survey results. Another study result showed that reading/hearing about the severity and contagiousness of COVID-19 was reported as the most common stressor (13). Overall, their financial concerns were rated as the most stressful factor. The most common treatments were distraction techniques, active coping, and seeking emotional support for social stress management. In addition, Waselewski et al. observed that 35.2% of the United States youth reported unavailability of appropriate resources during the early phase of COVID-19 (14). This study also concluded that the emotional responses were mostly negative (anxiety or depression), while coping strategies included staying connected and maintaining positivity.

Interestingly, another study by Rosen et al. (15) investigated the association between pandemic-related stressors and psychopathology, which was found to be reduced among youths ($n = 224$, mean age 12.6 ± 2.6) who had limited passive screen time, and it was absent in children having lower news media consumption related to the pandemic, but this was not seen in adolescents age group. Rettew et al. (16) conducted a personality assessment survey with the Big Five Inventory (BFI) among college students to find the association of traits with adjustment to the COVID-19 pandemic. The authors found that a higher proportion of extraversion openness, agreeableness, and conscientiousness and a lower proportion of neuroticism were associated with positive outcomes. However, there was an increased perceived threat and a higher anxiety for COVID-19 among individuals with adverse early life experiences, e.g., maltreatment. Importantly, childhood maltreatment is also associated with reduced flexibility in appraising the challenges, which mediates the association between maltreatment and anxiety (17).

Another study by LaCaille et al. (18) examined the changes in health behaviors and perceived stress in emerging adults over the first year of college to determine whether pre-pandemic health behaviors were protective of mental health and stress during the initial changes after the COVID-19 pandemic. Sedentary time was found to be increased, whereas physical activity decreased over time. However, 20–35% of students reported improvements in these behaviors. Dietary changes appeared to be mixed, with some improvements noted early during COVID-19. Their perceived stress increased over time. The authors also looked for protective effects on mental health and stress during the pandemic based on the subject's health behaviors, and diet quality emerged as a significant predictor.

Psychological Toll and Coping Ways in Elderly Adult Population

The elderly populations were on the receiving end during this COVID-19 pandemic due to the increased risk of mortality and morbidity. This risk has been exacerbated by the high incidence



of comorbid conditions found in this population. Consequently, the mental health of the elderly population was affected to considerable degrees during the pandemic. An important survey in 2021 was conducted to determine the effect of stressors on the mental health of people >55 years and found that 32% of the people screened positive for either depression, anxiety, or loneliness (19). Another study by Eastman et al. (20) investigated the relationship between symptoms and changes in alcohol consumption in the same age group and reported that 11% of the people increased their alcohol consumption during the pandemic. Furthermore, this study also found that participants who screened positive for either depression, anxiety, or loneliness had a greater risk of increasing their alcohol consumption during this time. Whitehead (21) found that more calamitous expectations of the pandemic increased perceived stress in its participants (>60 years), which led to an overall negative effect on this population.

Broadly, coping mechanisms/skills also formed an integral part in dealing with the negativities of the COVID-19 pandemic. One major study by Pearman et al. (22) found that proactive coping strategies and resilience helped to lessen the stress in elderly adults compared with younger people.

One of the surveys by Finlay et al. (23) investigated various coping methods used by the participants and reported that positive methods, namely, exercising, adjusting attitudes and modifying pre-set routines, and staying socially connected, as well as methods that were health-limiting, like overeating, were main adaptations by this population. However, another study examined people more than 65 years and categorized coping mechanisms into two types, namely, problem-focused coping and emotion-focused coping (24). The former mechanism entailed taking precautions against getting infected, and the latter one focused on including a daily routine, creative activities, and connecting with other people, which was similar to findings of other survey-based studies. Vannini et al. (25) reported that higher resilience was associated with increased use of adaptive coping and decreased use of maladaptive behaviors. In this study, resilience was found to be the strongest predictor of stress, and the high values of resilience decreased the effects of self-blaming. The authors also found that resiliency training exercises can lead to better preparedness regarding stronger mental health during such situations. Minahan et al. (26) showed that maladaptive coping methods can lead to detrimental outcomes, wherein avoidant coping mechanism was

TABLE 1 | An overview of the included studies on child and adolescent, and HCWs studies.

Study	Mode	Population (n)	Age (Mean SD)	Psychological symptoms	Common coping methods reported
Garritty et al. (10)	Survey	195	21 (1.7)	Fear/worry about health (91%); sleep pattern disruption (86%); difficulty in concentration (89%); increased concerns about academic performance (82%)	Negative coping (ignoring COVID-19 news, sleeping longer, distraction, drinking, and smoking), positive coping (meditation and breathing exercises, spiritual measures, keeping routines, and positive reframing), self-management
Son et al. (11)	Survey	2,031	23 (5.5)	Increase in preexisting anxiety (71%), depression (48%), anxiety (38%), and suicidal thoughts (18%)	Support from others, smartphone apps, university health services
Wang et al. (12)	Survey	1,015	39 (13.5)	Variable stressors related to COVID-19 infection	Distraction, active coping, and seeking emotional social support
Rosen et al. (15)	Survey	484	18 (0.3)	Mood decline	–
Park et al. (13)	Survey	950	19 (2.8)	Anxiety or depression	Staying connected and maintaining positivity
Hamm et al. (28)	HCW Survey	657	–	Depression (48%), anxiety (33%) and acute stress (48%)	Physical therapy or exercises
Shechter et al. (29)	HCW Survey	288	46 (11.5)	Stress, increased anxiety/depression	–
Comfort et al. (30)	HCW Survey	517	–	Insomnia (18%), depression (17%), anxiety (13%) PTSD (7.5%)	Avoidance coping, humor, positive reframing
Daly and Robinson et al. (46)	Survey	126	73 (7.4)	Depressed mood (27%), loss of interest (21.4%), change in sleep quality (25.1%), and change in alcohol use (6.4%)	Adaptive coping methods

HCWs, healthcare workers.

a strong contributor to COVID-19-related stress, depression, anxiety, and loneliness.

Rutherford et al. (27) assessed COVID-19 as a trauma stressor and compared the elderly population with preexisting PTSD who reported that living alone and along with physical illness were associated more frequently in comparison with the control group, i.e., without preexisting PTSD ($p = 0.02$). Contrastingly, Hamm et al. (28) examined the elderly adult population with preexisting depression and found that these were more concerned about the risk of contracting the virus than the risks of isolation. This population exhibited better resilience and had virtual contact with friends and family. However, their quality of life suffered due to continued physical distancing. However, the depression, anxiety, and suicidal ideation symptom scores did not differ as compared with pre-pandemic scores.

Psychological Toll and Coping Mechanisms in Healthcare Workers

In a survey by Shechter et al. (29) in the New York area (the most severely affected city with COVID-19 in the United States), hospital staff reported depression (48%), anxiety (33%), and stress (48%) in HCWs. Although more than half (61%) reported an increased sense of meaning/purpose since the COVID-19 outbreak. The authors also reported

that the most common coping behavior was physical therapy or exercise, while most responders were interested in an individual therapist with online self-guided counseling. Comfort et al. (30) conducted a study on HCWs from an outpatient clinic in April–June 2020 and assessed their mental health challenges during the COVID-19 pandemic. The authors found that there was a two-third increase in stress levels, whereas there was a one-third increase in anxiety/depression levels. The reasons were mostly due to patient care, worrying about contracting and spreading infection, work- and home-related concerns, burnout, and fear of the unknown. Other contributory factors were lack of personal protective equipment, difficulty coping with co-worker illness, and absence (30).

Another study was conducted by Dehon et al. (31) among emergency care physicians (October–December 2020) to assess the psychological effects of the COVID-19 pandemic, and the authors found that predominantly, negative psychological effects were reported. These included feeling more stressed (31%), lonelier (26%), more anxious (25%), more irritable (24%), and sadness (17.5%), respectively. The prevalent psychiatric conditions were insomnia (18%) followed by depression (17%), anxiety (13%), and PTSD (7.5%), and these were prevalent mental health conditions. The major coping mechanism used by this population was avoidance of coping strategies like

TABLE 2 | An overview of the included studies on elderly populations, pregnant, and minorities.

Study #	Mode	Population # (n)	Age	Psychological symptoms	Common coping methods reported
LaCaille et al. (18)	Survey	Elderly (6,938)	67.3 ± 7.9	Leaving home only for essentials (69%), Placed on leave of absence/furloughed (in 55–74 years = 17%; in ≥75 years = 31%), Screening positive for: depression (32%), anxiety (29%), loneliness (29%)	NA (only looked at outcomes)
Kobayashi et al. (19)	Survey	Elderly (6,548)	67.7 ± 0.2	Increase in alcohol consumption compared to pre-COVID drinking (11%), Association with increased drinking: depression: OR = 2.66, 95% CI: 1.99–3.56; anxiety: OR = 1.80, 95% CI: 1.34–2.42; loneliness: OR = 2.45, 95% CI: 1.83–3.28. If positive for all 3, more likely to report increased alcohol consumption (OR = 3.87, 95% CI: 2.52–5.96, vs. no mental health outcomes)	Increased alcohol consumption was a coping mechanism for COVID-19 stressors
Eastman et al. (20)	Survey	Elderly (1,714)	Age was reported in 5-year increments from 60–90+, for a total of 7 response options coded 1–7; (mean = 2.35 ± 1.25)	pre-virus annual income was reported in \$25k increments from \$0 to \$150k+, for a total of 7 response options coded 1–7; marital status was coded 1 = single/divorced/widowed, 2 = married/partnered; and retirement status was coded 1 = fully retired, 2 = work part time or full-time. Perceived health was rated on a 4-point scale: 1 = very healthy (39.6%), 2 = somewhat healthy (52.1%), 3 = not very healthy (7%), 4 = in poor health (1.3%). Mean ± SD for variables were Income = 3.78 ± 1.7; Marital status = 1.7 ± 0.46; Retired = 1.34 ± 0.47, Health = 1.7 ± 0.65, Income decline = 151 ± 0.5, Perceived stress = 17.61 ± 2.93, Negative affect = 35.08 ± 4.05	NA
Whitehead (21)	Survey	Adults (515)	39.48 ± 11.85	Both knowledge and precautions remained related to stress and that anxiety about developing COVID-19 contributed a large portion of the variance ($\beta = 0.66$) but health was no longer significant. For the Age × COVID-19 Anxiety interaction, anxiety was associated with more COVID-19 stress for older adults relative to younger adults	Knowledge of COVID-19. Knowledge of precautions, proactive coping, education
Pearman et al. (22)	Survey	Elderly (6,938)	67.3 ± 7.9	NA (study was on coping methods used)	exercising and going outdoors (26%), modifying routines (25%), following public health guidelines (18.9%), adjusting attitudes (16.1%), and staying socially connected (15.3%). 20% used no coping methods. Some coping strategies were health-limiting (e.g., overeating) (1.1%)
Finlay et al. (23)	Survey	Elderly (430)	72.4 ± 6.7	Risk perception: Most considered themselves to be high risk due to (a) underlying health conditions and (b) due to age Financial impact: mixed (as retired, mostly) Emotions: anxiety, fear, loneliness, lack of social connections	Coping was problem- and emotion-focused. Problem-focused coping included precautionary efforts and emotion-focused coping included creating daily structure, pursuing new and/or creative activities, connecting with others in new ways, and minimizing news media exposure
Goins et al. (24)	Survey	Elderly (141)	74.36 ± 8.35	Perceived stress via PSS-14 questionnaire = 23.5 ± 5.2 (moderate); inversely related to age ($r = -0.29$, $p = 0.001$); more in women ($t = 2.05$, $df = 135$, $p = 0.042$); divided into: health of loved ones (most common), self-health, finances, cognition, sleep, appetite	The three most endorsed coping strategies were acceptance (mean and SD = 2.5 ± 0.8), positive reframing (mean and SD = 1.84 ± 1.06) and active coping (mean and SD = 1.7 ± 1.0), and the three least endorsed coping strategies were behavioral disengagement (mean and SD = 0.2 ± 0.5), substance use (mean and SD = 0.3 ± 0.7) and self-blame (mean and SD = 0.5 ± 0.7). The highest endorsed coping strategy was I've been eating healthy and well-balanced meals (mean and SD = 2.4 ± 0.8) and the least endorsed coping strategy was I've been practicing mindful movements (e.g., Yoga, Qigong and Tai Chi) (mean and SD = 0.7 ± 1.0)
Vannini et al. (25)	Survey	Adults (13,180)	52.42 ± 17.76	Posttraumatic stress was highly correlated with the psychosocial outcome variables of depression, anxiety, and loneliness. Objective social isolation (e.g., having limited contact with family and friends) was related to stress	Avoidant coping, approach coping, social support
Czeisler et al. (34)	Survey	Peripartum (162)	31 ± 4.8	Stress/anxiety; decline in nutrition, missed appointments; access to baby supplies; less in-health facility deliveries. Financial resources, COVID-19 information and research as it relates to maternal-infant health outcomes, access to safe healthcare, and access to baby supplies (formula, diapers, etc.) emerged as the primary resources needed by participants	Support from friends and family, telemedicine, birthing classes, counseling services, better screening for stressors

(Continued)

TABLE 2 | (Continued)

Study #	Mode	Population # (n)	Age	Psychological symptoms	Common coping methods reported
Barbosa-Leiker et al. (35)	Survey	Peripartum (527)	32.60 ± 4.52	Predictors of depressive symptoms, anxiety, and post-traumatic stress disorder were analyzed. The most common predictors were job insecurity, family concerns, eating comfort foods, resilience/adaptability score, sleep, and use of social and news media. Qualitative themes centered on pervasive uncertainty and anxiety; grief about losses; gratitude for shifting priorities; and use of self-care methods including changing media use.	Social support (84%) increased social media use (48%), sleep (44%), eating comfort foods (42%), decreasing news intake (42%), exercising (36%), peer support (32%). Harmful = alcohol (10%), other substance use (5%).
Kinser et al. (36)	Survey	Perinatal (60)	32.3 ± 3.8	Over three-fourths of the sample indicated a worsening of mental health during the pandemic, with 31.7% of women endorsing clinically elevated depression symptoms and 36.7% screening positive for anxiety.	Domestic tasks, increased time w/baby for postnatal, being in nature, social support, distracting oneself, exercise and healthy behaviors, better food and water habits, extended breastfeeding w/o need of pumping. Some also had avoidant coping mechanisms which were harmful.
Anderson et al. (37)	Survey	Latinx, Latin, and Hispanic (341)	40 ± 11.6	Respondents who identified as Latinx, Latina, or Hispanic were 10 times more likely to meet the threshold score for depression ($\chi^2 = 7.21, p = 0.007$). Similarly, individuals with prior mental health conditions ($\chi^2 = 12.22, p = 0.001$) and those who expressed feelings of social isolation due to COVID-19 ($\chi^2 = 10.07, p = 0.002$) were 3 times more likely to meet the threshold score for depression. As age ($r = -0.25$) and income ($r = -0.20$) increased, respondents were less likely to have prior mental health problems. Individuals who reported social isolation lived in communities with higher percentages of people in fair or poor health ($r = 0.20$), and were younger ($r = -0.25$).	NA
Saltzman et al. (38)	Survey	Latina (King County) (137)	42 ± 10.6	Very few women had been infected with COVID-19, and 23% reported having been tested. Most frequent reasons for not being tested were not knowing where to go (14%), concerns over the cost (15%), and not wanting to know if they were infected (12%). Most participants had concerns about paying for housing (76%) and food (73%). Depression and anxiety symptoms were in the moderate range.	Recommended preventive behaviors followed. Coping methods not discussed.
Ornelas et al. (39)	Survey	Latinx (underserved) (43)	45 ± 11.1	Six themes related to mental health stressors including economics (e.g., job insecurity), immigration (e.g., undocumented status), misinformation, family stress (e.g., changes in family dynamics and the home environment), health (e.g., limited healthcare access) and social isolation.	Coping skills of the community were categorized into four themes with multiple codes including behavioral strategies (e.g., identifying reliable information, relaxation, mindfulness, stimulus control), cognitive strategies (e.g., collectivistic thinking, gratefulness, self-compassion), social support and spirituality (faith, religiosity).
Garcini et al. (40)	Perspective study	African American	NA	Closure of African American churches (called as "Black Church") led to increased mental stress to the followers, as they served as a historical and cultural symbol for them and improved mental health in the community members dealing with racism.	NA
DeSouza et al. (41)	Survey	African American adolescents (12)	12–18	Participants struggled with adjusting to the changes in their daily routines, navigating virtual learning, and emerging mental health difficulties (e.g., anxiety).	Participants relied on emotion and problem-focused coping strategies, including strategies that were religious/spiritual in nature. Participants also relied on social support from family, school personnel, and their religious community.
Parker et al. (42)	Survey	Korean immigrants (790)	45.74 ± 12.14	In terms of psychological distress, almost half of the sample (49.4%) had a low level of psychological distress. The other half (49.2%) had a high level of psychological distress. A person's resilience was the most important predictor of the level of respondents' psychological distress (Importance 0.173; Normalized importance 100.0%), followed by experiences of everyday discrimination (Importance 0.144; Normalized importance 83.2%), COVID-19 discrimination (Importance 0.144; Normalized importance 59.8%) and social support (Importance 0.095; Normalized importance 55.1%).	Resilience, social support.
Choi et al. (43)	Survey	American Orthodox Jews (419)	39.17 ± 15.71	Participants reported significantly less than average impact of COVID-19 on religious observance, faith in God, and their character (e.g., patience, trust), and significantly more impact on sleep, fitness, work, family, finances, and emotions. A similar pattern of correlations was observed for secondary exposure via news media, social media, and one-on-one communications, which correlated with higher self-reported negative impact overall.	Positive religiosity.

HCWs, healthcare workers.

denial, substance use, venting, behavioral disengagement, self-distraction, and self-blame. These coping skills were among the strongest predictors of psychological distress, whereas humor and positive reframing were negatively associated with psychological distress among these subjects. Feingold et al. (32) assessed for posttraumatic stress growth during the second wave of COVID-19; HCWs in an NYC hospital reported greater appreciation of life, improved relationships, and personal strength when compared with the baseline characteristics during the first wave, which was around 7 months earlier.

In addition, Zoorob et al. (33) conducted a study in April 2020 among resident physicians and found that being male and aged above 39 years were associated with favorable wellbeing indices ($p < 0.01$), and they reported that the institutional support was a favorable contributor in this regard. However, various mindfulness practices were not found statistically significant for the improvement of wellness or resilience factors by this study.

Czeisler et al. (34) conducted a study during the COVID-19 pandemic to identify factors associated with adverse mental health symptoms, substance use, suicidal ideation, and the prevalence among unpaid caregivers of adults versus non-caregivers and reported that caregivers had significant and higher prevalence rates than non-caregivers in terms of adverse mental health symptoms including suicidal ideation (33.4 vs. 3.7%; $p < 0.0001$). The authors identified that the younger age group caregivers were disproportionately affected and found the urgency to access for mental healthcare resources to address their mental health challenges, especially among caregiving individuals.

Psychological Toll and Coping Ways in Pregnant and Postpartum Women

Typically, women experienced added difficulties compared with the general population during the COVID-19 pandemic, especially those who were in their peripartum period. This was due to decreased opportunities for routine obstetric care and available beds in hospitals. Barbosa-Leiker et al. (35) conducted an important study on peripartum women ($n = 162$) to examine stressors and types of resources required by them during the COVID-19 pandemic. The authors reported that 31% of pregnant participants vs. 5% postpartum had missed their appointments ($p = 0.007$), consequently leading to an increase in stress and anxiety levels, and this reason declined their nutrition levels. This increase in anxiety was attributed to fear of the fetus contracting COVID-19 infection (52% pregnant and 49% postpartum), followed by self or partner contracting the virus (38% pregnant and 32% postpartum), respectively. In addition, the authors reported that 41% of pregnant women and 19% of postpartum women used telemedicine to continue their routine obstetric care and found satisfaction with this new telemedicine process; 32% of postpartum women also revealed less access to cleanliness resources and baby supplies. The most prevalent reason for stress in 21% of pregnant women was a financial decline in income (35).

Another large survey was conducted by Kinser et al. (36) in peripartum women ($n = 527$) to investigate the predictors of depression, anxiety, and PTSD. The authors found that most

reasons were related to job insecurity, concerns about family, comfort foods, resilience/adaptability score, sleep, and use of social and news/media.

The study findings further added that social media had played a key role during this pandemic time. However, it was reported that continuous use of social media leads to “pandemic fatigue.” Moreover, 67% of pregnant and 73% of postpartum women reported that “taking a break from watching, reading, or listening to news stories, including social media” was one of the predominant methods of coping (35). In contrast, another study by Kinser et al. (36) reported that 48% of women reported an increase in the duration of social media use, and it was found that this was significantly associated with depressive symptoms ($p = 0.013$) and PTSD symptoms (0.002). However, various women also commented on the methods for self-care from this, and it was noticed that a principal theme was to avoid news and social media completely due to reasons that anxiety arising due to these can further add up to the normal stresses of childbirth and childcare, whereas another group of women suggested a different approach to social media, wherein they used it to connect personally with friends and family, which helped them to build social support and a sense of comfort. Therefore, making social media use and acting on decreasing the “sensational content” makes it a productive rather than detrimental tool which is similar to the use in the general population. Other coping mechanisms included exercise, healthy diet eating, mindfulness practices, connecting with loved ones, and getting good sleep (35). The authors also examined the disparities and factors associated with economic issues and reported that women with higher income were able to engage more regularly to take care of themselves ($p = 0.007$) and connect with other persons ($p = 0.047$) in comparison to women with lower income status who had financial problems ($p = 0.03$) (35). This typically reflects on the disparities contributed by a socioeconomic divide within the population, where persons from the lower end of strata not only have less access to healthcare but also face challenges in their personal life coping physically and emotionally with the burdens of the pandemic.

Finally, this pandemic became more devastating for the peripartum women who already exhibited depressive symptoms during the pre-COVID-19 period. Anderson et al. reported in a study that around 75% of the population had worsened their mental health, with 31.7% of women having clinically elevated depressive symptoms and 36.7% for anxiety symptoms. These subjects also reported a re-emergence of mental health symptoms. Self-isolation was found to be associated with depression, whereas spending time outdoors was found to be negatively associated (37). The authors also showed the role of wellness behaviors in decreasing psychological effects during a pandemic for at-risk population groups.

Psychological Toll and Coping Ways in Minority Groups

Various races/communities, especially African American people, were affected disproportionately by this COVID-19 pandemic, which remained a controversy due to the sociocultural divide.

A community-based survey was done in April 2020 by Saltzman et al. (38) to assess this among 341 participants, and it reported that those people who identified themselves as Latinx, Latina, and Hispanic had a 10 times more probability of having a threshold score for depression (38). Another survey by Ornelas et al. (39) was conducted to determine “how these Latina immigrants residing in King’s County coped with this pandemic” and reported that only a minority of women got infected with COVID-19; however, only 23% of them underwent the COVID-19 testing. This study also found that only 14% reported no knowledge of where to go, whereas 15% were concerned about the cost of the test and 12% did not want to know if they were infected at all. A total of 75% of the participants were worried about the housing and food costs. All these factors lead to a moderate range of depressive and anxious symptoms (38).

Another detailed survey was conducted by Garcini et al. in a Latinx community and reported six different themes of stressors, i.e., economics, immigration, misinformation, family-related concerns, healthcare, and social isolation. This community especially coped with COVID-19 *via* changing their behavior, collective thinking as a community, and spirituality (40).

Mainly, African American community was also affected directly and indirectly by this COVID-19 pandemic. A prospective study by DeSouza et al. examined the effects of the closure of African American Churches (popularly known as “Black Church”) that led to increased mental stress in the followers/believers. The reason being that these Churches served as a historical and a cultural symbol for them and these places helped to improve their mental health as a community to deal with racism (41).

Parker et al. investigated the African American Adolescent’s population perceptions of their experiences and reported that most of the participants had difficulty adjusting to their changed routines including virtual learning and simultaneously had to deal with great anxiety. These adolescents coped with this pandemic using problem-solving methods and getting social support from families and school members, even spirituality also played a part in coping strategies (42).

Another survey was done by Choi et al. on the Korean immigrant (population $n = 790$; the United States and Foreign-born) and found increased levels of stress during the COVID-19 pandemic. The authors predicted various critical factors for this such as a person’s resilience, experiences of day-to-day discrimination, and perception of racial discrimination toward Asians. This study stressed how superficial perceptual tendencies and bias toward a single racial group can be detrimental factors to the mental health of the community and advocated that various measures should be implemented to educate the general population about the risks as well as the redundancy of such behavior (43).

Another study by Pirutinsky et al. was conducted on the American Orthodox Jews population ($n = 419$) and reported high levels of concern and compliances with COVID-19 guidelines and lower stress levels. These were associated with higher religiosity, religious coping, and trust in a higher power leading to lower stress. This study shows that in a close-knit religious

community, the faith-directed coping strategy could promote a higher resilience during times of crisis (44).

Overall, these studies show that communities of color experienced a disproportionately increased stress during this COVID-19 pandemic too. However, it is attributable to the health care disparities in this population (leading to high mortality and morbidity within these groups). Authors also found that racism, racial bias and hatred, financial constraints, and lack of information also contributed to the declining mental health during the pandemic in these groups. Authors stressed that a common coping strategy among this population was faith and religion, with communities rallying around their beliefs and social support to form a cohesive unit to tide them through this time of crisis.

DISCUSSION

Most of the surveys included a coronavirus anxiety scale (CAS), which is a 5-item screening tool and was developed for clinical research and practice. This scale has good reliability and validity measures (90% sensitivity and 85% specificity) (45). Overall, data by Understanding America Study (UAS) suggests a substantial increase in psychological distress during the early COVID-19 pandemic period in March 2020 as compared with June 2020 based on PHQ-9 tools. This decline suggested induction of resilience at the population level (46).

The above extensive rapid review of literature validates the huge burden on mental health associated with the COVID-19 pandemic. The impact varied across different population groups and various coping mechanisms evolved. As the studies in different groups were noted, the authors identify a framework for the increased burden of mental health illness. The reasons can be broadly classified into three categories: (1) Individual factors, (2) Environmental factors, and (3) Disease-related factors.

(1) Individual factors include baseline mental health or mental illness even in the pre-pandemic phase that is now exacerbated due to several factors including deprived social interaction or loss of family member during the pandemic, limited access to psychiatric or psychological care, and substance use disorders.

(2) Environmental factors include the financial stress experienced with illness, hospitalization, accessing healthcare through COVID-19 illness, employment status, impact on several businesses, increased family time at home, the impact of social media, political controversies related to vaccination, and management of illness across times.

(3) Disease-related factors include the severity of COVID-19 illness, isolation associated with illness, and worsening co-morbid medical conditions in the context of the COVID-19 pandemic.

The etiology of mental illness is multifactorial and heterogeneous. The multifactorial nature of mental illnesses would incorporate various components like individual factors, environmental factors, and disease-related factors. Accordingly, the coping strategies need to be tailored based on the individual etiologies. Overall, the health system needs to identify these important public health concerns and optimize its resources including increasing the primary care provider screening and

public resources to tackle and mitigate the increased mental health illness associated with the COVID-19 pandemic. The importance of characterization of these risk factors from a clinician's perspective would be important as this can guide the suggestions on coping mechanisms or explore support resources in alignment with the respective etiology.

Some risk factors are uniquely positioned in that they can be the etiology in some, while others might be the coping methods in other groups. For example, working from home which is an environmental factor resulted in satisfaction for many employees as it increased family time and flexibility in daily life. Unfortunately, the performance pressure related to working from home increased stress, and also more family time was associated with some family discordance in some individuals. Many families separated by geography and limited by travel to connect utilized technology to connect and bridge, but unfortunately, this could not fulfill the emotional needs of in-person interactions.

This narrative review highlights psychological issues and coping methods and is summarized in **Table 1**. To note is that mental illness is an underreported and underdiagnosed problem in the community and without a doubt is also hugely under-identified amid the COVID-19 pandemic, which primarily presented as a medical illness but had a huge mental health impact.

Public resources to tackle mental health illnesses associated with this pandemic need a special focus. More resources need to be allocated and access to psychiatric care and psychological health evaluation needs to be increased. Primary care providers need to step in as a bridge to screen for mental health illnesses and refer to appropriate resources and follow up promptly. The end of the COVID-19 pandemic should not be the origin of a new mental illness pandemic, and as a society, we need to address this timely and mitigate it.

Strengths and Limitations

This rapid review has synthesized the evidence and discussed the currently available literature on the psychological challenges and coping ways during the COVID-19 pandemic on all the age groups, especially vulnerable groups like children, elderly, women, and HCWs. To our knowledge, this is the first rapid review investigating the United States population groups who were vulnerable in the context of psychological challenges, coping ways, and public support. However, this pandemic has affected almost every country on the earth and disrupted everyone's living in a way that no other outbreak has in our memory. The major

strength of our review is that it aspired toward greater inclusion in a rapidly changing COVID-19 landscape, while we adhered to a standard methodological approach and assessed the study quality and risk of bias using the GRADE approach. We followed best practice principles to evaluate the certainty of evidence, and we presented a tabulated and narrative synthesis. Our review has clear limitations in several forms as the majority of the studies included in this review were from the United States. Our major limitation of the review was that no empirical studies investigated this impact on these vulnerable populations, and thus, there is limiting generalizability to the general population. Our inclusion criteria did not include studies from any other developed countries and studies in languages other than English, limiting the generalizability of our results. We were not able to register on PROSPERO, and only two reviewers were responsible for the initial screening of papers and quality assessments.

Finally, our review's searches were carried out later in the pandemic, and it will be considered to match the emerging research from the other countries over the globe in the light of our review's findings.

CONCLUSION

This rapid review confirms that children, pregnant women, the elderly population, and HCWs were more at risk of significant psychological challenges, and they have developed various coping ways to show resilience during the COVID-19 pandemic. Various published survey studies suggest that symptoms of depression, distress, and anxiety are commonly found within these populations and lead to a significant impact on Mental Illness, Culture, and Society. We recommend more research be undertaken to identify interventions and personalized psychological approaches that can be delivered to mitigate the deterioration of people's wellbeing and support their mental health.

AUTHOR CONTRIBUTIONS

RK, SP, AS, JB, RM, and US contributed to the conception and design of the study. RM and AS organized the database. US performed the statistical analysis. RK wrote the first draft of the manuscript. SP, AS, RM, JB, and US wrote the sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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EDITED BY

Renato de Filippis,
Magna Græcia University, Italy

REVIEWED BY

Waraporn Kongsuwan,
Prince of Songkla University, Thailand
Mahlagha Dehghan,
Kerman University of Medical
Sciences, Iran

*CORRESPONDENCE

Mahmoud Reza Alebouyeh
Dr.alebouyeh1@gmail.com;
alebouyeh.mr@iums.ac.ir

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Grief experience among ICU staff with loss of family members during COVID-19 outbreak in IRAN: A qualitative study

Shabnam Nohesara ¹, Mahdieh Saeidi ²,
Hesam Mosavari ³, Leila Ghalichi ⁴ and
Mahmoud Reza Alebouyeh ^{5*}

¹Department of Psychiatry, School of Medicine, Mental Health Research Center, Psychosocial Health Research Institute (PHRI), Iran University of Medical Sciences, Tehran, Iran, ²Research Center for Addiction and Risky Behaviors, Iran University of Medical Sciences, Tehran, Iran, ³Student Research Committee, School of Medicine, Iran University of Medical Sciences, Tehran, Iran, ⁴Mental Health Research Center, Psychosocial Health Research Institute (PHRI), Iran University of Medical Sciences, Tehran, Iran, ⁵Department of Anesthesiology, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

Introduction: The COVID-19 crisis created a lot of problems in people's lives. Different lifestyles, mental health, communication, rituals and traditions, particularly those involved in mourning, have changed drastically. Medical staff faced numerous critically ill patients every day. This greatly distressed the staff, especially the ICU staff. The end result was considerable amounts of mental distress for the medical staff who lost family members to COVID-19 making the distress even more complex.

Methods: We carried out this qualitative research to study the grief experiences of 12 Iranian ICU staff members at the Rasoul Akram Hospital who had experienced the loss of a family member to the COVID-19 pandemic. We studied the effects of how their own grief experience and how constant exposure to critically ill patients influenced their work with patients. All semi-structured interviews were held in the presence of a faculty member of the psychiatry department of Iran University of Medical Sciences. The interview on the grief experience among ICU staff during the COVID-19 pandemic, consists of 4 issues: Familiarity, Experience during the COVID-19 pandemic, Grieving the loss of a family member and Effects of parallel grief.

Results: We found five common themes in the result of the experiences of the participants based on content analysis. These consisted of: complex grieving process, new experiences for coping with loss, more empathy for patients, change the meaning of death, and the need for support in work places. Likewise, there were 22 sub themes.

Conclusion: Paying attention to the details of staff members' life, gender differences, and cultural aspects can give us a better understanding and perception of their grief experiences. This understanding brings out valuable points which can help policy makers pass better laws for the wellbeing of society and people in order to promote leadership in turbulent times.

KEYWORDS

COVID-19, grief, experience, ICU staff, qualitative study

Introduction

The COVID-19 pandemic is a tragedy that caused a partial collapse of many social, economic, and health delivery systems worldwide. The world faced a pandemic that spread rapidly amongst people and took the lives of millions all around the world (1). Millions of people who lost their lives began their sad journey through hospitals and medical facilities that were miserably inadequate to handle the tidal wave of COVID patients overwhelming medical systems in all countries. Many physicians and nurses themselves lost their lives treating their COVID patients or lost their own family members without any opportunity to mourn their loved ones. The medical staff faced vast numbers of patients every day who were dying from COVID-19 (2, 3).

On the other hand, there was a lack of proper healthcare facilities in many medical centers lacking appropriate mental health care toolkits. This greatly distressed the medical staff, for they were terrified of transmitting the infection from the work area into their homes. The result was great mental distress for the medical staff who had to experience new and different coping strategies in a pandemic (4).

The pressure of working in the intensive care unit (ICU) brought on immense distress and a sense of acute responsibility with it. The pressure was added to by a sense of duty, changes to work protocols, the absence of loved ones, and the trauma of death all around (5).

Much research has shown that exposure to this pandemic has raised the risk of complicated grief caused by the fact that this infectious disease has been unknown and unpredictable, a lack of specific and efficient treatment to control and eradicate it, the continuity of the quarantine, the lack of the possibility to hold mourning rituals or funerals, the lack of the opportunity to be present in the ceremonies, strict laws of transportation, the mortality and morbidity of the virus, ICU staff's work environment that sometimes caused the risk of spreading the virus and even multiple fatalities in a family cluster in a short period (6–8).

Not being allowed to enter and stay with the patients of COVID-19 in hospitals and not being able to see them and say their last goodbye to their loved ones (9, 10) all raised the

risk of distress and caused mental illnesses such as anxiety, depression, sleep disturbance, post-traumatic stress disorder (PTSD) and other medical conditions which raised the rate of suicidal attempts and affected the quality of people's lives (11, 12).

The medical staff, especially those who function as frontline workers in the ICU, were not only losing their own patients in their professional life but, like the rest of the society, were losing their loved ones in their personal life. Therefore, their experiences of losing their loved ones in these times changed. To attend to health protocols and keep social distancing, ceremonies and mourning rituals were canceled or held with very few people. Mourning rituals differ according to culture, but the common element is that these rituals are ways to calm the person down and relieve the person in mourning (13). The duration of the ceremonies was also cut short, and those in mourning were deprived of performing the rituals and had to go through their time of mourning slowly, sometimes facing huge complications and complexities (14). The grief and sorrow of the ones left behind were not acknowledged by the societies and relatives and these people were not able to process their grief and it was left unprocessed (15).

ICU staff is facing the daily influx of critically ill patients. Seeing and caring for people at the end stage of life has a heavy emotional toll which is what ICU staff face. The lack of sufficient personal facilities, safe diagnostic tests, effective curative methods, and the uncertainty of laws concerning quarantine regulations added to the anxiety and stress of ICU personnel (16).

Apart from the professional roles, these people also played essential roles in their personal lives that involved deep emotional attachments with family members. Therefore, they also faced pressure with worries about their family's safety and health (17). COVID-19 changed ICU staff's sleep cycles which can create severe emotional and mental pressure. Seventy-five percent of ICU staff faced sleep disorders, 85% faced medium to high stress, and 61% faced both (18, 19). The assessments show that many frontline health workers also faced the death of their own loved ones to COVID-19. Some reports claim that 51% of ICU staff experienced burnout during the pandemic. These people experienced various mental disorders and complicated

grief because at times they were unable to be present at the death bed of their loved ones due to work pressures. They were deprived of the right to bid their loved ones farewell. They faced the unpredictable death of loved ones while they were also worried of such things as infecting family members. Knowing of the symptoms of the illness and its progression, prognosis and treatment can, on the one hand, positively influence them for they will have a realistic attitude on the illness and death while, on the other hand, it can create a sense of frustration and powerlessness to be of any help (20).

Some members of the medical team faced unique conflicts in confronting the death of their loved ones. Working in a place where they constantly meet critically ill patients while losing a family member to COVID-19 can have different effects on the way they deal with their grief. Facing patients in the work environment after the death of their loved ones desensitized some staff members and allowed them to deal more easily with the death of a patient and, in some cases, allowed them to empathize more with the patient. It sometimes made them re-experience the loss of their own loved one (21).

Every culture has certain mourning rituals to help the surviving individuals work through their experiences of loss and anguish. Social networking also provides limited channels for processing a sense of grief and loss, particularly for those who have heavy workloads and only limited time to leave the hospital to participate in mourning ceremonies (22, 23). In Iranian culture, there are mourning ceremonies of various kinds to help individuals do grief work. People come together in the deceased person's home to give moral support to the grieved person and keep the memory of the departed alive. They read from religious texts and pray for the salvation of the deceased in the afterlife (24). The mourners are not expected to work and carry on with their everyday tasks for a while after the loss of a loved one. During this time, they are supported by their families and friends so that they can go through the process of grieving. However, in the COVID pandemic, the work's extreme pressure prevented many health workers from going through this process to cope with their grief over their loss. Their sorrow continues to remain unprocessed (7).

There are very few studies to examine the experience of the frontline health care professionals who have lost their loved ones without the opportunity to do grief work during this pandemic. This was the impetus behind our attempt to study this phenomenon through qualitative research.

We studied the effects of how the grief experience of the health care providers working in the COVID-ICU influenced their work with patients and how constant exposure to critically ill patients influenced their own grief experience. We tried to identify and examine the different experiences of health workers who had lost their loved ones while serving those hospitalized for the COVID-19 in the ICU. One of our aims was to raise attention to the plight of these health workers to help with policies that would

decrease the pressure the medical staff is experiencing in such situations.

Methodology

Overview

A qualitative study was conducted on 12 men and women who worked in the ICU ward and the COVID-19 emergency ICU in the Rasoul Akram Hospital at the beginning of 2022 in Tehran, Iran.

Participants

At first, we identified the frontline COVID-19 medical staff in the hospital who had also lost a loved one to COVID-19 and invited them to join our study. In line with the ethical guidelines for clinical research to protect volunteers from trauma or abuse and inform them of the purpose and methods of the study, we obtained their informed consent before the interview making sure that they wanted to participate in the study on their own volition. We also assured their complete anonymity and their right to leave the study at any time they wished.

Data collection

For data gathering purposes, in this study individual semi-structured interviews were used in person in a safe and calm environment. From the 125 ICU personnel 22 had suffered the loss of a loved one and 12 participated in this study. The term "loved one" refers to immediate and secondary family members. Those who had lost a co-worker were not included in the study. At the beginning of the interview, the aim of the study and the way in which it would progress was fully explained to the interviewees. At the end of the study, they were asked to give their feedback in order to improve the process. It was also stated that in order to benefit best from the contents of the session, the sessions would be recorded. The interviewees were assured of the security and confidentiality of the sessions and of the fact that the records would be kept where only the interviewers and their aides would be allowed to listen to the contents. Once the sessions were recorded, they would be kept in a safe place where only the researchers on the cases and their aides could have access to them. All the interviews which were kept as audio files would be written out in full by the interviewer and aides, based on the content analysis, the data gathering would continue until we found no new data (25). In this way, data gathering would end upon the termination of the interview #12.

All the interviews were carried out by a psychiatrist on the medical staff of the university and an assistant which is why all

the interviews go through the same process. Apart from gaining the necessary information and carrying out the semi-structured interview, the psychiatrist would pay attention to the non-verbal communication of the participants. In case of witnessing any emotional sensitivity when describing difficult experiences while grieving, the psychiatrist would give appropriate emotional responses and pay particular attention to their non-verbal communication, their body language and acknowledge their emotions and act in a supportive manner. Next a special time, separate from the time of the interview, would be allotted to delving into these emotions of the individual. The person's mental state would be evaluated and in case it was necessary to go into psycho-education to control the situation communicational pathways to receiving necessary mental health services would be set up as psychotherapy and psychiatric sessions. Those interviewed who wished could then benefit from mental health services as they would be referred to a psychiatrist.

Initially the interview would be carried out with open questions. Then, depending on the needs of the individual the rest of the interview would be carried out with attention paid to details. In order to facilitate the process, a guideline would be set up to explain the methodology in detail by the psychiatrist and his aides explaining the beginning and process of the interview. Issues critical to the study and predicted conflicts would all be written out in full and placed at the disposal of the interviewer.

Interviews

Instructions on the interview on the grief experience among ICU staff during the COVID-19 pandemic, consists of 4 issues: familiarity, experience during the COVID-19 pandemic, grieving the loss of a family member and effects of parallel grief.

In the first issue "familiarity" the age and gender of the participants in the time and duration of their service in the intensive care or the COVID-19 ward were studied.

In the second issue, questions about their experiences during the COVID-19 pandemic and some open questions were asked. Examples of such questions are as follows:

How do you explain serving at a time of COVID-19? Can you estimate the number of patients whom you were responsible for? Can you estimate the number of your patients who died because of COVID-19? Do you remember your first patient who died of COVID-19?

The aim was to study burden and workload both pre and post COVID-19.

In the third issue, questions about grieving the loss of the loved one were asked. Examples of such questions are as follows:

Have any of the people close to you passed away from COVID-19? Who? Do you remember the date of their death? After losing your loved one to COVID-19, how did you feel? How did you grieve? Were you able to take some time off work? Did you have a ceremony?

In the fourth issue, items about the effects of parallel grief were assessed. Examples of such questions are as follows:

Did you continue taking care of COVID-19 patients after losing your loved one/ones? How did the grief experience influence your work with patients and how did constant exposure to critically ill patients influence your own grief experience?

Analysis

The given data in this research includes notes written by the staff who took care of patients. These semi-structured interviews focused on the four fields explained above. Each of these reports was considered as a unit of analysis and after being read many times the main codes were brought to attention and then categorized and classified and the main structures were formed.

Data analysis was carried out using the MAXQDA software. This provides a suitable environment for the analysis of data and producing the themes and sub-themes in a qualitative research (26). We also pursued an interactive set of categories and aimed for the flexibility to add new categories throughout analysis.

Interviews were transcribed as soon as possible. After verbatim transcription of the interviews, the text was read carefully and then independently coded by two researchers. The process was repeated several times to ensure the complete and correct understanding of the concepts. Units of the text were coded and recoded during this process, and codes were later organized into categories and themes. At this stage, the research team discussed the codes, categories and themes until consensus was achieved. The final set of codes, categories and themes were agreed upon by all members of the research team. After 12 interviews, no further codes emerged and recruitment ceased.

Trustworthiness

The transferability, credibility, and consistency of the data were certified based on the Guba and Lincoln criteria as an essential part of qualitative studies. These were considered through prolonged involvement in the subjects, external and peer check, and discussing any relevant literatures explaining the raw data recording process and providing an explanation for the coding and analysis processes (27, 28).

Ethical considerations

Informed consent was obtained from all the participants. This research was approved by the ethics research committee of the Iran University of Medical Sciences with unique number IR.IUMS.REC.1400.1148 and protocol number 22923. All the names were deleted to respect the anonymity of the participants.

TABLE 1 The list of themes and sub themes.

Complex grieving process	Feeling guilty for being the carrier
	Feeling guilty due to lack of treatment facilities and vaccinations
	Feeling guilty and regret for not having the chance to take care of the loved one because of work load
	Unprocessed feelings due to the uncompleted grief because of exposure to the rapid influx of critically ill patients
	The lack of emotional support in the work place
	Inability to express their emotional experience and sense of grief during loss
	Exposure to COVID-19 patients and its high mortality rate
New experiences for coping with loss	Not being able to hold funerals
	Keeping themselves busy to avoid annoying thoughts and memories of the deceased
	Taking time off
	Changing to Non-COVID-19 wards
	The role of religion and spirituality
	Receiving and asking support from co-workers, family members, hospital and society
More empathy for patients	The need to continue working in the COVID-19 ward
	More attention and kindness for patients
	More understanding of the family situation
	Spending more time caring for the patients to decrease the feeling of guilt
Change the meaning of death	Normalization of the concept of death and feeling apathetic
	Accepting death as an inevitable phenomenon and having less fear
The need for support in work places	The need to receive empathy from the work place at a time of grief
	The need to increase personal protective supplies in crises
	The need to reduce working hours

Results

The participants were two anesthesiologists, four nurses, two paramedics, and two service workers. The experiences of the participants in this article are shown in five themes and twenty-two sub themes (Table 1).

First theme: Complex grieving process

This issue contains six sub-issues which are directed toward the factors which complicate the grieving process. The factors shown in this issue show that these people's jobs and the work pressure they have to tolerate have a great effect on their experiences.

Feeling guilty for being the carrier

Some of these people explained that they were terrified by the fact that the illness was mysterious, unknown and rapidly spreading, especially in the beginning of the pandemic and they were constantly worried that they might be the cause of the virus being spread in society and in their families. Later when they heard that one of their loved ones was sick, they felt guilty that their job might be the reason.

*35 year old /female: * Each time after our shifts were over and we had to go home we were worried that we might take home the disease from the hospital. What if I made others sick? I wouldn't be able to forgive myself.*

*28 year old /female: * My loved one would not have died if I didn't work at a hospital.*

45 year old/female: In the beginning of the pandemic, everyone was scared of us because they knew we were working in the COVID-19 ward. My mother worked at the hospital in the NICU, but they were terrified of us who worked in the hospital.

Feeling guilty due to lack of treatment facilities and vaccinations

Many felt guilty for lacking the proper knowledge, skill, and tools, including vaccines, to prevent the demise of their patients. Some people regretted the lack of health facilities, especially in the beginning of the COVID-19 pandemic, especially those who had lost a loved one before the vaccinations started. They expressed their regret and that they wished the vaccinations had started sooner and everyone had the chance to use them.

*35 year old /female: * I think that if we had had vaccines sooner, this would not have happened to my uncle; my uncle who was not vaccinated passed away, he died innocently.*

*48 year old /female: * In the beginning we were desperate that there might not be any vaccination at all, but when we heard that the world was controlling the disease by getting vaccinated, we were heartbroken that the vaccine didn't come sooner and we had to watch our loved ones pass away.*

Feeling guilty and regret for not having the chance to take care of the loved one because of work load

Since we did not have a large enough work force and that there was an overflow of people coming into the hospitals, there wasn't time for the staff to take off from work and this caused less quality time with family, especially those families who lived in other cities. This caused a feeling of guilt in the staff and they felt that they didn't have much role in taking care of their loved ones.

28 year old /female: * If I could have taken time off work for a while and go to my home town to be with my father, perhaps I could have spent the last days of his life next to him. I regret the fact that I didn't have this opportunity.

45 year old /male: * In the beginning of the pandemic, we were not allowed to take time off work, our co-workers were affected by COVID-19 and were quarantined. I wanted to take time off work to stay with my family until they got well.

Unprocessed feelings due to the uncompleted grief because of exposure to the rapid influx of critically ill patients

Since the people we had interviewed constantly had to face critically ill patients and daily deaths, there was no time to process the grief they were experiencing to allow their emotions to be digested. These feelings accumulated. The interviewees reported the experience of people dying in front of them every day with no opportunity to talk about their feelings with anyone. In some shifts, they faced one patient after another dying with no time even to eat lunch or dinner.

35 year old /female: * Imagine that a number of people would die every day in front of your eyes. In some shifts we faced numbers of deaths, but we didn't even have time to eat dinner or talk to others about it.

The lack of emotional support in the work place

Due to the compressed work situation in hospitals and shifting working hours for people in different shifts there was no possibility of being alone and talking about emotions and feelings.

35 year old /female: * There was no opportunity to talk to anyone at work, we constantly had to see critically ill patients and we had no energy left to talk.

38 year old /male: * Each of us was handling our own worries. Who could talk to others about their feelings in such situations?

45 year old /male: * We were exhausted of constantly talking about illness, death and all the hardships we were facing. I preferred not to talk about anything else other than work.

Inability to express their emotional experience and sense of grief during loss

Some felt stunned and emotionally blocked. They attributed their numbness to their upbringing or personality types.

38 year old /male: * It has nothing to do with COVID-19. It is difficult for me to talk about my emotions with others.

45 year old /male: * Why should I go and tell others that I'm sad? I don't know how to do that. I'll do something about it myself. It's an embarrassment for me to do so.

Exposure to COVID-19 patients and its high mortality rate

These people expressed that the rapid spread of the disease and the high mortality rate made them feel unsure about the future. It stopped people from being able to cope with what was happening.

32 year old /female: * Our patients were dying so quickly that we couldn't understand what was happening.

45 year old /female: * It only took a few days from the time my aunt told me that my uncle was sick until he died. He was healthy and had no history of medical illness. He was middle aged and he died suddenly. Now after several months, I still haven't been able to come to terms with it.

Not being able to hold funerals

They expressed that to be able to stop the illness from spreading they did not hold a ceremony or memorial and this was extremely difficult for them because in our culture it is important that people stand by each other during the first days of a loved one's death and help each other come to terms with it. In most Iranian families there is a strong interpersonal interaction and people are by each other's sides during happy and sad moments. However, because of the fear of losing more people during the COVID-19 pandemic many changes were made.

35 year old /female: * Just the family came and the traditional ceremony was not held. They had a ceremony at the grave yard and another one with thirty people. However, I was more worried about my parents who are elderly. My mother was very close to my aunts and I was worried about her. I was scared that she would have a hard time at the memorial and I wanted to be by her side.

38 year old /male: * In the beginning, we didn't have any official ceremonies because of COVID-19, but our relatives came themselves. We weren't able to hold a ceremony.

Second theme: New experiences for coping with loss

People used different ways to cope with death and they chose different systems to heal. Many of the people who were interviewed used systems that came from their own spiritual culture to calm them down in such days.

Keeping themselves busy to avoid annoying thoughts and memories of the deceased

Some spent their time grieving the loss of their loved ones by constantly facing critically ill COVID-19 patients. They were trying to keep their minds occupied in different ways.

*38 year old /male: * I tried to sleep during my free time to stop my mind from thinking about the death of my dear one.*

*35 year old / female: * I spent more time with my husband and children so I wouldn't be alone. Any time I was alone my mind started to think of death.*

*28 year old /female: * I was raised in a religious family. After my father's death, I started to pray more often as if it calmed me down. I turned to God and this calmed me down.*

*35 year old / female: * I still haven't completely dealt with it. The only thing that calms me down is that I tell myself that what happens is only God's will. Life and death are in God's hands.*

*38 year old /male: * I read the biographies of religious leaders. They had also gone through hardships in their lives. This made me follow them and accept death as a truth much more easily.*

Taking time off

The duration of the time people needed off work to grieve their loved ones varied and some expressed that they needed more time off to be able to come to terms with the fact that their loved one was gone and others expressed that long working hours of not working made them stay home and do nothing. The memories of their deceased loved ones would keep on coming back to them and make these days miserable. It stopped them from going back to their normal routine. They wanted to work even if it meant returning to wards with critically ill patients busying themselves working.

*48 year old /female: * I try to keep my mind off. I try to take more shifts and spend more time at work to keep my mind off. If I'm alone, I spend all my time thinking.*

*28 year old /female: * I wish I had more time off work to spend more time with my family while grieving and I wish I could stay in my home town to grieve.*

*39 year old /female: * I'm glad that I quickly came back to work, my co-workers are empathetic and I feel useful. I'm not alone.*

Changing to non-COVID-19 wards

Some expressed that dealing with critically ill COVID-19 patients made them review the memories of the last days of their loved ones. Therefore, they asked to change their working place and move to a ward where there were no COVID-19 patients.

*48 year old female: * I myself have cardiovascular problems and I couldn't stand facing critically ill COVID-19 patients. It was difficult. I wanted to go to other wards.*

The role of religion and spirituality

Many of the interviewed people used religious methods to deal with grief. Strong cultural and religious beliefs in people helped them facilitate the experience of dealing with grief.

Receiving and asking support from co-workers, family members, hospital and society

Among the people who were interviewed the women had more tendency to ask for and receive support from the people around them. They expressed that it was easier for them to ask for emotional help at work and at home. They received help to calm down their families.

*48 year old/female: * The group members we worked with were nice people. I would talk to them about my feelings and they would support me. I didn't feel alone. After work I would talk to my husband, and it helped me a lot.*

Third theme: More empathy for patients

A lot of the people who were interviewed expressed that after the loss of a dear one, they felt more empathetic and compassionate toward patients. While helping them they would remember their recently lost loved one. They recalled how much pain they had suffered in the last days and this helped them concentrate and pay more attention to their patients and the people who were accompanying the patient.

The need to continue working in the COVID-19 ward

Some expressed that even though they had lost their loved one to COVID-19, they still had the desire to work in this ward.

*48 year old /female: * I am actually a positive person when it gets to hospitals no matter how often my co-workers say that it is difficult. There was a discussion among us regarding whether we would allow our daughters to become nurses or not. I was the only person who said why not if she wants to because nursing is an occupation in which you can be*

kind to the patients, especially in a time such as the COVID-19 pandemic. I don't regret working in this ward.

*39 year old /female: * If for a moment you can imagine that the person you are responsible for is your father, mother, brother or a relative you can be kinder to them.*

More attention and kindness for patients

Dealing with COVID-19 patients caused people to be more empathetic and kinder.

*39 year old /female: * I would give patients water. I even paid attention to the way they looked at me when I was tired.*

*28 year old /female: * It didn't make any difference in the number of people who passed away but it helped us treat them much better while they were alive. I somehow felt that they needed more attention, especially those who felt worse. Those who felt better would come and get remdesivir and go but those who were sicker needed more attention. We would think that they might not be around the next night.*

More understanding of the family situation

The individuals who were interviewed expressed that because they had taken care of their loved ones who were ill before their death, and had experienced all that the person next to the patient was experiencing, they were able to be more empathetic at work.

Spending more time caring for the patients to decrease the feeling of guilt

Some say that because they weren't able to spend time with their loved one, they felt guilty and now they feel better by spending more time with the patients.

*28 year old /female: * My father's death affected my interactions with COVID-19 patients and made me more*

empathetic. My father's memories came back to me, especially because I work in the type of environment in which my father passed away.

*48 year old/ female: * It affected me a lot. Making the decision to stay in the COVID-19 ward was easier. The situation which I had been in helped me talk better to the patients. In the beginning of COVID-19, unlike now, the patients didn't have anyone by their sides and we were the only people who were talking them. We were the only ones there to explain that for example you are going to go to the ICU, don't worry and we would explain what was about to happen. I felt that I could make up for all that I wasn't able to do for my father.*

Fourth theme: Change the meaning of death

These people explained that during the COVID-19 pandemic, especially after the death of their loved ones, the concept of death changed for them.

Normalization of the concept of death and feeling apathetic

Some expressed that because they repeatedly faced death they became apathetic and numb toward it.

*28 year old /female: * I had become cold hearted.*

Accepting death as an inevitable phenomenon and having less fear

Due to the constant daily exposure of health care workers to the death of patients from COVID-19 and due to endless attempts to save patients, these workers gradually developed an acceptance of death for they watched life go on regardless of what was happening. In this way their fear of death grew less.

*39 year old /female: * Generally speaking, I have come to better terms with death. Perhaps in the past I was scared but I don't worry much about it anymore.*

*32 year old /male: * In facing the death of the first patients, we were terrified but we were numb toward the patient's death. We had become used to it.*

Fifth theme: The need for support in work places

In crises the fact that others are thinking of you can have a great role in controlling the person's situation, a lot of colleagues were complaining that they were not receiving any support from the system they were working in.

The need to receive empathy from the work place at a time of grief

In times of crisis people fight to go on living while they are exhausted both physically and mentally. Being in an empathetic environment where they can feel loved and appreciated allows their ability to face and fight problems to increase. It gives them a sense of belonging and of being a member of a team. This can be an important factor in increasing resilience.

39 year old/ female: * We weren't expecting to have more time off because there was a lack of work force but they could have at least sent us a message of condolences.

45 year old /male: * If you go and give my name to the head of the wards of the hospital they wouldn't know me. Not that I expect the manager of the hospital to know me, but how many people lost their families at this time? The least they could have done was to have expressed condolences. We are all actually working here and everyone is getting benefits. It's not that we just work to get paid, everyone gets benefits.

28 year old /female: * Perhaps it's not right but I keep on going over what happened. I agree that COVID-19 is a disease which doesn't have a specific cure. In the beginning they did some things such as plasmapheresis. I insisted they inject IVIG which my father did not tolerate and they didn't give it to him again. But they didn't accept to freeze the plasma. Perhaps I wasn't in a situation to give such suggestions but no one suggested it to my family. I don't know but maybe it could have saved my father.

The need to increase personal protective supplies in crises

There was a considerable fear of getting infected, which in addition to discrimination on distribution of protective supplies led to desperation of health care workers, particularly at the beginning of the Pandemic.

39 year old/ female: * In the beginning we didn't have suitable clothing. They wouldn't give N95 masks to the staff. The beginning was horrible.

38 year old /male: * We lacked personal protective facilities and we didn't receive much support from the hospital.

The need to reduce working hours

They express that the hospital could have been more responsible, given more welfare amenities to the staff and reduced the working hours to avoid personnel exhaustion.

39 year old /female: * We didn't receive much support from the hospital, they didn't give us any time off. On the third day, they called my sister telling her that I should return to work without asking if we had buried our loved one yet or not.

48 year old/ female: * It would have been better if they had given us time off work. But it wasn't possible at that time. We can't blame the hospital. It was the peak of COVID-19 and most of the staff were sick. The shift that I was working (the time my aunt died) was when my colleague was sick and

I had to stand instead of him. The hospital could have shut down another ward to switch the staff to our ward but they didn't do that.

Discussion

Grief is a subject that requires utmost consideration in a global pandemic that took the lives of over 6 million people in just 2 years. There are some studies addressing grief in non-healthcare workers during the COVID-19 pandemic (29). However, the impact of personal loss (death of a loved one) and professional loss (death of patients) on the mental health of intensive care workers and other essential workers and how they grieve for these losses have not been well studied.

The experience of grief has often been challenging for ICU staff, even before the COVID-19 pandemic, and it has been more troublesome for those who lost loved ones. For example, there is a similarity in patient mortality rates between cancer patients and COVID-19 patients. Studies have shown that oncologists may experience a sense of failure or compassion fatigue (emotional and physical exhaustion that reduces their ability to empathize or feel compassion for others) after a patient's deaths (30, 31). As with health care workers caring for COVID-19 patients, oncologists witness their patient's suffering first hand and often feel responsible for their suffering and even for their deaths (32). Granek et al. found that oncologists experienced powerlessness (65%), self-doubt (60%), guilt (35%), failure (55%), sadness (70%), and loss of sleep (30%) when grieving for a deceased patient (31). However, the COVID-19 pandemic has heightened healthcare workers' fear and anxiety, aggravating pre-existing clinicians' "professional grieving" difficulties. Factors including a high mortality rate, being unprepared for the new conditions of work, absence of a cure, constantly changing treatment guidelines, demographics of patients, and sudden/unpredictable death of patients enhance the risk of ICU staff undergoing complicated or persistent grieving "I have become more cold-hearted than before" is what we repeatedly heard from the interviewees in this study, and this may show compassion fatigue to some extent (28).

The ICU staff's loss and grief during the COVID-19 pandemic have become more personal than ever because illness and death are possible for them and their loved ones. There has always been a chance of ICU staff experiencing counter-transference with patients who remind them of a loved one, but the epidemic has intensified these correlations (33). "I felt more compassion toward a patients/patients' family" is a statement that most of our participants reported during our interviews. It seems that the ICU staff's perception of grief, patients' suffering and family members' hardships changed after they lost loved ones. Our own findings

strongly support that view and show some important points including: complex grieving processes, new experiences for coping with loss, more empathy for patients, different meanings of death, and the need for the support of various workplaces.

However, it is unclear if their compassion is restored or if they are trying to compensate for any shortcomings toward deceased loved ones that they regret as one of our participants mentioned.

People experience grief differently in diverse cultures and contexts.

In Iran there is also several subcultures but generally continuous presence of people around survivors in early days of grief, is among important factors of effective social support. Consistent with the previous literature, the themes of this study showed that this effective social support has been reduced (8).

Strengths and limitations

To the best of our knowledge, this is the first qualitative study on the experience of grief among ICU staff during the COVID-19 pandemic in Iran.

Our sample was limited due to the fact that participants were self-selecting and came from one hospital and our findings may represent the experiences of this group thus limiting wider generalizability.

Implication of practice, research and policy

It is critical to pay particular attention and to support those working in stressful, sensitive positions such as ICU personnel who have suffered grief because it can directly affect the quality of their work. Quantitative tools must be prepared and used for the study of larger samples in different cultures.

For future researchers, we suggest conducting studies on a wider range and promoting comparisons between different ICU staff in different hospital care units to improve the quality of research, and we recommend an organization be set up to identify and support at-risk staff so that a supportive intervention can be built.

Much study is needed to better understand professional grief processes in critical care workers, risk factors for complicated grief, and how to help them persevere during the crisis. Managers of health systems must invest in policies based on wellbeing and functionality.

Conclusion

Profound loss and enduring grief were described by ICU staff who lost their loved ones during pandemic circumstances.

Different healthcare workers have different experiences when they face crisis and loss in their lives. Their cultural, spiritual, personal and work backgrounds have great effects in the formation of the way they handle crisis.

Health care professionals, especially those who worked in the ICU, experienced various degrees of stress and pain depending on their personalities, defense mechanisms, subcultures, family situations, career and work place during the COVID-19 pandemic. If we ignore them, they will remain hidden sufferers and this will have negative effects on the quality of their lives and their wellbeing.

Paying attention to the details of the ICU staff's life, gender differences, cultural and spiritual aspects and assessing all the angles of people's lives can give us a better understanding and perception of their experiences during crisis and loss. This understanding can bring out some valuable points which can help policy makers pass better laws for the wellbeing of society and people so as to promote leadership in turbulent times.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and this research was approved by the Ethics Research Committee of the Iran University of Medical Sciences with unique number IR.IUMS.REC.1400.1148 and protocol number 22923. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SN: project ideation, research design, interviews, supervision, analysis, article writing, and coordination. MA: research design, supervision, and article writing. MS and HM: article writing and interviews. LG: analysis, coordination, and supervision. All authors contributed to the study design and article writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

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Mental Health Status of Teachers During the Second Wave of the COVID-19 Pandemic: A Web-Based Study in Bangladesh

Md. Tanvir Hossain^{1*}, Md. Akhtarul Islam², Nusrat Jahan¹, Mst. Tanmin Nahar², Md. Juwel Ahmed Sarker³, Md. Mostafizur Rahman⁴, Farah Deeba⁵, Kazi Enamul Hoque⁶, Rina Aktar¹, Md. Mazharul Islam⁷, Mohammed Zaber Hossain⁸, Laila Siddiqua⁹, Zisan Mahbub¹⁰ and Md. Nazrul Islam¹¹

¹ Sociology Discipline, Social Science School, Khulna University, Khulna, Bangladesh, ² Statistics Discipline, Science, Engineering and Technology School, Khulna University, Khulna, Bangladesh, ³ Department of Development Studies, Faculty of Social Science and Humanities, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh, ⁴ Department of Disaster and Human Security Management, Faculty of Arts and Social Sciences, Bangladesh University of Professionals, Dhaka, Bangladesh, ⁵ Department of Clinical Psychology, Faculty of Biological Sciences, University of Dhaka, Dhaka, Bangladesh, ⁶ Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia, ⁷ Department of Sociology, Faculty of Social Science, Government Azizul Haque College, Bogura, Bangladesh, ⁸ Department of English, Bangladesh Military Academy, Bhatiali, Bangladesh, ⁹ Architecture Discipline, Science, Engineering and Technology School, Khulna University, Khulna, Bangladesh, ¹⁰ Upazila Health Complex, Dumuria, Bangladesh, ¹¹ Forestry and Wood Technology Discipline, Life Science School, Khulna University, Khulna, Bangladesh

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Mohammadreza Shalbafan,
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Iran

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Lingkan Barua,
Bangladesh University of Health
Sciences, Bangladesh
Emma Claesdotter-Knutsson,
Lund University, Sweden

*Correspondence:

Md. Tanvir Hossain
tanvirku05@soc.ku.ac.bd

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Background: Following the outbreak of the COVID-19 pandemic, the government of Bangladesh implemented strict non-therapeutic measures, i.e., “social distancing,” “lockdown,” “work from home,” in the first quarter of 2020. Like other professionals, teachers at schools, colleges and universities were confined within households. However, the introduction of online education imposed an additional burden on teachers along with growing household responsibilities, thus, affecting their psychological state.

Aims: This study was aimed to explore the prevalence of mental health problems among teachers in Bangladesh and to identify the associated risk factors.

Methods: This web-based cross-sectional study was conducted during the second wave of COVID-19 pandemic in Bangladesh. Data were collected from 381 teachers working at schools, colleges, and universities between 01 August and 29 August 2021 by administering a self-reported e-questionnaire using Google Form, where the mental health of teachers was assessed by depression, anxiety, and stress scale. Data were analyzed using IBM SPSS Statistics (Version 26) and STATA Version 16, and multiple linear regression was executed to predict mental health problems among teachers.

Results: The findings indicate that the overall prevalence of depression, anxiety, and stress among teachers was 35.4%, 43.7%, and 6.6%, respectively. The prevalence was higher among male and older teachers than among their female and younger colleagues. The findings further showed that place of residence, institution, self-reported health,

usage of social and electronic media, and fear of COVID-19 significantly influenced the mental health status of teachers.

Conclusion: It is strongly recommended that the government and policymakers provide proper mental health services to teachers in order to reduce mental health problems and thus sustain the quality of education during and after the pandemic.

Keywords: COVID-19, Bangladesh, teacher, depression, anxiety, stress, prevalence, mental health

INTRODUCTION

In late December 2019, the coronavirus disease (COVID-19) spread across China from Wuhan (1). Toward the end of January 2020, the World Health Organization (WHO) issued a warning about a public health emergency (2); and they declared a pandemic on 11 March 2020 (3). As of June 2022, around 6.3 million people have died of COVID-19, and it has infected over 533 million people worldwide (4). Healthcare systems were overwhelmed with infected and suspected COVID-19 patients in both developed and developing countries, leading to disarray in social, economic, educational, and political systems (5–7) and burdening the mental health of individuals, families, communities, societies, and countries across the world (8, 9).

Although government and international organizations immediately implemented non-therapeutic preventive and protective measures, including “social distancing,” “lockdown” or “home confinement,” and “face mask” (10, 11), the news of growing infections and death across the world caused panic among people (12). The situation was further worsened by exposure to “misinformation” on social and electronic media such as Facebook, Messenger, WhatsApp, Twitter, and television (13, 14). Thus, many people, irrespective of age, sex, occupation or region, experienced heightened mental health problems, including depression, anxiety, stress, fear, and poor sleep (15, 16); some even committed suicide (17, 18).

In Bangladesh, out of 1.9 million confirmed cases, over 29,000 people have died as of June 2022 (19). Since 2020, numerous studies have been carried out in Bangladesh to assess the impact of COVID-19 on the mental health of different occupational groups and cohorts, including medical professionals (20–22), marginalized workers (5, 23), children (24, 25), college and university students (26–28), and middle-aged and older adults (29). For example, a study on students in May 2020 revealed that the prevalence of anxiety and depression among university students was 81.7% and 82.4%, respectively, (28), while another study suggested that 27.1% of university students experienced poor sleep quality during April 2020 (27). Likewise, doctors also experienced heightened depression (55.3%), anxiety (48.4%), and stress (35.2%) during the pandemic (20).

Although a good number of studies focusing on the mental health condition of teachers have been conducted in other parts of the world (30–35), to the best of our knowledge, there has been none in Bangladesh. Teachers worldwide have been continuously working online under unfavorable circumstances during the pandemic in order to minimize the mental health burden of students and their guardians (36, 37). In doing so, teachers have

experienced an intensified psychological problem. For example, a study in India found that growing household responsibilities, e.g., home management, childcare, and elderly care, followed by the introduction of online platform-based education increased work burden and stress among female teachers; this adversely affected their psychological state, eventually leading to irritation and aggressive behavior (30). Studies in China reported growing anxiety and post-traumatic stress disorder (PTSD) among teachers in schools, colleges, and universities (34, 35).

Studies in western Europe have also identified volatile mental health conditions among teachers (31–33, 38, 39). Studies in Spain reported heightened depression, anxiety, and stress, particularly among female and older teachers and among teachers suffering from chronic diseases or living with chronically ill or COVID-19 infected family members (33, 38). Furthermore, work stability also affected the magnitude of mental health problems among teachers (38). Meanwhile, studies in England found that growing uncertainty, together with an increased workload, health vulnerabilities, exposure to non-stop negative news in media, and concern over the wellbeing of students and colleagues, negatively affected the mental health and wellbeing of primary and secondary teachers (31, 32). A Polish study on primary and secondary teachers showed that mental health problems rose to over 50% during the second phase of the COVID-19 pandemic among teachers for depression (54.99%), anxiety (50.73%), and stress (55%), respectively; number of children, partner employment status, and changes in quality and satisfaction of relationship were key determinants of depression, anxiety, and stress symptoms among the Polish teachers (39). Similarly, studies in the North and South America suggested that unpaid work overload, sense of uncertainty, home confinement-induced loneliness, loss of loved ones, and fear of the pandemic significantly deteriorated the mental health conditions of teachers, particularly female and older teachers (40–42). The lower mental health status of teachers subsequently affected their self-rated health status (43), leading to poor sleep and appetite, increased headaches and stomachaches and drug use, and distrust among teachers that compelled them to think about leaving the teaching profession (43, 44).

The aforementioned studies clearly suggest that teachers across the world have been experiencing increased mental health problems, including depression, anxiety, and stress; this is caused by a wide variety of factors, such as personal characteristics (age, sex, marital status, and race), socioeconomic status (work experience and levels, family composition) work, and COVID-19 related health issues (COVID-19 infection, loss of family members and friends, exhaustion, and health issues) which

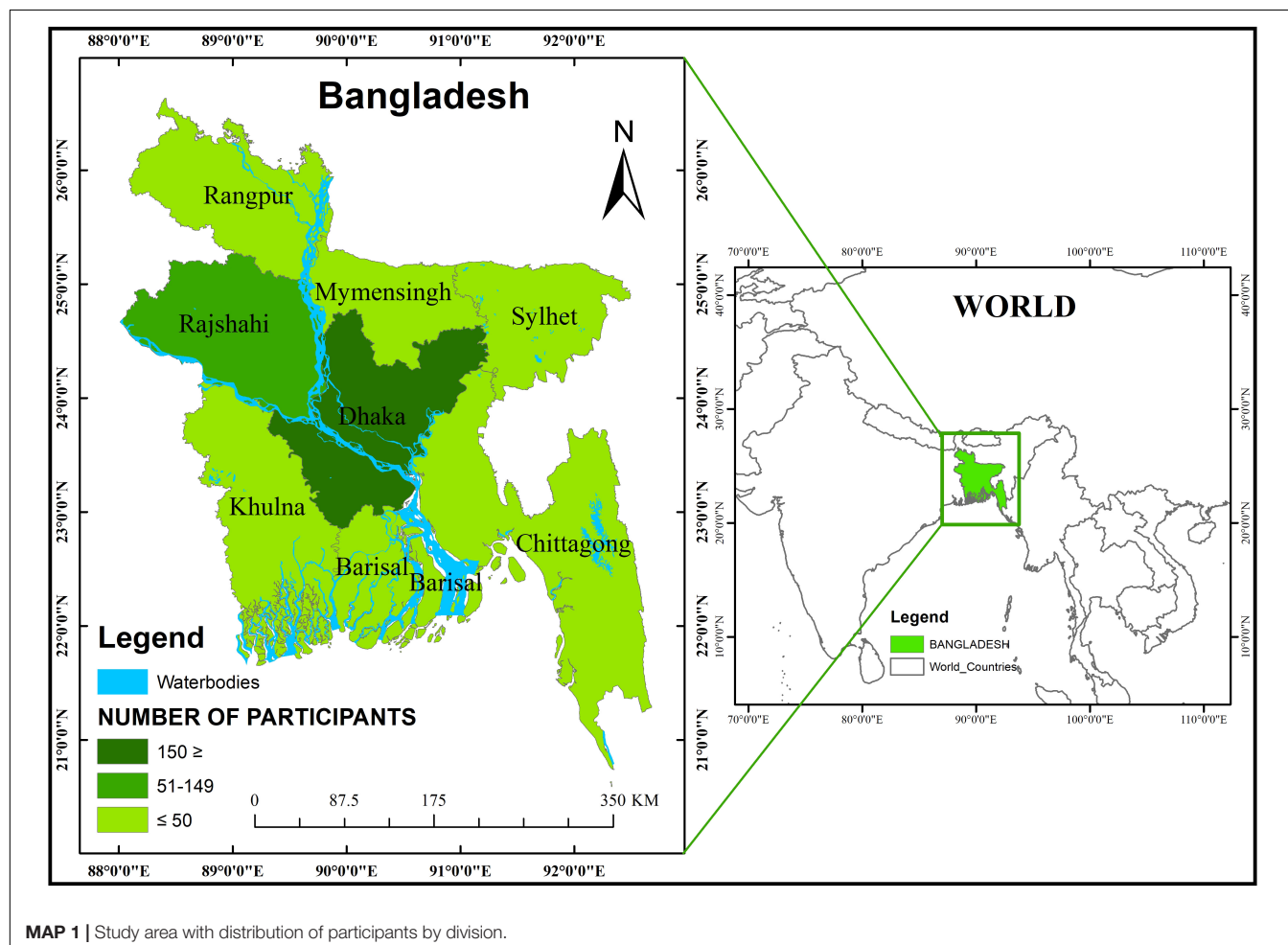
significantly determine the presence and absence of mental health problems. However, there has been a dearth of empirical studies in the context of Bangladesh; as a result, the present study aimed to assess the prevalence of mental health problems among teachers in Bangladesh and to identify the associated risk factors. This study may guide the government and its policymakers to formulate new policies and strategies for safeguarding the mental wellbeing of teachers in Bangladesh and in other parts of the world.

MATERIALS AND METHODS

Study Settings and Participants

This cross-sectional web-based survey was adopted to assess the prevalence of depression, anxiety, and stress among teachers during the second wave of the COVID-19 pandemic when complying with the “social distancing” recommended by the World Health Organization. Data were collected from teachers in various schools, colleges, and universities, using an anonymous semi-structured electronic questionnaire (e-questionnaire) in English through Google Form. The inclusion criteria of the participants were – (i)

Bangladeshi citizens, (ii) adults (≥ 18 years of age), (iii) living in Bangladesh during the second wave of COVID-19; (iv) employed as permanent teachers in their respective educational institutions; and (v) holding an active/valid email or social media account (Facebook/Messenger/WhatsApp). Considering these specifications, the researchers collected the e-questionnaire responses through institutional email and social media groups, and each participant was requested to share the e-questionnaire with their colleagues and friends; thus, this study followed the convenience sampling technique. It is important to note that around one million teachers are involved in teaching and learning at all three levels in Bangladesh (45, 46), of which a lion's share do not have access to the internet or email or social media account (47). In this study, however, a total of 439 responses were initially recorded between 01 August and 29 August 2021. Fifty-eight responses were excluded due to incompleteness or repetitive responses; therefore, responses from 381 teachers were eventually included in this study (see **Map 1**). In order to ensure transparency and to eliminate repeated question items, the e-questionnaire was pre-tested on a small group of teachers (20), working at different schools, colleges, and universities. The responses from the participants of the pre-test were excluded from the web-based survey to avoid biases.



Ethical Issues

This study was approved by the Ethical Clearance Committee of Khulna University, Bangladesh (Reference No. KUECC – 2021/09/26). In the first section of the e-questionnaire, an informed consent letter was attached where the participants responded anonymously by filling out the form. In the consent form, all participants were provided with information concerning the research purpose, confidentiality, and the right to revoke participation without prior justification. There was no incentive for the participants.

Measures

Socio-Demographic Information

The initial section of the e-questionnaire contained the socio-demographic information of the teachers, including their current age (“ ≤ 30 ,” “31 – 40,” or “ ≥ 41 ”), sex (“female” or “male”), place of residence (“rural” or “urban”), marital status (“unmarried,” “married,” or “others [widowed/widower or divorced/separated]”), type of institution at which they were working (“school,” “college,” or “university”) higher educational degree (“Master” or “PhD”), designation (“assistant/senior teacher/demonstrator,” “lecturer/assistant professor,” or “associate professor/professor”), self-reported health (“poor/fair,” “good,” “very good,” or “excellent”), COVID-19 testing status to find out whether s/he was infected or not (“not tested” or “tested”), vaccine status (“no” or “yes”), fear of COVID-19 (“not fearful” or “fearful”), exposure to information regarding COVID-19 (“never/sometimes/occasionally” or “often/always”), and usage of social and electronic media (“decreased,” “about the same,” or “increased”).

Depression, Anxiety, Stress Scale 21

The mental health of teachers was assessed by a widely used scale – depression, anxiety, stress scale (DASS) – developed in the mid-90s (48). The initial DASS comprised 42 items in a four-point Likert scale to measure the negative emotional states of depression, anxiety, and stress, 14 questions for each sub-scale (48), and later a short version of the DASS – the depression, anxiety, and stress scale 21 (DASS 21) – was developed and validated (49), where each sub-scale of depression, anxiety and stress consisted of seven items. The DASS 21 in English was used in this study considering the educational qualifications of teachers. A sum of scores of the seven items in each sub-scale was estimated to measure the presence and absence of depression, anxiety, and stress. The sum of scores ≥ 10 indicates the presence of depression, whereas it was ≥ 8 and ≥ 15 for anxiety and stress, respectively. The overall Cronbach's alpha (α) of the DASS 21 was 0.950, an excellent internal consistency (50), while the Cronbach's α of each sub-scale was $\alpha = 0.885$ (depression), $\alpha = 0.847$ (anxiety) and $\alpha = 0.877$ (stress), respectively.

Analysis

Data were analyzed in two consecutive phases using IBM SPSS Statistics (Version 26) and STATA version 16 for windows. Descriptive statistics, i.e., frequency and percentage analysis, were calculated to present the socio-demographic information of the participants. The prevalence of depression, anxiety, and

stress was estimated with standard error (SE). The simple linear regression (SLR) and multiple linear regression (MLR) analysis with unstandardized (B) and standardized Coefficient (β), at 95% confidence interval (CI; 51, 52) were utilized to identify the risk factors associated with mental health problems of teachers, e.g., depression, anxiety, and stress. Different factors were considered to be statistically significant when the p value was < 0.05 .

RESULTS

Descriptive Information of the Participants

Table 1 demonstrates the socio-demographic information of the participating teachers. Among the participants, more than 80% were older than 30 years and married, while more than half were male and lived in urban areas. Around 94% had a master's degree, however, working mostly in colleges and schools. Less than 10% of the participants reported having an “excellent” health status, and less than a quarter assess their COVID-19 infection status during the pandemic. Around 88% of teachers were vaccinated, and 62.2% of them admitted increasing social and electronic media usage during the pandemic.

Prevalence of Depression, Anxiety, and Stress Among Teachers During the COVID-19 Pandemic

The overall prevalence of depression, anxiety, and stress among teachers in Bangladesh was 35.4% (SE 0.024), 43.7% (SE 0.025), and 6.6% (SE 0.012), respectively. The prevalence was higher for male teachers in depression (42% vs. 22.6%), anxiety (24.6% vs. 19.1%), and stress (3.4% vs. 3.1%) than female teachers (see **Figure 1**). It is also apparent from **Figure 1** that depression (29.9%) and stress (2.9%) were higher among teachers with age between 31 to 40 years, while teachers older than 40 years of age showed greater anxiety symptoms during the COVID-19 pandemic in Bangladesh.

Determinants of Depression Among Teachers During the COVID-19 Pandemic

Table 2 indicates the SLR and MLR models with unstandardized and standardized coefficients with 95% CI. In the MLR model, place of residence, institution, self-reported health, fear of COVID-19, and usage of social and electronic media were found to be significantly associated with depression among teachers during the COVID-19 pandemic [R^2 Adjusted = 0.378, $F(20,360) = 10.95$, $p < 0.000$]. Depression among the teachers from the urban area was 1.37 units lower than the teachers from rural areas. Teachers who reported having good and excellent health were 2.06 units and 2.35 units less likely to be depressed, respectively, as opposed to teachers with poor/fair health status. College teachers showed less depression compared to schoolteachers. Teachers who feared COVID-19 revealed a 2.4 unit increase in depression compared to those who did not fear the COVID-19; on the other hand, there exists a 2.73 units reduction in depression for the teacher who has increased the

use of social and electronic media. Moreover, participants who maintained a stable social and electronic media usage showed a reduction in depressive symptoms.

Determinants of Anxiety Among Teachers During the COVID-19 Pandemic

Table 3 demonstrated that the MLR model is significant [R^2 Adjusted = 0.297, F (20,360) = 9.01, $p < 0.000$] and

indicated a significant association of teachers' institution, fear of COVID-19, and social and electronic media usage with anxiety among teachers during the COVID-19 pandemic. College teachers and university teachers showed a 2.76 and 2.45 unit decrease in anxiety symptoms, respectively, compared that to the schoolteachers. Teachers with a heightened fear of COVID-19 experienced a 2.18 unit increase in anxiety level compared to those not afraid of COVID-19. Teachers experiencing an increase in social and electronic media usage had a 1.73 units reduction in anxiety compared to teachers who reduced the use of social and electronic media during this pandemic.

TABLE 1 | Descriptive information of the participants ($n = 381$).

Variable	Frequency (%)
Age	
≤30	51 (13.4%)
31–40	163 (42.8%)
≥41	167 (43.8%)
Sex	
Female	149 (39.1%)
Male	232 (60.9%)
Place of residence	
Rural	158 (41.5%)
Urban	223 (58.5%)
Marital status	
Unmarried	35 (9.2%)
Married	336 (88.2%)
Others	10 (2.6%)
Institution	
School	129 (33.9%)
College	143 (37.5%)
University	109 (28.6%)
Education	
Master	357 (93.7%)
PhD	24 (6.3%)
Designation	
Assistant/senior teacher/demonstrator	128 (33.6%)
Lecturer/Assistant Professor	176 (46.2%)
Associate Professor/Professor	77 (20.2%)
Self-reported health	
Poor/Fair	41 (10.8%)
Good	201 (52.8%)
Very good	109 (28.6%)
Excellent	30 (7.9%)
COVID-19 testing status	
Not tested	297 (78.0%)
Tested	84 (22.0%)
Vaccine status	
No	46 (12.1%)
Yes	335 (87.9%)
Fear of COVID-19	
Not fearful	174 (45.7%)
Fearful	207 (54.3%)
Exposure to information	
Never/sometimes/occasionally	150 (39.4%)
Often/always	231 (60.6%)
Usage of social and electronic media	
Decreased	86 (22.6%)
About the same	58 (15.2%)
Increased	237 (62.2%)

Determinants of Stress Among Teachers During the COVID-19 Pandemic

Table 4 indicated that the MLR model for stress is significant [R^2 Adjusted = 0.312, F (20,360) = 9.63, $p < 0.000$] and showed that teachers' age, institution, self-reported health status, fear of COVID-19, and usage of social and electronic media were significantly associated with stress among teachers during the COVID-19 pandemic. Findings demonstrated that teachers with the age group 31–40 years and 41 or more years of age were less stressed compared to teachers younger than 30 years of age. College teachers showed 2.23 units lower stress symptoms than schoolteachers during the COVID-19 pandemic. Compared to the teacher who did not have a COVID test, a teacher with a COVID test was 2.17 times less stressed. Teachers with good and excellent health status were 1.87 and 2.88 units less stressed, respectively. However, teachers with heightened fear of COVID-19 experienced a 2.37 unit increase in stress level compared to teachers who were not afraid of COVID-19. Findings also showed that teachers experienced 3.49 units and 2.95 units reduction in stress with increased usage of social and electronic media and keeping the same usage, respectively.

DISCUSSION

This study aimed to assess the mental health status of teachers and to identify the possible risk factors. This study indicated that the prevalence of depression, anxiety, and stress among teachers was 35.4%, 43.7%, and 6.6%, respectively. The latest nationwide survey in 2019 suggested that the overall prevalence of depression, anxiety, and stress among the Bangladeshi population was 6.7%, 4.5%, and 2.1%, respectively, (53). It is, therefore, evident that teachers have experienced heightened mental health problems during the COVID-19 pandemic in Bangladesh. However, studies in Spain showed that the prevalence of mental health problems was more than 30% (depression) and 50% (anxiety and stress), respectively, among the Spanish teachers (33, 38). A two-phase study in Poland indicated that the mental health of teachers, e.g., depression, anxiety, and stress, deteriorated over time, from over 40% in September and October 2020 to over 50% in December 2020 and February 2021 (39). From the findings, it is suggested that teachers have been going through intensified mental health problems in the world during the pandemic largely due to growing household responsibilities (30), unpaid work overload, prolonged home confinement, sense of

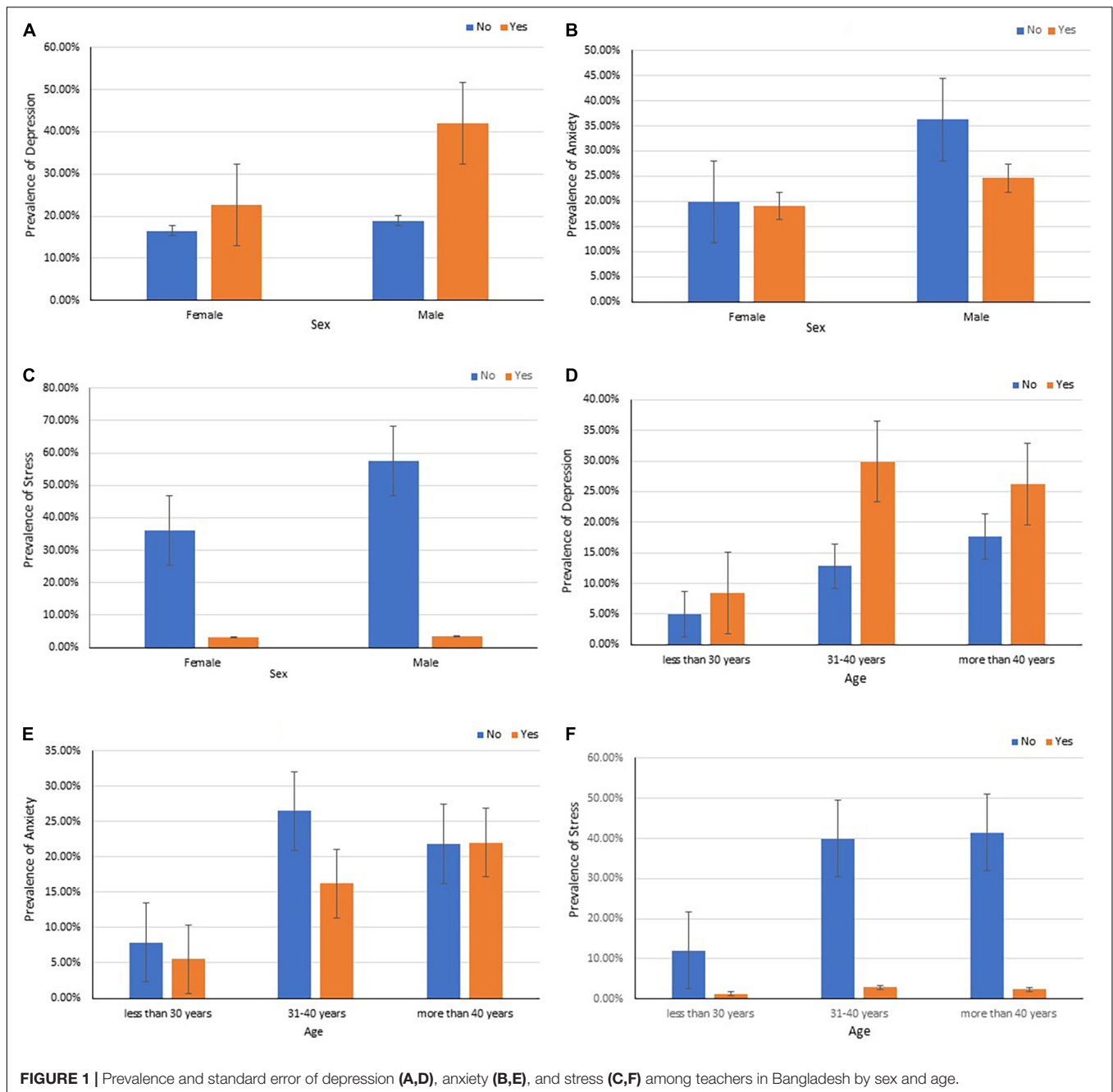


FIGURE 1 | Prevalence and standard error of depression (A,D), anxiety (B,E), and stress (C,F) among teachers in Bangladesh by sex and age.

uncertainty over work and life, loss of loved ones during the COVID-19 pandemic as well as non-stop exposure to negative news on social and electronic media (14, 33, 38, 42). If not appropriately addressed, the academia and education system worldwide may face further challenges in continuing academic and administrative works.

Findings from the bivariate analysis showed that male teachers were experiencing more mental health problems than their female colleagues, and likewise, teachers older than 31 years of age were also suffering from depression, anxiety, and stress compared to their colleagues younger than 30 years of

age. However, adjusted models of linear regression found no significant impact of sex and age on depression, anxiety, and stress. Previous studies showed more or less similar results. For example, a Chinese study noted that older teachers were more likely to experience a higher incidence of PTSD than their younger colleagues (34). However, female teachers suffered from a higher incidence of PTSD than their male colleagues. Other studies also correspond the same observations regarding the dynamics between age and sex structure with mental health problems among teachers during the COVID-19 (33, 35). Findings show that teachers, irrespective of age and sex,

TABLE 2 | Predicting depression among teachers during the COVID-19 pandemic.

Variable	Simple linear regression model						Multiple linear regression model					
	B	β	t	P-value	95% CI		B	β	t	P-value	95% CI	
					Lower value	Upper value					Lower value	Upper value
Age												
≤30 ^{ref}												
31–40	−1.840	−0.181	−2.29	0.023	−3.420	−0.260	−1.509	−0.148	−1.88	0.060	−3.085	0.066
≥41	−0.796	−0.079	−0.99	0.321	−2.371	0.780	−1.435	−0.142	−1.60	0.110	−3.199	0.327
Sex												
Female^{ref}												
Male	−1.514	−0.147	−2.89	0.004	−2.544	−0.484	−0.805	−0.078	−1.77	0.077	−1.69	0.087
Place of residence												
Rural^{ref}												
Urban	−3.747	−0.367	−7.68	0.000	−4.707	−2.788	−1.370	−0.134	−2.39	0.017	−2.497	−0.243
Marital status												
Unmarried^{ref}												
Married	−0.730	−0.047	−0.81	0.416	−2.491	1.033	−0.406	−0.026	−0.51	0.611	−1.977	1.164
Others	0.214	0.007	0.12	0.906	−3.343	3.771	0.678	0.022	0.45	0.656	−2.316	3.672
Institution												
School^{ref}												
College	−5.498	−0.529	−10.14	0.000	−6.563	−4.432	−2.530	−0.243	−2.55	0.011	−4.483	−0.576
University	−3.798	−0.341	−6.54	0.000	−4.940	−2.656	−1.620	−0.146	−1.51	0.133	−3.736	0.495
Education												
Master^{ref}												
PhD	−3.182	−0.153	−3.03	0.003	−5.249	−1.115	−1.259	−0.061	−1.01	0.315	−3.718	1.199
Designation												
Assistant/senior teacher/demonstrator^{ref}												
Lecturer/Assistant Professor	−2.876	−0.285	−5.58	0.000	−3.889	−1.863	0.516	0.051	0.70	0.487	−0.943	1.975
Associate Professor/Professor	−4.285	−0.246	−4.82	0.000	−6.033	−2.536	0.657	0.038	0.52	0.602	−1.823	3.139
Self-reported health												
Poor/Fair^{ref}												
Good	−0.339	−0.034	−0.39	0.694	−2.036	1.356	−1.179	−0.117	−1.57	0.118	−2.661	0.302
Very good	−1.244	−0.112	−1.35	0.178	−3.058	0.570	−2.063	−0.185	−2.54	0.011	−3.658	−0.467
Excellent	0.1626	0.008	0.13	0.893	−2.216	2.541	−2.352	−0.126	−2.23	0.026	−4.426	−0.279
COVID-19 testing status												
Not tested^{ref}												
Tested	−2.511	−0.207	−4.12	0.000	−3.712	−1.312	−0.978	−0.081	−1.82	0.069	−2.035	0.077
Vaccine status												
No^{ref}												
Yes	0.416	0.027	0.52	0.600	−1.143	1.975	0.090	0.006	0.12	0.902	−1.349	1.530
Fear of COVID-19												
Not fearful^{ref}												
Fearful	4.112	0.407	8.68	0.000	3.181	5.045	2.402	0.238	5.08	0.000	1.472	3.333
Exposure to information												
Never/sometimes/occasionally^{ref}												
Often/always	2.202	0.214	4.26	0.000	1.185	3.218	0.150	0.015	0.32	0.749	−0.773	1.074
Usage of social and electronic media												
Decreased^{ref}												
About the same	−4.753	−0.339	−6.07	0.000	−6.291	−3.214	−2.130	−0.152	−2.68	0.008	−3.696	−0.565
Increased	−4.991	−0.481	−8.61	0.000	−6.131	−3.852	−2.727	−0.262	−4.03	0.000	−4.059	−1.394

^BUnstandardized Coefficient, ^βStandardized Coefficient, ^{CI}Confidence interval, and ^{ref}Reference category.

were experiencing mental health problems; however, male and older teachers showed higher symptoms of depression, anxiety, and stress. Because in Bangladesh, most of the households are headed by male, and they are solely responsible to provide basic necessities. The prolonged home confinement, together with

countrywide lockdown, made it impossible for household heads, males in particular, to engage in regular income-generating activities or alternative livelihood opportunities to survive during the hardship (5, 23, 54). Therefore, male teachers may have experienced heightened mental health problems. In contrast,

TABLE 3 | Predicting anxiety among teachers during the COVID-19 pandemic.

Variable	Simple linear regression model						Multiple linear regression model					
	B	β	t	P-value	95% CI		B	β	t	P-value	95% CI	
					Lower value	Upper value					Lower value	Upper value
Age												
≤30 ^{ref}												
31–40	−0.972	−0.102	−1.29	0.199	−2.459	0.514	−1.467	−0.154	−1.88	0.060	−2.998	0.064
≥41	0.068	0.007	0.09	0.928	−1.414	1.551	−1.362	−0.143	−1.56	0.119	−3.076	0.351
Sex												
Female ^{ref}												
Male	−0.877	−0.091	−1.77	0.077	−1.850	0.096	−0.291	−0.030	−0.66	0.509	−1.158	0.576
Place of residence												
Rural ^{ref}												
Urban	−3.403	−0.355	−7.39	0.000	−4.308	−2.498	−0.916	−0.096	−1.65	0.101	−2.011	0.178
Marital status												
Unmarried ^{ref}												
Married	−0.097	−0.007	−0.12	0.908	−1.753	1.558	−0.130	−0.009	−0.17	0.867	−1.656	1.396
Others	0.457	0.015	0.27	0.788	−2.885	3.799	0.774	0.026	0.52	0.601	−2.135	3.684
Institution												
School ^{ref}												
College	−5.127	−0.526	−10.16	0.000	−6.119	−4.135	−2.759	−0.282	−2.86	0.005	−4.657	−0.861
University	−4.272	−0.409	−7.91	0.000	−5.335	−3.209	−2.447	−0.234	−2.34	0.020	−4.503	−0.391
Education												
Master ^{ref}												
PhD	−3.372	−0.173	−3.43	0.001	−5.306	−1.439	−1.889	−0.097	−1.55	0.121	−4.278	0.500
Designation												
Assistant/senior teacher/demonstrator ^{ref}												
Lecturer/Assistant Professor	−3.149	−0.332	−6.62	0.000	−4.085	−2.214	0.235	0.025	0.33	0.745	−1.182	1.653
Associate Professor/Professor	−4.352	−0.266	−5.30	0.000	−5.967	−2.737	0.809	0.049	0.66	0.510	1.602	3.220
Self-reported health												
Poor/Fair ^{ref}												
Good	0.750	0.079	0.92	0.356	−0.845	2.346	−0.232	−0.025	−0.32	0.751	−1.672	1.207
Very good	0.505	0.048	0.58	0.561	−1.201	2.212	−0.563	−0.054	−0.72	0.475	−2.113	0.986
Excellent	1.380	0.079	1.21	0.226	−0.857	3.618	−0.952	−0.054	−0.93	0.353	−2.966	1.062
COVID-19 testing status												
Not tested ^{ref}												
Tested	−2.366	−0.208	−4.13	0.000	−3.492	−1.241	−0.852	−0.075	−1.63	0.103	−1.878	0.173
Vaccine status												
No ^{ref}												
Yes	1.037	0.072	1.40	0.163	−0.422	2.498	0.286	0.019	0.40	0.688	−1.112	1.685
Fear of COVID-19												
Not fearful ^{ref}												
Fearful	3.704	0.391	8.26	0.000	2.822	4.585	2.183	0.230	4.75	0.000	1.279	3.087
Exposure to information												
Never/sometimes/occasionally ^{ref}												
Often/always	1.905	0.197	3.91	0.000	0.948	2.863	0.091	0.009	0.20	0.840	−0.805	0.989
Usage of social and electronic media												
Decreased ^{ref}												
About the same	−3.622	−0.276	−4.87	0.000	−5.086	−2.159	−0.721	−0.055	−0.93	0.352	−2.242	0.800
Increased	−4.427	−0.454	−8.03	0.000	−5.512	−3.343	−1.730	−0.177	−2.63	0.009	−3.025	−0.435

^BUnstandardized Coefficient, ^{β} Standardized Coefficient, ^{CI}Confidence interval, and ^{ref}Reference category.

older people are more susceptible to the COVID-19 infection, and the death rate for older people was higher than that of younger people (55); hence, older people were experiencing more health problems. Thus, it is necessary to provide age and sex-specific mental health services to teachers at all levels, both in

Bangladesh and other developing and developed countries. It should be noted that the prolonged COVID-19 pandemic could generate similar situations across the globe.

This study also found that teachers working at colleges and universities were less likely to suffer from depression, anxiety, and

TABLE 4 | Predicting stress among teachers during the COVID-19 pandemic.

Variable	Simple linear regression model						Multiple linear regression model					
	B	β	t	P-value	95% CI		B	β	t	P-value	95% CI	
					Lower value	Upper value					Lower value	Upper value
Age												
≤ 30 ^{ref}												
31–40	–1.592	–0.159	–2.02	0.044	–3.141	–0.043	–1.708	–0.172	–2.13	0.034	–3.287	–0.130
≥ 41	–0.706	–0.071	–0.90	0.369	–2.250	0.838	–2.235	–0.225	–2.49	0.013	–4.002	–0.468
Sex												
Female ^{ref}												
Male	–1.345	–0.133	–2.62	0.009	–2.354	–0.335	–0.602	–0.059	–1.32	0.186	–1.496	0.291
Place of residence												
Rural ^{ref}												
Urban	–2.960	–0.296	–6.04	0.000	–3.924	–1.996	–0.778	–0.078	–1.36	0.176	–1.907	0.349
Marital status												
Unmarried ^{ref}												
Married	–0.211	–0.014	–0.24	0.810	–1.935	1.513	0.377	0.025	0.47	0.637	–1.195	1.950
Others	1.285	0.042	0.73	0.468	–2.195	4.766	1.868	0.061	1.22	0.221	–1.131	4.867
Institution												
School ^{ref}												
College	–4.576	–0.450	–8.32	0.000	–5.657	–3.495	–2.229	–0.219	–2.24	0.026	–4.185	–0.272
University	–3.324	–0.305	–5.64	0.000	–4.482	–2.166	–1.897	–0.174	–1.76	0.079	–4.016	0.222
Education												
Master ^{ref}												
PhD	–2.877	–0.142	–2.79	0.006	–4.903	–0.851	–1.880	–0.093	–1.50	0.134	–4.343	0.582
Designation												
Assistant/senior teacher/demonstrator ^{ref}												
Lecturer/Assistant Professor	–2.188	–0.221	–4.24	0.000	–3.201	–1.173	1.322	0.134	1.78	0.076	–0.138	2.784
Associate Professor/Professor	–3.116	–0.183	–3.50	0.000	–4.866	–1.365	2.361	0.139	1.87	0.063	–0.124	4.846
Self-reported health												
Poor/Fair ^{ref}												
Good	–0.153	–0.015	–0.18	0.857	–1.811	1.506	–0.761	–0.077	–1.01	0.314	–2.245	0.722
Very good	–1.242	–0.114	–1.38	0.169	–3.016	0.532	–1.874	–0.172	–2.31	0.022	–3.472	–0.276
Excellent	–0.395	–0.022	–0.33	0.738	–2.722	1.930	–2.877	–0.157	–2.72	0.007	–4.953	–0.800
COVID-19 testing status												
Not tested ^{ref}												
Tested	–2.175	–0.183	–3.63	0.000	–3.354	–0.996	–0.862	–0.073	–1.60	0.110	–1.920	0.195
Vaccine status												
No ^{ref}												
Yes	0.758	0.050	0.98	0.329	–0.766	2.283	0.768	0.051	1.05	0.295	–0.673	2.211
Fear of COVID-19												
Not fearful ^{ref}												
Fearful	3.893	0.394	8.34	0.000	2.975	4.850	2.375	0.240	5.01	0.000	1.443	3.306
Exposure to information												
Never/sometimes/occasionally ^{ref}												
Often/always	2.202	0.248	4.98	0.000	1.514	3.486	0.551	0.055	1.17	0.242	–0.373	1.477
Usage of social and electronic media												
Decreased ^{ref}												
About the same	–4.857	–0.354	–6.35	0.000	–6.363	–3.352	–2.954	–0.216	–3.70	0.000	–4.522	–1.386
Increased	–4.946	–0.477	–8.55	0.000	–5.961	–3.731	–3.495	–0.344	–5.15	0.000	–4.830	–2.161

^BUnstandardized Coefficient, ^{β} Standardized Coefficient, ^{CI}Confidence interval, and ^{ref}Reference category.

stress compared to schoolteachers. Previous studies also showed that school teachers were more likely to suffer from mental health problems during the COVID-19 than their contemporary college and university teachers (35, 56). The higher mental health issues among school teachers could be generated either

from their low socioeconomic status (57, 58) to deal with the COVID-19 induced unstable socioeconomic conditions or from the additional academic burdens following the sudden switch from traditional lecture-theater based education to online platform-based education (37, 40). Considering the situation, it

is recommended for policymakers to initiate job-specific mental health services that would take into account the socioeconomic condition as well as work-related burdens when implementing different measures to deal with mental health issues, especially during the outbreak of a disease like the COVID-19.

The current study also exhibited that teachers with better health status and greater usage of social and electronic media had lower chances of experiencing depression, anxiety, and stress. These results complement the existing literature that showed people with physical illness were more likely to suffer from depression, anxiety, and stress than people without any physical ailments (33, 41). Regarding social and electronic media usage, previous studies showed that over-exposure to information during the COVID-19 increased mental health problems, including depression and anxiety (13, 14). However, the insights of the teachers gained from work experience and long educational history could allow them to differentiate between “information” and “misinformation,” and it may help them to be more conscious of the risk of the COVID-19.

Besides, the current study showed a positive relationship between fear of COVID-19 and the heightened mental health problems among teachers, and such a result adheres with recent studies conducted during the COVID-19 pandemic (7). For example, a study in China observed that people living with high fear of COVID-19 showed greater symptoms of anxiety (35). Another study also found that fear of COVID-19 directly or indirectly influenced the incidence of PTSD among teachers in China (59). The physical illness or the experience of COVID-19 infection by the teachers or by their family members could trigger the fear of COVID-19 (33, 38). This study, however, did not investigate the influence of COVID-19 infection on fear of COVID-19; therefore, it suggests further research to assess how the experience of teachers shaped their mental health problems.

STRENGTHS AND LIMITATIONS

This study has specific strong points. To our knowledge, this is the only study that explored the prevalence of depression, anxiety, and stress among teachers from all the divisions of Bangladesh during the COVID-19 pandemic. In this study, data were collected through the online platform to maintain the “social distancing” and reduce the risk of “human-to-human” infections. Besides, data regarding the teachers’ mental health were collected through a globally approved and reliable standardized questionnaire – DASS 21. Nevertheless, some limitations should be considered. This is a cross-sectional study; therefore, causality cannot be established. The participants were teachers, and it may limit the generalizability of the findings to other professional groups. The sample was selected using non-probability sampling, where the participants self-evaluated their mental health status, and such approaches may also limit the generalizability of the results. Moreover, the adjusted models identified some crucial determinants of teachers’ mental health, yet there may be a possibility of residual confounding; thus, more extensive research on a nationally representative population is required.

CONCLUSION AND RECOMMENDATIONS

The COVID-19 pandemic led to a heightened prevalence of depression, anxiety, and stress among teachers in Bangladesh. It is apparent that age, sex, residence, health condition as well as exposure to social and electronic media significantly influenced the incidence of mental health problems among teachers. Based on the outcomes of the study, it is strongly recommended that the government and its policymakers should devise effective measures to assess the mental health problems of teachers at individual, community, and institutional levels. The concerned authority should implement mental health services integrating individuals, close-relationship, and relevant other socioeconomic and politico-cultural factors to detect and minimize mental health problems during the COVID-19 pandemic and similar other emergency and non-emergency situations to ensure quality education, including the on-campus and off-campus/online education. Moreover, the authority should plan and implement programs aiming to establish and strengthen mental health services in each university, and a specific mental health center for cluster of schools and college. Because it is well evident that teachers’ mental health influences the wellbeing of their students as well as the guardians and the development of a nation.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Khulna University Ethical Clearance Committee. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

MTH: conceptualization, investigation, data curation, formal analysis, methodology, resources, software, and writing – original draft. MAI, NJ, and MN: data curation, formal analysis, software, and writing – original draft. MS, MR, MMI, MZH, and MNI: investigation and resources. FD, KH, RA, LS, ZM, and MNI: resources and writing – original draft. All authors contributed to the article and approved the submitted version.

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EDITED BY

Renato de Filippis,
Magna Graecia University, Italy

REVIEWED BY

M. Alvi Syahrin,
Immigration Polytechnic, Indonesia
Carlos Miguel Rios-González,
National University of
Caaguazú, Paraguay

*CORRESPONDENCE

Mehrdad Eftekhari Ardebili
mehrdad.eftekhari@gmail.com

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War, immigration and COVID-19: The experience of Afghan immigrants to Iran Amid the pandemic

Homa Mohammadsadeghi¹, Solmaz Bazrafshan¹,
Negar Seify-Moghadam¹, Golnaz Mazaheri Nejad Fard²,
Maryam Rasoulzadeh¹ and Mehrdad Eftekhari Ardebili^{1*}

¹Psychiatry Department, Medical School, Iran University of Medical Sciences, Tehran, Iran,

²Psychology Department, Shahid Beheshti University, Tehran, Iran

Introduction: Afghanistan's domestic upheaval following the Taliban's invasion leads to massive displacement of its population. The number of Afghan refugees in Iran has dramatically increased since the Taliban's takeover of Afghanistan in August 2021. Multiple pre-and post-migratory traumatic experiences affect immigrants' physical, psychological, social, and economic wellbeing. The coronavirus outbreak, considered a traumatic experience in human life in the 21st century, added to their problems in Iran and exposed them to new challenges. This qualitative study aimed to investigate their experiences early before, during, and after immigration and the pandemic's challenges to their lives in Iran.

Methods: In the present qualitative study, ten Afghan residents living in Iran who immigrated to Iran legally or illegally since the summer of 2021 and the last year after the second Taliban invasion were selected via purposive sampling. A semi-structured interview was applied to gather the data, and the data were analyzed through Braun and Clarke's thematic analysis method.

Results: Ten male participants with a mean age of 26 y/o were interviewed. Their residence in Iran was between 20 days and 8 months. Four main themes were extracted. The first theme, the *Tsunami of suffering*, represents a disruption of the normal flow of life. Six subthemes, including loss, being near death, insecurity, sudden hopelessness, leaving the country involuntarily, and reluctance to explore underlying emotions, are included in this category. The second one, *Lost in space*, describes the participant's attempt to leave Afghanistan following the extensive losses and violent death threats. Their experiences are categorized into four subthemes: the miserable trip, encountering death, life-threatening experiences, and being physically and verbally abused. The third theme, with its five subthemes, try to demonstrate the participants' experiences after getting to their destination in Iran. The last one, *Challenges of the COVID-19* explained the experience of Taliban return, war trauma, running away, and living as a refugee or immigrant coincided with the COVID pandemic.

Discussion: Our interviewees explained multiple and successive traumatic experiences of war, migration, and the pandemic. The central clinical features of survivors are fears of losing control, being overwhelmed, and inability to

cope. They felt abandoned because not only lost their family support in their homeland but could not also receive support in Iran due to the pandemic-related social distancing and isolation. They were dissociated and emotionally numb when describing their experience, which is a hallmark of experiencing severe, unprocessed traumas.

Conclusion: Gaining a better understanding of Afghan refugees lived experiences may help provide them with better social and health care support. Proper mental and physical healthcare support and de-stigmatization programs may reduce the impact of multiple traumas on their wellbeing.

KEYWORDS

war, immigration, COVID-19, Afghan, Iran

Introduction

Taliban emerged in Afghanistan in the mid-1990s following the withdrawal of Soviet troops, the collapse of Afghanistan's communist regime, and the subsequent breakdown in civil order. This domestic upheaval leads to massive displacement of its population (1). Afghan refugees comprise the largest refugee population in the world (2). The number of Afghan refugees in Iran has dramatically increased since the Taliban's takeover of Afghanistan in August 2021. About five thousand people arrive daily after the takeover, compared to two thousand people beforehand (3). Iran and Pakistan have been the primary host of Afghan refugees for over three decades (1). According to the most recent numbers from October 2020, 2,250,000 undocumented Afghans live in Iran out of 3,636,000. At the same time, 586,000 Afghans have passports, including those on student and extended family visas. Additionally, 780,000 Afghans are refugees (3).

Migration can be a psychological and physical trauma, mainly when it occurs forcefully and involuntarily. People flee to save their lives. It is inevitable, unavoidable, and is not their choice. Multiple pre-migratory stressors such as war, violence, insecurity, torture, murder, homelessness, and starvation force them to leave their home country (4–6). They are looking for a place where they could have opportunities to experience a peaceful and safe present and possible future (7). This unsafe and involuntary migration affects immigrants' physical, psychological, social, and economic wellbeing (8).

It is optimistic if we think it is the end of their miseries. There was frequent physical and psychological trauma along the way, and they experienced many difficulties in the host country (4). After migration, new problems would emerge once they arrive in the new place, and they should struggle with finding work, accommodation, stigmatization, health issues, and multiple losses (2, 6). Because of all these pre- and post-migratory traumatic experiences, they are vulnerable to developing severe mental disorders, post-traumatic stress disorder, mood disorders, and anxiety disorders (2, 9).

The coronavirus outbreak is also a traumatic experience in human life in the 21st century. It seriously impacts mental and physical health, economic and social conditions, and it has revealed that the human being is biologically vulnerable and fragile (10). COVID-19 was first identified in Wuhan, China, in Dec 2019, then spread rapidly to other countries (11). On February 19, 2020, the first cases of Covid-19 were reported in Iran (12). Until March 25, 2022, the disease has infected 7,145,877 people in Iran, and unfortunately, 139,865 of them have died (13).

The disease's unclear and unpredictable nature, the pandemic's unknown end time, and the seriousness of the condition were the major concerns that produced anxiety and disappointment. Social and interpersonal communication has been restricted, and family conflicts have increased due to home quarantines (12).

Refugees are a highly vulnerable subgroup of the population and are at higher risk in the pandemic (14). COVID-19 added to Afghans problems in Iran and exposed them to new challenges (15). Such as poor socioeconomic conditions and accessibility to health care services (14). While the importance of family support to psychological wellbeing is undeniable, Afghan immigrants have also lost this support system through forced relocation, disrupting tight family bonds and socialization during the pandemic (2).

There is not much research available to address this specific issue of an Afghan refugee living in Iran during the Taliban invasion and the pandemic. In this qualitative study, we explored their lived experience early before, during, and after the immigration and the pandemic's challenges to their lives.

Methods

In this qualitative research, the study population included Afghan residents living legally or illegally in Iran who have immigrated to Iran legally or illegally since the summer of 2021 and during the last year after the second Taliban invasion. We

selected the participants *via* the purposive sampling method, which continued until data saturation. The inclusion criteria consisted of age (at least 18 years old), fluency in the Persian language, having at least a high school diploma, no current drug abuse (not in the period of withdrawal or intoxication), and voluntarily acceptance to participate in the study. The exclusion criteria were a history of serious medical diseases such as cancer, diabetes and heart disease, the history of psychiatry and neurological disorders that interfered with the interview. At the beginning of the interview, we asked about the exclusion criteria.

The primary data collection tool was the semi-structured interview with participants. First, the interview guide was prepared, and then the text of the questions was read by several experienced experts. Questions were designed to be open-ended with a focus on the topic in the form of an interview guide. The interview guide ensured that the same information was obtained from all participants.

Initially, Afghan immigrants who wished to share their experiences with the researchers were selected among the available individuals regarding the inclusion and exclusion criteria. Before interviewing, the aim of the study was explained to the volunteers, and the confidentiality issues were discussed. The permission to record the interview was obtained concerning the proper protection of the audio documents. The participants ensured that the information would be applied just for the research without revealing their identity. The right to leave the interview at any time was among the other ethical considerations of the present study. The individuals then entered the process of a 1-h interview. During the interviews, there were two facilitators, one conducting the interview and the other recording the participants' feelings and reactions. Data collection continued to acquire relative saturation. Eventually, ten individuals were interviewed.

For managing, organizing and analyzing the data, Braun and Clarke's thematic analysis method (16, 17) was used. The recorded interviews were first transcribed in Word software for the content analysis. Then, the text was read several times, and the meaning units were extracted to understand the interviews' content in line with the research question. The codes were summarized and classified according to their similarity in the following. The information obtained was then discussed in meetings with the research team.

In order to evaluate the validity, credibility, and dependability of the research findings, two review methods, member check and peer reviewers check, were applied. After completing the data analysis, the findings were checked with the individuals who participated in the study. The data were analyzed again by another expert and compared to the analysis results of the researchers of the present study.

Ethics

The study was approved by the Mental Health Research center at the Iran University of Medical Sciences (IUMS). All participants filed an informed consent form reviewed and approved by the Ethics Committee of IUMS. The researchers keep the names of the participants confidential and do not disclose information that may lead them to be recognized.

Results

Ten male participants aged 19 to 45 (mean age = 26) were interviewed. Their residence in Iran was between 20 days and 8 months. Six participants were refugees, and 4 were immigrants. Four were single, and the rest (6) were married.

Tsunami of suffering

This theme represents widespread changes, disruption of normal flow of life, and impending danger of being murdered, which leads to widespread community fear. The changes took place rapidly and affected their life negatively in different ways; many aspects of their lives were influenced. The experiences are represented in six subthemes: loss, near death, insecurity, sudden hopelessness, leaving the country involuntarily, and reluctance to explore underlying emotions. The last subtheme is derived from interviewer notes and was seen in all participants; and reaffirmed by supplementary interviews with another interviewer. Table 1 shows the sub-themes, codes, and quotations of the Tsunami of suffering theme.

Lost in space/dangerous escape to Iran

The participants attempted to leave Afghanistan after extensive losses and violent death threats. However, this was not easy. They had to leave the country secretly and illegally and with the help of human traffickers. They had to tolerate misery in Afghanistan and Iran and take considerable risks on this journey. The participants' experiences in this trip are categorized into four subthemes: the miserable trip, encountering death, life-threatening experiences, and being physically and verbally abused. Table 2 shows the sub-themes, codes, and quotations of the Traumatic Escape theme.

From being a citizen to being a refugee

This theme is about the participants' experiences after getting to their destination in Iran. The related data are categorized into five sub-themes: stigma, awful condition of employment and difficulties in getting them, being away from

TABLE 1 Sub-themes, codes, and quotations of the Tsunami of suffering theme.

Sub-themes	Codes	Quotations
Loss	Becoming jobless	I was engaged in agriculture; I had my own shop. We would live on our own land. We abandoned all. All ran away.
	Becoming unhealthy and injured	I was a welder working for the Afghanistan military in the repair and maintenance section. When the Taliban rose to power, they closed that section.
	Becoming homeless	They bombed our station. My back was injured. Now I have limitations in work.
Being near death	Witnessing murder	Taliban Attacked our home several times. Our home was destroyed.
	Violence	We encountered the Taliban, and a bullet hit me. My brother was murdered.
		The Taliban would not let soldiers of the previous government stay alive.
		Governmental agents and people collaborating with the previous government were hit, imprisoned, and killed.
	Home under fire	Taliban would come near our house, shooting at it. We were at home while bullets hit our house. Our house was ruined.
	Torture	They hit my father several times to tell them my place.
Insecurity	Live secretly to save life	I would live secretly and would change my place frequently. There was a fight for life.
		Many Afghans saved money in banks. When the war began, banks closed instantaneously. Anyone who had money in banks lost it.
	Life threats	I was given a murder sentence both by phone and face-to-face in the attack on our home. They told me I was Shia and I should be the follower of true Islam again and start over.
	Economic insecurity	Many Afghans saved money in banks. When the war began, banks closed instantaneously. Anyone who had money in banks lost it.
Sudden hopelessness	Hopelessness	A kind of mental disorder afflicted all. All people's hopes gave way to hopelessness. When hope is gone, nothing remains except anarchy; people are just alive by hope. A huge wave of hopelessness suddenly broke on the people, especially young ones; they were suddenly hopeless about the future.
Leaving the country involuntarily	Abandoning the country to save the life	If I had not had to come to Iran, I wouldn't have been here. Who abandons his own home? Only God knows what I feel. I came here just to save my life.
	Economic reason for leaving	I was a tailor. After beginning the war, the people no longer had money to make clothes. I had to come to Iran.
Reluctancy to explore underlying emotions	Not willing to talk about feelings	Interviewer's note: He changed the topic after I asked him to talk about his emotional reaction to war trauma.
		Interviewer's note: I tried encouraging him to talk about his feelings, but I failed.

one's home and family, support of compatriots and friends, and reasons for staying in Iran.

The stigma sub-theme describes how the participants are viewed and treated differently because of their nationality. The second sub-theme, related to stigma, represents the participants' struggles to find a job and their particular problems in the workplace. One significant misery of them is being away from their families. Some of them did not have any news from their family. Amongst these stresses, the help and support of a friend or compatriot play a significant role in spending the initial period on finding a job and adapting to the situation. The last sub-theme explains that they endure the condition and stay here

despite their complex condition in Iran. Table 3 shows the sub-themes, codes, and quotations of the From Being a Citizen to Being a Refugee theme.

Challenges of the COVID-19

The experience of Taliban return, war trauma, running away, and living as a refugee or immigrant coincided with the COVID pandemic. The first sub-theme shows the participants' beliefs that COVID-19 was not a priority in their country and had to deal with more critical problems. They got used to hearing the

TABLE 2 Sub-themes, codes and quotations of the Traumatic Escape theme.

Sub-themes	Codes	Quotations
The miserable trip	Crying for misery	I suffered real misery on my journey to Iran. It was a fate worse than death. I had been crying every day, complaining to God about my condition.
Encountering death	Hunger	We had to walk for hours on the border of Iran. We were suffering from hunger.
	Feeling of being struck by a bullet	After crossing the border, an agent shot me just before getting to Iran-Shahr; we ran away; I supposed I was struck. Then I called the trafficker; he became angry about why we went far away and insulted me by saying obscene words.
	Being shot	... we went to the (Tajikistan) border; we slept on the plain, we struggled to cross the border, but we couldn't. Tajikistan's agents were shooting us. Many were hit and killed there.
Life-threatening experiences	Ready to die	You should be ready to die. We sit in a car, and if you say anything, you are done.
	Risk of death	16–18 people got into a sedan car to pass cities and the border. The car could be fired a volley of bullets. Drivers smoke heroin or opium. They are high and drive recklessly over 160 km/hr.
Being physically and verbally abused	Being beaten	We passed Pakistan's border hardly. We were 35 people who got on a Toyota pickup. The trafficker would yell continuously at us to sit down. I said my feet were broken. We were hit and insulted a lot there. If you say anything, they use dirty words and bit you.
	Harassment	I was interrogated about where I had come and what I had been doing for my life to make sure I was not from Isis. They looked in my bag and pockets. They upset you. They insult you. They empty your bag. There were both Taliban and Isis on the way. They stopped us. Hit us and took our money. If you say you are Shia, they take you and hit you. They hit. They kill.
	Cruel behavior	We were in the trunk of a Peugeot. Once I asked him to pull back the black cloth because I was unable to breathe. We were in a small and closed space. He said lots of obscene words. I felt I was dying.

death of people without doing something against it. The second sub-theme is about failures of the health system against COVID-19 both in Iran and Afghanistan. The participants' problems in getting vaccinated in Iran are represented as the third sub-theme. Due to the restricted social network of the participants in Iran, the restriction imposed by COVID-19 had a significant effect on them and led to more social isolation. Table 4 shows the sub-themes, codes, and quotations of the Challenges of the COVID-19 theme.

Discussion

This study explored the inner experiences of war induced sudden breakdown of the lives of Afghans, the traumatic escape, a change from being a citizen to a refugee, and their reciprocal interaction with the worldwide challenges of COVID-19 pandemic. War is an objective and massive trauma that severely impacts individuals' mental and physical health. While Afghan people fled to save their lives after the Taliban currently took over the country, they had challenging experiences during and after their migration. Iran has been

a host country for Afghan immigrants and refugees for the last three decades. However, during the pandemic crisis, the experience of relocation was more complicated.

Interviewing ten Afghan immigrants, *the Tsunami of suffering* was the main theme of their lived experience in recent years. They lost their job, home, and physical wellbeing. The survivors who accepted to interview were near death; they witnessed murder, violence, torture, and their home under fire. They felt insecure and hopeless and forced to leave the country either as a refugee or by holding a Visa. We found that they were reluctant to express their emotions, a hallmark of being seriously traumatized.

We found another main theme; the *feeling of being lost in space* while they had to escape to Iran. They explained their miserable trip and encountering death in their journey. They experienced life-threatening events and were physically and verbally abused.

The third main theme was the *feeling of transforming from a citizen in their homeland to a refugee in their host country*. They felt discriminated against and stigmatized. They explained the awful condition of employment and difficulties in maintaining their job, resulting in hopelessness and depression.

TABLE 3 Sub-themes, codes and quotations of the From Being a Citizen to Being a Refugee theme.

Sub-themes	Codes	Quotations
Stigma	Abuse	If you come to Iran from Afghanistan, you must put your life on the line. They treat you like a sheep, hit you, take your money, get your right, and if you say anything in return, you are fired.
	Looking different	On this trip to Iran, I have another feeling. People look at me differently.
	Rejecting attitude	No one let us enter his home when he knows we are Afghan.
	Verbal and physical punishments in camps	The Police arrested me for not having a visa, and I was taken to ... camp. I saw a non-human situation. They would hit all severely and use obscene words.
	Humiliation	You are not called by your name in all cities across Iran, such as Tehran, Isfahan, and Shiraz. They use 'this' to call you instead. If you go to other countries, you are respected. Iranians do not even mention your name.
Awful condition of employments and difficulties in getting them	Unstable jobs	There was construction work. I worked for 2 days, and then they told me they did not need me anymore. I sought a job and went somewhere, but I did not find any. They find an excuse to fire me. They criticize me, saying I do not have skills. They find a justification to expel you.
	Abuse by employer	I used to weld in Tehran. My employer postponed my salary several times. My brother had a car accident. I called my employer four times and told him I needed money. I asked him to give me a part of it. But he didn't. In the end, I gave up.
	Limitations	As I don't have a visa, I can't work, go out, do any recreational activities, or take a trip.
Being away from one's home and family	Not in contact with family	I haven't heard anything from my family. The home's telephone is off. I called someone and asked him to take the phone to my family, but the attempt was not successful.
	Away from family	I am far away from my wife and children, and this is the most difficult thing. I feel miserable. I am always sad. Why we Afghans are so dejected. We can't spend a couple of good days with our families.
Support of compatriots and friends	Support of a friend	I stayed at my friend's place. He helps me. I will stay there. He will help me to find a job.
	Financial support	I got money from friends and acquaintances before finding a job. It took 10 days to find a job.
	Sheltered by friends	My townspeople sheltered me; they worked for some small companies and had dorms. I stayed with them. Only my friends helped me with the costs of living.
Willingness to stay in Iran	Saving life	I was saved from the Taliban's threats.
	Sending money	I work here and send money to my family in Afghanistan.

They also described the vital support of their compatriots and friends. Their main reasons for staying in Iran were saving their lives and sending money to their families in Afghanistan.

The final theme was *challenges of the COVID-19*, which, surprisingly, felt like nothing to them. They were primarily numb to COVID-19. However, they explained the healthcare system's failures to face COVID-19 and the difficulties accessing vaccines in Iran. According to the quarantines, they could not receive enough support from their families and friends in Iran and felt socially more isolated.

A single trauma can result in mental disorders, but multiple and chronic cumulated traumas disrupt a person's mental integrity and dissociative self-state (18). Our interviewees explained multiple and successive traumatic experiences of war, migration, and the pandemic. They were dissociated and emotionally numb when describing their experience, which is a hallmark of experiencing severe, unprocessed traumas.

The threats to one's survival provoke anxieties that reflect concerns over survival, self-preservation, and safety (18). The central clinical features of survivors are fears of losing control, being overwhelmed, and inability to cope. In addition, the feeling of entrapment and sense of disintegration of self, emptiness, humiliation, and fears of abandonment or need for support may complicate the condition (18). Our interviewees experienced a tsunami of suffering, including fears, entrapment, and disintegration of their selves. They felt abandoned and not only lost their family support in their homeland but could not also receive support in Iran due to the pandemic-related social distancing and isolation.

The findings of our study were consistent with another study that determined a high prevalence of discrimination, including health disparities for immigrants in the host countries (19). Our interviewees described their difficulties, including discrimination in access to vaccines in Iran amid the pandemic.

TABLE 4 Sub-themes, codes and quotations of the COVID-19 sub-theme.

Sub-themes	Codes	Quotations
Emotional numbness to COVID-19	Less lethal than other threats	People believe we face a more serious crisis than COVID-19. The emergence and coming to power of Takfiri is more lethal than COVID-19. Moreover, they do not fear anything when they are hungry. Currently, there are grave problems, terrible famine, and poverty in Afghanistan to the extent that nobody fears COVID-19. COVID-19 is a forgotten subject. No one adheres to preventive protocols.
	Many people died	In just 1 month, 70 people died because of COVID-19 in my neighborhood. There was a hospital but didn't have good doctors. There was war, and doctors wouldn't go to hospitals. Life was difficult. Every day we used to hear the news of the death of someone. Three of my cousins died... my wife and my mother got sick. I got COVID-19 too. I wasn't able to walk for 10 days.
Healthcare system failures to face with COVID-19	Weak health system	Coronavirus consequences are more severe in Afghanistan. However, doctors are weaker; hospitals are more inefficient, there are problems with medication supply, and the fatality rate is higher.
Access to vaccine in Iran	Getting vaccinated	The situation was different here in Iran. Refugees who have come with passports and visas gain some advantages. They were able to get vaccinated. Those who had entered Iran illegally did not have access to any services and vaccines. They were afraid of being arrested by Police and expelled.
Social distancing caused social isolation	COVID limitation	One of my Afghan friends told me he was eager to invite me to his home, but he couldn't because of Coronavirus.

Based on another study (20), immigrants feel more sadness, depression, and loneliness several years after immigration than when they initially arrived. Challenges like lower income, acculturation and ethnic identity, and discrimination make them more vulnerable over time (18). Afghan refugees in Iran are a significant minority group vulnerable to physical and mental disorders. Enhancing their wellbeing in Iran during the following years requires precise and delicate planning. Providing proper mental and physical healthcare support and de-stigmatization programs are suggested.

One of our methodological limitations was related to the nature of the traumatic experience itself. Our interviewees were dissociated and emotionally numb when describing their experiences; we know this is a hallmark of experiencing severe, unprocessed traumas. However, these psychical defense mechanisms may be a barrier to a depth interview in the qualitative study. In addition, it was difficult for some interviewees to trust the interviewer. Because of their illegal residence in Iran, they refuse to give detailed information about themselves.

Since we had not had any other study in this area in Iran before, the finding of this study should be regarded as preliminary and suggestive. We need more study on more comprehensive ranges of people and include other resources such as writing and arts. Moreover, a data triangulation approach is needed in future studies.

According to the finding of this study, it is crucial to deliver primary care and mental health services to

Afghan immigrants regardless of their immigration documents. Health systems can give services with their national ID and ensure that their data will not be used to recognize or expel them. Simultaneously, health professionals should be trained to be familiar with their specific problems.

Conclusion

We sought to develop a richer understanding of the experiences of Afghan residents in Iran during the Taliban's dominance in their country amid the pandemic. Multiple pre- and post-migratory traumatic experiences affect immigrants' physical, psychological, social, and economic wellbeing. The coronavirus outbreak also complicated their situation. They encounter disruption of the normal flow of life due to loss, being near death, and insecurity. Their miserable trip, life-threatening experiences on their way to Iran, their difficult life situation in Iran, and the challenges of the COVID-19 had worsened the situation. Providing social and health care support in Iran may reduce the impact of multiple traumas on their wellbeing.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Mental Health Research Center. The patients/participants provided their written informed consent to participate in this study.

Author contributions

HM, MR, NS-M, and GM made substantial contributions to the conception and design of the work. SB had a substantial contribution to data gathering. ME analyzed and interpreted the data. All authors were contributors to writing the manuscript and read and approved the final manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Mohammadreza Shalbafan,
Iran University of Medical
Sciences, Iran

REVIEWED BY

Mohammadreza Davoudi,
University of Social Welfare and
Rehabilitation Sciences, Iran
Rakesh Kumar,
Mayo Clinic, United States
Fahad S. Alshehri,
Umm Al Qura University, Saudi Arabia
Mohammad Farris Iman Leong Bin
Abdullah,
Universiti Sains Malaysia
(USM), Malaysia

*CORRESPONDENCE

Ruihua Wei
rwei@tmu.edu.cn
Haibo Yang
yanghaibo@tjnu.edu.cn

[†]These authors have contributed
equally to this work and share first
authorship

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Anxiety and depression in dry eye patients during the COVID-19 pandemic: Mental state investigation and influencing factor analysis

Zhuo Chen^{1†}, Qing He^{1†}, Qianhui Shi¹, Yifan Xu¹,
Haibo Yang^{2*} and Ruihua Wei^{1*}

¹Tianjin Key Laboratory of Retinal Functions and Diseases, Tianjin Branch of National Clinical Research Center for Ocular Disease, Eye Institute and School of Optometry, Tianjin Medical University Eye Hospital, Tianjin, China, ²Tianjin Social Science Laboratory of Students' Mental Development and Learning, Academy of Psychology and Behavior, Tianjin Normal University, Tianjin, China

Objective: Investigate the anxiety and depression states among dry eye (DE) patients during the COVID-19 outbreak and analyze their influence factors.

Methods: The study was conducted in a tertiary eye hospital in Tianjin, China from March–April 2021. Four hundred twenty-eight DE patients were tested with the Ocular Surface Disease Index, Short Healthy Anxiety Inventory, Hospital Anxiety and Depression Scale, and Pittsburgh Sleep Quality Index. Descriptive statistics was used to assess the difference between DE with depression or anxiety among different groups. And multiple linear regression was used to explore factors that influence anxiety and depression in DE patients.

Results: The incidence rates of anxiety and depression among DE patients during COVID-19 were 27.34 and 26.87%, respectively. The proportion with comorbid anxiety and depression was 24.30%. Patients' education level ($t = -3.001, P < 0.05$; $t = -3.631, P < 0.05$), course of disease ($t = 2.341, P < 0.05$; $t = 2.444, P < 0.05$), health anxiety ($t = 3.015, P < 0.05$; $t = 2.731, P < 0.05$), and subjective sleep quality ($t = 3.610, P < 0.05$; $t = 4.203, P < 0.05$) had certain influences on anxiety and depression.

Conclusion: The results showed that subjective symptoms of DE patients were related to depression and anxiety. Higher education, shorter disease duration, lower health anxiety levels, and better subjective sleep quality were associated with the reduced depressive and anxiety symptoms in DE patients. These findings could be deemed beneficial to the treatment and prevention of DE during the COVID-19 epidemic.

KEYWORDS

dry eye, anxiety, depression, health anxiety, sleep, COVID-19, linear regression

Introduction

At the end of 2019, the novel coronavirus disease (COVID-19) pandemic started in Wuhan, China. COVID-19 is caused by Severe Acute Respiratory Syndrome (SARS) Coronavirus-2 (CoV-2), characterized by strong infectivity, a long incubation period, and a high fatality rate (1). The outbreak has also caused psychological distress, fear, and had an impact on the coping strategies of community members (2). Moreover, the incidence of depressive, anxiety, and comorbid depression and anxiety symptoms increased significantly during the pandemic, and these negative psychological outcomes may reduce quality of life (3–5). Still, with much about COVID-19 still unknown, healthcare professionals were forced to quickly adapt and learn to mitigate the rapidly rising infection and mortality rates (6). The most effective public health measure to manage the COVID-19 pandemic currently available remains the stay-at-home quarantine (7).

During the quarantine, the increase in work from home and online classes has led to a higher use of visual display terminals (VDTs). Blink intervals during prolonged staring and excessive tear evaporation from electronic screens are significant causes of dry eye (DE) (8). DE is a multifactorial ocular surface disease characterized by an imbalance in tear film homeostasis and associated symptoms, such as ocular surface inflammation, damage, and neurosensory abnormalities (9). Its prevalence ranges from 5–50% (10). The symptoms such as pain, dryness, itching, redness, foreign body sensation, and sensitivity can significantly affect an individual's ability to perform daily tasks, thereby affecting productivity (11, 12). In addition, the economic burden of DE-related productivity loss is becoming more apparent, with research showing that the symptoms of DE cost an estimated \$11,302 per person, as well as that the indirect costs account for the largest proportion of these total costs (13).

Simultaneously, numerous studies have found a significantly increased prevalence of depression and anxiety in DE patients (14). Research by van der Vaart et al. (15) revealed an association between DE, depression, and anxiety in more than 40,000 outpatients over the age of 18. Lendrem et al. (16) assessed the mental status of 639 patients with Sjögren's syndrome, finding that patients with anxiety or depressive symptoms accounted for 49.4% of the observed population. Further, Ayaki et al. (17) surveyed 730 people using the Hospital Anxiety and Depression Scale (HADS) and showed that DE patients scored significantly higher than non-DE patients.

In addition, studies have shown that the subjective symptoms of DE patients do not match the severity of objective examination of their ocular surface during clinical treatment (11, 18), nevertheless further findings on this issue remain to be validated. Regarding anxiety and depression in DE patients, the current study describes them as being mainly related to the following factors: sleep disorders, foreign body

sensation, long-term chronic pain, decreased visual quality, and various eye discomforts (19). Additionally, social factors and medical expenses can cause anxiety and depression in DE patients (20). Fortunately, as the medical model transitions from biomedical to biopsychosocial, ophthalmologists have recently started paying increased attention to the psychological status of DE patients (21).

The sleep characteristics in DE patients include poor subjective sleep quality, short sleep duration, and prolonged sleep latency (22). The severity of DE symptoms was significantly associated with clinical insomnia (23). Sleep disturbance may cause ocular surface hyperosmolarity to induce an inflammatory response that further damages the tear film, reducing its stability and increasing with tear evaporation, ultimately leading to DE (24, 25). Simultaneously, ocular discomfort and chronic pain from DE can also aggravate sleep disturbance in DE patients (17), and even cause or exacerbate symptoms of mood disorders in patients (26). Negative emotions can further enhance the body's perception of pain and stimulation. This may be due to the psychological modulation of pain perception involving effects on mood and hypnosis (27).

Health anxiety is an exaggerated level of concern about wellness caused by an individual's misinterpretation of somatosensory feelings or physical changes (28). This anxiety distorts the patient's cognition and assessment of their physical condition, resulting in depression, anxiety, other psychological problems, functional impairment, and iatrogenic injury (29). Since the concept of health anxiety was proposed, research on the topic has focused on the neurology, cardiovascular, and endocrinology fields, on samples of middle-aged and older people, and on factors related to their concerns (30, 31). However, few studies (32) have been done on chronic ocular diseases, such as DE (33). Research on health anxiety among DE patients could improve the societal and familial awareness of their psychological condition.

Many recent studies (34–36) have investigated anxiety and depression in DE patients. However, knowledge remains lacking on the influencing factors of these two psychological variables among DE patients. This study aimed to determine the prevalence of Anxiety and Depression and the risk and protective factors that contribute to psychological problems among DE patients. Our findings may help government agencies and ophthalmologists protect the mental health of DE patients against the backdrop of the spread of COVID-19 in China and worldwide.

Materials and methods

This cross-sectional study was conducted in a tertiary eye hospital in Tianjin, China from March–April 2021. Our pre-study showed that sleep was related to anxiety and depression, the linear regression coefficients (37) were ~ 0.9 and 2.5 , and

the standard deviations of sleep, anxiety and depression were 0.8, 4.5, and 4.2, respectively. Assuming that the type I error α of the hypothesis test is 0.05, the type II error β is 0.1, and the sample size is calculated as $n_{\text{anxiety}} = 402$, $n_{\text{depression}} = 38$, taking the larger value, the sample size is $n = 402$. Finally, 431 DE patients were enrolled by random sampling. All the patients were treated in the hospital's clinic and were diagnosed by professional ophthalmologists. The inclusion criteria were as follows: (1) diagnosed with DE; (2) 18 years or older, signing the informed consent forms, and voluntarily participating in this study; and (3) clear state of consciousness, thus being able to understand and complete the questionnaire independently. The exclusion criteria were as follows: (1) active disease of the anterior segment; (2) ocular chemical or thermal burns and ocular trauma; (3) a history of eye surgery in the past 3 months; (4) severe mental illness in the past 12 months (38): Schizophrenia (SZ), Bipolar Disorder (BD) and Major Depressive Disorder (MDD), obtained through collecting the psychiatric/past history of patients; (5) a history of organic brain disease, alcohol, or drug dependence; (6) if female, pregnant or lactating; and (7) other severe illnesses or conditions (e.g., unable to respond to the questionnaire, unable to take care of self, or severely illiterate). The study followed the tenets of the Declaration of Helsinki (39). This survey was reviewed and approved by the Medical Ethics Committee of Tianjin Medical University Eye Hospital [2020KY(L)-53]. Participants provided written informed consent to participate in this study and were able to withdraw from the study at any stage during the process. The data was desensitized and cannot be linked back to identify any participants.

Measures

Evaluation of DE

We performed clinical DE tests using first non-invasive tear film break-up time (F-NITBUT) and the Ocular Surface Disease Index (OSDI) scale according to the guidelines recommended by TFOS DEWS II (9). The OSDI scale comprises three questions: ocular symptoms, visual-related functional effects, and environmental triggers. Scores for this scale are divided into three levels based on symptom severity and frequency: with or without (0–12), mild (13–22), moderate (23–32), and severe DE (33–100). The scale is widely used in the clinical evaluation of DE and has good sensitivity and specificity (40).

Tests were performed using the Keratograph 5M to assess objective indicators of DE. The examination was done by the same physician. All patients were examined in the same examination room, in a dark room environment, and with consistent temperature and humidity (41). The abnormal F-NITBUT was defined as <10 s, the abnormal score for OSDI was defined as ≥ 13 , and subjects meeting these two criteria were considered as DE patients (42).

Assessment of health anxiety

The Short Healthy Anxiety Inventory (SHAI) was developed by Salkovskis and is widely used to measure the level of health anxiety (43). The scale comprises 18 items related to the likelihood of disease (Illness Likelihood, IL) and the negative outcome of disease (Negative Consequences, NC). Each item features four declarative sentences representing different degrees and is responded on a scale ranging from 0–3 (0, low; 1, mild; 2, moderate; and 3, severe). The total score ranges from 0–54, with higher scores indicating higher anxiety levels. The threshold score for the screening of health anxiety based on the Chinese version of the SHAI is 15 points (44). The Cronbach's alpha for the scale in this study was 0.61.

Assessment of anxiety and depression

Zigmond and Snaith (45) created the HADS in 1983. It is mainly used to screen anxiety and depression in general hospital patients. The scale comprises 14 items, with seven assessing depression and seven measuring anxiety. Items are responded on a 4-point scale (0–3 points). If the total score for anxiety and depression is greater than or equal to 8, it indicates that these conditions are present. The Chinese version of the scale has good reliability and validity (46). The Cronbach's alpha for the scale in this study was 0.80.

Sleep quality assessment

The Pittsburgh Sleep Quality Index (PSQI) was compiled by Buysse, a psychiatrist at the University of Pittsburgh, in 1989 (47). The Chinese version of the PSQI has demonstrated good internal consistency and construct validity (48). The PSQI is used to assess participants' sleep quality over the last month. Its 18 items consist of seven components, including sleep quality, time taken to fall asleep, time to sleep, sleep efficiency and disorders, hypnotic drugs, and daytime dysfunction. Each component is scored on a scale of 0–3, and the cumulative score of each component comprises the total PSQI score. The total score ranges from 0–21. The higher the score, the worse the sleep quality. It is used for clinical and basic research on sleep quality evaluation. A score exceeding 6 indicates the presence of a sleep disorder (48). The Cronbach's alpha for the scale in this study was 0.67.

Statistical analysis

The questionnaires were entered and processed using the commercial software SPSS, of version 23.0. Descriptive statistics, including frequency, percentage,

normality, mean, t -test, and the χ^2 test were used to assess the difference between DE with depression or anxiety among different groups. Additionally, univariate regression and multiple linear regression analyses were performed to investigate which variables could influence the development of other variables. $P < 0.05$ was set as the significance level.

Results

Among the 431 DE patients enrolled, 428 (99.30%) completed the questionnaire and met the inclusion criteria, with an average age of 48.20 ± 15.09 years. Table 1 presents the descriptive statistics of the primary study variables. We observed similar proportions of DE patients with anxiety (117 of 428, 27.34%) and depressive symptoms (115, 26.87%) in the sample. The proportion of DE patients with comorbid anxiety and depression was 24.30% (104), indicating that most anxiety or depression patients were of this type. Based on a 6-point cutoff, 65.40% (280) patients had sleep disorder, and the mean total score of each dimension is presented in Table 2. The mean total scores for the OSDI, F-NITBUT, and health anxiety were 44.41 ± 15.99 , 5.34 ± 2.30 , and 16.14 ± 4.83 , respectively (Table 2).

First, univariate regression analysis was used to screen for the influencing factors of anxiety and depression (dependent variables). The independent variables were the same for both analyses, including significant demographic variables (family location, monthly income, education level, disease duration), the score for OSDI, TBUT, health anxiety, and the seven dimensions of the PSQI. The results showed that, without considering other factors, the factors influencing anxiety symptoms in DE patients were demographic variables, score for OSDI, health anxiety, subjective sleep quality, sleep latency, sleep disturbance, sleep medication used, and daytime dysfunction. Depressive symptoms were influenced by demographic variables, score for OSDI, health anxiety, subjective sleep quality, sleep latency, sleep disturbance, and sleep medication used.

Then, multiple stepwise regression analyses were conducted to exclude the influence of confounding factors. All the meaningful variables included in the univariate regression above entered the regression equation, with anxiety or depression as the dependent variable. The statistical results of the four multiple regression models with anxiety and depression as dependent variables are shown in Tables 3, 4 ($P < 0.01$).

The statistical results of all coefficients in the linear regression with anxiety and depression as dependent variables are shown in Tables 5, 6. Specifically, education level ($B = -0.418$, $t = -3.001$, $P < 0.05$), disease duration ($B = 0.383$, $t = 2.341$, $P < 0.05$), health anxiety ($B = 0.087$, $t = 3.015$, $P < 0.05$), and subjective sleep quality ($B = 0.539$, $t = 3.610$, $P < 0.05$) also had a significant effect on anxiety. Meanwhile, education level ($B = -0.523$, $t = -3.631$, $P < 0.05$),

disease duration ($B = 0.415$, $t = 2.444$, $P < 0.05$), health anxiety ($B = 0.082$, $t = 2.731$, $P < 0.05$), and subjective sleep quality ($B = 0.673$, $t = 4.203$, $P < 0.05$) had a significant effect on depression.

Discussion

This study used multiple linear regression to investigate a group of DE patients in outpatient clinics during the COVID-19 pandemic. Research shows that the prevalence of anxiety disorder is $\sim 10\%$ in the general population (49), implying that the rates in the current study (27.24%) were much higher. Moreover, depression rates in the general population are estimated to range between 3.6 and 8.5% (50). Again, the study rate of 26.87% was considerably higher than the range for the general population. One potential reason for the high incidence of anxiety and depression in this study may be that the COVID-19 pandemic and self-isolation measures have influenced the population's mental health. Specifically, research shows that mental health problems such as acute stress, anxiety, and depression are positively associated with the pandemic (51–53). Another possible explanation is that the pandemic has had a negative impact on the way people live, with students and staff forced to study and work online for extended periods of time. When people focus on digital screens, their blink intervals tend to be longer, dropping in frequency from ~ 18 to 3 or 4 per min (54). Simultaneously, the intensity or strength of the blink is reduced, and partial blinking occurs, resulting in the eyelid not fully covering the corneal surface (55). This increases tear evaporation, which may increase the incidence of DE and worsen DE symptoms (56, 57). Moreover, long-term chronic ocular surface pain, irritation, visual fatigue and other subjective symptoms of DE can negatively impact patients' cognitive processes and mental health (58). However, some studies have shown that depressive symptoms and severity in DE patients are not related to the severity of DE signs or symptoms (59). Confirmatory conclusions require further research in the future. This study also found a comparatively higher proportion of combined anxiety and depression (24.30%), and previous studies have shown that combined depression and anxiety may impair social functioning, reduce quality of life, and be more likely to increase the recurrence of mental illness and lead to suicide (60). Society and health care institutions should pay attention to this (61).

Consistent with our results, multiple studies have found (11, 32, 62) that scores for anxiety and depression scales were not associated with the objective examination of DE. The symptoms of DE can be considered as being subjective, entailing that they are affected by individual differences in sensitivity to DE signs and basic health conditions. For instance, individuals with DE may experience different symptoms even if they have the same objective examination of their ocular

TABLE 1 Demographic comparison of influencing factors of depression and anxiety in DE patients.

Group	Depression (<i>n</i> = 115)	NO Depression (<i>n</i> = 313)	χ^2	<i>P</i>	Anxiety (<i>n</i> = 117)	NO Anxiety (<i>n</i> = 311)	χ^2	<i>P</i>
Age^t	50.76 ± 14.70	47.26 ± 15.14	−2.133	0.034	50.74 ± 14.98	47.25 ± 15.05	−2.140	0.033
Sex			0.003	0.959			1.964	0.161
Male	32 (26.67%)	88 (73.33%)			27 (22.50%)	93 (77.50%)		
Female	83 (26.95%)	225 (73.05%)			90 (29.22%)	218 (70.78%)		
Menstruation			3.197	0.074			2.585	0.138
Menopause	49 (31.41%)	107 (68.59%)			52 (33.33%)	104 (66.67%)		
Non menopause	34 (22.37%)	118 (77.63%)			38 (25.00%)	114 (75.00%)		
BMI			2.377	0.498			4.201	0.241
<18.5	3 (14.29%)	18 (85.71%)			2 (9.52%)	19 (90.48%)		
18.5≤BMI<25	74 (28.68%)	184 (71.32%)			76 (29.46%)	182 (70.54%)		
25≤BMI<30	34 (25.95%)	97 (74.05%)			35 (26.72%)	96 (73.28%)		
≥30	4 (22.22%)	14 (77.78%)			4 (22.22%)	14 (77.78%)		
Family status			3.274	0.070			3.542	0.060
Single	9 (16.67%)	45 (83.33%)			9 (16.67%)	45 (83.33%)		
Married	106 (28.27%)	268 (71.73%)			108 (28.88%)	266 (71.12%)		
Household location			7.714	0.005			8.563	0.003
Urban	82 (23.91%)	261 (76.09%)			83 (24.19%)	260 (75.81%)		
countryside	33 (38.82%)	52 (61.18%)			34 (61.82%)	51 (38.18%)		
Monthly Income			7.190	0.005			11.134	0.011
≤2,000 CNY	8 (53.33%)	7 (46.67%)			9 (60.00%)	6 (40.00%)		
2,000–5,000 CNY	32 (31.07%)	71 (68.93%)			27 (26.21%)	76 (73.79%)		
5,000–8,000 CNY	39 (25.83%)	112 (74.17%)			46 (30.46%)	105 (69.54%)		
>8,000 CNY	36 (22.64%)	123 (77.36%)			35 (22.01%)	124 (77.99%)		
Education levels			10.933	0.012			10.969	0.012
Primary Education	16 (42.11%)	22 (57.89%)			17 (44.74%)	21 (55.26%)		
Middle School Education	29 (34.94%)	54 (65.06%)			29 (34.94%)	54 (65.06%)		
High School Education	29 (26.36%)	81 (73.64%)			26 (23.64%)	84 (76.36%)		
University or higher	41 (20.82%)	156 (79.18%)			45 (22.84%)	152 (77.16%)		
Course of disease			7.994	0.046			10.284	0.016
≤1year	45 (22.72%)	153 (77.28%)			48 (24.24%)	150 (75.76%)		
1–3year	44 (28.03%)	113 (71.97%)			38 (24.20%)	119 (75.80%)		
3–5year	15 (29.42%)	36 (70.58%)			21 (41.48%)	30 (58.52%)		
> 5 year	11 (50.00%)	11 (50.00%)			10 (45.45%)	12 (54.55%)		
Frequency of visit (Within 1 year)			5.078	0.166			7.659	0.054
First visit	47 (23.86%)	150 (76.14%)			44 (22.34%)	153 (77.66%)		
≤6 times	50 (26.88%)	136 (73.12%)			54 (29.03%)	132 (70.97%)		
6–12 times	13 (38.24%)	21 (61.76%)			15 (44.12%)	19 (55.88%)		
> 12 times	5 (45.45%)	6 (54.55%)			4 (36.36%)	7 (63.64%)		

TABLE 2 Descriptive statistics for sleep condition and health anxiety in DE patients.

Variable	Mean	SD
PSQI total score	9.16	4.83
Subjective Sleep Quality	1.31	0.93
Sleep Latency	1.47	1.20
Sleep Duration	1.25	1.07
Sleep Quality	1.36	1.16
Habitual Sleep Efficiency	1.06	0.52
Sleep Disturbance	0.40	0.93
Used Sleep Medication	2.30	2.01
Daytime Dysfunction	1.25	1.07
OSDI	44.41	15.99
F-NITBUT	5.34	2.30
Health anxiety	16.13	4.83

surface. Additionally, irritant ocular symptoms may impact visual performance and perception in DE patients (63). Visual perception disturbances, in turn, may affect visual performance and lead to or exacerbate depression and anxiety (64, 65). A study showing the role of health anxiety, depression, and anxiety symptoms in DE may explain the lack of correlation between symptoms and objective signs of disease (32). Although there are few studies on the pathological mechanism of anxiety and depression caused by DE, it has been determined that the high expression of inflammatory cytokines in the central nervous system of patients with Sjögren's syndrome is closely related to the occurrence of depression (66). Indeed, elevated levels of chronic inflammatory cytokines lead to changes in neuroendocrine and central nervous system metabolites, which can then lead to or exacerbate anxiety and depression symptoms (67). Additionally, anti-anxiety/depressant medication is a risk factor for DE (68). However, there are also studies indicate (18, 69) that there exists an association between uncomfortable symptoms and signs of DE, but no firm conclusions can be drawn for the time being.

The standard coefficient of education level was negative. This indicated that the lower the patient's education level, the more likely they were to develop depression and anxiety. This result may reflect that DE patients with lower education levels had less economic and social resources, could not scientifically and rationally manage stressful life events such as the DE, and paid less attention to own health problems. These possible explanations were shown in a study in the Tibetan areas of China (20). Furthermore, prior research shows that patients with lower education levels were more likely to live in disadvantaged, hazardous, or unhealthy occupations, have inadequate nutrition and exercise habits (70), reside in unfavorable environments with poor medical care, and develop depression and anxiety over time (71). A previous study showed that higher education levels

are associated with depressive symptoms (72), which needs to be further verified.

The standard coefficient of the course of the disease was positive. This result indicated that with the prolongation of the disease course, the patient's anxiety and depression worsened. During clinical treatment, with the prolongation of the course of the disease, the confidence of DE patients in recovery is likely to be negatively affected. Furthermore, they may become increasingly worried about the severity of DE and the effect of treatment, which may then lead to depression and anxiety. This finding was consistent with previous studies on other diseases, which show that long disease duration, severe symptoms, and impaired social function were associated with anxiety and depression (73).

Among the 428 DE patients in this study, 61.4% showed health anxiety. This number was higher than the prevalence of health anxiety in the general population, which was 5% in one study (74), and 9% in another research on comprehensive medical institutions (31). As shown in Tables 5, 6, health anxiety had a significant impact on anxiety and depression. Based on research on health beliefs and health anxiety (75), we infer that patients with health anxiety may be more sensitive to somatic and/or physical symptoms for some specific reasons (e.g., stress from past unfortunate and negative events) and prone to repetitively seeking out medical consultation and examination. Furthermore, patients with a high health anxiety disorder may be prone to viewing DE as a persistent disorder after experiencing a period of eye discomfort. Health anxiety can lead to poor perception of physical performance and have a significant negative impact on daily life, leading to a gradual shift in the patient's coping style toward negativity. This coping style reduces the patient's recovery expectations. These individuals do not actively cooperate with treatment. Patients will show a sense of hopelessness, which eventually leads to depression and anxiety (76, 77). The commonsense model of self-regulation (78) also posits that personal beliefs about threats (e.g., chronic diseases) can be generated by individuals and affect how they cope with illness. This may cause patients to often fail to follow doctor's orders or take their medicines on time. These behaviors worsen their condition and lead to more severe anxiety and depression. Previous studies have also confirmed that health anxiety will affect individuals' correct cognition and assessment of their physical conditions (79), resulting in psychological problems such as anxiety and depression, potentially leading to functional impairment and iatrogenic injury (29). During the treatment process, the therapist needs to gain the patient's trust, show understanding and sympathy for the patient, and cannot focus too much on very subtle physical symptoms. Still, the patient's physical health cannot be ignored (80).

The mean total score for PSQI was 9.16 ± 4.83 , indicating poor subjective sleep quality, which is a significant component of sleep. Lack of sleep can cause lipid metabolism disorders, thereby destroying the microvilli morphology of

TABLE 3 Summary of multiple regression models of influencing factors of anxiety.

Model	<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	<i>SE</i>	Change statistics				
					<i>R</i> ² change	<i>F</i> change	<i>df</i> ₁	<i>df</i> ₂	<i>P</i>
1	0.179	0.032	0.030	2.95319	0.032	14.040	1	426	0.000
2	0.232	0.054	0.049	2.92296	0.022	9.858	1	425	0.002
3	0.274	0.075	0.068	2.89349	0.021	9.701	1	424	0.002
4	0.295	0.087	0.078	2.87831	0.012	5.482	1	423	0.020

Model 1 Include independent variables: Subjective Sleep Quality, Model 2 Include independent variables: Subjective Sleep Quality, Education Level, Model 3 Include independent variables: Subjective Sleep Quality, Education Level, Health Anxiety, Model 4 Include independent variables: Subjective Sleep Quality, Education Level, Health Anxiety, Course of Disease.

TABLE 4 Summary of multiple regression models of influencing factors of depression.

Model	<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	<i>SE</i>	Change statistics				
					<i>R</i> ² change	<i>F</i> change	<i>df</i> ₁	<i>df</i> ₂	<i>P</i>
1	0.236	0.056	0.053	3.07813	0.056	25.071	1	426	0.000
2	0.295	0.087	0.083	3.02982	0.032	14.692	1	425	0.000
3	0.326	0.106	0.100	3.00115	0.019	9.158	1	424	0.003
4	0.348	0.121	0.113	2.97988	0.015	7.076	1	423	0.008

Model 1 Include independent variables: Subjective Sleep Quality, Model 2 Include independent variables: Subjective Sleep Quality, Education Level, Model 3 Include independent variables: Subjective Sleep Quality, Education Level, Health Anxiety, Model 4 Include independent variables: Subjective Sleep Quality, Education Level, Health Anxiety, Course of Disease.

TABLE 5 Summary of linear regression model coefficients of influencing factors of anxiety.

Variable	Univariate regression				Multiple linear regression			
	<i>B</i>	Beta	<i>t</i>	<i>P</i>	<i>B</i>	Beta	<i>t</i>	<i>P</i>
Monthly income	−0.357	−0.103	−2.139	0.033				
Education levels	−0.453	−0.151	−3.162	0.002	−0.418	−0.140	−3.001	0.003
Course of disease	0.463	0.132	2.749	0.006	0.383	0.109	2.341	0.020
Health anxiety	0.094	0.151	3.160	0.002	0.087	0.141	3.015	0.030
F-NITBUT	−0.088	0.063	−1.404	0.161				
OSDI	0.026	0.009	2.862	0.004				
SSQ	0.574	0.179	3.747	0.000	0.539	0.168	3.610	0.000
SL	0.275	0.111	2.296	0.022				
SD	0.028	0.135	0.206	0.837				
HES	0.102	0.125	0.813	0.416				
SDE	0.795	0.139	2.889	0.004				
USM	0.480	0.149	3.120	0.002				
DD	0.170	0.114	2.370	0.018				

OSDI, Ocular Surface Disease Index; TBUT, SSQ, Subjective Sleep Quality; SL, Sleep Latency; SD, Sleep Duration; HSE, Habitual Sleep Efficiency; SDE, Sleep Disturbance, USM, Used Sleep Medication; DD, Daytime Dysfunction.

corneal epithelial cells, so that tears cannot be adsorbed on the cornea's surface. Moreover, decreased sleep quality can disrupt the circadian rhythm of tear osmolarity, leading to ocular surface hyperosmolarity and tear film instability. These conditions are believed to be the main factors causing DE (9, 81, 82). Among DE symptoms, eye discomfort and chronic pain are associated with sleep quality, stress

perception, as well as anxiety and depression as (83), with more than 40% of DE patients experiencing poor sleep quality (17, 84). Simultaneously, sleep quality is closely related to anxiety and depression. Yoo et al. (85) have found that sleep deprivation weakened connections between the amygdala, medial prefrontal cortex, and orbitofrontal cortex, and this compromise affects the regulation function of the emotional

TABLE 6 Summary of linear regression model coefficients of influencing factors of depression.

Variable	Univariate regression				Multiple Linear Regression			
	<i>B</i>	<i>Beta</i>	<i>t</i>	<i>P</i>	<i>B</i>	<i>Beta</i>	<i>t</i>	<i>P</i>
Monthly Income	−0.524	−0.143	−2.991	0.003				
Education levels	−0.588	−0.186	−3.914	0.000	−0.523	−0.166	−3.631	0.000
Course of disease	0.544	0.147	3.067	0.002	0.415	0.112	2.444	0.015
Health anxiety	0.093	0.142	2.971	0.003	0.082	0.125	2.731	0.007
F-NITBUT	−0.051	0.067	−0.761	0.447				
OSDI	0.028	0.009	2.904	0.004				
SSQ	0.799	0.236	5.007	0.000	0.673	0.198	4.203	0.000
SL	0.292	0.111	2.314	0.021				
SD	0.205	0.142	1.442	0.150				
HES	0.253	0.131	1.929	0.054				
SDE	0.874	0.145	3.024	0.003				
USM	0.821	0.183	3.850	0.000				
DD	0.139	0.076	1.833	0.067				

OSDI, Ocular Surface Disease Index; TBUT, SSQ, Subjective Sleep Quality; SL, Sleep Latency; SD, Sleep Duration; HSE, Habitual Sleep Efficiency; SDE, Sleep Disturbance, USM, Used Sleep Medication; DD, Daytime Dysfunction.

disturbance network and leads to affective disorders. Gujar et al. (86) also found weakened connections between the medial prefrontal cortex and the orbitofrontal cortex in sleep-deprived patients, disrupting the mesolimbic reward brain network. Another study (87) showed a slight two-way link between depression and insomnia, showing that structural and functional abnormalities of the amygdala, prefrontal cortex, anterior cingulate cortex, and insula may be the underlying causes of insomnia and mood disorders. In conclusion, poor sleep quality is associated with DE, and is more likely to lead to individual metabolic dysfunction and neurotransmitter secretion disorders, cognitive decline, depression and anxiety (88), which should be noted in clinical practice.

Patients can also manage the disease scientifically in daily life to help with the treatment of DE, such as appropriately increasing the environmental humidity, exercising outdoors, wearing protective glasses, and ingesting food that can promote tear secretion. The limitations of this study are as follows. First, the cross-sectional design precludes the possibility of causal analysis. Second, the subjective questionnaire survey method was used to investigate the sleep quality of DE patients, and no objective instruments were used to detect sleep conditions. Subjective reporting may produce distorted and inaccurate participant accounts of sleep time and delay. Third, the patients come from a single region (Tianjin, China, and surrounding areas), so these findings may not apply to other regions or countries because social and cultural factors may also play essential roles in disease formation. Fourth, this study did not assess social support, which may be an important protective factor

against depression and anxiety during the COVID-19 pandemic (89, 90).

Conclusion

Our findings indicated some risk factors for anxiety and depressive symptoms in DE patients and directly inform the development of psychological interventions for DE patients to minimize the psychological impact of the COVID-19 pandemic. This study also provided a research basis for evaluating DE prevention, control, and treatment efforts during the COVID-19 pandemic. In the future, longitudinal studies are warranted and will enable us to systematically understand the process and laws of the psychological development of DE patients.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Medical Ethics Committee of Tianjin Medical University Eye Hospital. The patients/participants provided their written informed consent to participate in this study.

Author contributions

ZC, QH, and QS: material preparation, data collection, and analysis were performed. The first draft of the manuscript was written by ZC and QH. All authors commented on previous versions of the manuscript. All authors contributed to the study conception, design, read, and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Mohammadreza Shalbafan,
Iran University of Medical
Sciences, Iran

REVIEWED BY

Rubia Carla Formighieri Giordani,
Federal University of Paraná, Brazil
Gaia Sampogna,
University of Campania Luigi
Vanvitelli, Italy
Kun-Shan Wu,
Tamkang University, Taiwan

*CORRESPONDENCE

Laura Orsolini
loriolini@staff.univpm.it

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Fear and anxiety related to COVID-19 pandemic may predispose to perinatal depression in Italy

Laura Orsolini*, Simone Pompili, Antonella Mauro,
Virginio Salvi and Umberto Volpe

Unit of Clinical Psychiatry, Department of Neurosciences/DIMSC, Polytechnic University of Marche,
Ancona, Italy

The COVID-19 pandemic situation significantly affected the mental health of the general and clinical population. However, few studies investigated which COVID-19-related psychopathological determinants may predispose to perinatal depression. We evaluated the impact of COVID-19 related anxiety and fear on perinatal depression in Italy. We retrospectively screened 184 perinatal outpatients afferent to Perinatal Mental Health outpatient service, during March 2020-March 2021, by administering the Edinburgh Postnatal Depression Scale (EPDS), the Fear of COVID-19 (FCV-19-S) and the Coronavirus Anxiety Scale (CAS). Among these, 85 patients agreed to be recruited in the present study. The mean EPDS score was 9.0, experiencing a clinically relevant perinatal depression in 45.7% of the sample. The mean FCV-19-S score was 15.0 and CAS was 1.7. Linear regression analyses demonstrated that FCV-19-S and CAS scores statistically significantly predicted EPDS total scores. A positive significant correlation was reported between FCV-19-S and EPDS and between CAS and EPDS. During the COVID-19 pandemic, women in their perinatal period, independently of previous psychiatric history, experienced increased levels of anxiety, fear and psychological distress, due to subsequent isolation, quarantine, lockdown and deprivation of their normal social support. Further preventive and screening strategies should be implemented in order to early identify at-risk pregnant and puerperal women during the COVID-19 pandemic.

KEYWORDS

COVID-19, depression, peripartum, perinatal mental health, postpartum, pregnancy, women's mental health

Introduction

The COVID-19 pandemic situation significantly affected the mental health of the general and clinical population (1–5). The COVID-19-related situation determined a significant psychological distress, by determining increased levels of fear, anger and uncertainty, anxiety and depression symptomatology, suicidality, post-traumatic-related symptomatology, sleep disorders, and it facilitated the onset of *de novo* brief psychotic

episodes, and so forth (6–15). Although few studies investigated the impact of COVID-19 pandemic and related restrictive measures on the women's mental health, during the pregnancy and the postpartum period, it was documented an overall increased incidence of anxious and depressive symptomatology in the perinatal period during the COVID-19 pandemic compared to pre-COVID-19 times (16–18).

The perinatal period (i.e., that period including all pregnancy and the first postpartum year) (19), indeed represents a critical vulnerable period for the *de novo* onset and recurrence of mental conditions, especially among women with a positive psychiatric history or those who experience gestational and/or delivery complications (20, 21). Based on the bio-psycho-social paradigm of mental disorders (22), the perinatal period may predispose women to experience high psychological distress due to physiological, biological, and social changes (17, 23–25). Moreover, within this framework, experiencing stressful and subjectively perceived traumatic events, during the perinatal period, may predispose women to the onset of *de novo* psychopathological manifestations, also in not predisposed pregnant and puerperal women (26). Therefore, one could argue that the COVID-19 pandemic and related restrictive measurements may have more likely represented a stressful and cumulative traumatic variable which might have modified the psychopathological trajectory in pregnancy and postpartum period, as already reported in the general population (27, 28) and in samples constituted by pregnant and postpartum women (18, 29–31). In fact, the gradual shaping in health care access and services due to the lockdown and restrictive regulations imposed by governments, including limitations in the access to gynecological, obstetrician and perinatal care and the restricted (or interrupted) possibility for partner and/or family member(s) of pregnant and puerperal women to assist them during pregnancy follow-ups, the delivery and postpartum period, significantly determined a psychological distress, an increased uncertainty and indeed fueled feelings of fears, anxiety and worries among pregnant and postpartum women (32–34). Moreover, perinatal women's mental health was also compromised by anxiety levels and worries related to disinformation overflow about COVID-19 pandemic and consequences for pregnant women's health and new-borns' health in case of COVID-19 infection during the pregnancy and/or early postpartum, as well as the uncertainty about the future (24, 35, 36).

Therefore, within the context of a multicenter nationwide population-based naturalistic observational project on perinatal depression, a retrospective chart-review study was carried out at the Unit of Clinical Psychiatry, Department of Neurosciences, University-Hospital “Ospedali Riuniti,” in Ancona, Italy, in collaboration with the Unit of Clinical Gynecology and Obstetrics, University Hospital “Salesi,” in Ancona, Italy. The main purpose of the larger observational protocol was to implement diagnostic and therapeutic interventions for early

detection of at-risk women for occurring perinatal mental disorders as well as provide timely treatments. Within this larger project, our study firstly aimed at retrospectively analyzing those data collected during the COVID-19 pandemic, to evaluate the potential impact of COVID-19 related anxiety and fear on perinatal women's mental health, particularly perinatal depression levels. Given the exploratory nature of the study, we had no *a priori* hypothesis.

Methods

Study design and selection of participants

A retrospective chart-review study was carried out by recruiting all women afferent to the Peripartum Psychiatry Outpatient Service of the Unit of Clinical Psychiatry, at the University Hospital “Ospedali Riuniti,” Polytechnic University of Marche, Ancona, Italy, and/or hospitalized at the Unit of Clinical Gynecology and Obstetrics at the University Hospital “Salesi,” in Ancona, Italy, during the timeframe March 2020 to March 2021. Written informed consent was obtained from the patients after they were informed about the purpose of the study and the related methods. The study was introduced as aiming to assess whether pregnant or puerperal women's mental health changed during the Italian phase I-II-III of the COVID-19 pandemic and whether factors associated with the COVID-19 restrictions affected the course of perinatal symptomatology. Patients were retrospectively included in the study if they met the following inclusion criteria: (a) ≥ 18 years old; (b) education level not lower than elementary school; (c) absence of linguistic difficulties (i.e., not Italian speaker or foreign without a sufficient ability to understand Italian language); (d) no intellectual disability; (e) absence of severe medical conditions not related to the pregnancy and/or postpartum clinical situation; (f) pregnant women or within their first year of postpartum; (g) signed informed consent for collecting and analyzing clinical data for research purpose, collected during the baseline assessment. Participants were excluded if they met one or more of the following exclusion criteria: (a) intellectual disability or cognitive impairment; (b) diagnosis of organic mental disorder according to the DSM-5 criteria (37); (c) being under the influence of substances and/or alcohol; (d) incomplete filled out questionnaire; (e) refusal to participate to the research study. Recruited patients had also the possibility to withdraw their participation without any kind of clinical and therapeutic consequences. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Institutional Review Board approved our study. This research study was conducted retrospectively from data obtained for

clinical purposes. All patients gave written consent to the use of clinical data for research purposes.

Measures

An *ad hoc* case report form was specifically designed by the researchers to collect sociodemographic data (e.g., age, ethnic, marital status, housing condition, employment status, education level) and clinical data and pregnancy-related correlates (e.g., family context, social support, medical history, psychiatric personal and family history, number of children, obstetric-gynecologic variables, such as last menstruation date [LMD], estimated delivery date [EDD], previous history of miscarriages or induced abortion, delivery course and immediate outcomes).

As a screening tool for diagnosing pregnant and postpartum women who are at risk for perinatal depression, it was used the *Edinburgh Postnatal Depression Scale* (EPDS) (38–40). EPDS is a 10-items, four-point Likert-type self-assessment questionnaire, which was developed based on the American College of Obstetrics and Gynecology (ACOG) recommendations (41), to assess mood in pregnant women during the past week. The EPDS total score ranges from 0 to 30, with a clinically relevant cut-off ≥ 12 which indicates a higher risk for perinatal depression in the Italian sample (42, 43).

The following scales have been administered to evaluate the following COVID-19-related psychopathological dimensions: i.e., experiences of fear by using the Fear of COVID-19 Scale (FCV-19-S) (44, 45) and anxiety symptomatology by using the Coronavirus Anxiety Scale (CAS) (46–48). The FCV-19-S is a 7-items, 5-point Likert-type questionnaire (1 = “strongly disagree”, 5 = “strongly agree”), measuring the emotional fear occurring during COVID-19 pandemic. The total score ranged from 7 to 35, with a cut-off ≥ 16.86 that was used to identify a significant risk of fear and other related disorders in the Italian sample (44, 45). The CAS is a 5-item, 5-point Likert-type self-report tool designed to measure the levels of dysfunctional anxiety related to the COVID-19 pandemic over the preceding 2 weeks, with a clinically relevant cut-off ≥ 9 in the Italian sample (46, 48).

Statistical analysis

Statistical analyses were performed using SPSS (MACOS version 26; IBM Corp, Harmony [NY], 2019). Descriptive statistics were expressed as mean and standard deviation (SD) for the qualitative variables (EPDS, WDEQ, CAS and FCV-19-S), whereas normally distributed; while as median and 95% Confidence Interval (CI) when not normally distributed. After analyzing the continuous variables for skewness, kurtosis, normality distribution through the Shapiro-Wilk test, and the equality of variances by Levene test, parametric or non-parametric statistical tests were used when appropriate.

Categorical variables (i.e., socio-demographic features, clinical and pregnancy-related variables) were presented in frequency (n) and percentage (%). Student's t -test for independent data and the non-parametric Mann-Whitney U-test for independent data were used, when appropriate, to compare the mean values of continuous variables among the two groups (pregnant vs. puerperal women) and between two groups (women with a significant EPDS score and women with a not significant EPDS score). The Chi-Square test was used to examine differences in the distribution of all categorical variables between two groups (pregnant vs. puerperal women) and between two groups (women with a significant EPDS score and women with a not significant EPDS score). One-way analysis of variance (ANOVA) or Kruskal-Wallis tests were used, where appropriate, to compare all continuous variables according to all socio-demographic and clinical categorical variables. Bivariate Pearson's correlations were used to investigate potential relationships between EPDS scores and other secondary continuous variables (CAS and FCV-19-S). A linear regression analysis was run to predict EPDS scores (dependent variable) from CAS (independent variable) and EPDS scores (dependent variable) from FCV-19-S (independent), after verifying all socio-demographic variables in both models as well. All the analyses were two-sided with a significance level settled at $p < 0.05$.

Results

Socio-demographic features of the sample

All socio-demographic characteristics of the included subjects are summarized in Table 1. A total of 184 women were consecutively assessed during the timeframe March 2020–March 2021. Among these, 85 patients gave written informed consent, agreed to provide their data for research purposes, and were recruited in the present study. After excluding those patients who subsequently decided to withdraw from the study ($N = 6$) and patients who did not fully fill out the questionnaires ($N = 9$), a final sample consisting of 70 subjects was finally included. The mean age was 34.8 years ($SD = 5.8$), without any significant differences between pregnant and postpartum women ($p = 0.566$). All women declared to be married or cohabiting with their partner, while 50% of the sample ($N = 35$) declared to be full-time employed and with an average middle-level of financial status declared ($N = 61$; 87.1%) (Table 1). Most women were assessed between January 2021 and March 2021 ($N = 60$; 85.7%), during the third trimester of their pregnancy ($N = 36$; 51.4%) and during the first postpartum trimester ($N = 24$; 34.3%). Most participants had a previous pregnancy ($N = 44$; 62.9%) and about 20% of participants ($N = 14$) declared to have experienced at least one miscarriage. Less than half of participants reported a current regular pregnancy course ($N = 33$; 47.1%) while

TABLE 1 Socio-demographic characteristics of the sample.

	Total Sample (N = 70)	Pregnant group (N = 41)	Postpartum group (N = 29)	<i>p</i> -value ^{*,**}
Age (years)	M = 34.8 (SD = 5.8)	M = 35.1 (SD = 6.0)	M = 34.3 (SD = 5.7)	* <i>t</i> (68) = 0.577 <i>p</i> = 0.566
Nationality				**
Italian	60 (85.7%)	36 (87.8%)	24 (82.8%)	$\chi^2(10) = 10.656$
From other European countries	4 (5.7%)	2 (4.9%)	2 (6.9%)	<i>p</i> = 0.385
From non-European countries	6 (8.6%)	3 (7.3%)	3 (10.3%)	
Marital status				
Married/cohabiting	70 (100%)	41 (100%)	29 (100%)	n.d.
Level of education				**
Secondary School	7 (10%)	5 (12.2%)	2 (6.9%)	$\chi^2(3) = 0.884$
High school	26 (37.1%)	14 (34.1%)	12 (41.4%)	<i>p</i> = 0.829
University degree	26 (37.1%)	16 (39%)	10 (34.5%)	
Post-Degree	11 (15.7%)	6 (14.6%)	5 (17.2%)	
Employment status				**
Student	3 (4.3%)	2 (4.9%)	1 (3.4%)	$\chi^2(4) = 1.444$
Housewife	3 (4.3%)	2 (4.9%)	1 (3.4%)	<i>p</i> = 0.836
Employed	52 (74.3%)	29 (70.7%)	23 (79.4%)	
Unemployed	12 (17.1%)	8 (19.5%)	4 (13.8%)	
Familiar nucleus				**
Co-habitant partner/husband	35 (50%)	21 (51.2%)	14 (48.3%)	$\chi^2(1) = 0.059$
Co-habitant partner/husband and sons	35 (50%)	20 (48.8%)	15 (51.7%)	<i>p</i> = 0.808
Socio-economic status				**
Low annual income	6 (8.6%)	5 (12.2%)	1 (3.4%)	$\chi^2(2) = 1.799$
Medium annual income	61 (87.1%)	34 (82.9%)	27 (93.1%)	<i>p</i> = 0.407
High annual income	3 (4.3%)	2 (4.9%)	1 (3.4%)	

M, mean; SD, standard deviation; n.d., not detected.

* Student's T-test; ** Pearson's χ^2 test.

most participants declared a desired pregnancy ($N = 63$; 90%) (Table 2).

Clinical and psychopathological features of participants

Table 3 provides a summary of clinical and psychopathological data. Most of participants did not report any previous psychiatric history ($N = 64$; 91.4%), any previous psychiatric hospitalization ($N = 69$; 98.6%), any psychopharmacological therapy before pregnancy ($N = 61$; 87.1%) and/or during pregnancy ($N = 61$; 87.1%), either any current psychotherapy ($N = 66$; 94.3%) (Table 3).

The mean total score at the EPDS was 9.0 (SD = 5.3), being experienced a clinically relevant perinatal depression ($EPDS \geq 12$) in 45.7% of the sample, without any significant differences between pregnant and puerperal women ($p = 0.304$) (Table 3).

The mean total score at FCV-19-S was 15.0 (SD = 6.2), with clinically relevant COVID-19-related fear ($FCV-19-S \geq 16.86$) experienced by 27.1% of participants, without any significant differences between pregnant and puerperal women ($p = 0.179$). Statistically significant higher FCV-19-S scores were found in women who had a previous psychiatric hospitalization ($p = 0.029$). Significant higher FCV-19-S scores were found in women with clinically relevant CAS total scores ($p = 0.001$) and clinically relevant EPDS total scores ($p = 0.004$) (Table 4). A positive correlation was found between FCV-19-S and EPDS ($r = 0.390$, $p < 0.001$) (Table 5). Linear regression analysis demonstrated that FCV-19-S scores statistically significantly predicted EPDS total scores [$F(1,68) = 12.218$, $R^2 = 0.152$, $p < 0.001$] (Figure 1). No socio-demographic and/or clinical variables included in the regression model demonstrated to be predictive of EPDS scores.

The mean total score at CAS was 1.7 (SD = 2.8), with clinically relevant anxiety related to COVID-19 ($CAS \geq 9$) experienced by 4.3% of women, without any significant differences between pregnant and puerperal women ($p = 0.732$).

TABLE 2 Obstetric-gynaecological characteristics of the sample.

	Total sample (N = 70)	Pregnant group (N = 41)	Postpartum group (N = 29)	p-value*
Previous Pregnancy(ies)				*
Current first pregnancy	26 (37.1%)	15 (36.6%)	11 (37.9%)	
Current second pregnancy	28 (40.0%)	15 (36.6%)	13 (44.8%)	$\chi^2(2) = 0.980$
>2 previous pregnancies	16 (22.9%)	11 (26.8%)	5 (17.2%)	$p = 0.613$
Previous miscarriage	14 (20%)	8 (19.5%)	6 (20.7%)	*
				$\chi^2(1) = 0.015$
				$p = 0.903$
Previous induced abortion	3 (4.3%)	2 (4.9%)	1 (3.4%)	**
				$\chi^2(1) = 0.083$
				$p = 0.629$
Medical assisted procreation**	5 (7.1%)	4 (9.8%)	1 (3.4%)	**
				$\chi^2(1) = 1.004$
				$p = 0.305$
Pregnancy course				*
Regular without complications	33 (47.1%)	14 (34.1%)	19 (65.5%)	$\chi^2(2) = 6.708$
At-risk/with complications	37 (52.9%)	27 (65.9%)	10 (34.5%)	$p = 0.015$
LMD				
2019 first semester	2 (2.9%)	1 (2.4%)	1 (3.4%)	n.v.
2019 second semester	6 (8.6%)	3 (7.3%)	3 (10.3%)	
2020 first semester	45 (64.3%)	23 (56.1%)	22 (75.9%)	
2020 second semester	17 (24.3%)	14 (34.1%)	3 (10.3%)	
EDD				
2019 First semester	4 (5.7%)	1 (2.4%)	3 (10.3%)	n.v.
2019 Second semester	5 (7.1%)	3 (7.3%)	2 (6.9%)	
2020 First semester	59 (84.3%)	25 (85.4%)	24 (82.8%)	
2020 Second semester	2 (2.9%)	2 (4.9%)	0 (0%)	
Gestational and/or postpartum assessment period				
1 st pregnancy trimester	2 (2.9%)	2 (4.9%)	0 (0%)	n.v.
2 nd pregnancy trimester	3 (4.3%)	3 (7.3%)	0 (0%)	
3 rd pregnancy trimester	36	35 (85.4%)	1 (3.4%)	
1 st postpartum trimester	(51.4%)	0 (0%)	24 (82.8%)	
2 nd postpartum trimester	24 (34.3%)	0 (0%)	1 (3.4%)	
3 rd /4 th postpartum trimester	1 (1.4%)	1 (2.4%)	3 (10.3%)	
	4 (5.7%)			

EDD, estimated delivery date; LMD, last menstruation date; n.v., not valid. Significant p-values are in bold.

* Pearson's χ^2 test; ** Fisher's exact test.

** for the current pregnancy.

Significant higher CAS scores were found in women who were positive for perinatal depression at EPDS ($p = 0.040$) (Table 4). A statistical trend with higher CAS scores was observed in those women with a previous psychiatric history of depressive episode(s) and/or major depressive disorder, compared to women without a previous psychiatric history ($p = 0.054$). A positive correlation was found between CAS and EPDS ($r = 0.362$, $p < 0.001$) and between CAS and FCV-19-S ($r = 0.641$, $p < 0.001$) (Table 5). Linear regression analysis demonstrated that CAS scores statistically significantly predicted EPDS total scores [$F(1,68) = 10.278$, $R^2 = 0.131$, $p = 0.002$] (Figure 2).

No socio-demographic and/or clinical variables included in the regression model demonstrated to be predictive of EPDS scores.

Discussion

During the COVID-19 pandemic, pregnant and puerperal women worldwide reported increased levels of mental distress due to lack of access to healthcare, social isolation, sleep loss, feelings of fear and uncertainties (49–55). Overall, our sample reported a clinically relevant perinatal depression, as measured

TABLE 3 Clinical and psychopharmacological characteristics of the sample.

	Total sample (N = 70)	Pregnant group (N = 41)	Postpartum group (N = 29)	p-value ^{*,**}
Previous psychiatric history				
Anxiety disorder	3 (4.3%)	2 (4.9%)	1 (3.4%)	n.v.
Depressive disorder	2 (2.9%)	2 (4.9%)	0 (0%)	
Bipolar disorder	1 (1.4%)	1 (2.4%)	0 (0%)	
None	64 (91.4%)	36 (87.8%)	28 (96.6%)	
Previous psychiatric history				**
None	64 (91.4%)	36 (87.8%)	28 (96.6%)	$\chi^2(1) = 1.635$
Yes	6 (8.6%)	5 (12.2%)	1 (3.4%)	$p = 0.389$
Previous psychiatric hospitalization				**
None	69 (98.6%)	40 (97.6%)	29 (100%)	$\chi^2(1) = 0.707$
Yes	1 (1.4%)	1 (2.4%)	0 (0%)	$p = 0.586$
Psychopharmacotherapy before pregnancy				
None	61 (87.1%)	34 (82.9%)	27 (93.2%)	n.v.
Antipsychotics	5 (7.1%)	4 (9.8%)	1 (3.4%)	
Antidepressants	2 (2.9%)	2 (4.9%)	0 (0%)	
Anxiolytics	2 (2.9%)	1 (2.4%)	1 (3.4%)	
Current psychopharmacotherapy				**
None	61 (87.1%)	35 (85.4%)	27 (93.1%)	$\chi^2(1) = 1.548$
Yes	9 (12.9%)	7 (17.1%)	2 (6.9%)	$p = 0.289$
Current psychotherapy				**
None	66 (94.3%)	38 (92.7%)	28 (96.6%)	$\chi^2(1) = 0.465$
Yes	4 (5.7%)	3 (7.3%)	1 (3.4%)	$p = 0.637$
EPDS				*
< 12	38 (54.3%)	20 (48.8%)	18 (62.1%)	$\chi^2(1) = 1.209$
≥ 12	32 (45.7%)	21 (51.2%)	11 (37.9%)	$p = 0.272$
EPDS, median				***
(95% CI)	8.5 (7.7–10.2)	12.0 (7.8–11.1)	8.0 (6.3–10.2)	$U = 509.5$
FCV-19-S				*
not clinically relevant	51 (72.9%)	28 (68.3%)	23 (79.3%)	$\chi^2(1) = 1.043$
clinically relevant	19 (27.1%)	13 (31.7%)	6 (20.7%)	$p = 0.307$
FCV-19-S, median				***
(95% CI)	14.0 (13.5–16.4)	15.0 (13.8–18.2)	13.0 (11.8–15.1)	$U = 482.0$
CAS				**
not clinically relevant	67 (95.7%)	39 (95.1%)	28 (96.6%)	$\chi^2(1) = 0.083$
clinically relevant	3 (4.3%)	2 (4.9%)	1 (3.4%)	$p = 0.629$
CAS, median				***
(95% CI)	1.0 (1.1–2.4)	1.0 (0.8–2.8)	1.0 (0.7–2.6)	$U = 622.0$
				$p = 0.732$

* Pearson's χ^2 test; ** Fisher's exact test; *** U Mann-Whitney test.

M, mean; SD, standard deviation; n.v., not valid; EPDS, Edinburgh Postnatal Depression Scale; FCV-19-S, Fear of COVID-19; CAS, Coronavirus Anxiety Scale; CI, Confidence Interval.

by EPDS, in 45.7% of the sample, with a higher rate, compared to previous international and national studies carried out before the COVID-19 pandemic (56–63). In fact, the prevalence of

perinatal depression was estimated between 10–20% in non-Italian samples (59–62). While, in the few studies conducted to assess the Italian prevalence of perinatal depression, a highly

TABLE 4 Psychopathological differences according to the EPDS screening.

	EPDS– (N = 38)	EPDS+ (N = 32)	<i>p</i> -value*
FCV-19-S	13.0	16.5	<i>U</i> = 849.0
total score,	(11.6–14.2)	(14.8–20.0)	<i>p</i> = 0.004
median (95% CI)			
CAS	1.0	2.0	<i>U</i> = 774.5
total score,	(0.5–1.9)	(1.2–3.7)	<i>p</i> = 0.040
median (95% CI)			

EPDS+, with EPDS total score ≥ 12 ; EPDS–, with EPDS total score < 12 ; FCV+, with FCV-19-S ≥ 16.86 ; FCV–, with FCV-19-S < 16.86 . Significant *p*-values are in bold.

* *U* Mann-Whitney test, two-tailed.

M, mean; SD, standard deviation; EPDS, Edinburgh Postnatal Depression Scale; FCV-19-S, Fear of COVID-19; CAS, Coronavirus Anxiety Scale; CI, Confidence Interval.

TABLE 5 Linear regression models.

	B	SE	Beta	t	<i>p</i>-value
(constant)	3.962	1.548		2.559	0.013
FCV-19-S	0.335	0.096	0.390	3.495	<0.001

	B	SE	Beta	t	<i>p</i>-value
(constant)	7.798	0.697		11.185	<0.001
CAS	0.673	0.210	0.362	3.206	0.002

EPDS, Dependent Variable. Significant *p*-values are in bold.

* SE, standard error; CI, Confidence Interval; Significance at *p* < 0.01 (two-tailed).

variable prevalence was observed ranging from 1.6 to 26.6%, even though all of these studies were carried out before the COVID-19 pandemic indeed (42, 56–58, 64). Our findings are in line with previous published (both international and Italian) studies carried out during the COVID-19 pandemic which reported significantly higher depression rates in pregnant women than studies conducted before the pandemic, with a prevalence ranging from 30 to 43% (16, 18, 29, 31, 53, 65–71).

Although the effects of COVID-19 pandemic on perinatal mental health are still not fully investigated, pregnant and puerperal women represent indeed a particular vulnerable/at-risk population for developing mental health disorders, particularly during stressing situations, such as the current COVID-19 pandemic (72). Accordingly, our findings found that women, who have some mental distress related to the current COVID-19 outbreak, as measured by FCV-19-S and CAS scores, manifested clinically significant scores at EPDS. In particular, significant higher levels of COVID-19 fear were found in women who had a previous psychiatric hospitalization, by suggesting that women with a pre-existing psychiatric history may be more likely vulnerable to manifest fear of COVID-19 and, indirectly, manifest higher perinatal depressive levels compared to those without a previous psychiatric history.

However, being our sample more represented by women without a psychiatric diagnosis, further larger studies specifically recruiting and comparing pregnant and postpartum women with and/or without a pre-existing psychiatric diagnosis should be carried out to better investigate this hypothesis. Moreover, our findings reported a significant positive correlation between fear of COVID-19 and COVID-19-related anxiety levels, as well as between fear of COVID-19 and perinatal depression levels, as already documented in previous studies (73–75). Furthermore, our findings documented a significant positive correlation between COVID-19-related anxiety and perinatal depression levels, as already demonstrated in previous studies (76, 77). In fact, the fear of contagion and for the health of the child, the difficulty in promptly accessing to health care system due to the COVID-19 restrictive measures, as well as the poor availability in being supported by own partner and/or family members during the hospitalization for the delivery may represent all factors which may have determined increased depressive and anxious symptoms in women during the peripartum period (67, 70, 72, 78). The increased levels of COVID-19 anxiety seems to be related to specific concerns about the impact of the COVID-19 on maternal health, fetal/neonatal health, vertical transmission of COVID-19 infection from mother to fetus and worries regarding the potential separation and social distancing from family and social relationships during the perinatal period due to quarantine measures (67, 79, 80). In fact, the most critical fears and worries experienced by pregnant and postpartum women regard the possibility of family members to be not present during the perinatal period, during the hospitalization, labor and childbirth while restriction policies in hospital settings are in place (31, 81).

Moreover, most participants of our study did not report any previous psychiatric history and/or psychiatric hospitalization and/or any psychopharmacological treatment and/or psychological support before pregnancy. Therefore, our findings suggest that increased levels of perinatal depression may be experienced during the COVID-19 pandemic, more likely due to isolation and quarantine experience, also by pregnant and puerperal women, independently by pre-existing psychiatric disorders. Moreover, our sample is more representative of perinatal period comprising the third trimester of pregnancy and the first postpartum trimester, hence, one could argue that our findings might potentially reflect the effect of the COVID-19 pandemic during this period and that higher levels of perinatal depression observed in our sample might be due an effect dependent on the perinatal stage, as already documented in previous studies (31, 82). In fact, according to these studies, the risk of negative psychological consequences during the COVID-19 pandemic may be increased especially in pregnant women in their third trimester who foresee delivery during the pandemic, as they may experience elevated stress and anxiety due to the potential adverse outcomes on the fetus and the infant (31, 79, 82). Despite a larger longitudinal

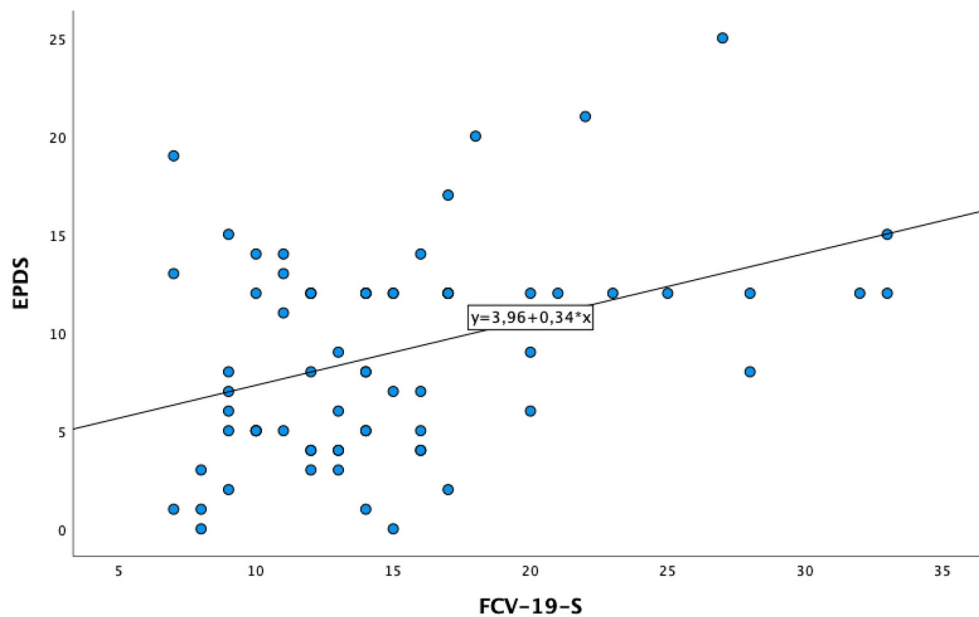


FIGURE 1
Linear regression model between FCV-19-S and EPDS.

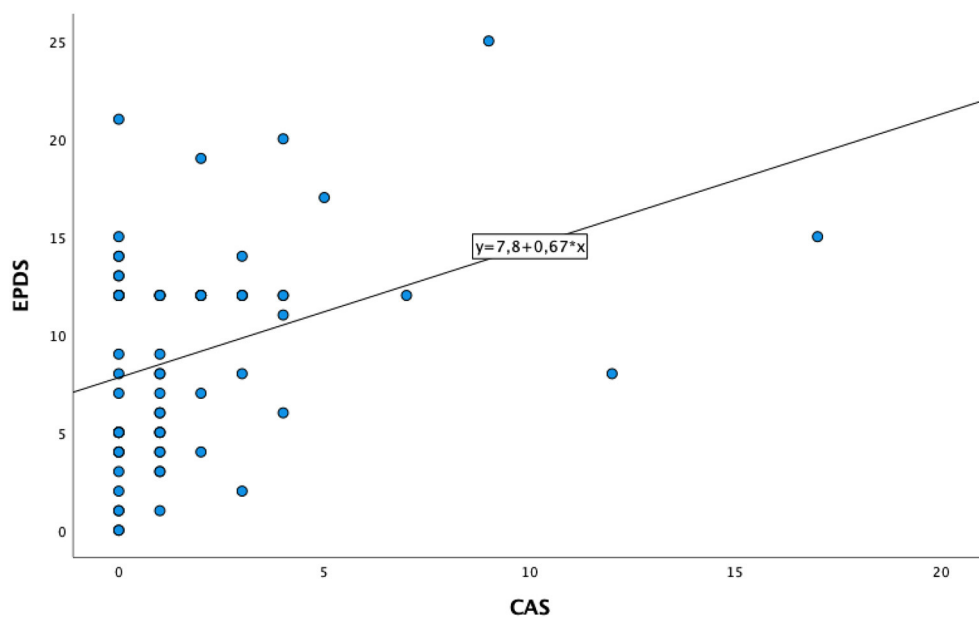


FIGURE 2
Linear regression model between CAS and EPDS.

study by Mei et al. (30) found that the gestational trimester had no correlation with depression, anxiety and stress rates. Therefore, further studies should assess and investigate the perinatal stage variable on perinatal depression, anxiety and stress.

Despite the abovementioned promising findings, the present study has several limitations. Firstly, the cross-sectional study design and the small sample size may limit the generalizability of the findings and may not be fully representative of the full peripartum period, being mainly recruited women at

their third trimester of pregnancy and during their first postpartum trimester. The attrition rate between women assessed and women included was indeed mainly due to expressed worry by pregnant and puerperal women recruited during the COVID-19 pandemic to find some relevant COVID-19-related psychopathology and the lack of time to fill out all questionnaires administered (particularly among puerperal women). The lack of a control group constituted by not-pregnant women, coming from both a clinical and not-clinical sample, may not allow the comparability of the findings and may not adequately evaluate the gender-effect on the development of higher depressive scores, independently by the pregnancy and/or postpartum period during the COVID-19 pandemic. Moreover, another issue is the lack of a control group constituted by males, for instance including the partners of recruited women and/o coming from the general population may not allow to discriminate whether the observed effect of COVID-19-related anxiety and fear may really impacting on the perinatal depression due to the gender effect or rather the COVID-19-related psychopathological burden in the vulnerable population of pregnant and/or puerperal women. Secondly, our sample is constituted mainly by women without a previous psychiatric history which may not allow us to completely evaluate the differential impact of the COVID-19 pandemic on pregnant and/or postpartum women with a previous psychiatric disease and compare them with those with a negative psychiatric history. Thirdly, although we collected several socio-demographic and clinical variables in our sample, we did not find that none of these socio-demographic and/or clinical variables demonstrated to be significant predictors of EPDS scores. However, these findings could be mainly due to the small sample size here recruited. Therefore, a larger study recruiting also women with more heterogeneous socio-demographic features could allow researchers to better understand whether a specific socio-demographic and/or clinical profile could represent a predictor of EPDS scores during the COVID-19 pandemic. Moreover, even though the administered assessment tools here chosen, demonstrated to be valid and highly reliable measures of COVID-19-related fear and anxiety symptomatology, some limitations of these self-report questionnaires should be carefully considered and discussed when we interpret our findings. For instance, while some studies reported no gender differences on the FCV-19S (45), other studies reported higher FCV-19S scores in females compared to males (4, 48). Similarly, CAS scores were found to be higher in females compared to males in the development and psychometric study of the tool (48, 83). Finally, our sample is represented by women without a previous and/or a current COVID-19 infection, hence, our findings may not completely evaluate whether the pregnant women with COVID-19 infection may be more or less likely to develop a perinatal depression compared with pregnant women without COVID-19 infection and/or not pregnant women with COVID-19 infection.

Therefore, further research directions performing longitudinal and case-control studies with larger sample sizes, including as potential variables the concomitant COVID-19 infection during pregnancy and/or postpartum period, should be conducted to better evaluate whether the gender-effect might explain the increased levels of depression in pregnant and/or postpartum women during the COVID-19 pandemic, as already reported in previous Italian studies which observed more severe psychological symptoms during the COVID-19 pandemic reported by females compared to males in Italian population (84–86). In fact, “caution is needed when reporting opinions or data coming from cross-sectional studies, especially in the absence of proper controls for lockdown” (87). Moreover, further studies should investigate how experiencing feelings of fear and anxiety related to the COVID-19 might determine increased levels of depression, independently by the pregnancy and/or postpartum period in women compared to men. Moreover, one should better investigate whether women with a previous psychiatry history may be more or less likely to develop increased levels of perinatal depression compared to women without a previous psychiatry history during the COVID-19 pandemic, independently by the variable to be infected with COVID-19 or not. Overall, our findings may indeed address clinicians to better evaluate and early identify those women at high-risk to develop perinatal depression during the COVID-19 pandemic, by investigating their levels of fear and perceived anxiety/distress due to the COVID-19 situation for preventive, screening and monitoring strategies. Finally, one could argue that a possible strategy which may help to improve screening activities could be implementing a smartphone-based screening tool consisting of CAS and FCV-19-S questionnaires which could be periodically and virtually administered to those pregnant and puerperal women to indirectly identify those at-risk to develop a perinatal depression in order to propose a psychological and/or psychiatric support (whereas necessary).

Conclusion

The COVID-19 pandemic and subsequent isolation, quarantine and lockdown represent a risk factor for pregnant and postpartum women who may experience a deprivation of their normal sources of family and social support and, hence, experience increased psychological distress. Our findings might address clinicians and politicians towards tailored clinical and policy implications to be implemented in the perinatal women, such as providing dedicated spaces and/or support figures, trained specifically on perinatal mental health consequences due to the COVID-19 pandemic and related restrictions, if possible. Trained mental health professionals can help women feel less isolated while facing the labor and postpartum period, within hospitals, during the COVID-19 pandemic, by offering psychoeducational interventions on perinatal mental health as

well as COVID-19 and perinatal mental health issues. Moreover, implementing public mental health policies to allow a direct and indirect screening for perinatal depression during the COVID-19 pandemic.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

LO and UV: conceptualization. LO: methodology, formal analysis, and writing—review and editing. LO, AM, and SP: data curation and collection. SP and LO: writing—original draft preparation. LO, VS, and SP: investigation. VS: visualization.

UV: supervision. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The handling editor MS declared a past co-authorship/collaboration with one of the authors LO.

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EDITED BY

Mohammadreza Shalbafan,
Iran University of Medical Sciences,
Iran

REVIEWED BY

Anna Vittoria Mattioli,
University of Modena and Reggio
Emilia, Italy
Shu-Feng Tsao,
University of Waterloo, Canada

*CORRESPONDENCE

Amir M. Hajiyavand
a.hajiyavand@bham.ac.uk

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Evaluation of COVID-19 pandemic on components of social and mental health using machine learning, analysing United States data in 2020

Seyed-Ali Sadegh-Zadeh¹, Mahboobe Bahrami²,
Amirreza Najafi³, Meisam Asgari-Ahi⁴, Russell Campion¹ and
Amir M. Hajiyavand^{5*}

¹Department of Computing, Staffordshire University, Stoke-on-Trent, United Kingdom, ²Behavioral Sciences Research Center, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran, ³Department of Information Technology Engineering, Tarbiat Modares University, Tehran, Iran, ⁴Department of Information Technology Management, University of Tehran, Tehran, Iran, ⁵Department of Mechanical Engineering, School of Engineering, University of Birmingham, Birmingham, United Kingdom

Background: COVID-19 was named a global pandemic by the World Health Organization in March 2020. Governments across the world issued various restrictions such as staying at home. These restrictions significantly influenced mental health worldwide. This study aims to document the prevalence of mental health problems and their relationship with the quality and quantity of social relationships affected by the pandemic during the United States national lockdown.

Methods: Sample data was employed from the COVID-19 Impact Survey on April 20–26, 2020, May 4–10, 2020, and May 30–June 8, 2020 from United States Dataset. A total number of 8790, 8975, and 7506 adults participated in this study for April, May and June, respectively. Participants' mental health evaluations were compared clinically by looking at the quantity and quality of their social ties before and during the pandemic using machine learning techniques. To predict relationships between COVID-19 mental health and demographic and social factors, we employed random forest, support vector machine, Naive Bayes, and logistic regression.

Results: The result for each contributing feature has been analyzed separately in detail. On the other hand, the influence of each feature was studied to evaluate the impact of COVID-19 on mental health. The overall result of our research indicates that people who had previously been diagnosed with any type of mental illness were most affected by the new constraints during the pandemic. These people were among the most vulnerable due to the imposed changes in lifestyle.

Conclusion: This study estimates the occurrence of mental illness among adults with and without a history of mental disease during the COVID-19 preventative limitations. With the persistence of quarantine limitations, the prevalence of psychiatric issues grew. In the third survey, which was done under quarantine or house restrictions, mental health problems and acute stress reactions were substantially greater than in the prior two surveys. The findings of the study reveal that more focused messaging and support are needed for those with a history of mental illness throughout the implementation of restrictions.

KEYWORDS

mental health, COVID-19 pandemic, social behaviours, psychiatry issues, machine learning, statistic analysis, prediction model

Introduction

SARS-CoV-2 (SARS) originated from Wuhan, China, (1) in December 2019, breaching international borders, slowing economies around the world. COVID-19 is a contagious disease that manifests itself in a variety of ways having common symptoms such as fever, cough, exhaustion, shortness of breath, and headaches (2, 3). During the initial months of the COVID-19 pandemic, countries all over the world took extraordinary steps to stop the SARS CoV-2 virus from spreading (4). California experienced the first state-wide shutdown on March 19, 2020. Within months, the country had passed some type of limitation, with the majority of the inhabitants of the United States being asked to stay at home and restrict their physical proximity to people (5). Mapping, where United States has been shut down, “The Washington Post, March 18, 2020.” As a result, the majority of “non-essential” job operations in municipal governments terminated or migrated to remote videoconferencing or work from home possibilities. This resulted in widespread furloughs and mass unemployment for a significant portion of the population (6): United States now has 22 million unemployed, wiping out a decade of job gains “The Washington Post, April 17, 2020,” (7). There is no doubt that such efforts fundamentally altered the social and psychological aspects of a large part of the population. As a result, the pandemic’s long-term impacts and accompanying limits on cultural, social, and mental health will almost certainly be a subject of research for years ahead.

The economic repercussions of the shelter-in-place countermeasures were quickly felt across the country, followed by social and psychological consequences (8). As an example, over 33 million Americans filed new jobless claims within the first 6 weeks of state-wide stay-at-home directives, a level of job loss not seen since the Great Depression (6): United States now has 22 million unemployed, wiping out a decade of job gains (The Washington Post, April 17, 2020). In terms of mental and

social health, the unprecedented increase in unemployment was concerning, given the well-documented findings that high unemployment, financial worries, and feelings of loneliness are major causes of suicide, substance misuse, domestic violence, and other mental health and social health concerns (9). The broad uncertainty about the pandemic’s probable course, as well as broad concerns about health and economic instability as a result of the lockdown restrictions, has raised fears that a boom in mental health issues is on the future (10, 11). The concern about the disease, its transmissibility, as well as its mortality led to panic and generalized anxiety, raising concerns that, as in other nations, post-traumatic psychosocial stressors could last long after the pandemic ended (12, 13).

Prior disease outbreak quarantines have been demonstrated to greatly increase manifestations of post-traumatic stress disorder and depression in the general population (14–16). Furthermore, extended stay-at-home mandates and social distancing measures might have unanticipated mental health repercussions, as they limit many of the aspects of everyday living that contribute to emotional strength, socialization, and life pleasure (17, 18). Because of the scale of the pandemic and its impact on daily life, many experts are concerned that mental health issues will continue to be a problem for years to come, with a negative impact on society and culture (19, 20). As a result, it appears that successful recovery from the outbreak will necessitate a thorough knowledge of the mental health repercussions that developed during the crisis’ severe stages.

Several research studies show that the pandemic could have a negative impact on people’s mental health (20–28). The COVID-19 pandemic’s stressors and motives to practice social distancing appear to be difficult for people to understand, resulting in poor mental health outcomes (20). Negative coping abilities, which are risk factors for depression, stress, and trauma among people of all ages, contribute to the inefficient ability to process stressful conditions like the pandemic (29). Another important component in determining people’s mental

resilience during times of crisis, such as the pandemic, was social support. During the pandemic, people felt high levels of low to moderate social support, which contributed to rises in anxiety and despair (30). Another risk for people's mental health during the pandemic was addiction (31). Despite being obliged to stay at home throughout the pandemic, some were found to be still using drugs. During the pandemic, people increased their use of alcohol and cannabis, with 49.3% engaged in drug use alone (29).

We looked at the prevalence of mental health disorders in a nationally representative sample of individuals in the United States, taken right at the start of the pandemic, during the first months of countrywide stay-at-home regulations. In this sample of data, we analyzed social relations and mental health concerns to identify the differences in mental health outcomes related to the lockdown. These data and analyses will be crucial in recording mental health and its impact on society during the early stages of the COVID-19 outbreak, as well as serving as a guideline for future studies on the crisis' long-term psychiatric effects.

Materials and methods

Dataset description

Data Foundation's national COVID-19 Impact Survey was used in this study (32). It provided data from the COVID-19 Impact Survey, which gives statistics on physical and mental health, economic security, and social dynamics in the United States as a result of the coronavirus pandemic. The probability-based survey, performed by National Opinion Research Center (NORC) at the University of Chicago for the Data Foundation, gives estimates for the entire United States, along with 10 states and eight urban regions. California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, and Texas are among the states, while Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, and Pittsburgh are among the urban regions. Data was collected in 3 phases (April, May, and June, 2020) to provide a picture of the global pandemic's impact on physical and mental health, economy, and employment in the United States during each phase. The three phases are a series of distinct cross-sectional investigations. Data was collected over the course of a week for each wave, with interviews done in both English and Spanish. Firstly, a random sample of United States homes was drawn from the non-partisan and impartial research organization NORC at the University of Chicago National Sample Frame and then contacted via mail, email, telephone, and field interviewers in the United States. People having merely a P.O. Box addresses were not included in the USPS Delivery Sequence File, and certain recently built homes were excluded from the study. A participant was chosen

at random from each household who lived with one or more than one adult housemate (family, friend, partner). The survey was available to all requested members online or by telephone with a NORC telephone researcher. The dataset is intended to provide a continuous assessment of the public's view, health, and economic situation during the outbreak to see how things are changing. When many pieces of information are available, it will be possible to track how concerns such as COVID-19 signs and financial status evolve over time. Physical health, economic and financial health, and social and mental health are the three main research areas covered by the survey. Mental health, work from home, communication, COVID-19 symptoms, chronic medical issues, behavioral components, and many more indicators were included in the survey questions. For this study, data from weeks 1 (April 20–26, 2020), 2 (May 4–10, 2020), and 3 (May 30–June 8, 2020) were available and integrated. The following are the five psychosocial questions we look at:

1. Felt nervous, anxious, or on edge?
2. Felt depressed?
3. Felt lonely?
4. Felt hopeless about the future?
5. Had physical reactions such as sweating, trouble breathing, nausea or a pounding heart when thinking about your experience with the coronavirus pandemic?

The following were the response options:

1. Not at all or less than 1 day
2. 1–2 days
3. 3–4 days
4. 5–7 days

Each answer was given a value of zero, one, two, or three, depending on the question. The mean score for questions 1, 2, 3, and 4 is 0.64 (SE = 0.01), whereas the mean score for question 5 is 0.15 (SE = 0.01).

Reliability and independency

In this study, a model was built for mental health markers to demonstrate the links between the attributes and the symptoms. The data were collected over the course of 7 days. A total of five attributes were considered for this which were nervousness, anxiety, depression, feeling lonely and feeling hopeless while four symptoms have been linked as the outcome of these attributes which were sweating, trouble breathing, pounding heart, and other symptoms. For this, an item reliability analysis was conducted to assess the consistency of responses to the mental health questions. This study constructed Cronbach alpha, a scale for quantifying the reliability of internal consistency. Following that, a pairwise chi-square test

of independence was added to look for correlations between mental health markers and other variables, with a P -value of 0.05 as the significance limit.

Machine learning techniques

Many media outlets today use the phrase “we live in the information age,” but many scholars feel we are living in the data age. We live in a world where a massive amount of data is generated every day in a variety of disciplines. As a result, these data can be applied to a variety of sectors, including mental health. Because of the vast volume of this data, typical data analysis methodologies and tools are frequently unavailable, making extracting information from it difficult. We are often unable to apply these approaches due to the differences between new data and old data, as well as the lack of responses to traditional queries; as a result, new ways, including the concept of machine learning, are required. Machine learning is a branch of research that enables machines to learn without having to plan ahead of time. Machine learning is the study of how computers learn from data and improve their performance. The main focus of the study is on automated learning and the detection of complicated patterns in order to create a system that can make intelligent data-driven decisions. The sorts of machine learning systems will be discussed in the following sections. Based on the amount and type of supervision they receive during training, machine learning systems can be divided into four categories, i.e., supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning.

Supervised learning was employed in this study. Each pattern in the set intended for teaching the algorithm has a label that represents the expected output in supervised learning. In supervised learning, there is a range of algorithms from which to choose, and four of them were utilized for the purpose of comparison in this study. The random forest algorithm is one of the ensemble methods that use a set of tree algorithms to conduct classification operations. To train each decision tree and, eventually, make decisions, this system employs data sets. The SVM algorithm produces decisions by determining the optimum data border that is the furthest away from all other categories (their supporting vectors). The logistic regression algorithm is determined using a class estimate function of each instance in the Naive Bayes algorithm, which calculates the likelihood of membership in each class using Bayesian theory. Hyperparameters in each of these models must be fine-tuned. To fine-tune these models, we used the grid search method. By experimenting with different parameters, this strategy aids in improving the model's accuracy. Two sets of training and test data are needed to evaluate these strategies. This data is utilized as training data for 80% of the time and as test data for 20% of the time. It is then put to use based on a variety of parameters. The accuracy criteria look at the model's performance across

all classes. When the relevance of the classes is equal, this criterion is important. The accuracy of the model in the presence or absence of circumstances is measured by sensitivity and specificity. These criteria have been chosen due to the relevance of decision making, assuming equal value of the classes and a greater importance of one of the classes.

Background on graph and network

Graph and network science are one of the fields that plays a major role in data science. Graphs were used to assess the reaction of several features in this study. Each feature's answers were taken to be 90 and the graph's edges to be pairs of responses that occur together. Because of the greater illustration and understanding of the relationships between the offered responses, this method was chosen. Some graph-related metrics, such as centrality, were calculated to determine the effect of each of the solutions. The centrality betweenness and closeness indices will be used to divide this calculation. The degree to which a response is in the shortest path between responses is measured in betweenness, while the proximity of each response to the other responses is measured in closeness. In general, each answer with a higher centrality index value is more essential. To create graphs and calculate various metrics, the Python programming language and Gephi software were utilized. The data was then processed using Python and the relevant data science packages. A subset of characteristics due to the model's complexity was selected and a vast amount of data features, as well as its correctness. Effective features have been exploited using Markov blanket.

Results

The results were collected over three months and every month is demonstrated separately. The total number of 8,769, 8,952, and 7,491 participants contributed to the survey in April, May and June, 2020 respectively. In this article, the working age is considered to be between 25 to 65 years old. This contains around 60% of participants. The average annual income in the United States is c.\$50K and this was the case for 60% of participants averaged over three months. 13,233 (52.5%) participants had a bachelor's degree or more. During the course of these three months, almost 30% of the total participants were living alone, while around 33% of the total number lived at least with one adult. On the other hand, c.24% lived with at least one child. [Table 1](#) indicates the detailed analysis of the collected data.

In this dataset, the respondents raised a concern regarding one or more of the mental health markers. In terms of mental health markers, 37.60% (9,481) of respondents reported nervousness, anxiety, or being on edge. 38.22% (9,639) reported depression, 37.95% (9,571) reported loneliness, and 38.02%

TABLE 1 The study attributes and the participation population.

Description	April 2020	May 2020	June 2020	Total
Total participant	8,769	8,952	7,491	25,212
Working age prior retirement 25 to 65 years old	5,843 (66.6%)	5,878 (65.6%)	4,919 (65.6%)	16,640 (66.0%)
Income \$50k	5,274 (60.1%)	5,410 (60.4%)	4,324 (57.7%)	15,008 (59.5%)
Education (minimum bachelor's degree)	4,626 (52.7%)	4,722 (52.7%)	3,885 (51.8%)	13,233 (52.5%)
Living alone	2,626 (29.9%)	2,761 (30.8%)	2,324 (31%)	7,711 (30.6%)
Living with kids	2096 (23.9%)	2093 (23.4%)	1807 (24.1%)	5996 (23.8%)
Adults only – no kid	5645 (64.3%)	5830 (65.1%)	4745 (63.3%)	16220 (64.3%)

(9,588) felt hopeless about the future. Out of this report, only 9.62% (2,425) declared at least one physical reaction such as sweating, trouble breathing, nausea or a pounding heart during the coronavirus pandemic. The social demographic features of dataset participants are depicted in [Figure 1](#).

Statistical results

This section reports the statistics regarding the impact of the COVID 19 pandemic on mental health of members of society by incorporating experiments and factors linked to the impact of COVID 19, such as the influence on social and cyberspace interactions and volunteer activities. In this study, the links between the various factors such as gender, age, income, education, race, and the level of trust in people such friends, families, neighbors, etc. were analyzed.

For this study, eight features were extracted from the dataset to conduct the Statistical Experiments which show the differences in behavior before and after the COVID-19 pandemic. The following list indicates the questions which will then be used for correlation to the comparisons shown in [Table 2](#):

- SOC2A: In the past month, how often did you talk with any of your neighbors?
- SOC2B: During a typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, how often did you talk with any of your neighbors?
- SOC3A: In the past month, how often did you communicate with friends and family by phone, text, email, app, or using the Internet?
- SOC3B: During a typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, how often did you communicate with friends and family by phone, text, email, app, or using the Internet?

- SOC4A: In the past month, did you spend any time volunteering for any organization or association, or not?
- SOC4B: During a typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, did you spend any time volunteering for any organization or association, or not?
- ECON4A: Think about 30 days from now, how likely do you think it is that you will be employed at that time?
- ECON4B: Think about 3 months from now, how likely do you think it is that you will be employed at that time?

In analyzing each experiment, a heat map diagram is demonstrated to compare the correlation between the features and a histogram of the variables for all three surveys is presented separately for each survey.

A variety of statistical tests was used to assess the correlations between variables in order to analyze the influence of the COVID-19 pandemic on participants' socio-mental features. The H0 hypothesis was rejected in all experiments using Pearson's chi-squared test.

As indicated in [Figure 2A](#), SE01 analyses the “conversations with relatives” attribute before and during the pandemic. A total of 25,000 respondents replied to this, and around 15,400 (60%) of them did not change their conversation time before and during the Pandemic.

The sum of the numbers above the diameter heat map indicates that 5,200 people reduced their time spent talking to relatives while 4,200 increased their conversation time. The correlation between the responses is demonstrated as a normalized distribution, which is a value between zero and one. Cells with higher positive numbers imply more correlation, where lower negative numbers suggest that the response event is contradictory, and values near zero show that the response event is independent.

[Figure 3A](#) demonstrates general behavior of social relationships over three months and compares the relationship

Features	Label	Answers	April Survey		May Survey		June Survey		Total	
			No.	%	No.	%	No.	%	No.	%
GENDER	Are you male or female	Male	3887	44.3	3987	▲44.5	3180	▼42.4	11054	43.84
		Female	4882	55.7	4965	▼55.4	4311	▲57.5	14158	56.16
AGE7	Age: 7 category	18-24	501	5.7	494	▼5.5	447	▲6.0	1442	5.72
		25-34	1457	16.6	1429	▼16.0	1225	▲16.3	4111	16.30
		35-44	1281	14.6	1318	▲14.7	1177	▲15.7	3776	14.97
		45-54	1287	14.7	1269	▼14.2	1017	▼13.6	3573	14.17
		55-64	1818	20.7	1862	▲20.8	1500	▼20.0	5180	20.54
		65-74	1728	19.7	1805	▲20.2	1465	▼19.6	4998	19.82
		75+	699	8.0	778	▲8.7	660	▲8.8	2137	8.47
HHINCOME	Household income	\$10,000 to under \$20,000	617	7.0	606	▼6.8	585	▲7.8	1808	7.6
		\$20,000 to under \$30,000	801	9.1	830	▲9.3	727	▲9.7	2358	9.9
		\$30,000 to under \$40,000	775	8.8	780	▼8.7	683	▲9.1	2238	9.3
		\$40,000 to under \$50,000	669	7.6	704	▲7.9	569	▼7.6	1942	8.1
		\$50,000 to under \$75,000	1576	18.0	1627	▲18.2	1320	▼17.6	4523	18.9
		\$75,000 to under \$100,000	1226	14.0	1291	▲14.4	1048	▼14.0	3565	14.9
		\$100,000 to under \$150,000	1338	15.3	1401	▲15.6	1126	▼15.0	3865	16.1
		\$150,000 or more	1134	12.9	1091	▼12.2	830	▼11.1	3055	12.8
		DON'T KNOW	25	0.3	16	▼0.2	13	▼0.2	54	0.2
		REFUSED	69	0.8	74	▲0.8	41	▼0.5	184	0.8
EDUCATION	What is the highest level of school you have completed?	SKIPPED ON WEB	119	1.4	122	▲1.4	105	▲1.4	346	1.4
		No HS diploma	281	3.2	290	▲3.2	313	▲4.2	884	3.5
		HIGH SCHOOL GRADUATE	1129	12.9	1155	▲12.9	973	▲13.0	3257	12.9
		Some college, no degree	1858	21.2	1876	▼20.9	1520	▼20.3	5254	20.8
		Associate degree	867	9.9	906	▲10.1	796	▲10.6	2569	10.2
		Bachelors degree	2496	28.5	2541	▼28.4	2029	▼27.1	7066	28.0
		Masters degree	1458	16.6	1519	▲17.0	1268	▼16.9	4245	16.8
		Professional or Doctorate degree	672	7.7	662	▼7.4	588	▲7.8	1922	7.6
RACETH	Race/ethnicity	Not sure	1	0.0	2	▲0.0	4	▲0.1	7	0.0
		SKIPPED ON WEB	6	0.1	4	▼0.0	2	▼0.0	12	0.0
		White, non-Hispanic	5464	62.3	5965	▲66.6	4531	▼60.5	15960	63.3
		Black, non-Hispanic	782	8.9	795	▼8.9	712	▲9.5	2289	9.1
		Hispanic	767	8.7	754	▼8.4	735	▲9.8	2256	8.9
		Other, non-Hispanic	583	6.6	623	▲7.0	579	▲7.7	1785	7.1
HHSIZE1	Household size (including children)	Removed for disclosure risk	1169	13.3	2	▼0.0	927	▲12.4	2098	8.3
		SKIPPED ON WEB	3	0.0	811	▲9.1	5	▼0.1	819	3.2
		REFUSED	3	0.0	4	▲0.0	4	▲0.1	11	0.0
		One person, I live by myself	2626	29.9	2761	▲30.8	2324	▲31.0	7711	32.1
		Two persons	3144	35.8	3189	▼35.6	2526	▼33.7	8859	36.9
HH_BANNER	Banner: HH STRUCTURE	Three persons	1271	14.5	1193	▼13.3	1050	▲14.0	3514	14.6
		Four persons	892	10.2	965	▲10.8	781	▼10.4	2638	11.0
		Five persons	446	5.1	453	▼5.1	396	▲5.3	1295	5.4
		Alone	2626	29.9	2761	▲30.8	2324	▲31.0	7711	34.7
LANGUAGE	Language	1 other adult only	3019	34.4	3069	▼34.3	2421	▼32.3	8509	38.3
		1 or 2 kids	1593	18.2	1609	▼18.0	1346	▼18.0	4548	20.5
		3 or more kids	503	5.7	484	▼5.4	461	▲6.2	1448	6.5
LANGUAGE	Language	English	8666	98.8	8879	▲99.1	7396	▼98.6	24941	98.9
		Spanish	105	1.2	77	▼0.9	97	▲1.4	279	1.1

FIGURE 1

Demography of COVID-19 impact survey participants.

between the period before the pandemic (indicated in blue) and during pandemic (indicated in red). The results show that almost 33% of the population did some networking during the week but only 28% of participants networked several times a month.

Figure 4 demonstrates the results obtained from the SE02 test, which examines how age and gender, income, education, race, and participants' trust affected their intention to talk with relatives. In the figure, the blue cells depict the statistical distribution of replies prior to the COVID-19 pandemic, whereas the orange cells depict the statistical distribution of responses during the COVID-19 pandemic. The numbers 1 to

5 on the vertical axis of the answers reflect the responses to the conversation question, where 1 indicates the maximum number of discussions (daily conversation) and 5 indicates the lowest number of interactions (do not make any conversation). The dot on the box also represents the average of the responses. It is predictable that no alteration would be reported for 'age', 'gender' and 'race' attributes. However, the results showed that the other attributes have also no changes.

The graphs indicated fewer variations to the mentioned attributes before and during the pandemic. However, they provide valuable information regarding the differences in communication behavior of different genders and also different

TABLE 2 Statistical experiments.

Number	Description	Associated questions
SE01	Changes in social relationships before and after the pandemic	SOC2A and SOC2B
SE02 SE04	Changes in age, income, education	SOC2A and SOC2B SOC3A and SOC3B
SE03	Changes in the use of virtual relationships before and after the pandemic	SOC3A and SOC3B
SE05	Change in participation in voluntary activities before and after COVID 19	SOC4A and SOC4B
SE06	Changes in age, income, education and Changes in the use of virtual relationships before and after the pandemic	SOC4A and SOC4B
SE07	Changes in job status of people before and after pandemic	ECON3, ECON4A, ECON4B

age groups. Based on this, women have broader social relationships than men. On the other hand, people in the age group 18–24 years old, 35–44 years old, and 65–74 years old indicated more social relationships before pandemic than the other age groups. This then indicates that the pandemic has had a greater impact on these particular group and has affected their relationships.

The impact of people's income on conversations is investigated in [Figure 4C](#). The scale of averages for middle-income persons is the only interesting element, since it reveals that their talks have stayed consistent since the outbreak. However, the pandemic has reduced the number of conversations in the other categories, and the average after the outbreak is greater than before the pandemic. [Figure 4D](#) depicts the level of education and the amount of conversations. As is well known, those with higher education (bachelor's, master's, and Ph.D.) had more talks both before and after the pandemic than others, and they were unable to entirely restrict their interactions. Furthermore, the average remains consistent for individuals without a diploma or schooling, demonstrating that those with a very low level of education have not limited their talks following the pandemic. Other groups, on the other hand, have more limited conversations. [Figure 4E](#) demonstrates that whites were less constrained in their interactions after the pandemic, while blacks had a lower mean, indicating an increase in their conversations after the pandemic began. [Figure 4F](#) depicts the effect of individual trust, demonstrating that people who trusted others had fewer ties, whilst persons who had no or little trust in others did not have much of a pandemic effect.

The link between the two features SOC2B and SOC2A is studied in the SE03 experiment which is demonstrated in [Figures 2 and 3](#). [Figures 2B](#) is a heat map which reveals

the majority of participants are using cyberspace. Unlike the previous heat map, the total of the numbers below the chart's diameter is more than the top diameter, indicating that people are increasingly using cyberspace and that the number of people who have increased their usage of cyberspace has been raised.

The histogram in [Figure 3B](#) demonstrates that the number of people who use cyberspace on a daily basis has significantly increased in all three surveys since the beginning of the pandemic. This is even more significant where the use of cyberspace happens on a daily basis since the beginning of the pandemic. As it is shown, the growth rate was higher in the first survey and decreased in the second and third polls. For this particular attribute, it is essential to consider the level of knowledge in using cyberspace and additionally the link between the age- and job-related factors.

The histogram in [Figure 3B](#) demonstrates that the number of persons who use cyberspace on a daily basis has increased in all three surveys since the beginning of the pandemic. As illustrated in [Figure 5](#), in general, the use of Cyberspace increased among all attributes during the pandemic. [Figure 5A](#) shows that women had generally a lower average of cyberspace users than men. However, both women and men are using cyberspace more than they were using it before the pandemic. [Figure 5B](#) shows that the age group between 15 and 24 years was the most engaged in cyberspace during the pandemic, however, as age increased, the use of the cyberspace decreases. Similar to before, this usage also increased during the pandemic which was because of being in lockdown. [Figure 5C](#) shows that there is no link between income and cyberspace usage.

In the SE05 Experiment, it is evident that the number of people who have quit volunteering since the pandemic has dramatically increased, according to the heat map in [Figure 2C](#). On the other hand, as shown in [Figure 3C](#), the intention of having volunteer activities significantly decreased during the pandemic. This may be due to the fear of COVID-19 or because of being locked down.

It was a general habit for the majority of the age groups to volunteer for certain jobs (this was less for the age group 25–34 years old). However, during the pandemic, both men and women declined to be volunteers, although women declined more ([Figure 6](#)). The volunteering of higher educated people has also decreased during the pandemic. The reason would be either a drop in the supply of volunteering work due to lockdown or it may again be fear of catching the virus. Regardless of the reason, this caused people to stay more indoors and socio-communication was decreased.

[Figure 2D](#) demonstrates the results from the SE07 Experiment which shows that most people did not notice a change in their employment prospects. Furthermore, the numbers above the diameter are higher than the numbers below the diameter, implying that people believe their chances of finding work during the pandemic have reduced. [Figure 3D](#) demonstrates the histogram of the probability of employment

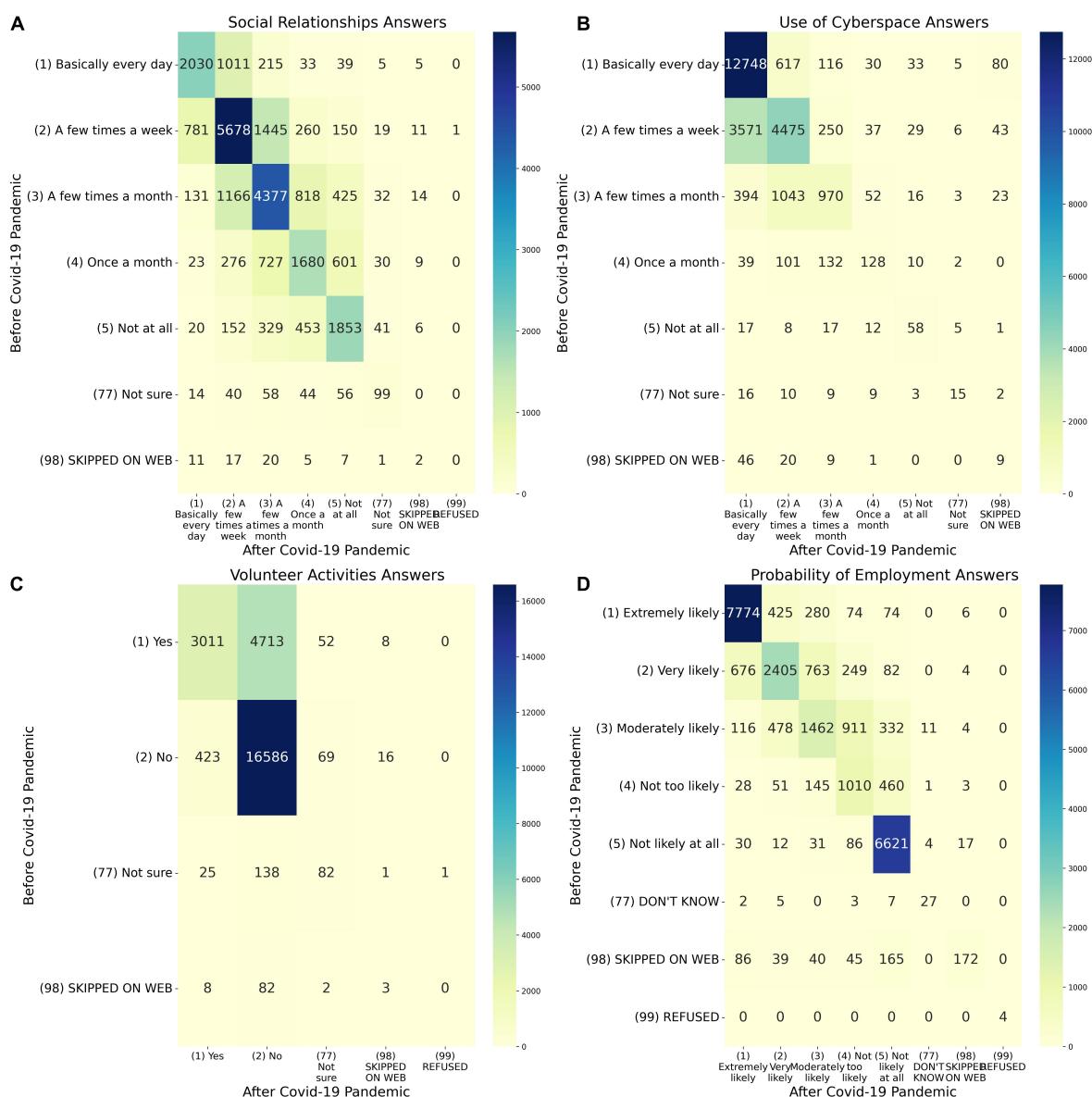


FIGURE 2

Heatmap analysis of the variables in Experiments. (A) Heatmap of social relationships answers between before COVID-19 pandemic (SOC2B) and during last month (SOC2A). (B) Heatmap of use of cyberspace answers between before COVID-19 pandemic (SOC3B) and during last month (SOC3A). (C) Heatmap of volunteer activities answers between before COVID-19 pandemic (SOC4B) and during last month (SOC4A). (D) Heatmap of probability of employment answers between before COVID-19 pandemic (ECON4B) and during last month (ECON4A).

during the three months. The motivation of applying for jobs remained similar before and during the pandemic. However, it is shown that people's hope regarding their chances of finding work had declined during the pandemic.

For data consistency evaluation, the Cronbach's Alpha measure was calculated for each experiment. The results in Table 3 illustrate the reliability of over 0.90 which demonstrates the highly reliable data as it was over 0.7 threshold. These experiments support the changes in social activities, use of cyberspace, volunteer activities and

employment probability in relation to gender, age, income, education, race and trust on people, all before and during pandemic.

In this study, a pairwise Pearson chi-square examination was conducted to evaluate the association between various variables, where P values were assigned to be less than 0.05 as shown in Table 4. Based on the independency examination of the data, it was found that there is no relation between the trust of the participants (SOC1) and the level of the volunteer activities (SOC4A and SOC4B) as it was expected.

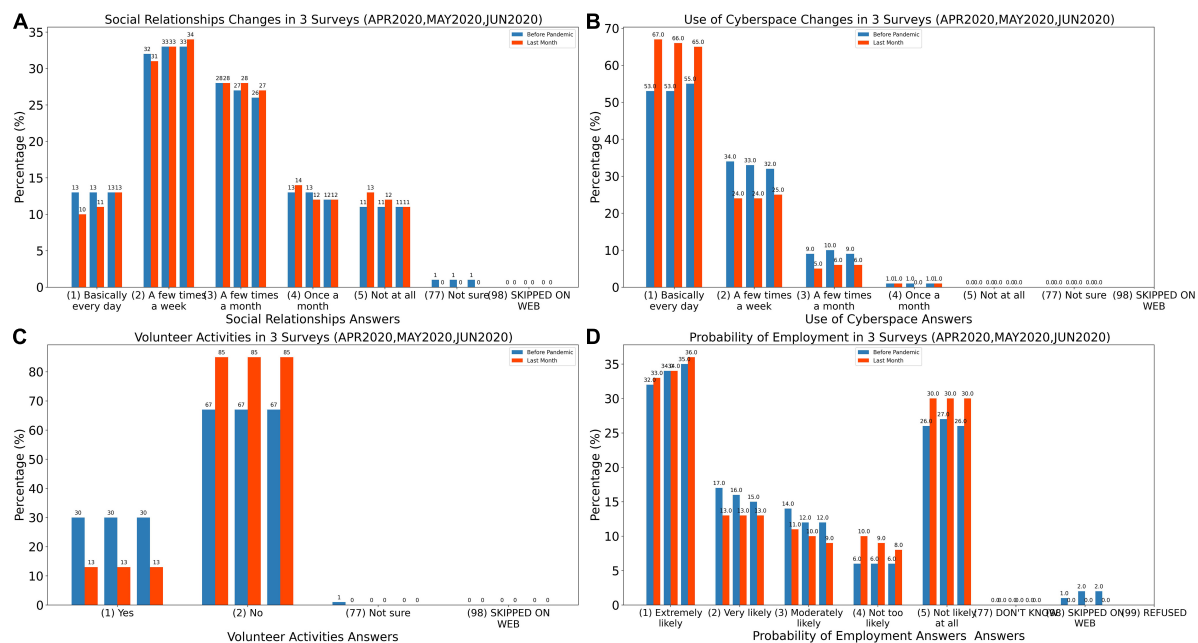


FIGURE 3

Histogram of analysis of the variables in Experiments. (A) Histogram of social relationships answers for before COVID-19 pandemic (SOC2B) and during last month (SOC2A). (B) Histogram of use of cyberspace answers for before COVID-19 pandemic (SOC3B) and during last month (SOC3A). (C) Histogram of volunteer activities answers for before COVID-19 pandemic (SOC4B) and during last month (SOC4A). (D) Histogram of probability of employment answers for before COVID-19 pandemic (ECON4B) and during last month (ECON4A).

Machine learning results

Graph and network science is one of the fields that has recently played a major part in data science. Graphs were used to assess the reaction of several features in this study. The responses to each of the features are treated as nodes in this section, and the edges of the graph are treated as pairs of replies that occur together. Some graph-related metrics, such as centrality, were calculated to determine the effect of each of the responses. The betweenness and closeness centrality metrics will be used to divide this calculation. Betweenness represents how short the path is from one response to all other responses, and closeness represents how closely responses to each other on average. In general, each answer with a higher centrality index value is more essential. To construct graphs and calculate various criteria, Python and Gephi were utilized.

Each answer with a higher centrality index score is, in general, more essential. We need to pick a subset of features due to the model's complexity and a large number of features, as well as its accuracy. Effective features in psychological conditions have been picked from this dataset based on the research [14] utilizing the Markov blanket. 80% of this data is used as training data and 20% as test data. The Synthetic Minority Oversampling Technique (SMOTE technique) was used to address the class imbalance. Some data were recognized as outliers and eliminated from the dataset under the supervision

of a fellow psychiatrist. Finally, several supervised learning approaches such as random forest, support vector machine, Naive Bayes, and logistic regression have been applied to predict mental health using the Python and the Scikit-learn package.

The graph in Figure 7 is made up of nodes representing the selected attributes from Table 1 and edges representing the association between pairs of responses that happened together. The relationship between the provided responses is well illustrated on the graph. Ninety edges are the names for the two basic components that make up each graph. A problem's actors are introduced as nodes, and the relationships between those actors are introduced as edges. In order to create the graph for this study, all of the data related to the features that were chosen as nodes was first retrieved. After that, focus has been placed on the responses that occurred simultaneously in order to extract the edges. In a graph, the strength of the link can be determined by the thickness of the edges; hence, in this graph, the thickness of the edges reflects the frequency of a pair of replies. How related they are to other replies affects the size of graph nodes. Nodes were grouped according to their closeness and betweenness centrality using the same color. The color of each node based on the betweenness, and closeness is shown in Figures 8A,B, respectively. In these diagrams, the centrality of each node is calculated to determine its relevance. According to the graphs R05, R06, R07, and R08 had the highest scores among all responses. All node scores are evident, and the nodes

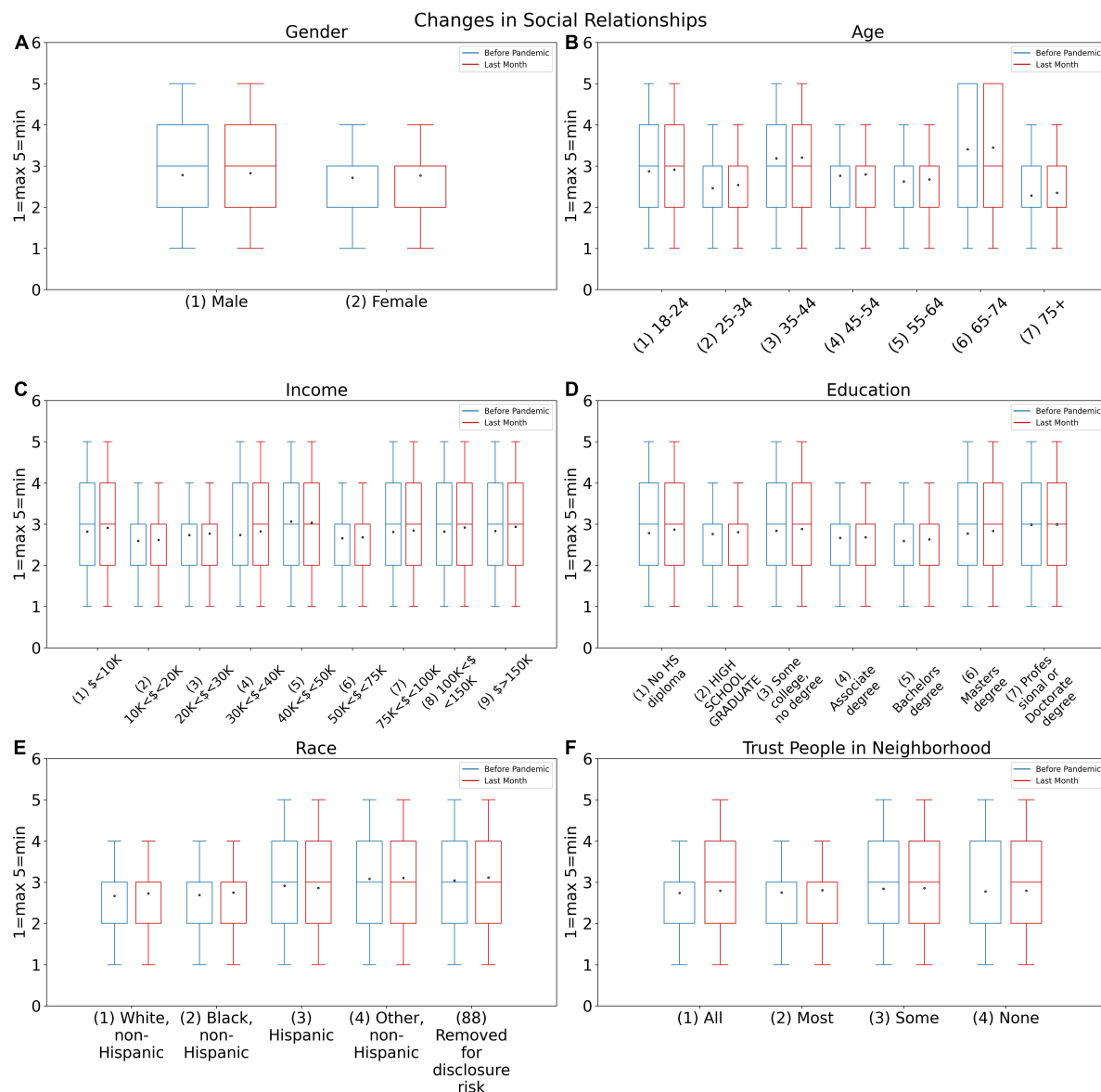


FIGURE 4

Changes in social relationships answers for before COVID-19 pandemic (SOC2B) and during last month (SOC2A) based on (A) Gender, (B) Age, (C) Income, (D) Education, (E) Race, and (F) Trust people in neighborhood.

were partitioned into groups of the same hue based on these ratings. The number of repetitions of each feature determines the thickness of each edge. The strongest feasible connection is formed between nodes R05 and R08, as indicated in the network. People in this connection have not had a fever, chills, or excessive sweating when staying at home. In the next category of strong connections, the connection between R05 and R23 as well as the connection between R08 and R23 is clear. Graph nodes are sorted by size based on how connected they are to other responses. The same color has been used to organize nodes based on betweenness and closeness centrality. As a result, nodes R05, R06, R07, and R08, which indicate whether or not to stay

at home and whether or not a fever, chills, or heavy sweating, are significant.

Mental health prediction model experiment

To predict mental health, we employed the soc5 feature as the label of the dataset. Age (age4), physical symptoms in the preceding 7 days (phys7_4), remaining at home (phys2_18), previous clinical diagnosis of mental health status (phys3h), level of neighborhood trust (soc1), and level of a verbal conversation with neighbors (soc2a and soc2b) were also used.

Three possibilities are considered for modeling based on the soc5 feature:

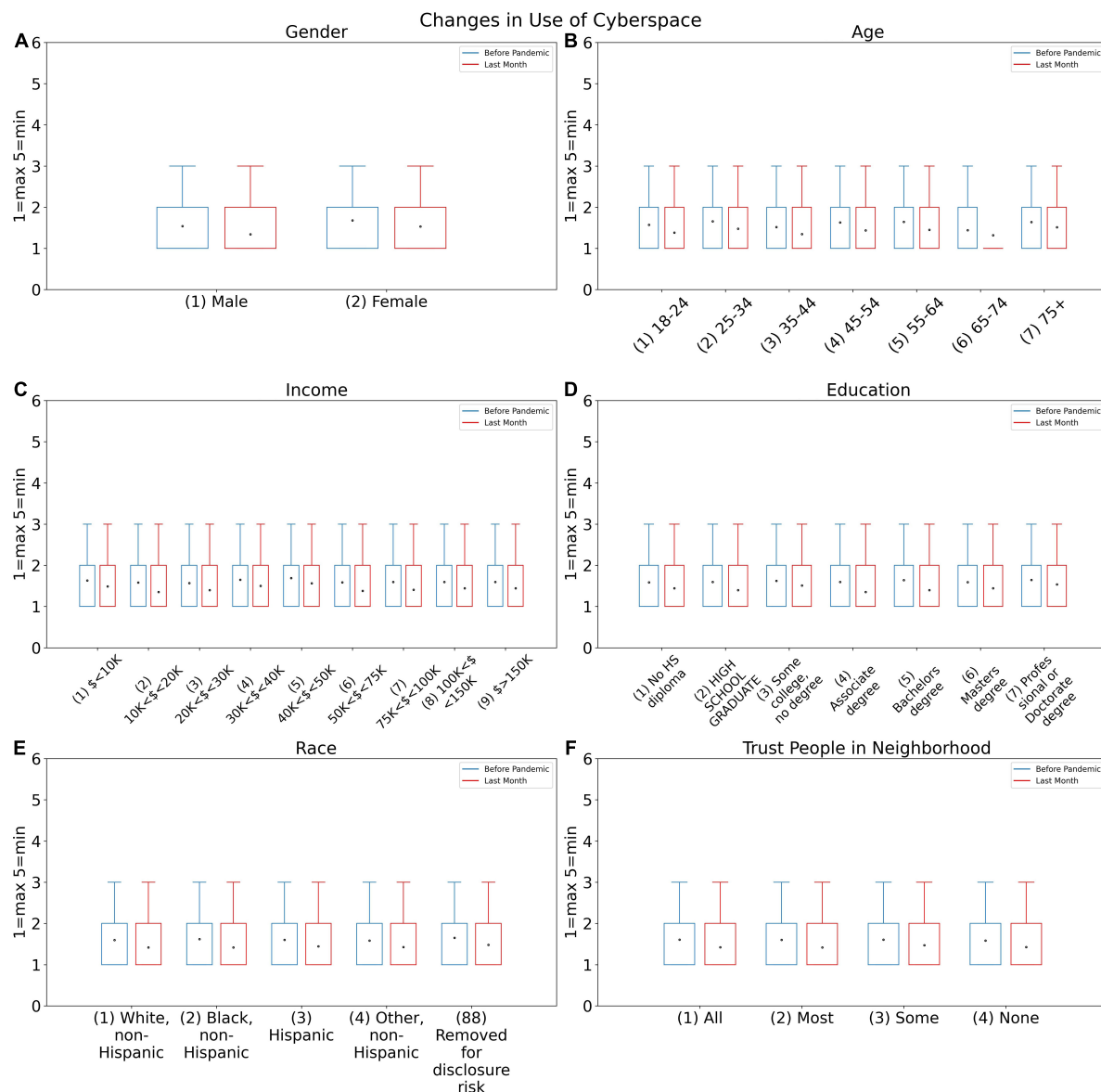


FIGURE 5

Changes in use of cyberspace answers for before COVID-19 pandemic (SOC3B) and during last month (SOC3A) based on (A) Gender, (B) Age, (C) Income, (D) Education, (E) Race, and (F) Trust people in neighborhood.

1. Psychological problems less than one day a week (zero class) and psychological problems more than 5 days in a week (class one).
2. Psychological problems less than one day a week (zero class) and psychological problems more than 3 days in a week (class one).

Psychological problems less than one day a week (zero class) and psychological problems more than 1 day in a week (class one).

Random Forest, SVM, Naive Bayes, and Logistic regression are the four different Machine Learning models which were

utilized to evaluate the accuracy, Sensitivity, Specificity, and Receiver operating characteristic (ROC). These ML models were employed to compare the results for each scenario. **Table 5** illustrated the results of these evaluations in April, May and June, 2020, respectively. The data split 80% of the data randomly for training, and 20% of the data were randomly assigned for Testing separately for each month. Each table is divided into three main sections based on the number of occasions that psychological problems occurred during the week. In **Table 5**, the maximums are indicated in green and the minimums are indicated in red. As it is illustrated in **Table 5**, the Random forest model contributes toward the highest obtained results for the

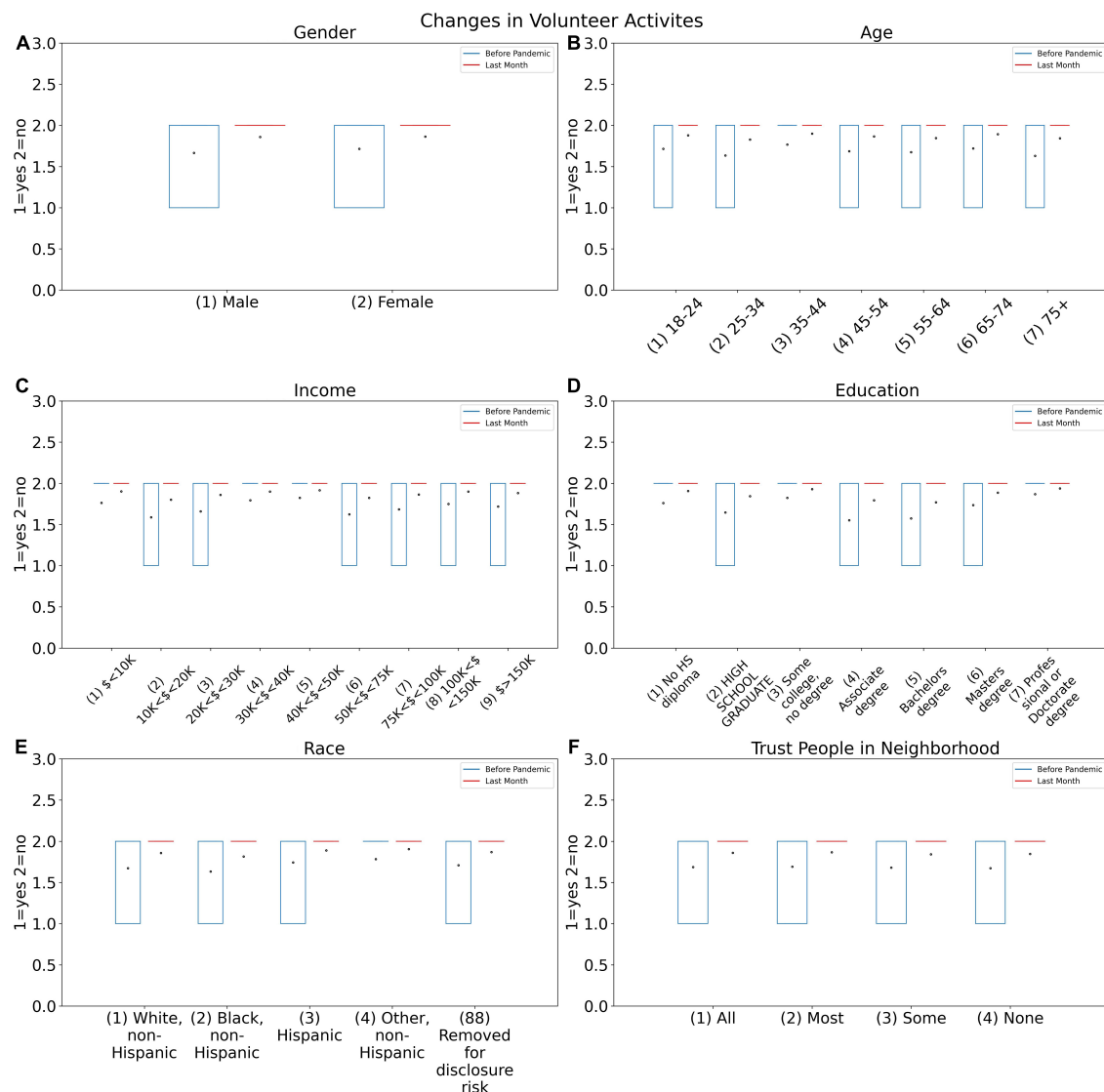


FIGURE 6

Changes in volunteer activities answers for before COVID-19 pandemic (SOC4B) and during last month (SOC4A) based on (A) Gender, (B) Age, (C) Income, (D) Education, (E) Race, and (F) Trust people in neighborhood.

majority of the accuracy, Sensitivity, Specificity and ROC. On the other hand, Logic Regression contributes the lowest number in achieving the maximums in the evaluating factors.

As can be seen in [Tables 2](#) and [6](#), in the first possibility, i.e., the riskiest cases of mental problems, the random forest model performed better in terms of accuracy and specificity than other methods. The SVM model, on the other hand, has performed better in the Sensitivity and ROC criteria. The Logistic Regression and Naïve Bayes models were also accurately performed. On the other hand, it can be seen that the performance of the models based on accuracy has significantly decreased from the first possibility, i.e., the riskiest cases, to the last possibility, i.e., the least risky cases.

Discussion

Mental health has significant social and cultural impacts. Mental disorders and suicide-related consequences have increased dramatically in all age groups and genders during the previous decade ([33](#), [34](#)). COVID-19's rapid growth caused governments around the world to close public meeting places, restaurants, universities, schools, and businesses. Social isolation, digital communication, and working and educating from home have all become the new normal, and many jobs have been lost as a result. This has resulted in a high degree of anxiety, tension, and depression over the world. No studies that used modeling to not only estimate but also to describe the

TABLE 3 Reliability analysis results (Cronbach's Alpha measure).

Reliability test	Gender	Age7	Hhincome	Education	Raceth	SOC1
SOC2B, SOC2A	1	0.994	0.993	0.994	0.999	0.999
SOC3B, SOC3A	1	0.992	0.973	0.955	0.999	0.999
SOC4B, SOC4A	1	0.965	0.988	0.978	0.999	0.999
ECON4B, ECON4A	1	0.909	0.955	0.954	0.999	0.999

TABLE 4 Independency analysis – Pearson Chi-Square test.

Independency Test	P-value			
	SOC2B, SOC2A	SOC3B, SOC3A	SOC4B, SOC4A	ECON4B, ECON4A
Gender	5.62×10^{-28} Reject H0	1.17×10^{-10} Reject H0	6.66×10^{-21} Reject H0	3.13×10^{-9} Reject H0
Age7	7.10×10^{-5} Reject H0	2.92×10^{-7} Reject H0	1.14×10^{-11} Reject H0	2.19×10^{-203} Reject H0
Hhincome	4.48×10^{-12} Reject H0	1.58×10^{-18} Reject H0	2.10×10^{-34} Reject H0	1.52×10^{-68} Reject H0
Education	3.52×10^{-7} Reject H0	3.52×10^{-39} Reject H0	1.09×10^{-71} Reject H0	1.08×10^{-54} Reject H0
Raceth	4.85×10^{-19} Reject H0	9.18×10^{-10} Reject H0	1.38×10^{-12} Reject H0	9.96×10^{-34} Reject H0
SOC1	3.26×10^{-4} Reject H0	9.03×10^{-3} Reject H0	0.80 (H0 holds true)	2.83×10^{-3} Reject H0

nuanced impacts of life events on mental health and followed by society and culture were found. The most clear finding of the research was that people who had previously been diagnosed with any type of mental disease were the most vulnerable to mental illness during the COVID-19 pandemic. As a result, governments should develop national-level programs to track the mental health of this target demographic on a regular basis and treat them appropriately.

As previously stated, the purpose of this study is to look into the impact of the COVID-19 pandemic on many aspects of people's social conditions and mental health status. These factors include the number of genuine social contacts, the extent to which people utilize social-media, and the extent to which people participate in volunteer activities and feeling of job insecurity. The goal of examining these criteria is to determine the pandemic's relative influence on people's mental health. Each of these factors on its own can indicate a trend of lifestyle changes and possibly a sign of changes in a person's mental health status during the COVID-19 pandemic. Measurement of the pattern that analyses these changes in various groups needs to be divided by gender, education level, income, age group, and race, to identify sectors of society that are more vulnerable in the pandemic. This issue aids in the development of tailored prevention and treatment protocols for certain groups. For example, a study that looked at the effect of social distance on anxiety, depression, and stress in Brazilian students found that disturbed sleep was a risk factor for mental health problems and that physical activity during quarantine was a protective factor to prevent mental health problems (35). Another study examined suicidal possibility in university students during

a pandemic and showed that the student population is a vulnerable group in this regard (36).

Anxiety symptoms were reported by 37.60 percent of respondents when it came to mental health markers. When asked about their experiences with the coronavirus pandemic, 38.22 percent had depression symptoms, 37.95 percent felt lonely, 38.02 percent felt gloomy about the future, and 9.62 percent had bodily reactions such as sweating, difficulty breathing, nausea, or a racing heart. Anxiety and depression symptoms were the most common mental health disorders during this period, according to numerous recent researchers in the field of the COVID-19 pandemic, which was also the case in this study. However, when the percentage of people with physical symptoms is compared to the percentage of people with mental health problems, it becomes clear that not all of these psychiatric issues are related to physical symptoms. As a result, the involvement of social pressures and changes in people's lifestyles in the development of mental health problems becomes clearer.

As illustrated in Figure 2, most people's actual social interaction patterns and daily talks (62.6%) were unaffected by the pandemic and showed no change. People who altered their social communication patterns throughout the pandemic, on the other hand, gradually reduced their daily discussions with others, implying that overall social engagement declined during the pandemic. The findings suggest that roughly 4,058 persons (16.3% of the population) who are affected by the pandemic have fewer daily social contacts. This decrease could be the consequence of people avoiding contact owing to severe fear, or it could be the effect of over-adherence to protocols.

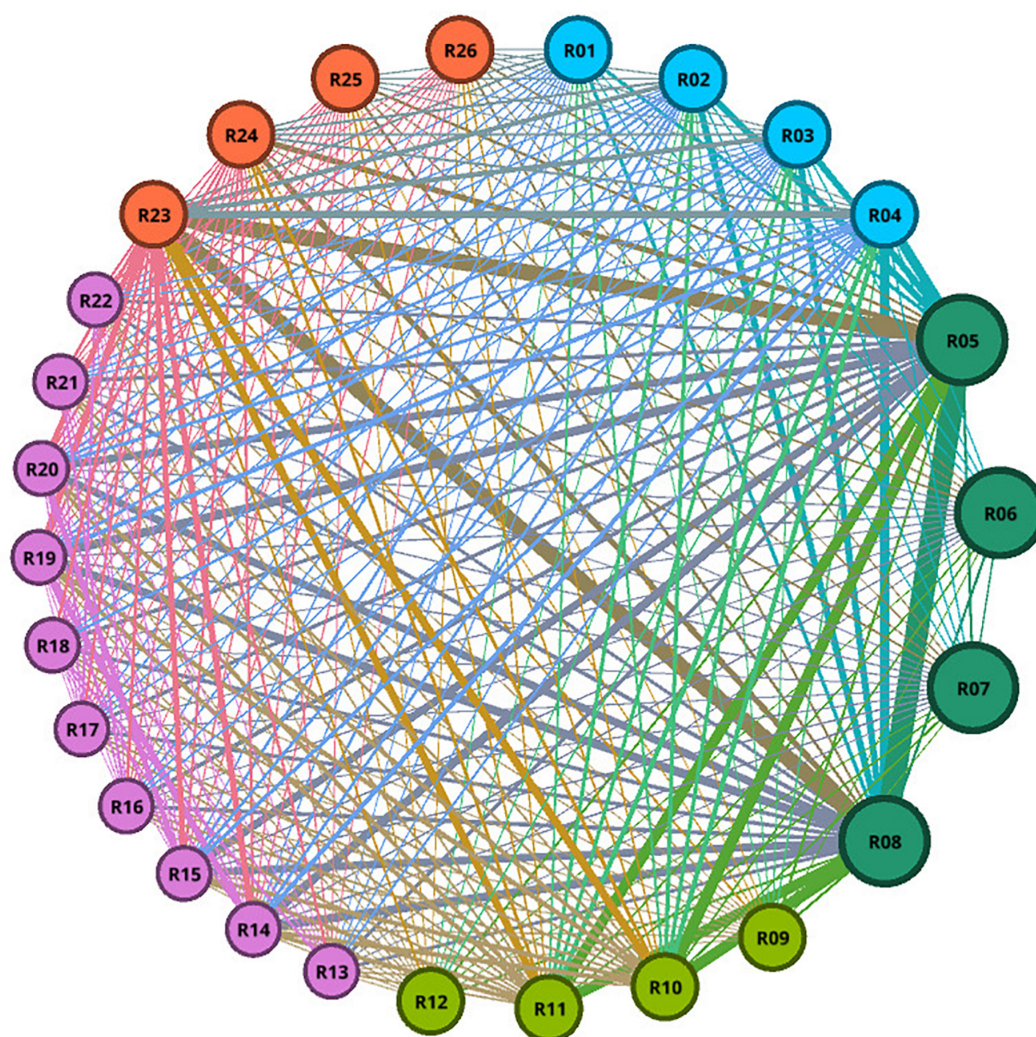


FIGURE 7

For all responders, a graph of selected feature responses is shown. The thickness of the lines indicates the strength of pairwise responses relations; a thicker association between two nodes indicates a stronger relationship. The size of graph nodes is determined by how connected they are to other answers. The same color was used to group nodes based on their closeness and betweenness centrality.

Under the impact of the COVID-19 pandemic, they may also experience generalized anxiety, which has resulted in social isolation. During the COVID-19 pandemic, almost 4,997 people (20% of participants) demonstrated an increase in interpersonal social activity. This increase in social relationships through communication with others may provide an opportunity for people to share their concerns and discuss them. This can be a self-healing mechanism for individuals.

Women had a greater and more diverse variety of social ties than men, as illustrated in [Figure 5](#), when analyzing the effect of gender on modifying social relationships during a pandemic. Following the COVID-19 pandemic, both men and women have witnessed a drop in interpersonal connections, with women experiencing a higher decline. This disparity could indicate

that women in this area are more vulnerable to the pandemic. A study published by the Lancet Commission on Women and Cardiovascular Diseases in 2021 also noted the importance of psychosocial factors such as depression and anxiety in the development of heart disease and the greater vulnerability of women in this area. The study found that women were more likely than men to experience social psychological damage such as chronic stress, grief, unemployment and lack of social support, which predisposed them to depression, anxiety and other mental health problems. Another cause of women's vulnerability in mental health can be endogenous and hormonal issues (37).

On the other hand, it is possible that women were more active in caring for children and maintaining the family at

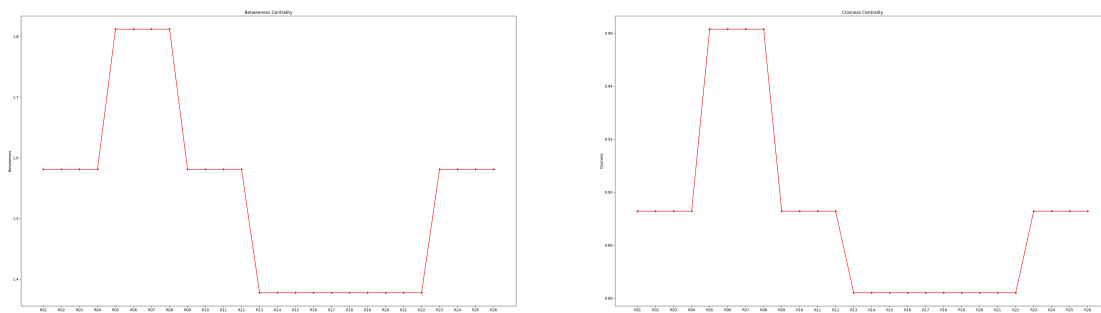


FIGURE 8

The importance of responses will be determined using the betweenness centrality metrics. Betweenness is a measure of how short the road between one reaction and all others is. Each answer with a higher centrality index score is, on average, more important. The importance of responses will be determined using the closeness centrality measures. Closeness refers to how similar responses are on average. Each answer with a higher centrality index score is, on average, more important.

home during the quarantine period than men, resulting in their isolation.

A 2020 study by Almeida et al. examined the effect of the Quaid pandemic on women's mental health and found that post-partum pregnant women with abortions and women exposed to domestic violence were more likely to develop mental health problems in a pandemic. This indicates that this population needs special attention during a pandemic to reduce the burden of mental health problems (38).

Another study examining the management of women's stress and lifestyle during the Quaid pandemic noted the effect of quarantine on reducing physical activity and increasing stress on increasing cardiovascular risk factors (39).

During the COVID-19 pandemic, the 18–24 age group was more constrained in interpersonal interactions than other age groups. This could be due to this age group's enthusiasm and proficiency in using social media as a substitute for actual interactions during the pandemic. Because peer group communication is so vital in the formation of personality and social skills in this age group, it is critical to give extra attention to this group during pandemics. However, the pandemic has had less of an impact on the social relations of those aged 45 and up. This could be because this age group makes up the majority of the community's employees, whose interpersonal ties are less harmed because of workplace communication.

The pandemic has resulted in a decline in interpersonal bonds among people of all socioeconomic levels. However, the findings demonstrate that this drop in interpersonal ties is not apparent in the middle class, as measured by income. One hypothesis is that, due to financial problems and fears of job instability, these people had more participation during the pandemic than other groups in society.

People with higher education (bachelor's, master's, and Ph.D.) had greater social contacts before and during the pandemic, but these interactions declined after the outbreak. In order to limit the danger of COVID-19, this might be done

consciously in this subgroup. As a result, after the pandemic, those with lower levels of education in the community have not changed their interpersonal ties.

Individuals on both ends of the trust scale (total trust or absolutely without trust) have had no effect on their social connections as a result of the pandemic. This is likely due to distrustful people's pessimism about news and prevention recommendations, and as a result, they do not follow these measures or do not believe in the risk of COVID-19 disease. They are likely to be reckless, misjudging the probability of the pandemic, and hence decided not to change their lifestyle.

According to Figure 5, the majority of people's use of social media has remained unchanged in the aftermath of the pandemic. However, over time, during the pandemic, people's participation in social media has increased, which has been the highest growth in the first survey. In other words, the average use of social media during a pandemic by individuals has increased on average. A study (40) looked into the psychological and social effects of the pandemic in the Najran City population, in Saudi Arabia. They discovered that during a pandemic, people's use of social media increased and was linked to despair and anxiety. This result contradicted the findings of our study (in which the pattern of use of the majority of people has remained unchanged), which could be attributable to variations in the populations investigated, study tools, or analysis approach.

More women than men sought refuge on social media during the pandemic, which is to be expected given the further decline in their actual social interactions (mentioned above). The 18–24 age group has used social media more than others, and they are also the ones who have seen the largest drop in interpersonal interactions.

The number of persons who have declined to volunteer since the pandemic broke out has risen dramatically. However, there was no discernible difference in the amount of these activities before and after the pandemic. This finding can be interpreted

TABLE 5 Model evaluation for all dataset.

Case	Dataset-months	Scenarios	Random forest	SVM	Naive Bayes	Logistic regression	Optimal
Participant with no Psychological problems Vs. Participants with psychological problems more than 5 days a week.	April2020	Accuracy	0.89	0.80	0.77	0.77	0.89
		Sensitivity	0.60	0.65	0.67	0.64	0.67
		Specificity	0.84	0.82	0.79	0.79	0.84
		ROC	0.72	0.74	0.73	0.72	0.74
	May2020	Accuracy	0.84	0.83	0.81	0.83	0.84
		Sensitivity	0.54	0.63	0.65	0.61	0.65
		Specificity	0.87	0.84	0.82	0.85	0.87
		ROC	0.70	0.74	0.74	0.73	0.74
	June2020	Accuracy	0.84	0.83	0.80	0.83	0.84
		Sensitivity	0.70	0.65	0.68	0.67	0.70
		Specificity	0.86	0.85	0.81	0.84	0.86
		ROC	0.78	0.75	0.75	0.76	0.78
Participant with no Psychological problems Vs. Participants with psychological problems more than 3 days a week.	April2020	Accuracy	0.75	0.76	0.75	0.73	0.76
		Sensitivity	0.54	0.52	0.54	0.58	0.58
		Specificity	0.80	0.82	0.80	0.77	0.82
		ROC	0.68	0.68	0.67	0.68	0.68
	May2020	Accuracy	0.73	0.77	0.76	0.75	0.77
		Sensitivity	0.35	0.39	0.39	0.38	0.39
		Specificity	0.88	0.89	0.89	0.89	0.89
		ROC	0.65	0.68	0.69	0.68	0.69
	June2020	Accuracy	0.79	0.78	0.75	0.75	0.79
		Sensitivity	0.51	0.54	0.56	0.58	0.58
		Specificity	0.87	0.85	0.80	0.80	0.87
		ROC	0.70	0.70	0.68	0.70	0.70
Participant with no Psychological problems vs. Participants with psychological problems more than 1 day in a week.	April2020	Accuracy	0.64	0.66	0.67	0.65	0.67
		Sensitivity	0.64	0.56	0.46	0.58	0.64
		Specificity	0.64	0.72	0.79	0.70	0.79
		ROC	0.65	0.64	0.63	0.64	0.65
	May2020	Accuracy	0.65	0.67	0.67	0.66	0.67
		Sensitivity	0.52	0.56	0.56	0.53	0.56
		Specificity	0.74	0.72	0.72	0.74	0.74
		ROC	0.63	0.64	0.63	0.64	0.64
	June2020	Accuracy	0.66	0.66	0.66	0.66	0.66
		Sensitivity	0.58	0.38	0.42	0.48	0.58
		Specificity	0.71	0.85	0.81	0.78	0.85
		ROC	0.64	0.61	0.62	0.64	0.64

Green, The highest reported value; Yellow, The second highest value; Red, The lowest value.

as a result of people's fear of developing or restrictions imposed during this time, such as quarantine. Individuals' decreased empathy and compassion during the pandemic, on the other hand, could be considered as another interpretation. The rate of rejection has been higher in women, and this drop has been seen across practically all age groups, which is surprising given women's perceived sensitivity. This difference is most likely owing to women's vulnerability to mental health issues during a pandemic, which has hindered their willingness to volunteer. Prior to Pandemic, people with greater incomes and higher education had the most volunteer engagement, which decreased after the Pandemic. This discovery is significant because it can aid in identifying persons who are willing to

take voluntary action. This shows that efforts encouraging people to participate more during the pandemic are needed. **Figure 2D** demonstrates that the majority of people (77.2%) did not experience employment insecurity during the pandemic compared to the previous, but they experienced increased job insecurity during the pandemic in the third survey. This can be read in light of changes in employment conditions and individual financial worries during the pandemic.

When reading the graph (**Figure 7**) used to model mental health prediction, it is important to note that some of the nodes and connections have had the largest impact on predicting mental health during a pandemic, as indicated in the image. People who have stayed at home during quarantine and used

TABLE 6 Nodes label for responses.

Response	Label
R01	Age 18–19
R02	Age 30–44
R03	Age 45–59
R04	Age 60+
R05	Stayed home
R06	Didn't Stayed home
R07	Felt any of (hot or feverish, chilly or cold or had chills, Been sweating more than usual) in the past 7 days
R08	Didn't felt any of (hot or feverish, chilly or cold or had chills, Been sweating more than usual) in the past 7 days
R09	Trust All people in your neighborhood
R10	Trust most people in your neighborhood
R11	Trust some people in your neighborhood
R12	Didn't trust people in your neighborhood
R13	Basically every day talk with your neighbors
R14	A few times a week talk with your neighbors
R15	A few times a month talk with your neighbors
R16	Once a month talk with your neighbors
R17	Not at all talk with your neighbors
R18	Typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, Basically every day talk with your neighbors
R19	Typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, A few times a week talk with your neighbors
R20	Typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, A few times a month talk with your neighbors
R21	Typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, Once a month talk with your neighbors
R22	Typical month prior to March 1, 2020, when COVID-19 began spreading in the United States, Not at all talk with your neighbors
R23	In the past 7 days, Not at all or less than 1 day Felt nervous, anxious, or on edge
R24	In the past 7 days, 1–2 days Felt nervous, anxious, or on edge
R25	In the past 7 days, 3–4 days Felt nervous, anxious, or on edge
R26	In the past 7 days, 5–7 days Felt nervous, anxious, or on edge

this method to prevent COVID-19, those who have not had any physical or psychiatric symptoms in the previous week, and those who are more comfortable with everyday contact are more confident that they will have fewer psychiatric problems during a pandemic, according to this model. This modeling aids in the identification of protective features that can be strengthened in individuals during future pandemics. On the other hand, it helps to identify vulnerable people with mental health problems. People having a history of medical issues and a history of past psychiatric problems, for example, appear to require more significant monitoring and preventive actions during a pandemic.

The utilization of machine learning techniques in data analysis in the realm of mental health issues is one of the study's

strengths. Also, analyzing the specifics of people's social ties and how they changed over time (as influenced by the Pandemic), can lead to a deeper understanding of how people's lifestyles changed during the pandemic. Given that more pandemics are almost likely to occur in the future, it is critical to use the information gathered to identify vulnerable people in each area and build effective preventative and treatment strategies. One of the study's flaws is that changes in people's social status can be impacted by a range of variables, some of which are ambiguous and have been neglected in this study. It is recommended that the findings of this study should be used in more specialized investigations in the field of mental health in vulnerable populations.

Limitations and future research

This study only analyses the data for the duration of three months. Although this provides an indication of the impact of COVID-19 on mental health, it requires more comprehensive studies for a duration of 12 months to provide enhanced analysis of the impact. This study aimed to provide an indication of this impact on mental health.

This study provides the insight from the United States dataset. The model is representative of the majority of the ethnicities and influences in the United States due to the relatively high sample size and multi ethnic participation in the survey but would not be sufficiently representative of the other geographical areas, various cultures and social behavior.

In future studies, the work advances the use of explainable AI to forecast population-level mental health using survey data, making it generally applicable. The algorithms will be applied as a screening tool to identify people who require assistance, and subsequent research using more data and attributes may improve prediction accuracy. To effectively manage and avoid psychiatric comorbidities as populations continue to fight the pandemic, prediction models for screening and monitoring the effects of COVID-19 on mental health are essential.

On the other hand, this analysis would be expanded to other regions as well as other cultures to illustrate the relation between the COVID-19 impact on mental health and cultural behavior.

Conclusion

This study analyzed the occurrence of mental illness among adults with and without a history of mental disease during the COVID-19 preventative limitations. Sample data was employed from the COVID-19 Impact Survey on April 20–26, 2020, May 4–10, 2020, and May 30–June 8, 2020 from United States Dataset. A total number of 8790, 8975, and 7506 adults participated in this study for April, May and June, respectively. Participants' mental health evaluations were compared clinically

by looking at the quantity and quality of their social ties before and during the pandemic using machine learning techniques. The result for each contributing feature has been analyzed separately in details. On the other hand, the influence of each feature was studied to evaluate the impact of COVID-19 on mental health. The overall result of our research indicates that people who had previously been diagnosed with any type of mental illness were most affected by the new constraints during the pandemic. These people were among the most vulnerable to mental illness due to the imposed changes in lifestyle. With the persistence of quarantine limitations, the prevalence of psychiatric issues grew. In the third survey, which was done under quarantine or house restrictions, mental health problems and acute stress reactions were substantially greater than in the prior two surveys. The findings of the study reveal that more focused messaging and support are needed for those with a history of mental illness throughout the implementation of restrictions.

Data availability statement

The original contributions presented in this study are included in the article, further inquiries can be directed to the corresponding author/s.

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Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work this and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Samer El Hayek,
University of Miami Health System,
United States

REVIEWED BY

Christof Kuhbandner,
University of Regensburg, Germany
Barbara Hildegard Juen,
University of Innsbruck, Austria

*CORRESPONDENCE

Manuel Schabus
manuel.schabus@plus.ac.at

†These authors have contributed
equally to this work and share first
authorship

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The coronavirus pandemic: Psychosocial burden, risk-perception, and attitudes in the Austrian population and its relation to media consumption

Manuel Schabus^{*†}, Esther-Sevil Eigl[†] and
Sebastian Stefan Widauer

Department of Psychology, University of Salzburg, Salzburg, Austria

Objective: The aim was to assess the psychosocial burden, risk-perception and attitudes regarding the coronavirus pandemic among the Austrian population after the second infection wave in Austria.

Methods: A self-designed questionnaire was available online from 17th January to 19th February 2021. Knowledge, attitudes, fears, and psychosocial burdens were collected in a comprehensive convenience sample of 3,848 adults from the Austrian general population.

Results: 67.2% reported their greatest fear was that a close relative could be infected; the fear of dying from COVID-19 oneself, however, was mentioned least frequently (15.2%). Isolation from family and friends (78%), homeschooling for parents (68.4%), and economic consequences (67.7%) were perceived as most stressful factors during the pandemic. Personal risk for COVID-19-associated (ICU) hospitalization was overestimated 3- to 97-fold depending on age group. Depending on the media mainly consumed, the sample could be divided into two subsamples whose estimates were remarkably opposite to each other, with regular public media users overestimating hospitalization risk substantially more.

Conclusion: The results show a high degree of psychosocial burden in the Austrian population and emphasize the need for more objective risk communication in order to counteract individually perceived risk and consequently anxiety. Altogether data call for a stronger focus and immediate action for supporting mental well-being and general health in the aftermath of the coronavirus pandemic.

KEYWORDS

COVID-19, pandemic, mental health, fear, risk assessment, media consumption

Introduction

On March 11, 2020, the World Health Organization (1) announced that COVID-19 had become a global pandemic. The societal impact of this pandemic is unprecedented and affects many different areas of people's lives all over the world. The public health risks are far-reaching and do not only affect those with a severe COVID-19 course (2, 3). In addition to the health risks associated with a COVID-19 infection especially for certain groups (4, 5), large segments of the population all around the world suffered from policies designed to prevent the spread of COVID-19 (2, 6–10).

The results of an international study (98 countries) with 9,500 participants suggest that large segments of the population suffer from COVID-19-related closure (7). About 11% of respondents fell into the highest stress category, and about 50% of respondents reported only moderate levels of mental health. Social support and psychological flexibility had the greatest positive impact on respondents' well-being. However, not everyone surveyed suffered, with nearly 40% of participants reporting levels of mental health consistent with flourishing. Also quarantine measures themselves can have negative consequences for the individuals involved. A review of 24 studies showed that the majority point toward negative psychological effects such as heightened anger, confusion, or even post-traumatic stress symptoms (2). The main stressors that had a negative impact included the duration of quarantine, inadequate care, fear of infection, and the feeling of misinformation. It is meanwhile well documented that families (9), pregnant women (11), children and adolescents (10, 12, 13), as well as parents and their children with special needs (14) are affected by the negative psychosocial consequences of COVID-19 and its associated countermeasures. Children, adolescents and students, are arguably one of the most overlooked populations in the context of COVID-19. Distance learning, social deprivation, and uncertainty about consequences for their career may affect this population the most. A meta-analysis found that the prevalence of depressive symptoms (34%) and anxiety symptoms (31%) were indeed higher as compared to other groups in the population (15, 16). Particularly disadvantaged subgroups of people may suffer the most from COVID-19 and the associated changes in the living environment (8), and it has been known for long that high socioeconomic status has a positive impact on almost all health-related aspects of life (17). A study in Chile for example found that infection fatality rates were greater in low-income communities due to comorbidities and lack of access to health care (18).

Among other measures, curfews, contact restrictions (19), distance regulations, and the closure of various industries (20)

and even schools (21) lead to serious and often adverse changes in the lives of many. Associated with that are fears and worries in all kinds of areas - personal, financial, economic, social and global. The effects of a life under permanent fear and uncertainty have become apparent in increased mental health issues like lower psychological well-being (22), increased rates of depression and anxiety (23) and rising numbers of insomnia symptoms (24).

Excessive levels of COVID-19-related risk perception have been shown to negatively affect individuals' mental health by increasing fear of death and decreasing happiness and positive attitudes toward oneself, life, and the future (25). Positivity, on the other hand, was positively related to happiness and negatively related to fear of death. Further results suggest that factors other than risk perception are also associated with increased fear of COVID-19 (26). Affective symptoms (which include both depressive and anxiety symptoms) and higher age also influence COVID-19 anxiety. In particular, a strong interrelation is observed between fear of COVID-19 and affective symptoms. Recently another study has shown that perceived COVID-19 anxiety is associated with increased levels of fear and greater engagement in preventive behaviors (27). An ever-increasing body of literature shows that fear and psychological distress are closely connected in COVID-19 (28, 29).

It is widely accepted that risk perception is strongly dependent on affective factors and not completely rational (30). In relation to COVID-19, indirect experiences conveyed through the media also had a significant impact on the formation of affective attitudes (31). Thus, it can be concluded that knowledge about the disease as well as the source of information can significantly influence one's individual risk perception and attitudes. In this specific context, it has already been shown that excessive media exposure is associated with greater experience of fear (32, 33) and concern (34). While the psychosocial consequences of the COVID-19 crisis are well documented in literature (2, 3, 13, 22, 24), at the time this study was planned, there were very few studies addressing knowledge and attitudes about the coronavirus pandemic in Austria. Fortunately, the situation has changed, and the Austrian Corona Panel Project (ACPP) has generated a publicly available dataset since the end of March 2020 (34). This dataset has since been collected weekly ($N = 1,500$) and is also used to study the social, political, and economic impact of the COVID-19 crisis and its associated freedom-restricting measures on the Austrian population. In order to expand the knowledge available in literature and possibly gain new insights, the present study examines the different attitudes and burdens among Austrian citizens and compares different subgroups of individuals by age and media consumption.

Materials and methods

This study examined knowledge, attitudes, fears, and psychosocial burdens regarding the coronavirus pandemic among the general public following the second wave of infection in Austria in February 2021. The aim of the study was to obtain an overview of the psychosocial burden, risk-perception and attitudes regarding the coronavirus pandemic within the Austrian population using a comprehensive convenience sample. The survey was available online from 17 January 2021 to 19 February 2021 and the responses of 3,848 adults living in Austria were included in the analyses.

Description of the measurements

The questionnaire consists of 38 questions, which were available *via* the questionnaire tool “LimeSurvey” (version 3.26). All users gave informed consent prior to filling out the questionnaire. The first six questions gathered demographic information about the participants (i.e., sex, marital status, employment, age group, educational qualification, diseases). After that, five questions assessed which source of information was used by participants to inform themselves about the coronavirus pandemic. Another 27 questions assessed the participants’ attitudes and opinions regarding their estimation of excess mortality, perceived risk of falling ill, vaccination readiness, testing strategy, COVID-19-related measures and perceived threat, fear and resources (for more details see the original questionnaire and an English translation available at <https://doi.org/10.17605/OSF.IO/T5RXB>).

Participants

Data of 3,848 adults living in Austria were analyzed (64.4% female, 35.3% male, 0.3% diverse). The main part of participants was married (44%) or in a partnership (29.2%). The remaining participants were single (20.2%), divorced (5.1%) or widowed (1.5%). Regarding the highest educational level, more than half of the sample had a university degree (45.9%) or a high school graduation (23.7%). 13.9% have done a vocational training, 11.6% had a secondary school or vocational school graduation. The remaining participants went to junior high school (3.5%), primary (0.2%) and lower secondary school (1.2%). While 54.8% reported to be employed, 14.9% were self-employed. Further 14.5% were students, 9.9% were retired, 3.3% were unemployed and 2.6% on maternity leave.

Broad advertisement of the survey in the Austrian media via the Austrian Press Agency (APA) and ORF (Austrian Broadcasting Corporation) as well as a homogeneous age distribution (see Table 1) made it possible to obtain a comprehensive overview of the current attitudes and state of mind of the Austrian society on the subject of “coronavirus.”

Only the 60–69 and 70+ age groups were less represented, with 11.4%, as expected for an online survey.

In addition, two extreme groups of individuals were compared in the sample: those who almost exclusively consume public media (i.e., public media daily and private media at a maximum a few times per month) ($n = 874$) vs. those who in addition frequently consume private media such as “ServusTV” or “Falter” (i.e., private media several times per week and who do *not* consume public media daily, $n = 812$). In text we refer to this as public vs. private TV as this was the main source of information for the participants of the current study. With regard to public media consumption in Austria, the “Austrian Broadcasting Cooperation ORF” is the one and only public television station available and consequently the one taken into consideration by the participants of the survey. These comparisons revealed contrasting responses, which are explained below as a complement to each section. In contrast, the effects across age and gender were largely equally distributed.

Results

Statistical analyses

All data were analyzed with SPSS version 27 (IBM Corporation, Chicago, IL, USA). Descriptive statistics were used to examine the distribution of responses. The Chi-square test was used to evaluate statistically significant deviations from the expected distribution of responses. *Cramer’s V* was provided as a measure of effect size. An alpha level of $p < 0.05$ was used for all statistical tests.

Perceived restriction and source of media information

87.5% of the participants feel “very” (56.3%) or at least “somewhat” (31.1%) constrained by the Corona-related measures. Most participants (79.6%) share these concerns/displeasure in private with friends or family “regularly” (41.6%) or “several times” (38%). Here, all age groups are about equally critical, with the 70+ age cohort being the least concerned (73.7%) and the 40–49 age group (87.2%) being the most critical. 26.8% of participants also engage themselves publicly by posting on forums, participating in demonstrations, or even taking legal action. More than one-third of participants (37.4%) were bothered “all the time” (19.1%) or “most of the time” (18.3%) by feelings of anger and unease as they have the impression that public reports are not really objective.

Focusing on the sub-groups which differ in their media consumption, we find that 45.5% of exclusive viewers of public TV vs. 70.3% of those who also regularly consume private TV sources felt “very” constrained by Corona-related measures. A Chi-square test showed that TV consumption

TABLE 1 Age distribution in the survey and the official Austrian norm.

	Age distribution survey						Statistic Austria - age distribution					
	Total		Men		Women		Total		Men		Women	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
18–29 ⁺	723	18.79	243	17.91	478	19.27	1,102,195	15.28	566,215	16.12	535,980	14.49
30–39	872	22.66	306	22.55	559	22.54	1,227,485	17.02	622,254	17.72	605,231	16.36
40–49	983	25.55	316	23.29	667	26.90	1,179,382	16.36	588,713	16.76	590,669	15.96
50–59	777	20.19	282	20.78	494	19.92	1,399,348	19.40	699,717	19.93	699,631	18.91
60–69	387	10.06	158	11.64	229	9.23	1,047,888	14.53	505,874	14.40	542,014	14.65
70+	106	2.75	52	3.83	53	2.14	1,255,629	17.41	529,304	15.07	726,325	19.63
Total	3,848	100	1,357	100	2,480	100	7,211,927	100	3,512,077	100	3,699,850	100

Note. For the Austrian reference data (source: Statistic Austria), we only considered age groups above 20 years, as this corresponds to the participants of the online survey. Consequently, the six age groups shown here sum up to 100% in both parts of the table. ⁺Our data is here compared to the available 20–29 age group as officially reported by Statistic Austria for the year 2021. The official age distribution for Austria is used to weight the survey data and accounts for under-representation of people 60+.

had a significant effect on the perceived constraint due to the COVID-19 restrictions ($X^2_{(3)} = 109.66$, $p < 0.001$). A *Cramer's V* of 0.25** confirmed this result and speaks for a moderate effect. Focusing on age, it was found that (vulnerable) groups beyond the age of 60 or 70 also feel “very” (47.6%; 70+: 39.5%) or “somewhat” (34.8%; 70+: 41.7%) restricted by Corona-measures. The results are quite similar for the younger age cohorts, with the only difference being that they seem even more restricted by the measures. Among 18- to 29-year-olds, 62.0% feel “very” or 27.0% “somewhat” restricted by Corona measures; among 30- to 39-year-olds, 61.4% feel “very” or 28% “somewhat” restricted; among 40- to 49-year-olds, 65.4% feel “very” or 26.2% “somewhat” restricted; and among 50- to 59-year-olds, 60.9% feel “very” or 28.4% “somewhat” restricted by Corona measures. Their concerns/displeasure about Corona are/is shared in private with friends or family by 65% of public TV viewers and 94.9% of private TV viewers “regularly” or “several times.” The Chi-square test showed that TV consumption had a significant effect on sharing concerns privately ($X^2_{(3)} = 229.80$, $p < 0.001$). A *Cramer's V* of 0.36** confirmed this result (moderate effect). Women and men are equally concerned and critical here, and even 72.6% of the 60 yrs group and 73.7% of the 70+ age group express their concerns about Corona-related measures and changes in existing laws “regularly” or “several times” in private.

Concerning feelings of anger and unease due to the impression that media coverage is not objective, it was found that there are significant differences between viewers of mainly public and (additionally) private television: 10.9% of public TV viewers compared with 69.2% private TV viewers rated media reports “all the time” or “most of the time” as not objective and neutral. The Chi-square test showed that the TV source had a significant effect on whether media reports are perceived as objective vs. biased ($X^2_{(1)} = 626.28$, $p < 0.001$). A *Cramer's V* of 0.6** confirmed this result and indicated a strong effect.

Fears

The greatest fears perceived in the current pandemic are (1) that a close relative will get infected (67.2%), (2) economic damage (46.9%), and (3) the restriction of freedom of expression or of fundamental rights (46%). On the other hand, the fear of dying from the coronavirus disease was mentioned least frequently (15.2%).

Responses differed significantly in a comparative analysis of perceived fear based on what TV medium is primarily consumed to gain information about the coronavirus pandemic (cf. Table 2).

Perceived burdens

The most worrisome burdens in the pandemic are: (1) not being able to maintain social contacts (77.4% not being able to meet friends, or 78.5% not being able to meet relatives), (2) home-schooling for parents (68.4%) and (3) economic consequences (67.7%). Even in the 60+ group, “not being able to meet friends or relatives in person” is ranked in the top 3 most stressful factors (80.3%). Surprisingly, the fear of being a carrier of the disease (45.1%), of falling ill oneself (24.4%) or of a lack of care due to a possible overload of the health care system (44.3%) is rated as less stressful than the previously mentioned social and economic consequences.

In the groups beyond the age of 60, not being able to meet friends (73.4%) or relatives (81.3%) in person is ranked in the top 3 most stressful factors. The other two include, just like among younger people, fear of collateral health damage (64.2%) and fear of economic harm (60.9%). Surprisingly, the fear of being a carrier of the disease (39.4%),

TABLE 2 Comparison of predominant fears in relation to media consumption: mainly public TV vs. also private TV consumption.

	Public TV	Private TV	X ² -value	p-value	Cramer-V
Fear that a close relative will be infected	77.8%	45.6%	129.60	<0.001**	0.32**
Worries about restrictions of fundamental rights and freedom of expression	26.4%	76.0%	279.36	<0.001**	0.48**
Fear of long-term physical consequences due to COVID-19	51.5%	20.8%	108.69	<0.001**	0.30**
Fear of severe symptoms following a COVID-19 infection	55.7%	15.6%	184.48	<0.001**	0.39**
Fear of dying due to COVID-19	20.1%	8.9%	25.60	<0.001**	0.14**
Fear of psychological damage	26.2%	41.4%	29.89	<0.001**	0.16**
Fear of economic damage due to the pandemic and pandemic measures	30.6%	64.7%	132.67	<0.001**	0.33**

Note. There are significant differences between the predominant fears of the two media consumption groups. Individuals who mainly use public television report more fear regarding the health consequences of a SARS-CoV-2 infection, whereas individuals who also use private television regularly report more fear regarding psychological and economic consequences and the decay of fundamental rights. Two asterisks (**) indicate a highly significant Chi-square test result.

of falling ill oneself (37.8%), or of a lack of care due to a possible overload of the health care system (45.7%) is rated as less stressful than the previously mentioned social and economic consequences.

Focusing on the two media consumption groups, we see that the four most worrisome burdens for the public TV group are (1) not being able to maintain social contacts (76.2% not being able to meet friends, or 78.5% not being able to meet relatives), (2) worries that a close relative gets SARS-CoV-2 infected (75.7%), (3) fear of being a carrier of the disease (63.7%) and (4) collateral damage for the health system such as delayed surgeries, etc. (58.6%). In contrast, the four most worrisome burdens for the private TV group are (1) economic consequences (84.6%), (2) collateral damage to the health system (79.7%), (3) not being able to maintain social contacts (79.9% not being able to meet friends, or 78.9% not being able to meet relatives), and (4) hearing/watching the news on the coronavirus pandemic (74.8%). Last but not least the subjective worry of falling ill with a SARS-CoV-2 infection varies dramatically between the two groups with 42.9% for the public TV and 7.4% for the private TV group.

Estimated probability of falling ill

The answer to the question “How likely do you think the “Coronavirus” is to cause you a life-threatening illness (in %) over the next 12 months?” is also of interest. Based on all cases already infected with SARS-CoV-2, the statistical probability (i) of being hospitalized [official data updated from (35); Trauner and Bachner, personal communication, June 13, 2022] ranges from 1.23% (20–29 years) to 36.85% (75–79 years), and (ii) of ending up in the intensive care unit (ICU) ranges from 0.10% (20–29 years) to 5.52% (70+).

Note that the subjectively experienced risk of the coronavirus (SARS-CoV-2) causing a life-threatening illness is overestimated 3-fold (70+) to 97-fold (<29) if we equate this with ICU admission in Austria. That is, Austrian citizens

aged 18–69 expect a chance of about 1:10 to encounter a life-threatening illness when they get infected by SARS-CoV-2. Scientifically, the more realistic chance of needing intensive care is at max. 1 in 230 for age 18–49, and 1:30 for an age of up to 69 according to the Austrian database (35) [updated data calculation from (35); Trauner and Bachner, personal communication, June 13, 2022; cf. Table 3]. Even lower risks are estimated by the QCovid risk calculator (UK data) from the University of Oxford (see below) (36).

Interestingly, however, excess mortality in the total population is not overestimated but rather underestimated. When asked about excess mortality for 2020, 27.6% assume a very high or high excess mortality but then estimate excess mortality at 3,735 cases on average (trimmed mean 3,547; 95% confidence interval 3,608–3,862). In fact, mortality was 5,350 cases higher than to be expected for 2020 in Austria. More specifically, mortality in Austria was measured at 83,386 ($\pm 2,791$) cases in 2019 and at 91,527 cases in 2020. Note however, that due to fluctuations in birth rates (e.g., baby boom generation 1946–1964) and an increasing proportion of older citizens, excess mortality increases more strongly in countries with an older population - such as Austria - as compared to countries with younger citizens (37). An adjusted excess mortality rate was for example calculated for Germany, a country that is comparable to Austria in many respects (38) and estimates excess mortality for the year 2020 at about 1% across all age groups (and about 4% for 90+).

Analyzing the (i) subjective estimate of SARS-CoV-2 causing a life-threatening disease as well as (ii) the excess mortality estimates separately for the two groups primarily consuming public TV vs. those who regularly also consume private TV show vastly differing numbers. Specifically, we find higher numbers in the group of public TV viewers for (i) subjective risk with 15.16% or 11-fold overestimation (public media) vs. 5.56% or 4-fold overestimation (private media) on average (cf. Table 3) and (ii) for the proportion of people expecting very high to high

TABLE 3 Risk for (ICU) hospitalization and subjectively perceived risk for a life-threatening illness due to a SARS-CoV-2 infection.

Age	Cases Hospital (%) [*]	Cases ICU (%) [*]	Subjective estimate of "Corona" causing a life-threatening illness	Factor of subjective over-estimation of risk	Subjective estimate of "Corona" causing a life-threatening illness (public media subgroup)	Subjective estimate of "Corona" causing a life-threatening illness (private media subgroup)
18–29 ⁺	1.23%	0.10%	9.65%	97	11.14%	7.27%
30–39	1.93%	0.22%	9.35%	43	13.49%	6.21%
40–49	2.95%	0.44%	8.86%	20	15.54%	3.95%
50–59	5.82%	1.11%	10.19%	9	14.63%	5.21%
60–69	15.38%	3.64%	12.78%	4	17.86%	6.36%
70+ ⁺	36.85%	5.52%	15.37%	3	17.73%	4.82%

^{*}Cases hospital and Cases ICU refer to hospitalization or ICU cases (in %) of all positive (EMS)-tested cases between 01.01.2020 and 28.02.2021. Data are derived from the Austrian factsheet for COVID-19 hospitalization (35) (updated calculation Trauner and Bachner, personal communication, June 13, 2022) best matching the survey time period. +Note that some age groups from the Austrian factsheet (35) were pooled to ensure correspondence with the survey age groups. "Subjective estimate of Corona causing a life-threatening illness" is the personal estimate of risk for the total group as well as the two subgroups based on media consumption. The respective factors of risk over-estimation are printed in bold for highlighting purposes. Calculation is made as follows: Subjective estimate of "Corona" causing a life-threatening illness (%) divided by Cases ICU (%). Hot colors highlight higher values for illustration purposes.

excess mortality (11.14 vs. 7.27% in the youngest group [18–29 years] 17.73 vs. 4.82% in the 70+ group). This difference is statistically significant for i) subjective risk ($t_{(1576.72)} = 14.53$, $p < 0.001$, $d = 0.67$) as well as ii) excess mortality ($t_{(198.46)} = 2.22$, $p = 0.028$, $d = 0.32$) in the 18–29 up to the 70+ age cohort ($t_{(241.06)} = 9.57$, $p < 0.001$, $d = 1.23$).

Vaccination and testing strategy

In terms of willingness to be vaccinated, 41.1% of participants said in February 2021 that they will "definitely" get vaccinated (4% of whom do so because of job requirements), 28.1% "preferred to wait" or were "still undecided," and 26.8% responded that they will "definitely not" get vaccinated. Among those who are in favor of vaccination, 47.1% say the primary reason for vaccination is "to be able to return to a normal life." "Protecting oneself" (31.3%) or "others" (21.6%) is less often cited as the driving factor. The majority of those who oppose vaccination (51.5%) believed that "the side effects of vaccination are not yet well enough known or researched" or "think the vaccine was approved too quickly and without sufficient studies." 6.4% of the total sample rejected vaccination in principle. One year thereafter and according to Statistics Austria (02/22/2022), 78.2% of the whole (eligible) population had been vaccinated at least once. With regard to (valid) recovery or still valid vaccination status, the situation in Austria as of April 30, 2022, is as follows: On average, 58.2% of persons aged 18 and older are (still validly) vaccinated (but not recovered), 19% are vaccinated and recovered, another 12.3% are exclusively (valid) recovered, and 9.5% are neither vaccinated nor recovered (39). According to our data in January/February 2021, 93.1% of those who had already performed a PCR or antigen test received a negative test result. Of these, 52% had performed a PCR test and 71.3% had performed an antigen test (by February 19, 2021). Consequently, 6.9% of respondents reported having already received a positive COVID-19 test result back then. Of these positive cases, 88.2% reported having "no" or "mild symptoms," and the remaining 11.8% reported severe symptoms without hospitalization (10.4%) or with hospitalization (1.4%).

Return to normality

The fact that (in January/February 2021) 40.8% of the participants did not expect a return to normality until 2022 or even later can be interpreted as a lack of perspective in the general population at the time of testing. Very similar and even more alarming results are found in the infant and adolescent population (aged 6–18) in Austria (40)). The points that a majority of participants mentioned as best helping (first 2 answer ranks) through the crisis were "spending time in nature"

(77.2%), “sports and exercise” (70.8%), as well as “meeting relatives or friends in person” (66.7%).

Discussion

Altogether the results of this comprehensive online survey reflect the high degree of the psychosocial burden and anxiety regarding SARS-CoV-2 in the Austrian population. As this was an *ad-hoc* study in an online format, it can be considered a convenience sample. The subjectively estimated threat of the disease (hospitalization or mortality) is vastly overestimated and contributes to the high degree of psychosocial burdens and anxiety in the Austrian population.

In this regard, the answer to the question “How likely do you think the “coronavirus” is to cause a life-threatening illness (in %) over the next 12 months?” is of special interest. Based on all cases already infected with SARS-CoV-2, the statistical probability (i) of being hospitalized [official data updated from (35); Trauner and Bachner, personal communication, June 13, 2022] ranges from 1.23% (20–29 years) to 36.85% (75–79 years), and ii) of ending up in the intensive care unit (ICU) ranges from 0.10% (20–29 years) to 5.52% (70+) as discussed above. Yet all numbers of this kind need to be treated with caution. The most important indicator for political decisions in the COVID-19 policy in Austria and Germany were based on such data and the fear of exceeding hospitalization capacities due to COVID-19 hospitalizations. However, numerous hospitals reported all COVID-19 patients including those patients who in fact were hospitalized for other illnesses and were identified as SARS-CoV-2 infected only after already being admitted to the hospital. For example, according to Bachner et al. (35), 73% of hospitalizations in Austria have COVID-19 as the main diagnosis; even when COVID-19 secondary diagnoses that can be directly related to COVID-19 are added, this number only increases to 78–84% (35).

Similar caution may be needed when interpreting COVID-19 mortality numbers. As an example, in the German COVID-19 autopsy registry (41) 1,095 individuals who died of or with COVID-19 were analyzed. The analysis revealed COVID-19 as the underlying cause of death in 86% of the autopsy cases with 52.5% death due to COVID-19 and 33.7% death due to events subsequent to COVID-19; in 14%, patients simply had a positive SARS-CoV-2 test but it was not the underlying cause of death.

Those interested in the individual risk of severe morbidity (hospitalization) and mortality due to a SARS-CoV-2 infection in relation to individual age, sex, but also comorbidities will get accurate estimates using the University of Oxford (UK) QCOVID risk calculator (36) (based on the UK data). In order to provide an estimate of what this data looks like, a few examples are shown: 20-year-old healthy male: 1:33.333 (0.003%) for severe disease, 1:1.000.000 (0.0001%) for mortality; 30-year-old healthy female: 1:5.102 (0.021%) for severe disease, 1:200.000 (0.004%) for risk of death; 40-year-old healthy male:

1:3.300 (0.031%) for severe disease, 1:66.667 (0.002%) for risk of death; 50-year-old overweight woman (BMI 28) with type II diabetes: 1:960 (0.037%) for severe disease, 1:6.536 (0.003%) for risk of death; 60-year-old man with COPD: 1:738 (0.091%) for severe disease, 1:4.274 (0.018%) for risk of death. It is open to discussion and should be addressed in future studies why data-based risk assessments such as results from the QCovid risk calculator for the UK, RKI data for Germany, or Austrian data from the Gesundheit Österreich GmbH (35) vary so widely in these numbers. Political decisions about counter-measures to restrict the spread of the virus of course have to be based on objective data such as hospitalization and ICU admission rates, but ideally also take into account that there is a clear risk stratification for COVID-19 which is highly dependent upon age and prior comorbidities such as obesity, or anxiety and fear-related disorders (42). Yet, what appears consensual is that the risk of dying from COVID-19 is very low for individuals under 65 years of age and has been even equated to the risk of a fatal accident on the daily commute to work by car (43).

In addition, the survey revealed serious differences between those who mainly consume public service media including public TV and those who also consume private media including private TV channels. These findings extend those of Kittel et al. (34), who found people with higher exposure to public broadcasting news to be more concerned by the pandemic's developments compared to those who used this source of information less frequently. Since psychosocial effects are well known to have long-term consequences on the immune system and overall health, it is important to provide an objective and data-driven discussion of the real risks for different groups of people in the population and take countermeasures to reduce the psychosocial burden for those who are in high need of support.

Cross-sectional data from the US determined which sources of information were most trusted for health information and how reliance on specific sources was related to the adherence to recommended Corona countermeasures (47). It was found that the majority of participants relied on government sources of information such as the CDC, FDA, WHO, and local health departments. In that survey, only 36% of participants reported trusting information from social media, with white and older respondents being more likely to trust government sources.

At the peak of the pandemic, a Greek survey showed that a vast majority of respondents (93.3%) spent up to 2 h per day seeking information about COVID-19 (48). Younger respondents spent less time searching for information about the disease than older respondents. Here internet news media and television were the most common sources of information among respondents. The majority of respondents also indicated that they watch television often to very often during the day and it was seen that older people watched more television as compared to younger people, who relied more on online resources.

Another study comparing mobility data and data on trust in government at a regional level in Europe found that regions with

higher trust restrict their non-essential mobility significantly more than regions with low trust (49). Alarming in our survey, various media consumption groups show marked differences and distrust (i) when asked about feelings of anger and unease due to the impression that media reports are not objective (11% public vs. 69% private media users) as well as in terms of (ii) individual risk assessment and burden with much stronger overestimation in mainly public media consumers (11-fold overestimation of personal risk) vs. still 4-fold overestimation in people consuming more private media.

This highlights the importance that public media and governments inform objectively and trustworthy through multiple channels in order to improve regulatory efficiency and compliance with state rules and laws. Exaggerated portrayals and biased reports, on the other hand, seem to have a significant negative impact on trust in media and politics, which, in turn, negatively influences compliance with preventive measures.

Another problem seems to be generally one of how science is communicated to the public. A study examining the extent to which liberals and conservatives are motivated to reject science that is inconsistent with their attitudes (50) found that both groups are highly motivated to interpret scientific information in a way that was consistent with their biases whereas they were more inclined to reject the scientific credibility of findings when the interpretation of the data was inconsistent with their attitudes. These results illustrate that also political attitudes can contribute to the misinterpretation or rejection of facts. In this context, it seems advisable to foster forums and platforms where open and critical discussion of all available data is possible and well communicated to the public so that well-informed and empirically data-driven opinions can form.

Tests for SARS-CoV-2 antibodies following (noticed/unnoticed) recovery were performed by only 15.9% of respondents in Austria by February 19, 2021. The latter is remarkable, as already in December 2020 SARS-CoV-2 immunization and seroprevalence (measuring cumulative exposure to SARS-CoV-2 infection) in the general population was estimated to be around 20% (44, 45) and after SARS-CoV-2 outbreaks like in Ischgl (Austria; March 2020) even up to 42% (46). Until February 2021, seroprevalence in the Austrian population was not systematically assessed and vaccination of the general population started in April/May 2021 independent of SARS-CoV-2 antibody status. Concerning the Austrian population's willingness to be vaccinated, a recent study with 1,350 participants reported that 70% of the 1,350 respondents thought the COVID-19 vaccine was effective in preventing and controlling the virus, with about 13% disagreeing, and 17% being unsure (data collection period: February 18, 2021 to March 17, 2021) (51). In that study, 55% were willing to adopt the vaccine when it became available, 18% did not want to be vaccinated, 17% wanted to wait, and 10% had already been vaccinated at that time. In our somewhat earlier survey comprising 3,848 Austrian adults (in January/February 2021)

44% were willing to get vaccinated, 28% were undecided or wanted to wait and 27% did not want to get vaccinated in general. According to the latest data from Statistics Austria (May 2022) (52), 50% of the population are currently vaccinated, 19% are vaccinated and recovered, 16.3% are exclusively recovered, and 14.7% are neither vaccinated nor recovered. This means that in total, 31% of the population in Austria had not been vaccinated by May 2022, which is almost identical to the number provided in our survey in January/February 2021. Note that from 5th February 2022 onwards, a vaccination mandate (from the age of 18) was active in Austria; this obligation was yet suspended again on March 12th and is to be re-evaluated in May 2022 (during the writing of this report).

It should be noted that this survey could unfortunately not verify representativeness in all aspects. As it is difficult to reach the elderly in online surveys, we have to mention that the 60+ groups were initially underrepresented in our data set. As it was an unfunded *ad-hoc* investigation, we unfortunately did not have the resources to reach out to elderly people directly by phone or face-to-face meetings. To adjust for this underrepresentation of people 60+ we therefore introduced a weighting factor and adjusted our outcome regarding age and gender according to the official distribution in Austria (according to Statistics Austria). Furthermore, as is true for all kind of surveys, we cannot completely rule out self-selection, or undercoverage of certain groups of the population. Yet we want to emphasize that we did all that we could in order to increase participation by broadly advertising the study in the Austrian media landscape (Austrian Press Agency, public television and newspapers, etc.). A sizeable proportion of over 3,800 people between 18 and 70+ participated in the end.

There are several other factors that could also been explored and that might limit the generalizability of the data but were not asked about in the survey (e.g., political views, migration background, social class, etc.). Critically, it should also be noted that admission to the ICU and the "subjective assessment that COVID-19 will lead to a life-threatening illness in the next 12 months" are not readily equated. The aim of this question was to obtain a subjective correlate of personal risk assessment; it is assumed that admission to the ICU is a plausible consequence of "life-threatening" illnesses. The QCovid risk assessment tool by the University of Oxford is a convenient way for any person 18+ to calculate the individual risk (including comorbidities) for hospitalization or COVID-19-associated mortality. As it is designed and validated for Great Britain, we cannot rule out that actual numbers for hospitalization and mortality might differ to some degree in Austria (according to differences in the medical system, differences in habits or overall health, etc.).

The time frame was also deliberate, as very few individuals already had COVID-19 at the start of the survey. The aim of this survey was to give as many Austrians as possible the opportunity to share their personal psychosocial burdens, concerns and attitudes related to the COVID-19 pandemic. Future research

should put particular emphasis on long-lasting consequences for mental health and especially on vulnerable populations who seem to have suffered most on a psychological level.

In summarizing, we eagerly await a scientific and non-emotionalized public discussion of “lockdown” measures which had been enforced to varying degrees around the world (53). Importantly, there is a need to balance risks and potential gains for varying age groups as well as groups with or without severe comorbidity. Particularly in the groups below 65 and foremost in children and adolescents, it needs to be carefully considered whether the psychosocial burden caused by school closures, social distancing and other lockdown measures has not done more harm than good. The aftermath of the pandemic is just beginning, and the public focus should finally be turned to those indirectly harmed by the coronavirus measures in order to counteract the deterioration of well-being and mental health in the general population.

As a final note, these Austrian data ($n = 3,848$), as well as the data from Germany ($n = 3,745$) and Switzerland ($n = 1,815$), can be accessed and visualized directly at bit.ly/CovidSurvey-DACH. It can be considered a “work in progress” database, where data is made accessible to scientists and the public.

Data availability statement

The datasets analyzed for this study can be found at <https://doi.org/10.17605/OSF.IO/T5RXB>.

Ethics statement

The Corona-related surveys were approved by the Ethics Committee of the University of Salzburg (EK-GZ

122013) and conducted in accordance with the Declaration of Helsinki with healthy volunteers. The patients/participants provided their informed consent digitally to participate in this study.

Author contributions

MS initiated the study, critically revised the article, and gave final approval for the version to be published. MS and E-SE were responsible for the conception of the article and data collection. MS, E-SE, and SW carried out the file analysis and evaluation and wrote the article. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Renato de Filippis,
Magna Græcia University, Italy

REVIEWED BY

Shabnam Nohesara,
Iran University of Medical
Sciences, Iran
Yulia Solovieva,
Meritorious Autonomous University of
Puebla, Mexico

*CORRESPONDENCE

Ozge Kilic
drozgekilic@gmail.com

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COVID-19 infection, vaccine status, and avoidance behaviors in adults with attention deficit and hyperactivity disorder: A cross-sectional study

Ozge Kilic^{1*}, Muhammed Emin Boylu¹, Sila Karakaya-Erdur¹,
Merve Suma-Berberoglu², Gisli Gudjonsson³, Susan Young⁴,
Erdem Deveci⁵ and Ismet Kirpinar¹

¹Department of Psychiatry, Faculty of Medicine, Bezmialem Vakif University, Istanbul, Turkey,

²Department of Psychiatry, Liv Hospital, Istanbul, Turkey, ³Department of Psychology, King's College London, Institute of Psychiatry, Psychology & Neuroscience, London, United Kingdom,

⁴Department of Psychology, Reykjavik University, Reykjavik, Iceland, ⁵Department of Psychiatry, Faculty of Medicine, Istanbul Medipol University, Istanbul, Turkey

Objective: We aim to examine infection risk and vaccine status of COVID-19 in attention deficit and hyperactivity disorder and evaluate the impact of demographic, clinical, and COVID-19-related factors on the infection status and behavioral avoidance of COVID-19.

Methods: This cross-sectional study assessed adults with attention deficit and hyperactivity disorder recruited from an outpatient psychiatry clinic. Patients and healthy controls completed a survey on sociodemographic data, COVID-19 infection status, and vaccine status. COVID-19 Disease Perception Scale, COVID-19 Avoidance Attitudes Scale, Attitudes toward COVID-19 Vaccine Scale, Adult Attention Deficit and Hyperactivity Disorder Self-report Screening Scale for DSM-5, Adult Attention Deficit and Hyperactivity Disorder Self-Report Scale Symptoms Checklist, Patient Health Questionnaire-9, and State-Trait Anxiety Inventory were applied.

Results: Ninety patients and 40 healthy controls participated. Patients did not differ from controls in COVID-19 infection and vaccine status, and behavioral avoidance of COVID-19. No demographic and clinical factor significantly affected the COVID-19 infection status. Patients scored higher than controls in the perception of COVID-19 as contagious ($p = 0.038$), cognitive avoidance of COVID-19 ($p = 0.008$), and positive attitudes toward the COVID-19 vaccine ($p = 0.024$). After adjustment of possible factors, a positive perception of the COVID-19 vaccine and a perception of COVID-19 as dangerous were the two factors significantly affecting behavioral avoidance of COVID-19 [$R^2 = 0.17$, $F(2) = 13.189$, $p < 0.0001$].

Conclusion: Infection and vaccine status of COVID-19 in patients did not significantly differ from controls. No demographic and clinical factor significantly affected the COVID-19 infection status. Approximately four-fifths of the patients were fully vaccinated as recommended by national and global health organizations. This has increased the knowledge base showing that the COVID-19 vaccine is acceptable and receiving the vaccine is endorsed by ADHD patients. Attention deficit and hyperactivity disorder itself may

provoke no kind of mental disturbance in sense of perception of the danger of this disease. Our findings have increased the knowledge base showing that the COVID-19 vaccine is acceptable and the actual practice of receiving the vaccine is endorsed in this population. Our message for practice would be to take into account not only the core symptoms and the comorbidities of the disorder but also the perception of the disease while exploring its link with COVID-19.

KEYWORDS

attention deficit disorder, attention deficit hyperactivity disorder (ADHD), COVID-19 vaccine, SARS-CoV-2, behavioral avoidance, risk-mitigation, coronavirus, COVID-19 infection

Introduction

Having entered its third year, the COVID-19 pandemic has resulted in 500 million people being infected and more than 6 million deaths by April 2022 according to World Health Organization. Several risk-mitigation behaviors were recommended to reduce the risk of transmission and infection. These included being vaccinated as officially recommended, wearing masks in public places, and avoiding close physical contact with people outside one's household (i.e., social distancing).

Vulnerable people have been identified as those having certain pre-existing medical and mental disorders. Attention-deficit hyperactivity disorder (ADHD) is one of the neurodevelopmental disorders that are on the updated list of the Centers for Disease Control and Prevention (CDC) as high-risk medical conditions for COVID-19 (1).

One of the most critical public health measures in response to COVID-19's prolonged nature has been the significance of risk-mitigation measures in limiting exposure and severe illness. If specific subgroups of the population had a higher risk of COVID-19 infection, considering the highly contagious nature of the coronavirus, targeted and tailored risk-mitigation strategies for these groups may aid in controlling the COVID-19 or other contagious diseases. For now, the available literature has been conflicting and does not consistently show that ADHD patients represent such a specific subgroup of the population. One of the studies that support ADHD is associated with COVID-19 was carried out in Israel from electronic health records of patients aged from 2 months to 103 years. The increased COVID-19 risk was suggested to be higher in untreated ADHD compared to treated ADHD patients (2). Patients with a recent ADHD diagnosis have been reported to have a significantly higher risk of COVID-19 in another study conducted up to July 2020 in the United States of America (3). ADHD was associated with a significantly higher rate of hospitalization and being symptomatic (4).

A systematic review and a meta-analysis demonstrated that ADHD patients have increased susceptibility and severity compared to controls (5). However, a recent longitudinal study that investigated pre-pandemic and pandemic data on neurodevelopmental conditions did not show strong evidence of differences in the distribution of infections in those with ADHD compared to those without (6). Other studies failed to show that youth with ADHD were more likely to experience COVID-19 infection compared with non-ADHD peers (7). On the contrary, Rajkumar et al. (8) demonstrated that ADHD prevalence was statistically inversely linked with COVID-19 prevalence after controlling for medical conditions, demographic, climate-related, and economic variables. Other researchers demonstrated that rates of recovery increased with the prevalence of ADHD and proposed ADHD may have evolutionary benefits for managing coronavirus, as opposed to being a risk factor (9).

The fight against the pandemic is highly dependent on individual compliance (10). If a specific group of people has an increased risk of COVID-19, this may relate to an increased risk of infecting other people. For example, youth with the combined presentation of ADHD were shown to fail to comply with hygiene behaviors. Other than hygiene behaviors another risk mitigation factors are avoidance behaviors. We identified only one study that explored avoidance behaviors among the youth of 5–21 ages that has shown no association (11). The most promising method of containing the COVID-19 pandemic is the use of vaccines to prevent SARS-CoV-2 infection. Adolescents with ADHD were reported to have greater hesitancy and less confidence in COVID-19 vaccine safety compared to adolescents without ADHD (12). We could not identify a study that explored the vaccine attitude among adults with ADHD.

Therefore, with this study, we aim to examine: (1) COVID-19 infection and vaccine status in adults with ADHD; (2) factors that affected infection risk; and (3) factors that impact avoidance of COVID-19.

TABLE 1 Sociodemographic and clinical characteristics of ADHD patients (*n* = 90).

	Males (<i>n</i> = 46)	Female (<i>n</i> = 44)	χ^2	<i>p</i>
Age (median, min-max)	23 (18–42)	23 (18–54)		0.740
Educational status	<i>n</i> (%)	<i>n</i> (%)	1.374	0.503
High school and lower	15 (32.60)	10 (22.72)		
Bachelor	27 (58.69)	28 (63.64)		
Graduate and higher	4 (8.71)	6 (13.64)		
Vocational status			0.007	0.934
Employed/student	40 (86.95)	38 (86.36)		
Unemployed	6 (13.04)	6 (13.64)		
Marital status			1.152	0.283
Married	9 (19.64)	5 (11.44)		
Single	37 (80.36)	39 (88.56)		
Income level			3.490	0.175
Low	5 (10.88)	10 (22.71)		
Moderate	28 (60.92)	19 (43.19)		
High	13 (28.20)	15 (34.10)		
Medication type			1.356	0.527 ^a
Methylphenidate	33 (71.74)	28 (63.66)		
Atomoxetine	1 (2.14)	3 (6.82)		
None	12 (26.12)	13 (29.52)		
COVID-19 infection status				
COVID-19 positive	17 (37.00)	19 (43.25)	0.363	0.547
COVID-19 negative	29 (63)	25 (56.75)		
COVID-19 vaccination			1.084	0.655 ^a
Fully vaccinated	36 (78.26)	38 (86.36)		
Incompletely vaccinated	6 (13.04)	4 (9.09)		
Not vaccinated	4 (8.70)	2 (4.55)		

^aFisher Freeman Halton Exact test. χ^2 , Pearson chi-square value.

We hypothesized that ADHD patients would exhibit a higher rate of COVID-19 infection and fewer avoidance behaviors compared with controls. They would be equally willing to accept the COVID-19 vaccine. The perception and avoidance of COVID-19, attitudes toward the COVID-19 vaccine, inattention, hyperactivity-impulsivity (HI) anxiety, and depression would impact the behavioral avoidance of COVID-19.

Methods

Participants and procedures

This study adopted a cross-sectional design. It was conducted under the Helsinki Declaration of 1975. Ethics committee approval was obtained from the university's non-interventional research ethics committee. Participants' informed

consent was obtained prior to the collection of data. To adhere to the epidemic prevention policy, questionnaires were distributed online. No incentive was given to participate in the study. All data collection from patients and controls took place between January 2021 and March 2022.

The study population was derived from the database of previous adult patients who admitted to the psychiatry outpatient clinic of a tertiary university hospital between January 2019 and December 2020. From all patients that were screened, those whose diagnostic codes were recorded in the principal diagnosis field as ADHD were identified. To be included, the patients had to be between 18 and 60 years old, be able to read and write without help, and had been diagnosed with ADHD by a psychiatry specialist with a face-to-face clinical interview according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (13). Exclusion criteria for patients were schizophrenia spectrum and other psychotic disorders, dementia, bipolar disorder, and unwillingness to participate. Two hundred sixty-six patients with ADHD that comply with this criteria were identified and contacted by phone. After explaining the purpose of the study, they were invited to complete the online questionnaire which was shared through an online link. The survey was created using Google Forms[®], a free program. Out of 266 invitations, 60 responses were received with a response rate of 22.6%. There were no significant differences in terms of age, gender, and education between patients that participated and those that did not participate. Additionally, 30 volunteering ADHD patients that have visited and have been diagnosed in the same outpatient clinic completed the online link between January 2021 and March 2022.

For recruitment of the healthy controls, advertisements in the hospital, waiting rooms, and university campus were used. Inclusion criteria for controls were age between 18 and 60 years old, and the ability to read and write without help. Exclusion criteria for controls were being diagnosed with a current psychiatric disorder, being prescribed any psychotropic medication currently, and having an active unstable medical illness. Healthy controls received the same Google form link and completed the survey online.

Patients and controls were matched for sex, education, and income level. The median age of the controls was significantly higher than the patients (Table 2). Data from 130 participants (90 patients and 40 healthy controls) were analyzed for the study.

Outcomes

The main outcomes were behavioral avoidance score and the presence of a history of COVID positive testing. The sources of data for the main outcomes were a subgroup score of Avoidance Attitudes from the COVID-19 scale and the self-report of the patient on COVID testing or not. Primary independent variables of interest were age, the ADHD symptom scores of IN, HI,

TABLE 2 Characteristics of patients and controls in terms of clinical and COVID-19 characteristics.

Characteristics	Patients (n = 90)	Controls (n = 40)	χ^2	p
Age (median, min–max)	23 (18–54)	25 (19–40)		0.019
Sex	n (%)	n (%)	0.014	0.907
Male	46 (51.1)	20 (50)		
Female	44 (48.9)	20 (50)		
Educational status			2.744	0.098
High school and lower	25 (27.8)	17 (42.5)		
Bachelor and higher	65 (72.2)	23 (57.5)		
Vocational status			0.064	0.8
Unemployed	12 (13.3)	6 (15)		
Employed/student	78 (77.5)	34 (34.5)		
Income level			0.370	0.831
Low	15 (16.7)	5 (12.5)		
Moderate	47 (52.2)	22 (55.00)		
High	28 (31.1)	13 (32.5)		
Inattention	24 (4–36)	9.50 (3–17)	—	<0.001
Hyperactivity impulsivity	19 (6–36)	9 (5–15)	—	<0.001
ASRS-5	15 (4–24)	8 (2–11)	—	<0.001
PHQ-9	15 (2–38)	7 (0–24)	—	<0.001
STAI-I	40 (32–59)	38.5 (32–46.7)	—	0.055
STAI-II	43 (27–61)	38 (12–48)	—	<0.001
P-COVID-19			—	
Dangerousness	4.33 (2.67–5)	4.33 (2.67–5)	—	0.436
Contagiousness	3.91 (2–5)	3.50 (1.75–5.00)	—	0.038
ATV-COVID-19			—	
Positive attitudes	3.5 (1–5)	3 (1–5)	—	0.024
Negative attitudes	3.60 (1.4–4.80)	3.10 (1.8–5)	—	0.192
AA-COVID-19			—	
Cognitive avoidance	2.50 (1–4.40)	2.00 (1–4)	—	0.008
Behavioral avoidance	3.90 (1.4–5)	3.2 (2.20–5.00)	—	0.053
COVID-19 infection status	n (%)	n (%)	0.638	0.424
COVID-19 positive	36 (40)	19 (47.5)		
COVID-19 negative	54 (60)	21 (52.5)		
COVID-19 vaccination			4.815 ^b	0.071 ^a
Fully vaccinated	74 (82.22)	37 (92.5)		
Incompletely vaccinated	10 (11.11)	0 (0)		
Not vaccinated	6 (6.67)	3 (7.50)		

^aFisher-Freeman-Halton Exact test, other comparisons between categorical variables were carried out with Chi-square.

^bFisher's exact test value: 5.275. Continuous data were compared with Mann-Whitney U. STAI-I & STAI-II, state and trait anxiety inventory I-II; PHQ-9, patient health questionnaire-9; ATV-COVID19, attitudes toward the COVID-19 vaccine; P-COVID-19, perception of the COVID-19 disease; AA-COVID-19, the avoidance attitudes from COVID-19.

subscores of COVID-19 Disease Perception, attitude toward COVID-19 vaccine, depression score, and state and trait anxiety scores. Missing data were very few and the mean score of that variable was entered to replace missing data. To prevent the potential source of selection bias, we attempted to recruit all eligible patients diagnosed with ADHD that were in the database, every patient was contacted with three reminders during data collection. The selection of the independent variables was based on the characteristics that could affect COVID-19 infection and behavioral avoidance of it. These were the disorder's clinical presentation, potential comorbidities, and the patients' image of COVID-19 infection and its vaccine. Quantitative variables from three COVID-19 scales and Adult ADHD Self-Report Scale Symptoms Checklist (ASRS v1.1) were handled in two subgroups of quantitative variables because of the different constructs they were representing.

Data collection tools

The online survey consisted of three parts (i) demographics (sex, age, marital, educational status, vocational, living, and income status), (ii) clinical characteristics (medication, COVID-19 testing, COVID-19 vaccination), and (iii) validated scales. COVID-19 vaccination status was classified as complete, incomplete, or no vaccination concerning the recommendations of the national health authority. Less than two live attenuated vaccines or less than three inactive vaccines were accepted as incomplete vaccination based on the national vaccine administration strategy.

COVID-19 disease perception scale

Perception of COVID-19 (P-COVID-19) was measured by a valid and reliable scale. The scale consists of seven items and two sub-dimensions: “dangerousness” and “contagiousness” and is in a five-point Likert structure. The expressions are evaluated as “I strongly disagree (1),” “I do not agree (2),” “I am undecided (3),” “I agree (4),” “I strongly agree (5).” Sub-dimension of dangerousness covers perceptions and beliefs about the danger posed by COVID-19. The contagiousness subdimension consists of items related to perceptions of the contagiousness of the disease. Some items in the dangerousness sub-dimension are reversely coded. A value between 1 and 5 is obtained by dividing the total score obtained by summing the item scores in the scale sub-dimension by the number of items in that sub-dimension. High scores in the dangerousness sub-dimension indicate a high perception of the dangerousness of the disease, and high scores in the contagiousness sub-dimension indicate the perception of the contagiousness of the virus. Inverse items 1 → 5; 2 → 4; 3 → 3; 4 → 2; It is encoded as 5 → 1 (10).

Attitudes toward the COVID-10 vaccine scale

Attitudes toward the COVID-19 Vaccine (ATV-COVID19) scale has 9 items, 4 items for a positive attitude, and 5 items for a negative attitude. The statements in the scale are evaluated as “Strongly disagree (1),” “Disagree (2),” “Undecided (3),” “Agree (4),” and “Strongly agree (5).” Items in the negative attitude sub-dimensions are scored inversely. The item scores are summed in each subdimension and divided by the number of the items in the subdimension, a value between 1 and 5 is obtained. High scores obtained from the positive attitude sub-dimension indicate that the attitude toward the vaccine is positive. Vaccine negative attitude is calculated after the items in the negative attitude sub-dimension are reversed, and the higher scores indicate a lower negative attitude. Inverse items 1 → 5; 2 → 4; 3 → 3; 4 → 2; It is encoded as 5 → 1 (10).

Avoidance attitudes from COVID-19

The Avoidance Attitudes from COVID-19 (AA-COVID-19) scale consists of 10 items and is a five-point Likert scale. It has two sub-dimensions, cognitive avoidance, and behavioral avoidance. Behavioral avoidance from COVID-19 includes items such as “avoiding participating in social activities to prevent the disease,” “avoiding taking public transport to prevent getting sick,” “not kissing when greeting people you know,” “not shaking hands when greeting people,” “avoiding using public toilets.” Examples of items from the cognitive avoidance sub-dimension include “Distracting your attention when exposed to news about the disease” and “not reading news about the pandemic.” Expressions in the scale are evaluated as I definitely do not (1), I do not (2), I am undecided (3), I do (3), and I definitely do (5). There is no reverse item on the scale. The item scores are summed in each subdimension and divided by the number of the items in the subdimension, a value between 1 and 5 is obtained. High scores from the sub-dimensions indicate high levels of avoidance in the relevant domain (10).

Adult ADHD self-report scale symptoms checklist

Adult ADHD Self-Report Scale (ASRS-v1.1) Symptoms Checklist is an 18-item 5-point Likert-type scale that questions ADHD symptoms in adults according to DSM-IV criteria. It is developed by The World Health Organization (WHO). Inattention and HI are two subscales of the ASRS. Each item is scored between 0 and 4. (0–4 = never, rarely, sometimes, often, to very often) Total scores ranged from 0 to 72 (14). In the reliability analysis, the internal consistency of the scale was

found to be high (Cronbach's alpha = 0.88). The Cronbach alpha value calculated for the subscales was also found to be high, 0.82 for “attention deficit” and 0.78 for hyperactivity/impulsivity. In addition, the 2-week test-retest consistency, evaluated in 50 subjects, was high ($r = 0.85$ for total scores; $r = 0.73$ – 0.89 for subscales). The validity and reliability of the Turkish version of the ASRS were developed by Dogan et al. (15).

Adult ADHD self-report screening scale for DSM-5

Among the valid ADHD screening scales that are currently in use, most of them are calibrated to DSM-IV criteria including the ASRS-v1.1. However, DSM-5 reduced the required number of symptoms from six to five, and the age of onset was updated to seven instead of 12. ASRS-v1.1 was updated according to DSM-5. Adult ADHD Self-Report Screening Scale for DSM-5 (ASRS-5) is a 5-point Likert-type ADHD screening scale consisting of 6 items developed by WHO in line with the DSM-5 diagnostic criteria. Each item is scored between 0 and 4. Total scores ranged from 0 to 24 (16). A validity study was performed (17).

Patient-health questionnaire-9

The nine-item, one-page patient health questionnaire-9 (PHQ-9) is a screening test for depression with high sensitivity and specificity (88% sensitive, 88% specific if the score is ≥ 10). Each item is scored between 0 (not at all) and 3 (nearly every day). The total score ranges from 0 to 27. A possible depressive disorder is indicated with values of 10 and above (18). Turkish reliability of the patient health questionnaire-9 was conducted by Sari and colleagues (19). The diagnostic validity of the 9-item PHQ-9 was established in studies involving 8 primary care and 7 obstetrical clinics. PHQ-9 scores > 10 had a sensitivity of 88% and a specificity of 88% for major depressive disorder. The reliability and validity of the tool have indicated it has sound psychometric properties. The internal consistency of the PHQ-9 is high.

State and trait anxiety inventory

It is a 4-point Likert-type self-report scale that includes two separate scales (STAI-I and STAI-II) each of which consists of 20 items and a total of 40 items. High scores indicate a high level of anxiety. State anxiety refers to how the individual feels at a certain moment and under certain conditions, and trait anxiety refers to how he feels regardless of the situation and conditions. The total score on the scale ranges from 20 to 80. Higher scores show higher levels of anxiety and lower scores show lower levels of anxiety (20). Internal consistency coefficients for the scale

have ranged from 0.86 to 0.95; test-retest reliability coefficients have ranged from 0.65 to 0.75 over a 2-month interval (21). Test-retest coefficients for this measure in the present study ranged from 0.69 to 0.89. Considerable evidence attests to the construct and concurrent validity of the scale (21). Validity and reliability of the Turkish version of the STAI were carried out by Oner and Le Comte (22).

Statistical analysis

The statistical power analysis showed that a minimum sample of $n = 55$ would have the assumption of linear multiple regression to achieve 80% power ($\beta = 0.2$) with a 5% significance level ($\alpha = 0.05$) in a two-tailed test (23). SPSS Version 26.0 was used to analyze the data (IBM Inc. Armonk, NY, USA). The normality test, Kolmogorov Smirnov, was used to examine the data distribution. Descriptive statistics were presented as number and proportion for categorical variables, and non-normal distributed variables as “median (min-max).” Nonparametric statistical methods were used because the data were not normally distributed. The Mann–Whitney U -test and The Kruskal–Wallis test were used to compare non-normalized continuous variables. The Chi-Square test, Fisher Exact test, and Fisher-Freeman-Halton Exact Test were used to compare categorical variables. Univariate logistic regression was carried out to examine the impact of variables on the outcome of COVID-19 infection status. Spearman correlations coefficients were used to analyze associations between the independent variables and the outcome. Multiple linear regression with a backward method was applied to analyze factors significantly impacting avoidance of COVID-19. A statistically significant result is defined as a p -value of <0.05 (two-tailed).

Results

Sociodemographic and clinical characteristics of patients with ADHD

Table 1 shows that there were no significant sex differences in any of the sociodemographic, clinical, or COVID-19 infection or vaccination characteristics among patients.

Comparison of patients and controls in terms of clinical and COVID-19 characteristics

Patients and controls did not significantly differ in gender, education, and income level. The median age of patients (23, min-max: 18–54) was significantly lower than the controls (25, min-max: 19–40; $p = 0.022$). ADHD patients' score was

higher than controls in inattention, hyperactivity-impulsivity, depression, and trait anxiety measured by ASRS v1.1., and ASRS-5, PHQ-9, and STAI-II, respectively (Table 2).

Regarding COVID-19 measures, ADHD patients were more likely to have a perception of COVID-19 as contagious, a more positive attitude toward the COVID-19 vaccine, and greater cognitive avoidance (i.e., avoiding thinking about COVID-19) than controls. There were no significant group differences in perception of COVID-19 as dangerous and behavioral avoidance of COVID-19. The majority of the patients and controls had been fully vaccinated. There was no significant group difference in infection status (Table 2).

Characteristics of patients by COVID-19 positive or negative testing

When patients were split into two groups, the first group was composed of patients who have ever tested positive for COVID-19, and the second group was composed of those who have never tested positive for COVID-19. There was no significant difference in terms of any sociodemographic and clinical variables between these two groups of patients (Table 3).

Factors affecting the status of COVID-19 infection

Univariate logistic regression analyses were performed in patients and controls to determine which factors impacted positive or negative COVID-19 infection status. The analyses showed that there was no significant impact of any of the sociodemographic and clinical variables on infection status.

To investigate the effect of the type of ADHD medication on COVID-19 status in patients, a Chi-square analysis (COVID-19 infection status X the presence of ADHD medication) was carried out. No significant group differences were found between patients who were on an ADHD medication and those who were not [$X^2 (1, N = 90) = 0.923, p = 0.337$]. Mann–Whitney U -test revealed that behavioral avoidance did not significantly differ between ADHD patients on medication and patients, not on medication ($p = 0.339$).

Correlations of clinical characteristics, COVID-19-related factors, and behavioral avoidance of COVID-19

Spearman correlation coefficients were used to test the associated factors with behavioral avoidance of COVID-19. Findings were summarized in Table 4. Perception of COVID as dangerous and contagious, attitudes toward COVID-19 vaccine,

TABLE 3 Characteristics of patients by COVID-19 positive or negative testing.

Characteristics (median, min-max)	Test positive for COVID-19 (<i>n</i> = 36)	Test negative for COVID-19 (<i>n</i> = 54)	<i>p</i>
Age	21.5 (18–47)	23 (18–54)	0.145
ASRS total score	45.5 (19–64)	42 (7–72)	0.783
Inattention	26 (8–34)	24 (4–36)	0.465
Hyperactivity-impulsivity	18.5 (9–30)	19.50 (6–36)	0.717
ASRS-5	15 (5–22)	15 (4–24)	0.588
PHQ-9	14 (3–38)	17 (2–27)	0.701
STAI-I	41 (34–48)	40 (32–59)	0.088
STAI-II	43 (27.5–54)	44(27–61)	0.941
P-COVID-19	4.67 (3–5)	4 (2.67–5)	0.051
Dangerousness			
Contagiousness	3.9 (2–5)	3.88 (2–4.75)	0.947
ATV-COVID-19	3.5 (1–5)	3.5 (1–5)	0.601
Positive attitudes			
Negative attitudes	3.4 (1.4–4.8)	3.6 (2–4.6)	0.970
AA-COVID-19			
Cognitive avoidance	2.6 (1–4.2)	2.4 (1–4.4)	0.533
Behavioral avoidance	4 (1.6–5)	3.8 (1.4–4.8)	0.378
Sex	<i>n</i> (%)	<i>n</i> (%)	0.722
Male	17 (47.22)	29 (53.70)	
Female	19 (52.78)	25 (46.30)	
Educational status			0.311
High school and lower	12 (33.33)	13 (24.07)	
Bachelor	22 (61.11)	33 (61.11)	
Graduate and higher	2 (5.56)	8 (14.82)	
Vocational status			1.000
Employed/student	31 (86.11)	47 (87.03)	
Unemployed	5 (13.89)	7 (12.97)	
Marital status			0.722
Married	5 (13.89)	9 (16.66)	
Single	31 (86.11)	45 (83.34)	
Income level			0.462
Low	4 (11.11)	11 (20.37)	
Moderate	21 (58.33)	26 (48.14)	
High	11 (30.56)	17 (31.49)	
Medication type			0.319 ^a
Methylphenidate	24 (66.67)	37 (68.51)	
Atomoxetine	0 (0.00)	4 (7.40)	
None	12 (33.33)	13 (24.09)	
COVID-19 vaccinated			0.909 ^a
Fully vaccinated	30 (83.33)	44 (81.48)	
Incompletely vaccinated	5 (13.88)	5 (9.26)	
Not vaccinated	1 (2.79)	5 (9.26)	

(Continued)

TABLE 3 (Continued)

Characteristics (median, min-max)	Test positive for COVID-19 (<i>n</i> = 36)	Test negative for COVID-19 (<i>n</i> = 54)	<i>p</i>
Presence of ADHD medication			0.921
No	14 (25.9)	9 (25.0)	
Yes	40 (74.1)	27 (75)	

^aFisher-Freeman-Halton Exact test, other comparisons between categorical variables were carried out with Chi-square, Continuous data were compared with Mann-Whitney U.

STAI-I & STAI-II, state and trait anxiety inventory I-II; PHQ-9, patient health questionnaire-9; ATV-COVID19, attitudes toward the COVID-19 vaccine; P-COVID-19, perception of the COVID-19 disease; AA-COVID-19, the avoidance attitudes from COVID-19.

depression score, and age were significantly correlated with behavioral avoidance (Table 4).

Factors affecting behavioral avoidance of COVID-19

Factors that were associated with behavioral avoidance using a cut-off of the *p*-value of 0.10 in Spearman correlation analysis were perception of COVID-19 as dangerous and contagious, positive and negative attitudes toward COVID-19 vaccine, depression score, and age. These were entered into multiple linear regression which was performed to predict behavioral avoidance of COVID-19 (*n* = 130). The final linear regression model included the perception of COVID-19 as dangerous and a positive attitude toward the COVID-19 vaccine as variables that significantly impact the outcome of behavioral avoidance. The model explained 17% of the variance in the whole group [$R^2 = 0.17$, $F(2) = 13.189$, $p < 0.0001$; Table 5].

Discussion

This study looked at COVID-19 infection, COVID-19 vaccine, and the factors that affect COVID-19 infection and behavioral avoidance of COVID-19. Our research was driven by the few and inconsistent findings in the literature regarding COVID-19 risk in ADHD, lack of data on vaccine status in ADHD, and scarcity of data to guide recommendations specified for this group. We think that the gap must be filled to know where to intervene to support ADHD patients by adhering to protective measures. Contrary to our expectations, the COVID-19 infection status, COVID-19 vaccine status, perception of COVID-19 as dangerous, and behavioral avoidance of COVID-19 in adults with ADHD were not significantly different compared with controls. No demographic and clinical factors

MENTAL ILLNESS, CULTURE, AND SOCIETY: DEALING WITH THE COVID-19 PANDEMIC

Topic Editors:

Mohammadreza Shalbafan, Iran University of Medical Sciences, Iran

Renato de Filippis, Magna Græcia University, Italy

Samer El Hayek, Erada Center for Treatment and Rehab, United Arab Emirates

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TABLE 5 Linear regression analysis exploring factors that impact behavioral avoidance of COVID-19.

Factors	Coefficient (B)	SE	95% CI	<i>p</i>
Perception of COVID-19 as dangerous	0.346	0.092	0.164–0.528	0.000
Positive attitudes toward the COVID-19 vaccine	0.166	0.059	0.048–0.164	0.006

Model $F(2) = 13.189$, $p < 0.0001$, $R^2 = 0.17$.

significantly affected the COVID-19 infection status. Avoidance of COVID-19 was significantly correlated with age, perception of COVID-19 as dangerous and contagious, and a positive perception of the COVID-19 vaccine. After adjustment of other factors, a positive perception of the COVID-19 vaccine and perception of COVID-19 as dangerous were the two factors significantly affecting behavioral avoidance of COVID-19 in ADHD. Approximately four-fifths of the patients were fully vaccinated as recommended by national and global health organizations.

COVID-19 infection status in ADHD

COVID-19 infection status did not significantly differ among patients and controls which was not in line with some studies (2, 3) but corroborated with others (7). The discrepancy may firstly be explained by differences in the timing of the studies. Studies by Merzon and Wang analyzed the health records during the first wave of the pandemic when several uncertainties exist about COVID-19 (2, 3). We collected data much later and in the second half of the pandemic. The disease got to be recognized as a contagious and dangerous public health condition with known consequences. Mitigation efforts including the positive attitudes toward the vaccine and the high vaccination rate may have provided adequate protection that individual risk-taking behaviors were subdued and any group differences in COVID-19 status may have been repressed. This raises a very important implication which is addressing the dangerousness and contagiousness of the COVID-19 infection and adequately informing individuals with ADHD and possibly other mental disorders may reciprocate despite the increased risk of infection in the first place. Secondly, differences in methodology may account for different findings. The first study assessed the ADHD rate among people from the general population while we looked into the COVID-19 rate among ADHD people. Thirdly, ADHD can be considered a mental disorder with neuropsychological disturbances that may manifest in three levels: behavior, cognitive functions, and separate component of cognitive functions (24). Despite hyperactivity-impulsivity, attentional control difficulties, and a complex system of executive function disturbances including neurodynamic deficits (25), ADHD itself may provoke no kind of mental disturbance in sense of perception of the danger of this

disease and protection of it by avoidance behaviors and receiving the vaccine.

Different cultural contexts with variances in pandemic management may affect the findings (2). Fourthly, the relatively higher educational status of the patients in our study may have additionally contributed to the findings. Education was reported to be a factor that predicted risk-mitigation behaviors against COVID-19 (26). The characteristic of a college degree and above education was shown to be a protective factor for COVID-19 infection (27). Besides inattention (3) having fewer worries and a diminished level of concern were proposed to be other reasons for not taking the necessary precautions (7).

Our findings are consistent with a study in children where researchers showed that children with ADHD were not more likely to experience COVID-19 infection. This study followed a similar methodology to ours and demonstrated the COVID-19 rate among ADHD and controls (7). Another study exhibited no correlations between ADHD and population size infection and mortality rates from coronavirus. Interestingly, this study showed that recovery rates (recovery-population ratio) rise with the prevalence of ADHD. ADHD might provide an evolutionary advantage in coping with the disease like the non-dominant gene that helps to compete with malaria in sickle-cell disease (9).

We found that no demographic or clinical factors significantly impacted COVID-19 infection status. COVID-19 positive test status did not differ between treated and untreated ADHD patients whereas this finding did not corroborate with two studies that demonstrated that treated ADHD subjects had a lower risk for COVID-19 than untreated ADHD (2, 28). The discrepancy could be explained by the different study populations. The first study included both children and adults and the latter study included only children (28). Another explanation could be different presentations of ADHD during childhood and adulthood. HI symptoms are more dominant during childhood whereas more subtle or subsided during adulthood. It is expected that untreated children may participate in activities that may raise the risk of COVID-19 (e.g., running around, leaving their seats) (11, 29). On the other hand, young adults are expected to have more behavioral limits and a stronger awareness of the idea of social distance therefore could be more complying with precautions than children (30).

We found males and females with ADHD had similar rates of COVID-19 infection and vaccination rates whereas a positive association of COVID-19 infection with the male gender was demonstrated in the study by Merzon et al. (2). On the contrary,

Wang and colleagues demonstrated among people who tested positive for COVID-19, women with ADHD had higher odds of COVID-19 infection than males with ADHD and who were diagnosed with ADHD within the year before the study was carried out. The data regarding the gender, ADHD, and COVID-19 infection risk appear inconsistent.

Behavioral avoidance in ADHD patients

Avoidance behaviors are one of the COVID-19 risk mitigation measures (11) which are very important in the management of and fight against the pandemic. They include physical distancing, staying at home, avoiding close contact like shaking hands or kissing, and avoiding participating in social activities and public places. We found that significant factors in the behavioral avoidance outcome were the perception of COVID-19 as dangerous and positive attitudes toward the vaccine but not any clinical characteristics of ADHD symptoms, state and trait anxiety and depression.

Our findings on behavioral avoidance corroborate a very recent study that investigated the risk-mitigation practices in youth with ADHD. Of five different groups of disorders including ADHD, only anxiety disorders were associated with avoidance behaviors (which included avoiding groups, indoor settings, and other people's homes) (11). Cognitive avoidance which is known to be an unhealthy coping mechanism was higher in ADHD patients compared with controls.

Vaccination tendencies and actual practice in ADHD adults

Our findings increased the knowledge base by demonstrating that the acceptability of the COVID-19 vaccine and actual practice of receiving the vaccine was endorsed in ADHD patients with no significant difference from healthy controls. To the best of our knowledge, this finding has not been previously reported in the literature. Approximately four-fifths of the patients had the full vaccination as recommended by the national and global health bodies. Although there was a higher number of patients who had incomplete COVID-19 vaccination compared to controls, this did not reach statistical significance. In a study with children with ADHD, one-fourth of caregivers of ADHD children were hesitant to vaccinate their children (31).

Strengths and limitations

This study expands our knowledge on the perceptions of COVID-19 and its vaccine and the avoidance behaviors which are important to mitigate the risk of infection. To the best of our knowledge, the data have not been reported before in

the literature. Nevertheless, our study has limitations. First, it should be taken into account that data were gathered throughout various pandemic phases without distinguishing the different phases of the pandemic although there was a match and balance between patients and controls. Second, the findings' generalizability could be hampered by the relatively small sample size. Third, the sample of our study may not reflect the perceptions and behaviors of ADHD patients from all cultural backgrounds. Additionally, healthy controls were selected based on their self-report of having no psychiatric disorders and medications, which is a further limitation. The age range in our study was 18–54 so the findings may not represent older adults with ADHD. Most of the ADHD patients were contacted by phone to invite to the study and only those who were willing to participate were recruited; although this may pose a selection bias, there were no significant differences in age, gender, and education in those who participated and those who did not. Only one patient had a chronic medical disorder and only two patients had substance use disorder in our sample. Therefore, examining the role of comorbid medical diseases except for depression and anxiety on COVID-19 infection was not possible.

Those with ADHD may exhibit different stress symptom profiles compared with typically developing subjects (29). These differences may necessitate measuring anxiety and depression symptoms to develop targeted strategies (30). COVID-19-related perceptions may also play a role in explaining the link (32).

To conclude, this study looked at COVID-19 infection and vaccine status and the factors that affect COVID-19 infection status and behavioral avoidance of COVID-19 among adults with ADHD. Our research was driven by the few and inconsistent findings, lack of data on vaccine status, and scarcity of data to guide recommendations specified for this group. We think the gap must be filled to intervene and support ADHD patients to adhere to protective measures. To the best of our knowledge, COVID-19 vaccine acceptability among ADHD has not been reported before in the literature. Approximately four-fifths of the patients were fully vaccinated as recommended by national and global health organizations. Contrary to our expectations, the COVID-19 infection and vaccine status, perception of COVID-19 as dangerous, and behavioral avoidance of COVID-19 did not differ from controls. No factor significantly affected the COVID-19 infection status. After adjustment of possible factors, a positive perception of the COVID-19 vaccine and perception of COVID-19 as dangerous were the two factors significantly affecting behavioral avoidance of COVID-19 but not the clinical characteristics of ADHD symptoms, state-trait anxiety, and depression. Our findings have increased the knowledge base showing that the COVID-19 vaccine is acceptable and the actual practice of receiving the vaccine is endorsed among ADHD patients.

Our message for practice would be to take into account not only the core symptoms and the comorbidities of the disorder

but also the perception of the disease among patients. ADHD itself may provoke no kind of mental disturbance in sense of perception of the danger of this disease.

Further studies to better understand the mechanisms of mental illness and COVID-19 infection are in need (33). A comparison between the early findings and later findings on COVID-19 risk among ADHD individuals during the course of the pandemic is warranted.

Data availability statement

The datasets presented in this article are not readily available because of confidentiality restrictions on the patient data. Requests to access the datasets should be directed to OK, drozgekilic@gmail.com.

Ethics statement

The studies involving human participants were reviewed and approved by Bezmialem Vakif University Clinical Research Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

Author contributions

OK, MB, ED, and IK contributed to the conception and design of the study. MS-B and SK-E organized the database. OK,

MB, MS-B, and SK-E carried out data collection. OK performed the statistical analysis and wrote the first draft of the manuscript. OK, MB, GG, SY, and ED wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Samer El Hayek,
Shezlong, Egypt

REVIEWED BY

Mohammad Ali Zakeri,
Rafsanjan University of Medical
Sciences, Iran
Yao Meng,
Nanjing Medical University, China
Theodore Charles Masters-Waage,
Singapore Management
University, Singapore

*CORRESPONDENCE

Yuhuan Xia
xiayh726@163.com

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How and when perceived COVID-19 crisis strength impacts individuals' life satisfaction and sleep quality: A moderated mediation model

Yuanyuan Lan¹, Changlin Han¹, Xiaotong Liu¹, Qinqin Cao¹,
Siyuan Chen² and Yuhuan Xia^{3*}

¹School of Business, Qingdao University, Qingdao, China, ²School of Economics and Management, Beijing Jiaotong University, Beijing, China, ³School of Innovation and Entrepreneurship, Shandong University, Qingdao, China

The COVID-19 pandemic has caused millions of deaths, seriously hampering people's lives and their productivity. Drawing on social information processing theory, this research developed a moderated mediation model to investigate the influence of perceived COVID-19 crisis strength on individuals' well-being. The results from a sample of 441 suggest that individuals' perceived COVID-19 crisis strength indirectly affects their life satisfaction and sleep quality *via* their perceived risk of being infected. Moreover, both individuals' trust in local government and mindfulness trait can buffer the positive effect of perceived COVID-19 crisis strength on their perceived risk of being infected. At the same time, they also buffer the indirect impact of individuals' perceived COVID-19 crisis strength on life satisfaction and sleep quality through perceived risk of being infected. This research provides several practical implications for governments and individuals to mitigate the negative influences of the COVID-19 pandemic and help individuals boost life satisfaction and sleep quality.

KEYWORDS

perceived COVID-19 crisis strength, perceived risk of being infected, life satisfaction, sleep quality, trust in local government, mindfulness

Introduction

The coronavirus disease that emerged in 2019 (COVID-19) has resulted in a devastating global event that has disrupted personal and work lives, caused a global economic slowdown, put a heavy strain on healthcare systems, and created a great deal of uncertainty for workers (1–3). The COVID-19 pandemic has lasted for more than 2 years. From the first known outbreak of COVID-19, the cumulative number of confirmed cases of infections has exceeded 513 million worldwide, including more than 6 million deaths. In China, people have experienced many COVID-19 waves, and recently the “highly mutated” Delta and Omicron variants resulted in another wave of infections. Overall, the COVID-19 outbreak has upended people's normal lives, causing great mental stress and tremendous public anxiety.

In the existing literature, numerous researchers have demonstrated the negative effects of the COVID-19 pandemic on the psychological and behavioral outcomes of individuals. For example, Trougakos et al. (4) demonstrated that COVID-19 health anxiety could increase individuals' emotion suppression, thereby adversely affecting their psychological need fulfillment. Unmet psychological needs can not only reduce individuals' goal progress and family engagement, but also trigger more somatic complaints in individuals. Research by Yoon et al. (5) showed that COVID-19 news consumption was positively related to increased uncertainty, which, in turn, negatively affects individuals' goal progress and creativity in the workplace. Lin et al. (6) found that the COVID-19 pandemic increased employees' job insecurity and further triggered employees' emotional exhaustion, organizational deviance, and saving behavior. Other studies have also tried to explore the factors that could mitigate the detrimental influences of the COVID-19 pandemic on individuals. For example, Chen et al. (1) found that individuals' proactive personality was associated with perceived strengths use, and thus their performance, resilience, and thriving will remain at a higher level than those with lower proactive motivation in the COVID-19 pandemic.

Despite the great progress in studying the COVID-19 pandemic, there still remain several unanswered questions. To begin with, research on the impact of perceived COVID-19 crisis strength is in its infancy. To a large extent, perceived COVID-19 crisis strength refers to an individual's judgment regarding COVID-19 severity (7). Existing studies primarily focus on the impact of the COVID-19 pandemic itself on individuals (8, 9), rather than the impact of their judgment of the severity of COVID-19 on individuals. Individuals' attitudes and subsequent behaviors are, to a large extent, directly determined by their judgment of what they are confronted with. Individuals' subsequent responses can vary because their perceived COVID-19 crisis strength is different. Therefore, it is necessary to further explore the influence of perceived COVID-19 crisis strength. Moreover, little is known about the underlying mechanism and potential boundary conditions by which individuals' perceived COVID-19 crisis strength affects their well-being. Well-being indicates a positive physical, mental, and social condition (10). Throughout the COVID-19 pandemic, people's well-being has been particularly vital for social stability. Although previous studies have examined the impact of perceived COVID-19 disruption on well-being (11, 12), it is unclear how and when perceived COVID-19 crisis strength predicts individuals' well-being.

Therefore, in this study, drawing upon social information processing theory, we developed a model to explore how individuals' perceived COVID-19 crisis strength affects their well-being. The core assumption of social information processing theory is that individuals view received social information as a crucial cue, which can significantly affect their attitudes, cognitions, and behaviors (13). In the current study,

given that the COVID-19 pandemic is a stressful social event, we proposed that individuals' perceived COVID-19 crisis strength may increase their perceived risk of infection, which indicates a "subjective assessment of the probability of a specified type of accident happening and how concerned we are with such an event" (p.152) (14). When individuals perceive a high risk of COVID-19 infection, their well-being, such as life satisfaction and sleep quality, declines. Morgeson et al. (15) indicated that the strength of an event is considered from three dimensions: novelty, disruption, and criticality. In other words, the more novel, disruptive, and critical an event is, the more likely it is to influence individuals' recognitions and behaviors. Thus, when individuals perceive that the COVID-19 pandemic will be more severe, they may feel at high risk of infection, which is negatively related to their happiness and well-being—but positively related to their death distress (16, 17).

Furthermore, social information processing theory also shows that individual differences can alter the extent to which individuals interpret and respond to received social information (13). In this study, our attention focused on individuals' trust in local government and the personal trait of mindfulness, and we attempt to explore how these two factors moderate the relationship between individuals' perceived COVID-19 crisis strength and perceived risk of infection. Specifically, trust in local government means individuals believe the actions taken by local governments during the COVID-19 outbreak is effective and correct (18). Individuals who trust in local government are apt to believe that government could do a good job of environmental sanitizing, and take effective actions to protect citizens' lives, thus perceiving a low risk of being infected. However, when perceiving the same strength of the COVID-19 pandemic, individuals who do not trust local government may not believe the government is able to adopt effective COVID response policies, thus perceiving a high risk of being infected. In this study, we speculate that individuals' trust in local government may attenuate the positive relationship between perceived COVID-19 crisis strength and perceived risk of infection.

Mindfulness involves a non-judgment awareness and attention to the current moment (19), which refers to openness, awareness, and receptive attention (20). In other words, individuals with a higher level of mindfulness often purposely focus their attention on their ongoing and present experiences, as well as maintain a non-judgmental attitude (19, 21). Existing works suggest that mindfulness intervention is helpful for decreasing anxiety, depression, and emotional exhaustion during the COVID-19 pandemic (22), and is effective for relieving stress after COVID-19 lockdowns (23). Moreover, Zheng et al. (24) indicated that the interaction between COVID-19 stressors and mindfulness could affect sleep duration. Consistent with these works, we posit that, compared to individuals with low levels of mindfulness, those with high levels of mindfulness are less likely to perceive risk of being

infected because they have the ability to fully experience the event without resorting to extremes either over-focusing on or inhibiting the experience. Therefore, mindfulness may buffer the positive effect of perceived COVID-19 crisis strength on perceived risk of infection. Figure 1 shows the theoretical model.

Theoretical background and hypotheses

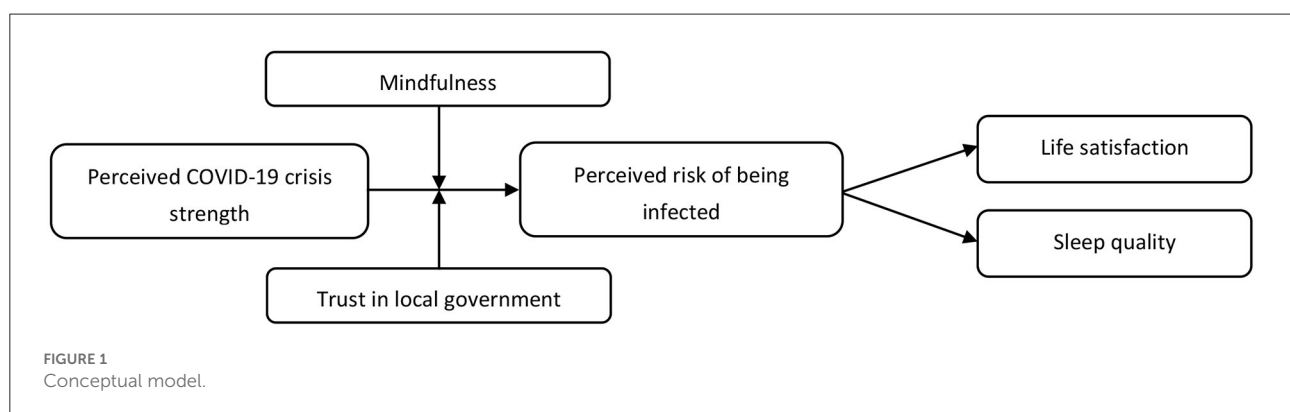
To understand the consequences of the COVID-19 pandemic, this research developed a moderated mediation model to explain the potential effects of individuals' perceived COVID-19 crisis strength on their well-being by using social information processing theory. Social information processing theory indicates that when individuals receive social information, they may interpret the information and form their own cognition, which in turn, shapes their attitudes and behaviors (13). Furthermore, social information processing theory also proposes that individual differences can constrain the process through which individuals respond to obtained social information (13). In the existing literature, this theory has been found suitable for exploring the factors that may influence individuals' well-being. For example, drawing upon social information processing theory, Zhang et al. (25) found that organizations' socially responsible human resource management practices can positively promote employees' perspective-taking and, subsequently, boost their well-being. Meanwhile, they also showed that employees' substantive attributions to socially responsible human resource management practices can magnify the positive effects; however, employees' symbolic attributions may reduce the positive effects. In the context of the COVID-19 pandemic, individuals use various cues to evaluate the risk of being infected, which in turn, affects their well-being. Indeed, scholars have characterized crises, such as the COVID-19 pandemic as social information that individuals obtain from the social environment (26, 27). Therefore, based on social information processing theory, this paper constructed a conceptual model to reveal how individuals' perceived

COVID-19 crisis strength affects their well-being, including life satisfaction and sleep quality.

Perceived COVID-19 crisis strength and perceived risk of being infected

The current studies have indicated that the strength of an event refers to its novelty, disruption, and criticality (15). Specifically, novelty means the extent to which an event is a new or unexpected phenomenon, or the degree to which the event differs from existing events, behaviors, and features (28, 29). The disruption involves a discontinuity in the external environment, in which the situation has changed (30). In other words, disruption means things do not continue the way they did prior to the extent (15). Moreover, the criticality reflects the extent to which an event is important, essential, or a priority to an entity (31). Morgeson et al. (15) pointed out that the more critical an event, the more likely it will to be seen as a salient event and the more likely it will require more attention and actions. The perceived risk of being infected refers to individuals' subjective assessment of the possibility of their being infected by COVID-19 and how concerned they are about the COVID-19 infection (14, 32). Individuals' perceived risk related to COVID-19 infection means not only the likelihood of experiencing the detrimental consequences caused by COVID-19 infection, but also their affective reactions to the COVID-19 infection, which may include worry or concern about their own safety (17, 32).

In this section, this paper argues that individuals' perceived COVID-19 crisis strength may be positively related to their perceived risk of being infected. In the context of the COVID-19 pandemic, *novelty* refers to individuals' perception that the COVID-19 is new and unexpected; *disruption* refers to the degree to which individuals perceive their existing tasks are interrupted by COVID-19; and *criticality* refers to whether individuals perceive their long-term development will be affected by COVID-19 (3, 6, 33). According to social information processing theory (13, 25), the obtained information may



shape individuals' cognitions and perceptions. COVID-19 is a disease caused by the novel coronavirus which is different from previously known coronaviruses. Faced with this novelty, individuals may have limited knowledge about the procedures or guidelines to deal with such a crisis effectively (34). In terms of the disruption, the COVID-19 pandemic has changed the world, and the crisis seems to have put everyone's lives on hold (35). Specifically, to control the spread of COVID-19, many individuals have had to stay at home, and many enterprises or stores have been closed (36). Individuals' usual work and life activities have been highly disrupted by COVID-19. Moreover, the global economy and cross-border exchanges have stagnated. For example, the COVID-19 pandemic has had a dramatic impact or disruption on the tourism industry (37, 38). It has been more than two years since the COVID-19 outbreak first broke out, and it is still unknown when the pandemic will end. It seems to be possible that COVID-19 is likely to continue to have significant influences on individuals, and cause uncertainty about their futures (39).

Accordingly, when individuals glean information cues regarding the COVID-19 pandemic from the social environment, and view it as more novel, disruptive, and critical, they are less likely to have the confidence to cope with COVID-19 well. They will experience more changes in their usual life and feel they lose control of their future lives. Finally, they will view the COVID-19 pandemic as more serious, which may increase individuals' perceptions and fears regarding COVID-19 infection. In contrast, those who perceive the COVID-19 pandemic as less novel, disruptive, and critical, may have fewer concerns about this crisis, and feel that the way they live and work does not require too many changes, and their future development will not be heavily affected by COVID-19. Their perceptions and fears about COVID-19 infection will remain at a low level. Thus, we propose the following hypothesis:

Hypothesis 1: Individuals' perceived COVID-19 crisis strength is positively related to their perceived risk of being infected.

The mediating role of perceived risk of being infected

After illustrating the positive relationship between the strength of individuals' perceived COVID-19 crisis and their perceived risk of being infected, this paper further explores the influences of individuals' perceived risk of COVID-19 infection on their well-being focusing particularly on two forms of individuals' well-being: life satisfaction and sleep quality. Life satisfaction is a form of subjective well-being that reflects individuals' cognitive assessment of whether or not they are satisfied with their life (40). Sleep quality, another form of well-being, refers to a subjective evaluation of their sleep

experience that includes not only a sense of rest upon waking, but also the satisfaction with sleep (41, 42). Existing studies have investigated the factors that may influence individuals' life satisfaction and sleep quality. For example, scholars have shown that job satisfaction and core self-evaluation can be positively associated with individuals' life satisfaction (43, 44). Kuppens et al. (45) examined the effects of emotions on individuals' life satisfaction judgment and found that positive emotions were positively related to life satisfaction, while negative emotions were negatively related to life satisfaction. Thomsen et al. (46) indicated that individuals' rumination was significantly associated with poor subjective sleep quality. In turn, poor quality of sleep can lead to more psychological and physical health complaints and increased negative effects, such as anxiety, fatigue, and depression (42).

In this study, this paper argues that individuals perceived high risk of being infected may negatively affect their well-being, including life satisfaction and sleep quality. Social information processing theory indicates that individuals can process the obtained social information to form their cognitions and further develop their behaviors (13). Individuals' perceived high risk of infection is inherently a stressful and negative cognition. Previous studies have demonstrated that individuals rely on their emotional experiences to form subjective evaluations of well-being (45). Therefore, the stressful and negative cognition may trigger their lower level of well-being judgment. In addition, individuals' perceptions of being at risk of infection requires them to devote more personal effort to cope with such risks. Thus, the perceived high risk of COVID-19 infection may drain individuals' psychological and physical resources, ultimately leading to emotional exhaustion (32), which is a strong predictor of a lower level of well-being. Furthermore, existing studies have provided some empirical support for this argument. For example, Kwok et al. (47) indicated that perceived COVID-19 risk was positively related to individuals' anxiety, worry, and disruption of daily routines. Zhang et al. (48) showed that the perceived risk of COVID-19 infection may induce distress and reduce life satisfaction among working adults. Accordingly, we propose the following hypotheses:

Hypothesis 2a: Individuals' perceived risk of being infected is negatively related to their life satisfaction.

Hypothesis 2b: Individuals' perceived risk of being infected is negatively related to their sleep quality.

Integrating the discussion on hypotheses 1 and 2 and drawing upon social information processing theory, we further speculate that individuals' perceived COVID-19 crisis strength may affect their well-being including life satisfaction and sleep quality *via* their perceived high risk of being infected. Thus, we propose the following hypotheses:

Hypothesis 3a: Individuals' perceived risk of being infected mediates the relationship between perceived COVID-19 crisis strength and life satisfaction.

Hypothesis 3b: Individuals' perceived risk of being infected mediates the relationship between perceived COVID-19 crisis strength and sleep quality.

The moderating roles of trust in local government and mindfulness

After revealing the mediation mechanism of individuals' perceived risk of being infected in the relationship between perceived strength of the COVID-19 pandemic and individuals' well-being, going a step further, this research further explores the boundary conditions that may constrain this indirect effect. Social information processing theory suggests that individual differences may affect the process of individuals' interpretation and response to the obtained social information (13, 25). Therefore, in this section, this paper mainly focuses on the moderating effects of individuals' trust in local government and individuals' mindfulness.

Specifically, individuals' trust in local government refers to the extent to which individuals believe the actions taken by the local government are effective in dealing with COVID-19 (18). During the outbreak of the COVID-19 pandemic, as front-line administrative units, local governments have a responsibility to prevent the spread of the COVID-19 pandemic (49). To effectively manage the COVID-19 pandemic, many local governments have formulated appropriate response policies and made reasonable adjustments, according to the immediate development of the crisis within their jurisdiction (50). In the context of the COVID-19 pandemic, individuals' trust in local governments may depend on their evaluation of the governments' coping capacity and performance (51). In other words, when individuals perceive that the measures made by the local government are strongly effective in preventing and stopping the spread of COVID-19, they may view the local government as credible and trustworthy (52). Existing studies have indicated that individuals' trust in the local government can decrease their perceptions of risk related to the COVID-19 crisis (53). Shanka and Menebo (18) also found that individuals' trust in the government is a strong predictor of their behaviors, and those who have more trust in local government are less likely to complain about the policies and measures, and more likely to be confident in dealing with COVID-19. Therefore, we propose the following hypothesis:

Hypothesis 4: Individuals' trust in local government moderates the relationship between perceived COVID-19 crisis strength and perceived risk of being infected, such that this relationship will be less positive when individuals' trust in local government is high.

In addition, this paper also explores the moderating effect of individuals' personal trait of mindfulness on the relationship between individuals' perceived COVID-19 strength

and their perceived risk of infection. Mindfulness refers to receptive attention and awareness of present events and experiences (19, 54–56). Previous studies have demonstrated that mindfulness has a positive impact on human functioning, including attention, emotion, cognition, and behavior (19). In particular, the research on organizational behaviors has shown a positive association between mindfulness and improved workplace functioning (57). For example, the personal trait of mindfulness has been linked to higher job performance (58, 59) and citizenship behavior (54). Other studies have also demonstrated there are positive relationships between trait mindfulness and individuals' prosocial behavior and ethical behavior, as well as negative relationships between mindfulness and deviant behavior and counterproductive behavior (59, 60).

In this section, this research speculates that mindfulness may attenuate the positive relationship between perceived COVID-19 crisis strength and perceived risk of infection. Specifically, mindful individuals may be more aware and attentive when doing things, rather than automatically running through their tasks and activities (21, 61). In other words, mindfulness involves a process of decoupling, and mindful decoupling allows individuals to mentally step back from and observe present moment internal states and external events from a metacognitive perspective (54, 57, 62). That is, compared to those who are less mindful, mindful individuals will be more objective in observing current events, rather than immersing in the present experiences (62). Therefore, in the context of the COVID-19 pandemic, compared to those with a lower level of mindfulness, mindful individuals will be more likely to objectively analyze external situations they may face, and less likely to be concerned about COVID-19 infection. Existing research has provided some support for this argument. For example, Dillard and Meier (63) found that individuals with a higher level of mindfulness reported lower levels of stress, anxiety, worry, and negative emotions about COVID-19. In addition, they also noted that mindfulness was positively related to individuals' use of healthy coping strategies, such as seeking social support and positive reframing. Thus, we propose the following hypothesis:

Hypothesis 5: Individuals' mindfulness moderates the relationship between perceived COVID-19 crisis strength and perceived risk of being infected, such that this relationship will be less positive when mindfulness is high.

Moderated mediation

Integrating the discussion for hypotheses 3, 4, and 5, we further propose that individuals' trust in local government and their level of trait mindfulness not only moderate the direct relationship between their perceived COVID-19 strength and perceived risk of being infected, but also the indirect relationship between their perceived COVID-19 strength and their well-being (i.e., life satisfaction and sleep quality) *via* perceived risk

of being infected. This argument is consistent with Howell et al.'s (64) findings that mindfulness is positively associated with self-regulation of sleep and well-being. Accordingly, we propose the following hypotheses:

Hypothesis 6: Individuals' trust in local government moderates the indirect relationship between perceived COVID-19 crisis strength and (a) life satisfaction, and (b) sleep quality via perceived risk of being infected, such that these indirect effects will be weaker when trust in local government is high.

Hypothesis 7: Individuals' mindfulness moderates the indirect relationship between perceived COVID-19 crisis strength and (a) life satisfaction, and (b) sleep quality via perceived risk of being infected, such that this indirect effect will be weaker when mindfulness is high.

Method

Sample and procedure

The data for this research were collected from multiple subsidiaries of a large construction company. Most of these subsidiaries are located in Beijing, Tianjin, Henan province, and Guangdong province, and all of these cities and provinces had affected areas with confirmed COVID-19 cases when the data were collected in January 2022. With the help of these companies' human resource management departments, a total of 563 employees with management positions voluntarily participated in this survey. To obtain the truest thoughts of the participants, we promised all their responses would be anonymous, and all answers would be used for academic research only.

To improve the quality of the collected data, we removed responses that selected the same option for most questions (65). Moreover, given that a short response time meant that participants did not put enough effort into responding to surveys (66), we also removed respondents who took less than half the average time to answer the questionnaire¹. In the end, 441 valid responses were obtained, yielding a 78.33% response rate. Among these valid samples, 61.22% were female, the average age was 32.10 years old ($SD = 7.72$), 58.96% of them held a bachelor's degree, and 9.52% held a master's degree or above.

Measures

All English scales were translated into Chinese following the back-translation procedure (67), and we made minor modifications to the expression of some items to ensure all items

were appropriate for our research context. All items were rated with a 7-point Likert scale, except the demographic variables.

Perceived COVID-19 crisis strength. Participants rated their perceived COVID-19 crisis strength using an 11-item scale developed by Liu et al. (7). A sample item was "This COVID-19 crisis causes me to stop and think about how to respond." The Cronbach's α was 0.814. The anchors of this scale were a 7-point scale ranging from 1 = strongly disagree to 7 = strongly agree.

Perceived risk of being infected. Participants rated their perceived risk of being infected at work using an 8-item scale developed by Yildirim and Güler (68). A sample item was "Worry about oneself contracting COVID-19." The Cronbach's α was 0.903. The 7-point scale ranged from 1 = negligible to 7 = very large.

Life satisfaction. Participants rated their life satisfaction using Cheung and Lucas's (40) 1-item scale: "Prior to any lifestyle changes due to COVID-19, in general, how satisfied are you with your life in the past week?" The anchors of this item were a 7-point scale ranging from 1 = very dissatisfied to 7 = very satisfied.

Sleep quality. Participants rated their life satisfaction using Lam et al.'s (69) 1-item scale: "How would you evaluate the quality of your past week's sleep?" The anchors of this item were a 7-point scale ranging from 1 = not very good to 7 = very good.

Trust in government. Participants rated trust in government with a 3-item scale developed by Shanka and Menebo (18). A sample item was "I think the government in my area is able to manage the COVID-19 pandemic properly." The Cronbach's α was 0.895. The anchors of this scale were a 7-point scale ranging from 1 = strongly disagree to 7 = strongly agree.

Mindfulness. Participants rated their mindfulness with a 15-item scale developed by Brown and Ryan (21). A sample item was "I could be experiencing some emotion and not be conscious of it until some time later." The Cronbach's α was 0.966. The anchors of this scale were a 7-point scale ranging from 1 = almost always to 7 = almost never.

Control variables. Prior works suggest that individuals' gender, age, and education level could influence their life satisfaction and sleep quality (70, 71). Thus, following previous research (72), we controlled participants' gender, age, and education level.

Data analysis

Data were analyzed using SPSS version 25 and Mplus 8.3. We used the Chi-square degrees of freedom ratio (χ^2/df), comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean residual (SRMR) to examine the fit of the model to the data. When χ^2/df is below 3, CFI and TLI are above 0.90, RMSEA is lower than 0.08, and SRMR is lower than 0.05, the

¹ We tested our hypotheses without removing the responses that took less than half the average time to answer the questionnaire. The results showed that the exclusions did not affect the interpretation of the results.

results indicate a good fit. In addition, we conducted a structural equation model using maximum likelihood estimation with 5,000 bootstrap estimations to examine hypotheses 1 to 7.

Results

Discriminant and convergent validity

Mplus 8.3 was used to conduct a confirmatory factor analysis (CFA) to examine the discriminant validity of the key variables (i.e., perceived COVID-19 crisis strength, perceived risk of being infected, mindfulness, and trust in local government). Because both the scale of life satisfaction and sleep quality are a single item, this research did not include these two variables when conducting the CFA. As shown in Table 1, the four-factor model ($\chi^2 = 1,318.371$, $df = 623$, $\chi^2/df = 2.116$, $CFI = 0.931$, $TLI = 0.926$, $RMSEA = 0.050$, $SRMR = 0.056$) fit the data better than the other three models. The results reveal that our key variables have good discriminant validity.

Factor loadings, average variance extracted (AVE), and reliabilities are presented in Table 2. The factor loadings of all items ranged from 0.538 to 0.920, higher than the threshold value of 0.5. The values of all composite reliability (CR) of the four variables ranged from 0.923 to 0.970, higher than the threshold value of 0.7. Moreover, the values of the AVE of the four variables ranged from 0.555 to 0.829, higher than the threshold value of 0.5. The results indicate our key variables have good convergent validity.

Descriptive statistics

Means, standard deviations, and correlations are presented in Table 3. The results showed that perceived COVID-19 crisis strength was positively related to perceived risk of being infected ($r = 0.565$, $p < 0.01$), and perceived risk of being infected was negatively related to life satisfaction ($r = -0.428$, $p < 0.01$) and sleep quality ($r = -0.387$, $p < 0.01$).

Test of the direct effects

The results are presented in Table 4. The results showed that perceived COVID-19 crisis strength positively affected perceived risk of being infected ($\beta = 0.664$, 95% CI = [0.536, 0.793]), and perceived risk of being infected negatively affected life satisfaction ($\beta = -0.347$, 95% CI = [-0.467, -0.227]) and sleep quality ($\beta = -0.291$, 95% CI = [-0.409, -0.173]), supporting hypotheses 1, 2a, and 2b.

Test of the indirect effects

The results in Table 4 also showed that the indirect effect of perceived risk of being infected in the relationship between perceived COVID-19 crisis strength and life satisfaction was -0.231 (95% CI = [-0.322, -0.139]), and the indirect effects of perceived risk of being infected in the relationship between perceived COVID-19 crisis strength and sleep quality was -0.193 (95% CI = [-0.280, -0.106]), respectively. Thus, hypotheses 3a and 3b were supported.

Test of the moderating effects

Moreover, the results in Table 4 also showed that the interaction between perceived COVID-19 crisis strength and trust in local government negatively affected perceived risk of being infected ($\beta = -0.137$, 95% CI = [-0.214, -0.060]), indicating that trust in local government negatively moderated the relationship between perceived COVID-19 crisis strength and perceived risk of being infected. To show the moderating effect more clearly, simple slopes for different levels of trust in local government were plotted (see Figure 2). Thus, Hypothesis 4 was supported.

In addition, the interaction between perceived COVID-19 crisis strength and mindfulness negatively affected perceived risk of being infected ($\beta = -0.155$, 95% CI = [-0.246, -0.065]), indicating that mindfulness negatively moderated the relationship between perceived COVID-19 crisis strength and perceived risk of being infected. To show the moderating effect

TABLE 1 Confirmatory factor analysis.

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
Four-factor model: PCCS, PRBI, MIN, TILG	1318.371	623	2.116	0.931	0.926	0.050	0.056
Three-factor model: PCCS+PRBI, MIN, TILG	1715.814	626	2.741	0.891	0.884	0.063	0.068
Two-factor model: PCCS+PRBI+MIN, TILG	4062.829	628	6.469	0.658	0.637	0.111	0.159
One-factor model: PCCS+PRBI+MIN+TILG	4855.361	629	7.719	0.579	0.554	0.123	0.166

N = 441. PCCS, Perceived COVID-19 Crisis Strength; PRBI, Perceived risk of being infected; MIN, Mindfulness; TILG, Trust in local government. Same for following tables.

TABLE 2 Factor loadings, AVE, and reliabilities.

Variables	Factor	Loadings	Cronbach's α	CR	AVE
Perceived COVID-19 crisis strength	PCCS1	0.825	0.814	0.931	0.555
	PCCS2	0.739			
	PCCS3	0.783			
	PCCS4	0.773			
	PCCS5	0.734			
	PCCS6	0.735			
	PCCS7	0.675			
	PCCS8	0.538			
	PCCS9	0.810			
	PCCS10	0.790			
	PCCS11	0.748			
Perceived risk of being infected	PRBI1	0.805	0.903	0.923	0.600
	PRBI2	0.768			
	PRBI3	0.729			
	PRBI4	0.704			
	PRBI5	0.791			
	PRBI6	0.788			
	PRBI7	0.804			
	PRBI8	0.803			
Mindfulness	MF1	0.865	0.966	0.970	0.681
	MF2	0.829			
	MF3	0.819			
	MF4	0.815			
	MF5	0.821			
	MF6	0.816			
	MF7	0.833			
	MF8	0.821			
	MF9	0.810			
	MF10	0.833			
	MF11	0.845			
	MF12	0.827			
	MF13	0.826			
	MF14	0.809			
	MF15	0.807			
Trust in local government	TILG1	0.920	0.895	0.936	0.829
	TILG2	0.910			
	TILG3	0.901			

N = 441.

more clearly, simple slopes for different levels of mindfulness were plotted (see [Figure 3](#)). Thus, Hypothesis 5 was supported.

Test of the moderated mediation effects

Furthermore, [Table 4](#) also showed that perceived risk of being infected played a stronger mediating role in the

relationship between perceived COVID-19 crisis strength and life satisfaction when individuals had a low level of trust in local government (i.e., conditional mediation effect = -0.278 , 95% CI = $[-0.387, -0.170]$) vs. high (i.e., conditional mediation effect = -0.183 , 95% CI = $[-0.268, -0.098]$), and the difference between the two indirect effects was 0.095 (95% CI = $[0.029, 0.161]$), supporting Hypothesis 6a.

Perceived risk of being infected played a stronger mediating role in the relationship between perceived COVID-19 crisis strength and sleep quality when individuals had a low level of trust in local government (i.e., conditional mediation effect = -0.233 , 95% CI = $[-0.336, -0.130]$) vs. high (i.e., conditional mediation effect = -0.153 , 95% CI = $[-0.232, -0.075]$), and the difference between the two indirect effects was 0.080 (95% CI = $[0.023, 0.136]$), supporting Hypothesis 6b.

Perceived risk of being infected played a stronger mediating role in the relationship between perceived COVID-19 crisis strength and life satisfaction when individuals had a low level of mindfulness (i.e., conditional mediation effect = -0.285 , 95% CI = $[-0.396, -0.173]$) vs. high (i.e., conditional mediation effect = -0.177 , 95% CI = $[-0.262, -0.091]$), and the difference between the two indirect effects was 0.108 (95% CI = $[0.030, 0.185]$), supporting Hypothesis 7a.

Perceived risk of being infected played a stronger mediating role in the relationship between perceived COVID-19 crisis strength and sleep quality when individuals had a low level of mindfulness (i.e., conditional mediation effect = -0.238 , 95% CI = $[-0.343, -0.134]$) vs. high (i.e., conditional mediation effect = -0.148 , 95% CI = $[-0.228, -0.068]$), and the difference between the two indirect effects was 0.090 (95% CI = $[0.025, 0.155]$), supporting Hypothesis 7b.

Discussion

Drawing on social information processing theory, this paper developed a moderated mediation model to examine the influences of perceived COVID-19 crisis strength on individuals' well-being. The findings reveal that perceived COVID-19 crisis strength has a positive impact on perceived risk of infection, which in turn decreases life satisfaction and sleep quality. This finding not only validates previous studies' conclusions that, during the COVID-19 pandemic, individuals' well-being became worse ([73](#)) but also further substantiates the underlying mechanism by which individuals' perceived COVID-19 crisis strength affects their well-being. Moreover, both trust in local government and mindfulness negatively moderated the direct relationship between perceived COVID-19 crisis strength and perceived risk of being infected, as well as the indirect effects of perceived COVID-19 crisis strength on both life satisfaction and sleep quality *via* perceived risk of infection. Such findings are consistent with Ye and Lyu's ([74](#)) research, which suggests that risk perception is low for

TABLE 3 Means, standard deviations, and correlations.

	Mean	SD	1	2	3	4	5	6	7	8	9
1. Gender	0.61	0.49	-								
2. Age	32.10	7.72	-0.208**	-							
3. Education level	2.83	0.98	0.225**	-0.032	-						
4. PCCS	4.06	0.89	-0.022	0.099*	-0.041	(0.814)					
5. PRBI	3.68	1.24	0.071	0.004	0.083	0.565**	(0.903)				
6. LS	4.59	1.53	-0.044	0.122*	-0.023	-0.405**	-0.428**	-			
7. SQ	4.74	1.49	-0.072	0.033	-0.072	-0.374**	-0.387**	0.542**	-		
8. MIN	4.15	1.22	0.115*	-0.051	-0.086	-0.198**	-0.164**	0.304**	0.233**	(0.966)	
9. TILG	5.06	1.41	0.061	-0.165**	-0.095*	-0.165**	-0.057	0.007	0.056	-0.121*	(0.895)

N = 441. LS, Life satisfaction; SQ, Sleep quality. Same for following tables. Internal consistent reliability (alpha) coefficients are shown along the diagonal in bold italics. Gender, 0 = male, 1 = female. Education, 1 = high school, 2 = associate degree, 3 = bachelor degree, 4 = master degree, 5 = Ph.D. ** p < 0.01, * p < 0.05.

TABLE 4 Summary of direct, indirect, and moderate effects.

	Estimates	S.E.	95% CI	Remarks
Direct effects				
PCCS → PRBI	0.664	0.065	[0.536, 0.793]	Supported (H1)
PRBI → LS	-0.347	0.061	[-0.467, -0.227]	Supported (H2a)
PRBI → SQ	-0.291	0.06	[-0.409, -0.173]	Supported (H2b)
Indirect effects				
PCCS → PRBI → LS	-0.231	0.047	[-0.322, -0.139]	Supported (H3a)
PCCS → PRBI → SQ	-0.193	0.044	[-0.280, -0.106]	Supported (H3b)
Moderate effects				
TILG * PCCS → PRBI	-0.137	0.039	[-0.214, -0.060]	Supported (H4)
MIN * PCCS → PRBI	-0.155	0.046	[-0.246, -0.065]	Supported (H5)
Conditional indirect effects at values of TILG (PCCS → PRBI → LS)				
-1 SD (TILG)	-0.278	0.055	[-0.387, -0.170]	Supported (H6a)
+1 SD (TILG)	-0.183	0.043	[-0.268, -0.098]	
Difference	0.095	0.034	[0.029, 0.161]	
Conditional indirect effects at values of TILG (PCCS → PRBI → SQ)				
-1 SD (TILG)	-0.233	0.052	[-0.336, -0.130]	Supported (H6b)
+1 SD (TILG)	-0.153	0.040	[-0.232, -0.075]	
Difference	0.080	0.029	[0.023, 0.136]	
Conditional indirect effects at values of MIN (PCCS → PRBI → LS)				
-1 SD (MIN)	-0.285	0.057	[-0.396, -0.173]	Supported (H7a)
+1 SD (MIN)	-0.177	0.044	[-0.262, -0.091]	
Difference	0.108	0.04	[0.030, 0.185]	
Conditional indirect effects at values of MIN (PCCS → PRBI → SQ)				
-1 SD (MIN)	-0.238	0.053	[-0.343, -0.134]	Supported (H7b)
+1 SD (MIN)	-0.148	0.041	[-0.228, -0.068]	
Difference	0.090	0.033	[0.025, 0.155]	

N = 441. SE, standard error; CI, confidence interval. Values for quantitative moderators are the mean and plus/minus one SD from mean.

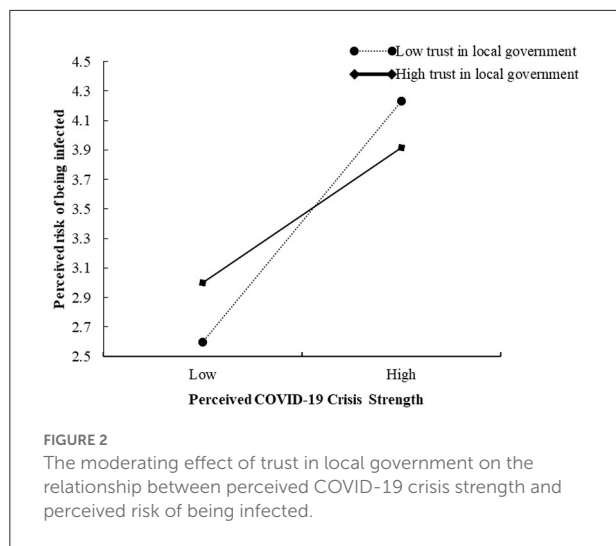
individuals with a high trust in government. Meanwhile, our findings also confirm Bossi et al.'s (23) and Matiz et al.'s (22) findings, who found that mindfulness-based training

is beneficial for mitigating the negative impacts of the COVID-19 outbreak.

Theoretical implications

This paper contributes to the literature in several ways. First, this research contributes to the COVID-19 literature by investigating individuals' life satisfaction and sleep quality in the context of the COVID-19 pandemic. Previous researchers have mainly focused on the influence of the COVID-19 pandemic on individuals' mental health such as anxiety (75), workplace behaviors such as work engagement (7), and tourists' responses such as health tourism intentions (76). Although some scholars have paid attention to individuals' well-being during the COVID-19 pandemic (77, 78), these researchers ignored individuals' life satisfaction and sleep quality, which have vital implications regarding their life and health. Our research not only responds to Lin et al.'s (6) call to further explores more outcomes of COVID-19, but also enriches the research on perceived COVID-19 crisis strength.

Second, this research contributes to the literature by testing how perceived COVID-19 crisis strength affects individuals' well-being from the information processing perspective. Previous research predominately investigated the COVID-19 pandemic from the perspective of event system theory (79); transactional theory of stress and coping (80); existence, relatedness, and growth theory (81), and so on. These studies focused on the intensity of the COVID-19 pandemic, or individuals' psychological responses to the COVID-19 pandemic. However, considering that the COVID-19 pandemic could be a kind of information cues from the social environment (82), how individuals process the social information they obtained also should not be overlooked. This research serves as a useful bridge to our understanding of the COVID-19 crisis with individuals' well-being, and provides a

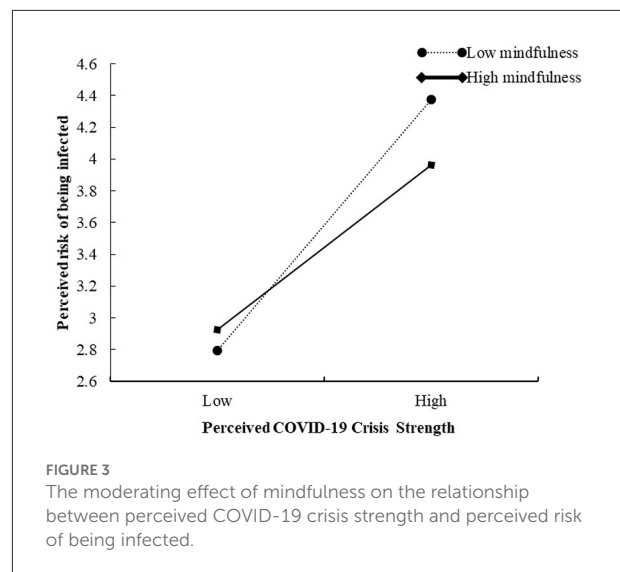


new perspective on how to reduce the negative impact of the COVID-19 pandemic.

Third, the current research contributes to the literature because it examines when perceived COVID-19 crisis strength decreases individuals' well-being in the context of the COVID-19 pandemic. Although previous empirical studies have discussed the boundary conditions for the COVID-19 pandemic's effects, these studies have been limited to the moderating role of job type (83), organizational tenure, health stressors (84), and so on, ignoring the positive influence of the government and mindfulness. Previous research (85) has indicated that when individuals have high trust in the government, they are more likely to engage in preventive measures. Such findings provide evidence for the buffering role of trust in local government. Moreover, evidence suggests mindfulness not only helps boost immunity, but also helps alleviate depression and anxiety (86). For individuals, therefore, mindfulness may be a potential boundary condition for the negative effects of the COVID-19 pandemic. This research enriches the nomological network of perceived COVID-19 crisis strength, thus contributing to a more complete understanding of how we can relieve the negative impacts of perceived COVID-19 crisis strength.

Practical implications

This research also has several practical implications. First, this research confirmed that the perceived COVID-19 crisis strength is detrimental to individuals' life satisfaction and sleep quality. The COVID-19 pandemic has lasted for more than 2 years now. The facts have shown that, in the short term, this event cannot be prevented. However, individuals can mitigate the negative psychological effects of the COVID-19 pandemic



by changing their minds. For example, individuals should pay more attention to positive news, such as that more and more research institutes are developing vaccines and medicines to fight against COVID-19, and many volunteers are currently fighting the pandemic. Moreover, the main reason individuals report poor life satisfaction and sleep quality is that they are afraid of being infected. Thus, to address these issues, individuals should take good protective measures, maintain good hygiene and health habits, and prepare for the sufficient necessities of life.

Second, the findings in this paper reveal that trust in local government could alleviate the negative effects of perceived COVID-19 crisis strength. Thus, it is vital to increase citizens' trust in local government. To begin with, governments should adopt authoritative and effective measures to fight against COVID-19. For example, the construction of a strong public health system must be accelerated, and nucleic acid detection capabilities and medical care capabilities must be enhanced. In addition, establishing a mechanism for observing and analyzing public opinion also helps increase citizens' trust. For example, government could rely on information systems to capture the events that cause public dissatisfaction, list the main events, analyze public opinion, and find the key points and requirements of the public. Furthermore, individuals should also trust government so they can work together to win the anti-COVID war.

Third, in addition to trusting local government, this research also confirmed that individuals' mindfulness can help decrease the negative effects of perceived COVID-19 crisis strength. Although mindfulness is a kind of personality trait, individuals can gain high levels of mindfulness through training. For example, individuals can be trained in the following ways: mindful sitting meditation, body scan, mindful movement, 3-min breathing, lovingkindness meditation, focused attention,

slowing down, and so on (87). To reduce the probability of contracting COVID-19, individuals can learn correct mindfulness practices through websites, books, and applications. In addition, individuals can try to connect with those who have high levels of mindfulness and learn some tips for increasing their mindfulness. In doing so, individuals will see a significant decrease in stress (19) and experience more well-being in their daily lives (88).

Limitations and future research

As with previous research, this research has several limitations. First, this study used a cross-sectional design, which limits the ability to infer causality. Thus, future studies should adopt longitudinal designs to test the relationship between the focal variables in this paper. It would be interesting to see what happens to individuals' well-being as the COVID-19 crisis strength changes. Second, this research proposes and examines trust in local government and mindfulness as moderators that would mitigate the negative impacts of perceived COVID-19 crisis strength on individuals' life satisfaction and sleep quality. Yet, other moderators, such as family members, friends, and social factors should not be overlooked. For example, family members can provide support and comfort to individuals to help them override the negative effects caused by the COVID-19 pandemic. Third, the intensities of the COVID-19 pandemic and government response to COVID-19 vary around the world, so the influence of perceived COVID-19 crisis strength on individuals' well-being may also vary by country. Thus, future research could conduct cross-culture comparisons regarding the impacts of perceived COVID-19 crisis strength. Fourth, because all key variables measured in this study were perception based and the actual information people are attending to is not identified, future works should measure these variables with more objective methods.

Conclusion

In sum, drawing on social information processing theory, this study investigated the effect of perceived COVID-19 crisis strength on individual well-being (i.e., life satisfaction and sleep quality). We further examined the potential mediating role of risk of being infected and the moderating roles of individuals' trust in local government and mindfulness in the relationship between perceived COVID-19 crisis strength and well-being. The results showed that individuals' perceived COVID-19 crisis strength can decrease their life satisfaction and sleep quality by strengthening the perceived risk of being infected. Furthermore, both individuals' trust in local government and mindfulness buffered the direct positive effect of perceived COVID-19 crisis strength on perceived risk of

being infected, as well as the indirect effects of perceived COVID-19 crisis strength on both life satisfaction and sleep quality. Therefore, to promote individuals' life satisfaction and sleep quality, government is encouraged to adopt effective measures to fight against COVID-19 to increase people's trust, and individuals should undergo training to enhance their mindfulness.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

This study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethical Committee of School of Business, Qingdao University.

Author contributions

YL: methodology, software, formal analysis, investigation, writing—original draft preparation, and supervision. YL and YX: conceptualization, validation. CH and XL: resources and data curation. CH, XL, QC, SC, and YX: writing—review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Samer El Hayek,
Shezlong, Egypt

REVIEWED BY

Chinwe Ezeokoli-Ashraph,
North West Regional Health Authority,
Trinidad and Tobago
Consuelo Ponce De Leon,
University of the Andes, Chile

*CORRESPONDENCE

Clara Gitahy Falcão Faria
claragitahy@gmail.com

†These authors have contributed
equally to this work and share first
authorship

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Understanding and addressing COVID-19 vaccine hesitancy in low and middle income countries and in people with severe mental illness: Overview and recommendations for Latin America and the Caribbean

Clara Gitahy Falcão Faria ^{1*}†, Ursula Medeiros Araujo de Matos ^{1†}, Liana Llado-Medina ^{2†}, Victor Pereira-Sanchez ^{3,4,5,6}, Rafael Freire ^{1,7} and Antonio Egidio Nardi ¹

¹Laboratory of Panic and Respiration, Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro, Brazil, ²School of Medicine, University of Puerto Rico, Bayamón, Puerto Rico, ³Department of Psychiatry, Columbia University, New York, NY, United States, ⁴Division of Translational Epidemiology and Mental Health Equity, New York State Psychiatric Institute, New York, NY, United States, ⁵Department of Child and Adolescent Psychiatry, New York University Grossman School of Medicine, New York, NY, United States, ⁶Department of Psychiatry, Amoud University, Borama, Somalia, ⁷Department of Psychiatry and Center for Neuroscience Studies, Queen's University, Kingston, ON, Canada

Despite the speedy development of vaccines for COVID-19, their rollout has posed a major public health challenge, as vaccine hesitancy (VH) and refusal are high. Addressing vaccine hesitancy is a multifactorial and context-dependent challenge. This perspective focuses on VH in the world region of Latin America and the Caribbean (LAC) and includes people suffering from severe mental illness, therefore covering populations and subpopulations often neglected in scientific literature. We present an overview of VH in LAC countries, discussing its global and historical context. Vaccine uptake has shown to widely vary across different subregions of LAC. Current data points to a possible correlation between societal polarization and vaccination, especially in countries going through political crises such as Brazil, Colombia, and Venezuela. Poor accessibility remains an additional important factor decreasing vaccination rollout in LAC countries and even further, in the whole Global South. Regarding patients with severe mental illness in LAC, and worldwide, it is paramount to include them in priority groups for immunization and monitor their vaccination coverage through public health indicators.

KEYWORDS

vaccine hesitancy, severe mental illness, mental health, COVID-19, Latin America and the Caribbean

Introduction

Since the World Health Organization (WHO) declared the coronavirus pandemic (COVID-19) in March 2020, the outbreak has brought an unparalleled public health crisis. Initially, different preventive efforts varying in strictness and enforcement were adopted in response to it: physical distancing, lockdowns (1), canceling elective procedures (2), and redeployment of health care professionals (3). However, implementing and sustaining those measures to their full extent proved to be a significant challenge (1), and the development of a safe and affordable vaccine soon became a vital need. Scientific efforts were carried out with unprecedented speed and global coordination and investment, and by the end of 2020 there were 240 vaccines in development, with 9 in final stages of testing (4).

Despite the rapid development and approval of vaccines, their rollout has posed another significant challenge, as vaccine hesitancy (VH) and refusal are high in part of the general public (5), reaching as high as 40% in Russia and 26% in France as of January 2021 (6, 7). Besides vaccine availability, in order to reduce morbidity and mortality from COVID-19, a high vaccine uptake is necessary to reach herd immunity (8). Experience from previous pandemics and public health emergencies shows that addressing VH is a multifactorial and context-dependent challenge that must be addressed simultaneously at global, regional, and national levels (8–11).

Latin America and the Caribbean (LAC) is a world region home to a vast and young portion of the world population spread around many different low-and-middle income countries (LMIC) that largely share cultural roots, language, and religious beliefs in a unique way. Its demographic and cultural characteristics, the actual, devastating and unequal impact of the pandemic in LAC countries (12), and the traditional marginalization of this world region in scientific literature, dominated by Anglo-Saxon and high-income countries, provides a need and an opportunity to explore the state and challenges of vaccine rollout there, and a discussion of the unique cultural, religious, and mental health aspects associated to VH in this region. In this perspective paper, a group of mental health clinicians and researchers in the Americas present an overview of attitudes and hesitancy toward COVID-19 vaccines in general and in LAC countries, discussing its global and historical context. We will also address the cultural and religious factors contributing to the current scenario and particularly, as concerning people living with mental illness. Furthermore, we will outline potential strategies to improve vaccination intention (VI) and public trust in the LAC region.

Vaccine hesitancy and anti-vaccine culture before and during COVID-19

VH is not a new phenomenon (13), rather it has been described since the inception of vaccines in the 1870s in England (13). In the USA, the anti-vaccination movement and a state government clashed in the landmark case *Jacobson v. Massachusetts*, which ruled that the state could mandate vaccination by law in order to protect the population (13). Similarly to the strategy being adopted by some countries today, in the nineteenth century many vaccination mandates were imposed in order to contain smallpox outbreaks (14). Those measures sparked resistance from liberal sectors of society which argued that they constituted a violation of civil liberties (15). Nowadays, anti-vaccination activism poses an even larger resistance as it harnesses powerful platforms able to reach big audiences worldwide, since the internet has become a major source of health information for the public (16, 17).

It is important to conceptualize the contemporary anti-vaccination movement as a spectrum of beliefs and concerns rather than a two-dimensional concept (18). Studies analyzing the vaccine hesitancy movement before COVID-19 show that VH is often demonstrated by postponing vaccines and increasing the delay between doses rather than complete refusal, which represents a smaller percentage of the anti-vaccination movement (18).

Culturally, before COVID-19 era, two main factors influenced VH: first, the fact that for a long time the diseases that vaccines prevented were largely unknown to the population (18, 19) thanks to the success of previous vaccination rollouts, therefore resulting in a low perceived benefit of vaccines when compared to the perceived risks. The trend that has been observed by public health specialists is that as an outbreak of a preventable disease occurs, vaccination rates improve (18). Secondly, highly publicized research that was later retracted led to a major public backlash against vaccines, as it falsely related the measles, mumps, and rubella vaccines to autism (20, 21). When it came to COVID-19, even before a vaccine was available, the terms “mercury” and “autism” were widely popular Google searches in association with the upcoming vaccine (22).

Furthermore, there is a group where VH data is particularly lacking: mental health patients. Recent studies (23–25) have shown that people experiencing severe mental health conditions are more likely to face longer hospitalizations due to COVID-19 and suffer worse outcomes and mortality rates, thus making it necessary to prioritize their vaccination and further explore VH in this group. Although VH has been widely explored in the general population and the development of the COVID-19

vaccine has been widely covered by the media, there have not been peer-reviewed studies exploring how the anti-vaccination movement affects people with severe mental illness, specifically those who experience persecutory delusions (24, 25). Recently, one study in the UK looked at the relationships of mental health diagnosis and symptoms of mental distress with VH in a general population sample and found no association (23). However, there is no data on community-based or in patient samples, which could potentially reveal a very different scenario.

Strategies to increase vaccination uptake

One of the most defended strategies to increase vaccination coverage consists of increasing government's commitment and transparency toward health policies and promoting social economic growth for the society at large (26). This might be very effective in the long term, as it decreases mistrust from the population toward pharmaceutical and governmental organizations. However, the implementation of these measures would not address the problem promptly, and it requires profound structural changes in governmental and health systems all over the globe, particularly in underdeveloped nations, where poor health access and social inequalities are important barriers to vaccine uptake.

Among short-term strategies, those that tackle misinformation are of uttermost importance. Governments and health organizations should focus on conveying the message that vaccines are effective and safe while demonstrating the competence and reliability of the institutions that deliver them (27). However, recent research has shown that combating *fake news* and providing more information is not sufficient to change behavior (28). One of the factors that was shown to influence negatively on VH is a poor relationship with healthcare providers, pointing out to the importance of the rapport between patients and healthcare professionals (29). Moreover, in the case of COVID-19 vaccines, for the pharmaceutical industry and health and government authorities the emphasis should be to prove and convey that no developmental or regulatory corners were cut in the development and approval process, which were facilitated by extensive prior research, unprecedented levels of international collaboration among researchers, and massive public investment in research, development and manufacturing capacity.

Since the start of the pandemic, the mortality risk in patients who have suffered from COVID-19 has been studied. It has been found that, in individuals who were recipients of the Pfizer-BioNTech, Moderna, or Janssen vaccines there was a lower mortality risk than in unvaccinated comparison groups. After these comparison groups were analyzed and stratified by age, sex, race and ethnicity, they still showed a lower mortality in vaccinated adults compared to non-vaccinated adults. Therefore, the lower mortality risk after COVID-19

vaccination implies that there are beneficial vaccine effects on these individuals. Additionally, hospitalized individuals due to COVID-19 were less likely to have an mRNA COVID-19 vaccine (30). Spreading evidence based information is one potential way to increase vaccination uptake (31).

Vaccine hesitancy and anti-vaccine culture in Latin America and the Caribbean

In LAC countries vaccine uptake is heterogeneous and immunization rates are prone to vary across different subregions (32–37). The extent to which people believe in COVID-19 conspiracy theories varies significantly across LAC countries as well as by socio-demographic characteristics (36). For instance, VI in Trinidad and Tobago was estimated at 62.8%, which largely contrasts with other countries such as Cuba, Chile, Uruguay, Argentina, and Brazil, which have the highest number of administered doses per 100 habitants (34).

Some authors have suggested that a country's resilience to misinformation and conspiracy theories depends on several political and economic indicators such as the level of societal polarization, the amount of populist and partisan communication, the strength of public service media, and the adoption of social media (38–41). When it comes to LAC, many countries indeed confront higher societal polarization, besides from having weaker public service media systems compared to other Western nations. Many countries in LAC such as Venezuela, Brazil, Argentina, and Bolivia are undergoing intense economic and political crises, which are driving social division. Even though more research is warranted, current data points to a possible negative correlation between societal polarization and vaccination uptake in those nations. For instance, in Brazil, Ebeling et al. found that anti/pro COVID-19 vaccination stances are biased by political polarization, right and left, respectively (42).

In terms of other social, demographic, and cultural aspects, research indicates several risk factors to VH, with heterogeneity across studies. For instance, religion, healthcare access barriers, being part of a more conservative political party, and low education levels have been shown to have a positive correlation with VH (33–37). Age and gender also presented with divergent results across different studies: Urrunaga-Pastor et al. (9) found increased age to be protective, whilst other studies found it to be a risk factor. De Coninck et al. (38) correlated increased age with less misinformation and conspiracy beliefs, while Puri et al. (26) found older age as one of the risk factors for vulnerability for social media appeals. Regarding gender, some studies have put male gender as a risk factor for VH, however findings are contradictory, with other studies pointing to female gender as a risk factor (9).

Discussion

Overall, VH has been shown to be influenced by (1) lack of confidence, which is the lack of trust in the vaccine or provider, (2) complacency, which is the perception that there is no value or a need for a vaccine, and (3) lack of convenience, which refers to the perceived lack of access or services toward vaccination. COVID-19 VH can be explained by a combination of both underlying issues common to VH in general, as well as to the public's particular concerns specific to the SARS-CoV-2 vaccines (34, 35). Mistrust and misinformation are among the main reasons for missed vaccinations. Many individuals, mainly those who have been historically marginalized in their home countries, may find it difficult to trust their government, health system, and the pharmaceutical industry. Limited access to evidence-based information combined with social media spread of inaccurate yet appealing narratives can further propagate misinformation and fear, thus ramping up immunization refusal (32).

On the other hand, fear appraisal strategies have been used for health promotion for many years. It is understood that even though fear can change current behavior, it cannot produce a long lasting and real change. For instance, people can get vaccinated for COVID-19 due to extensive fear-promoting propaganda or governmental pressure, but they will not be truly aware of the importance of vaccination (38, 39). Currently, refusal occurs in many cases due to fear toward vaccines—mainly COVID RNA vaccines—safety. As opposed to fear-promotion, empathetic information delivery strategies that address public's fears could be more effective and sustainable in promoting long lasting change.

Moreover, besides mistrust and misinformation, campaigns hampered up by the anti-vaccination movement, which are commonplace worldwide, healthcare and vaccine access are huge challenges in LAC, as some countries as Venezuela, for example, are facing severe political crises (33, 43). Others, such as Peru, face deep inequalities with some sectors of society receiving the vaccine before the rest of the population based on socioeconomic advantage rather than medical priority (44). However, some countries, such as Brazil, had a mostly successful vaccination rollout, maintaining a low VH rate: in a survey conducted with 173,000 participants VH was around 10.5% (45). Brazil is an interesting case study as, before the COVID-19 pandemic, the country already had an established successful national public immunization program rolling for 46 years, despite its many inequalities (46). It has been suggested that, despite a conservative government in power repeatedly accused of spreading misinformation about vaccines, VH in Brazil is still low due to the country's longstanding history of immunization thanks to the massive investment over decades in the Brazilian National Immunization Program. In summary, the VH landscape in LAC is highly heterogeneous and still understudied (34, 35, 37).

In addition, there is a group needing urgent attention not only in LAC countries but also worldwide when it comes to vaccination intention and hesitancy: individuals with severe mental illness. This is a particularly big challenge in the LAC context, as many countries such as Brazil, Colombia, Costa Rica, and Peru are facing the challenge to provide treatment for a growing number of patients while transitioning to a community-based care model, and face shortage of mental health services provision in the community (47, 48). It is also important to highlight that many people with severe mental illness in LAC are socially marginalized and face many difficulties in terms of access to health and social services. There seems to be no research looking into the factors that influence vaccination uptake in patients living with a mental illness, however, an important factor in the general population is the rapport with the main healthcare provider, as previously discussed (31). This research gap is even more appalling since people with severe mental health disorders are at higher risk of being infected by SARS-CoV-2 and have increased COVID-19 associated mortality rates, as also previously mentioned (24–26). Especially for a population group facing difficulties to access healthcare in general, we suggest that mental health practitioners should play a pivotal role in the understanding and addressing of their VH and uptake.

Strategies to increase vaccination coverage in LAC, especially in patients with severe mental illness

Besides delivering transparent, trustworthy, and empathetic information to the public and encouraging active demand for vaccination, facilitating health service access can contribute to the number of immunizations of those individuals that are not opposed to the vaccine, but also will not actively seek immunization, following the public health principle of “making healthy choices, easy choices” (49). Poor accessibility remains an important factor that decreases vaccination coverage in LAC countries and even further, in the whole Global South (50). Regarding patients with severe mental illness in Latin America and the Caribbean and worldwide, it is necessary to transform them into priority groups for immunization and monitor their vaccination coverage through public health indicators. One possible strategy is to partner with community mental health centers and inpatient units, making vaccination more accessible to those marginalized groups.

Conclusion

Our perspective identified a major research gap in terms of VH in LAC populations, including people with severe mental

illness. Further work is needed to develop region and country-based strategies to increase immunization rates tailored to common and unique socio-cultural factors. Regarding LAC, the VH landscape is highly heterogeneous. Among the factors that are believed to contribute to a decreased vaccination coverage in LAC countries, we can name unequal access, mainly in rural areas; political and socio-economic crisis; societal polarization; and misinformation propagated by social media paired with poor access to evidence-based health information.

To summarize, the COVID-19 vaccination process is one of the greatest global health challenges of our time. In order to achieve the global health agenda of increased vaccination coverage, no marginalized group should be left behind. We would like to strongly emphasize the need for further investment in research in VH and associated factors in LMIC populations, including all of LAC, and especially including people with severe mental health illness.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

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Author contributions

CF, UM, and LL-M created the concept of the manuscript, conducted the literature review, and wrote it. VP-S helped create the concept of the manuscript, supervised all steps of the work, and reviewed the manuscript draft. RF and AN provided guidance and supervision, and proofread the manuscript. All authors approved the final version of the manuscript and assumed their responsibility as coauthors.

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EDITED BY

Samer El Hayek,
Shezlong, Egypt

REVIEWED BY

Mikiro Kato,
University of Tsukuba Hospital, Japan
Kongmeng Liew,
Nara Institute of Science and
Technology (NAIST), Japan

*CORRESPONDENCE

Yoshihisa Fujino
zenq@med.uoeh-u.ac.jp

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Effect of working place infection control practices on workers' psychological distress: A large-scale cohort study during the COVID-19 pandemic in Japan

Toyohiko Kodama¹, Tomohiro Ishimaru², Seiichiro Tateishi³,
Ayako Hino⁴, Mayumi Tsuji⁵, Akira Ogami⁶, Tomohisa Nagata²,
Shinya Matsuda⁷ and Yoshihisa Fujino^{2*}

¹Department of Nursing, School of Health Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan, ²Department of Environmental Epidemiology, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan, ³Department of Occupational Medicine, School of Medicine, University of Occupational and Environmental Health, Kitakyushu, Japan, ⁴Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan, ⁵Department of Environmental Health, School of Medicine, University of Occupational and Environmental Health, Kitakyushu, Japan, ⁶Department of Work Systems and Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan, ⁷Department of Public Health, School of Medicine, University of Occupational and Environmental Health, Kitakyushu, Japan

Background: The COVID-19 pandemic has dramatically transformed the work environment and practices worldwide. Long-term infection control practices may increase the psychological distress of workers, and, conversely, inadequate infection control practices in the working place may increase the fear of infection. This study aimed to determine the relationship between infection control practices in the working place and employee mental state during the COVID-19 pandemic in Japan.

Methods: This study was conducted in December 2020 and February 2021. The participants had undergone a preliminary survey, which revealed that they were in a good mental state. Their psychological distress was investigated via a second survey, and the factors associated with distress were studied using a logistic model.

Results: The results of the second survey indicated that 15.3% of participants demonstrated psychological distress. This was associated with leave-of-absence instructions, instructions for shortening business hours, and requests to avoid the working place in case of any symptoms.

Conclusion: The study found that while some infection control practices reduce workers' distress, others worsen it. Employers need to consider infection control practices as well as the worsening mental state of employees

following a decrease in income caused by such measures. Follow-up studies may be necessary to clarify the long-term effects on workers' mental states.

KEYWORDS

COVID-19, infection control, Kessler Psychological Distress Scale (K6), psychological distress, working place

Introduction

The COVID-19 pandemic has brought about significant changes in public health, particularly in mental health. Fear of infection, unstable employment and economic conditions, as well as countermeasures against infection, such as avoidance of physical contact and restrictions on movement, have reduced opportunities for social interaction; this has had a deteriorating effect on the mental state of the population. Previous studies showed increased anxiety and mental burden in areas where lockdowns have been ordered (1). Other negative effects associated with lockdowns include worsening of mental illnesses, depression, alcohol dependency, and suicide (2–4). Along with healthcare, the COVID-19 pandemic has also dramatically transformed the work environment and practices (5–7). Various measures were implemented to prevent the COVID-19 infection in the working place, including mask-wearing, physical distancing, daily health checks, personal hygiene such as hand hygiene, and working from home. The implementation of appropriate infection control practices in the working place may positively affect the mental state of workers by creating a safe environment, which has been reported to reduce anxiety and depression (8, 9). Proactive infection control practices may not only reduce workers' anxiety and fear of infection but also increase their confidence in the working place. However, many infection control practices are efforts to maintain physical distance and reduce social contact, which have been associated with loneliness and psychological distress (10, 11). In the COVID-19 pandemic, other factors can also possibly cause psychological distress among workers. For example, in working place where telecommuting is difficult, such as restaurants and leisure facilities, shortening work hours or reducing work days to prevent infection may decrease workers' income. Low income is associated with poorer mental health (12, 13). Excessive infection control practices may also reduce workers' willingness to express their thoughts and feelings, reducing psychological safety in the working place. However, the factors contributing to the workers' psychological distress in working place infection control practices have not yet been clarified.

A previous study has shown that the mental state of the Japanese deteriorated during the early stages of the COVID-19 pandemic (12). This study by Kikuchi et al. was a longitudinal

survey of Japanese mental states from February 2020 to April 2020 (12). However, the number of people infected during that period was about one-tenth of the number during the peak period, which has led to a gap in existing research. Additionally, no studies about workers' mental state were conducted during the peak of the outbreak in Japan, which experienced a rapid spread of the infection from January 2020. For instance, the third wave of infection struck Japan in December 2021, leaving over 7,000 people infected daily. However, as far as we know, no cohort studies have surveyed workers' mental states after the third wave. An increase in the number of infected people would have a serious impact on employment and the economy, forcing workers to take long-term measures to prevent infectious diseases in their working place. While long-term infection control practices may increase the psychological distress of workers, inadequate infection control practices in the working place may increase the fear of infection.

We hypothesized two hypotheses in this study: first, working place infection control practices would reduce psychological distress if they created a safe environment; second, if working place infection control practices continued to maintain physical distance and reduced social contact, workers' psychological distress would worsen. These two hypotheses were tested.

Materials and methods

We conducted a prospective cohort study using an online questionnaire that focused on Japanese workers during the pandemic. The survey was commissioned by Cross Marketing Inc., (Tokyo, Japan). Of the registered monitors, 605,381 were sent an invitation *via* e-mail to participate. The sampling plan was designed to collect an equal number of respondents with comparable sex and office and non-office worker status. Of these, a total of 55,045 registered monitors answered the initial screening questions to participate in the survey, and 33,302 who matched the survey's criteria (worker status, region, sex, and age) responded to the survey (14). The baseline survey was conducted from December 22 to 26, 2020, in Japan, during the beginning of the third wave of the pandemic. We have already reported details from the Protocol for our study (14). Research data were gathered from participants who had employment contracts at the time of this study. The participants' data were

allocated by sex, prefecture, and occupation. We were able to detect incorrect responses using several algorithms. First, we prepared a step-by-step question in which respondents were asked to choose the third highest number from a list of five numbers. A total of 93% of respondents gave the correct answer to this question. Second, the system recorded the time taken to answer the question. Third, responses from respondents who were extremely underweight or short in stature were judged to be incorrect. As the height and weight questions required numerical input using the keyboard, it was assumed that incorrect responses were more likely to occur than when the inputs were simple click responses. Many of the incorrect entries for height and weight were found to include “000” or “999.” Based on the statistical distribution of height among Japanese adults, we excluded values of 140 centimeters or less, as these are extremely exceptional. Fourth, we verified whether there were any inconsistencies in the responses to questions that were repeated throughout the survey. The questions used to check for inconsistencies were those that asked about the presence or absence of family members living with the respondent and the area of residence; of the 33,087 respondents, 27,036 were determined to have answered the questions appropriately. In particular, the question about the status of family living together was asked more than once; for example, “Do you have a roommate?” “Do you live with an elderly person?” and “Do you have pre-school children?” Respondents with discrepancies in their responses were excluded. In addition, those who were determined to have given incorrect answers in any of the above four conditions were often observed to have given incorrect answers in the other three conditions as well (14). As a result, from the initial 33,302 participants, only 27,036 were included in this study. After the baseline survey, we followed the cohort and conducted a follow-up survey from February.

This study was approved by the Ethics Committee of the University of Occupational and Environmental Health, Japan (R2-079 and R3-006).

Assessment of workers' psychological distress

To assess workers' psychological distress, we used the Japanese version of the Kessler Psychological Distress Scale (K6) (15–17) at baseline and the follow-up survey. The validity of the Japanese version of the K6 was confirmed (16, 17). A follow-up study was conducted from February 18 to February 19, 2021. In the current study, the cutoff for psychological distress was a K6 score of five or higher. The validity of the cutoff scores has also been confirmed (17).

Infection control against COVID-19 at the working place

We investigated the status of infection control against COVID-19 in the participants' working place in the baseline and follow-up study. We examined the presence of instructions from the working place regarding infection control following the re-declaration of the state of emergency in January 2021. The survey items about infection control in the working place covered leave-of-absence instructions, instructions for shortening business hours, limits to business travel, prohibitions against eating together, instructions for wearing a mask, instructions to disinfect thoroughly with alcohol when entering and leaving rooms, recommendations for daily temperature checks, encouragement of telecommuting, and requests not to come to work if not feeling well.

Other covariates

We obtained information on participants' profiles, characteristics, and socioeconomic status of the company they worked at in the baseline survey. The follow-up survey items, which are thought to influence psychological distress, contained the following factors: sex, age, marital status, number of employees, job type [mainly desk work (e.g., clerical job, computer work), jobs mainly involving interpersonal communication (e.g., hospitality practice, sales position), and mainly labor (e.g., field operation, care staff)], and education.

Statistics

To estimate the impact of the state of emergency declaration on infection control measures at the working place by examining depressed workers in the second survey, even though they were not psychologically distressed in the first survey. In the baseline survey, 7,766 participants who had a K6 score of five or higher were excluded, as our study focused on workers who had demonstrated robust mental state at baseline but then deteriorated, as evidenced in the follow-up survey. After excluding inappropriate responses and workers who were unemployed at the follow-up survey and adding those who reported a healthy mental state in the baseline survey, 12,022 workers were included in the analysis. This was followed by an analysis of the changes in the mental state of the participants, which were evidenced by the follow-up survey responses (see a flow diagram of the study in Figure 1).

Odds ratios (ORs) for psychological distress and instructions from working place regarding infection control were estimated using a logistic model. ORs were calculated by introducing all the instructions at the same time. Psychological distress was

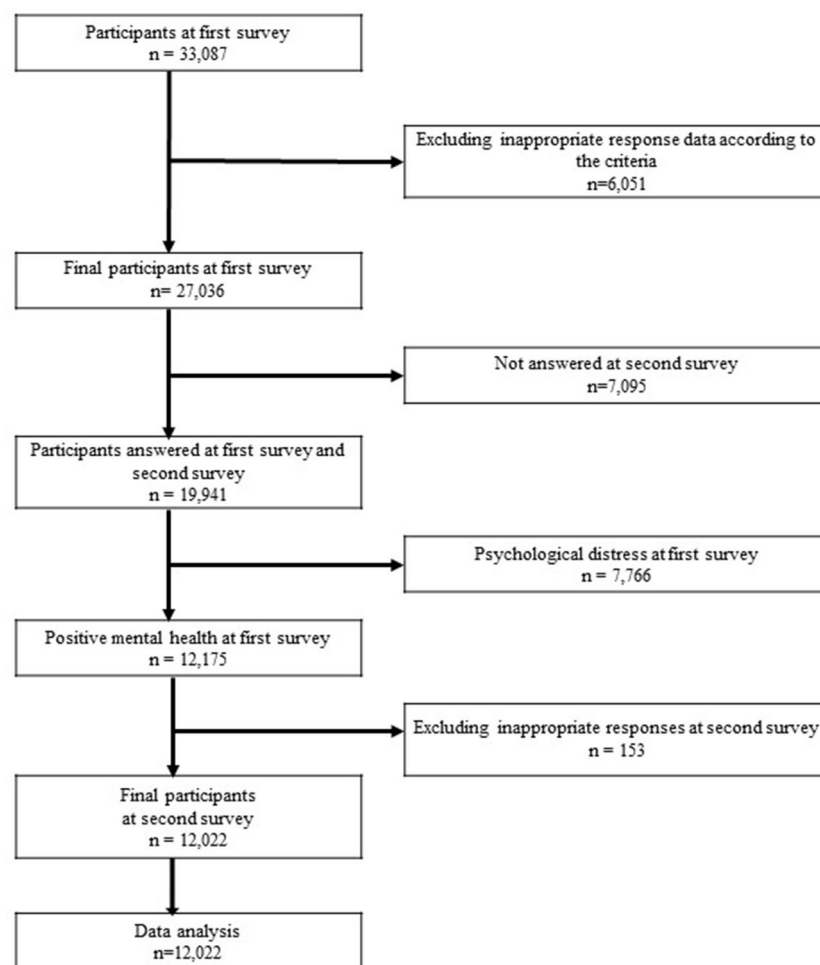


FIGURE 1
Flow diagram of the study.

defined as a K6 score of five or higher. The multivariate model was adjusted for age, sex, marital status, number of employees, job type, and education. Working place measures to curb infection at the baseline involved the following: leave-of-absence instructions, instructions for shortening business hours, limits to business travel, prohibitions against eating together, instructions for wearing a mask, instructions to disinfect thoroughly with alcohol when entering and leaving rooms, recommendations for daily temperature checks, encouragement of telecommuting, and requests not to come to work if not feeling well. A *p*-value of < 0.05 was considered statistically significant. We used SPSS ver. 22 for Windows (IBM Corp., Tokyo, Japan) for analysis.

Results

The follow-up survey found that, of the 12,022 participants, 1,842 (15.3%) exhibited psychological distress. Table 1 shows

the characteristics of the participants whose responses were recorded regarding the number of infection control practices (age, K6 score, sex, marital status, job type, education). The average age was 49.6, the average score of K6 was 1.95, and more than half of the participants were married. Most workers in working places were <30 employees. The most common job type was “mainly desk work.” More than 70% of the participants reported that their educational background was that of vocational school.

Table 2 shows the number of implemented infection control practices in the working place and the details thereof. “Instructions for wearing a mask” (66.7%) was the most common infection control practice, followed by “thoroughly disinfect with alcohol when entering and leaving rooms” (64.0%). In contrast, the least common infection control practices were “instructions for leave of absence” (9.1%), followed by “instructions for shortening business hours” (10.2%).

TABLE 1 Characteristics of the participants according to the number of working place COVID-19 infection control practices.

	Number of working place COVID-19 infection control practices (<i>n</i> = 12,022)
	Mean (SD) or %
Age (SD)	49.6 (9.9)
K6 (SD)	1.95 (3.7)
Sex, female	4,796 (39.9%)
Marital status	
Married	7,333 (61.0%)
Divorced or deceased spouse	1,137 (9.5%)
Unmarried	3,552 (29.5%)
Number of employees in the working place	
1–29	4,150 (34.5%)
30–99	1,742 (14.5%)
100–999	3,066 (25.5%)
≥1000	3,066 (25.5%)
Job Type	
Mainly desk work	6,494 (54.0%)
Jobs mainly involving interpersonal communication	2,803 (23.3%)
Mainly labor	2,725 (22.7%)
Education	
Junior high school	136 (1.1%)
High school	3,066 (25.5%)
Vocational school/college, university, graduate school	8,820 (73.4%)

Table 3 uses the logistic model to show the association between workers' distress and instructions from the working place regarding infection control. The multivariate model included age, sex, marital status, job type, and education. Psychological distress was strongly associated with instructions for leave of absence, instructions for shortening of business hours, and requests regarding not coming to work if unwell.

Participants who answered "No" to the question about instructions for leave of absence had significantly lower ORs (OR = 0.66, 95% CI = 0.55–0.79, $p < 0.00$). Participants who answered "No" to the questions about instructions for shortening the number of business hours had significantly lower ORs (OR = 0.78, 95% CI = 0.65–0.94, $p = 0.008$). Participants who answered "No" to requests not to come to work if they were unwell had significantly higher ORs (OR = 1.31, 95% CI = 1.09–1.56, $p = 0.003$).

Discussion

We examined the COVID-19 infection control practices in the working place during the re-declaration of the state of

TABLE 2 Implemented COVID-19 infection control practices in the working place.

	Number of working place COVID-19
Instructions for leave of absence	1,090 (9.1%)
Instructions for shortening business hours	1,228 (10.2%)
Refrain from or limit business travel	5,037 (41.9%)
Refrain from eating together	6,918 (57.5%)
Instructions for wearing a mask	8,016 (66.7%)
Thoroughly disinfect with alcohol when entering and leaving rooms	7,698 (64.0%)
Recommendations for daily temperature check	6,928 (57.6%)
Encouragement of telecommuting	3,150 (26.2%)
Request not to come to work when you are not feeling well	7,685 (63.9%)

emergency and observed that, while some control practices had a significant favorable impact on workers' mental state, others had an unfavorable impact. In addition, workers in working place with little or no infection control practices were at a higher risk of psychological distress than workers in places with more infection control practices (other than instructions for leave of absence and shortening business hours).

This study showed that requests to "not come to work if not feeling well" were associated with a reduced risk of psychological distress. These results support our first hypothesis (working place infection control practices would reduce psychological distress if they created a safe environment). The absence of workers with poor health provides other workers with a sense of security that the infection will not be spread in the working place. Such measures also allow the workers who are feeling unwell to avoid the anxiety of infecting others. Sickness presenteeism is the act of going to work despite poor health; this has been observed prior to the COVID-19 pandemic. The reasons behind such behavior, including having a low income, unstable employment, guilt over increased burden on colleagues, and a lack of employees (18). Sickness presenteeism is known to be associated with poor mental health among workers (19). Workers who engage in frequent sickness presenteeism are reported to have a higher risk of developing depression in the future (20). The reasons are thought to include a worsening relationship with superiors and colleagues due to decreased work efficiency and poor sleep (20). On the contrary, during the COVID-19 pandemic, workers will not feel conflicted about taking a leave of absence if the working place has a clear policy of requesting not to come to work if they are not feeling well. In addition, reducing infection anxiety in the working place will help prevent the deterioration of workers' mental state. The company's proactive infection control practices may increase workers' confidence in the working place,

TABLE 3 Association between psychological distress and instructions from the working place regarding infection control.

	Univariate			<i>p</i>	Multivariate*			<i>p</i>
	OR	95% CI			OR	95% CI		
Instructions for leave of absence								
Yes	reference				reference			
No	0.65	0.54	0.78	< 0.001	0.66	0.55	0.79	< 0.001
I do not know	0.95	0.54	1.67	0.864	0.94	0.53	1.65	0.821
Instructions for shortening business hours								
Yes	reference				reference			
No	0.79	0.66	0.94	0.009	0.78	0.65	0.94	0.008
I do not know	0.89	0.52	1.54	0.683	0.87	0.50	1.50	0.608
Refrain from or limit business travel								
Yes	reference				reference			
No	0.99	0.84	1.16	0.887	0.97	0.83	1.14	0.734
I do not know	1.31	0.93	1.85	0.120	1.25	0.88	1.76	0.207
Refrain from eating together								
Yes	reference				reference			
No	1.09	0.92	1.31	0.324	1.10	0.92	1.32	0.277
I do not know	1.14	0.77	1.71	0.514	1.12	0.75	1.67	0.583
Instructions for wearing a mask								
Yes	reference				reference			
No	0.98	0.81	1.19	0.828	1.02	0.84	1.24	0.858
I do not know	1.45	0.89	2.38	0.136	1.48	0.91	2.41	0.118
Thoroughly disinfect with alcohol when entering and leaving rooms.								
Yes	reference				reference			
No	1.06	0.88	1.28	0.514	1.06	0.88	1.28	0.546
I do not know	0.98	0.63	1.53	0.926	0.94	0.60	1.47	0.791
Recommendations for daily temperature check								
Yes	reference				reference			
No	0.88	0.75	1.03	0.111	0.93	0.80	1.10	0.400
I do not know	1.04	0.69	1.56	0.871	1.12	0.74	1.69	0.585
Encouragement of telecommuting								
Yes	reference				reference			
No	0.93	0.80	1.07	0.295	0.88	0.76	1.03	0.103
I do not know	1.06	0.73	1.54	0.754	1.03	0.71	1.50	0.876
Request not to come to work when you are not feeling well								
Yes	reference				reference			
No	1.28	1.07	1.52	0.008	1.31	1.09	1.56	0.003
I do not know	1.40	0.95	2.05	0.086	1.46	1.00	2.13	0.052

*The multivariate model included sex, age, marital status, number of employees, job type and education.

leading to their psychological safety (21). Psychological safety is defined as individuals' perceptions of the consequences of taking interpersonal risks in their working place (22), and it has been shown to improve work performance, information sharing, and learning in the working place (23). In addition to the above, it has also been reported to be useful in preventing the deterioration of workers' mental health during the COVID-19 pandemic (24)—a finding that is consistent with our view.

The current study did not support our second hypothesis (i.e., if working place infection control practices continued to maintain that workers should physically distance themselves and reduce social contact, workers' psychological distress would worsen). However, if working place infection control practices continued to be implemented over an extended period of time, the results could be consistent with our second hypothesis. For example, refraining from eating together would decrease

the risk of infection and reduce the fear of infection, but if this practice is prolonged, loneliness could be exacerbated by reduced communication and social interactions. Even if an infection control measure has a positive impact on mental health at one point in time, it may have different long-term effects.

Nevertheless, the instructions regarding leave of absence and shortening the business hours were associated with worsening workers' distress. Perhaps the workers' income decreased, and their economic situation worsened due to the instructions for leaves of absence and shortening business hours. Economic stress can affect a worsening mental state (25), and low income is also associated with poorer mental health (12, 13). As the leave of absence and shortening of business hours directly affect the worker's economic situation, it may have led to increased psychological distress. The second survey of this study was conducted from February 18 to 19, 2021; prior to that, a state of emergency was re-declared from January 8, 2021. In many areas, restrictions were placed on the hours of operation of restaurants, amusement centers, and other establishments that attract large numbers of people, as well as on serving alcoholic beverages. As workers in these occupations are often part-timers or non-regularly employed (26), who have lower incomes than those in regular employment (27), the decrease in income may have had a significant impact on psychological distress.

This study suggests that infection control practices in the working place are expected to reduce the prevalence of COVID-19 infections and are also beneficial to the workers' mental health. In the COVID-19 pandemic, as mental health is an emergent public health issue, infection control in the working place should be encouraged, as well as infection prevention and mental health support. Requests to not come to work when employees are not feeling well, which have been effective for workers' mental health, have been implemented in more than 60% of working places, but increased implementation is desirable. On the other hand, infection control practices that lead to a decrease in income were associated with worsening psychological distress, suggesting the need for employers to consider not only infection control practices but also worsening mental health. It would be advisable to make careful decisions regarding instructions for leave of absence and shortening business hours and to provide financial support as well. Naturally, infection control measures will be implemented differently depending on the type of work. For example, the infection control practices implemented in the food and medical service industries, which require on-site labor, will differ from those in industries where workers can easily shift to work at home. Even within the same type of work, managers and frontline workers may be affected differently by infection control practices in the working place. Organizational culture may also influence the willingness to take infection control measures in the working place and the mental state of workers; however, this study did not go that far. More detailed studies are needed

in the future, as the enterprise characteristics and workers' line contents vary widely.

In addition, this study has some limitations. First, due to the nature of Internet surveys, selection bias was inevitable, even though data for participants in this study were collected using a diverse selection of sex, occupation, and region to minimize participant bias. Second, because the cohort was relatively short-term (3 months), it may not fully reflect the impact of infection control practices on mental health. Third, as the infection control practices are self-reported by the participants, the response may be tainted by subjective evaluation. However, we believe that misinterpretation of the answers is unlikely to occur because the options within the questions describe specific measures. Finally, the implementation status of infection control practices varies greatly depending on enterprise characteristics. Therefore, enterprise characteristics may also be an alternative indicator in terms of disease control practices. In this study, the analysis is adjusted for company size, worker occupation, and educational background. However, the possibility of the effects of unobserved enterprise characteristics cannot be excluded.

Conclusions

This study found an association between workers' psychological distress and infection control practices in the working place during the COVID-19 pandemic. Infection control practices may have both positive and negative impacts on workers' mental health. Requests to not come to work if not feeling well were shown to improve workers' mental health, whereas infectious disease control practices that lead to reduced income were shown to worsen workers' distress. Follow-up studies may be necessary to clarify the long-term effects on workers' mental health.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the University of Occupational and Environmental Health, Japan. The patients/participants provided their written informed consent to participate in this study.

Author contributions

YF was the chairperson of the study group. TI conceived the research questions. TK analyzed the data with YF and drafted the initial manuscript. All authors were designed this research protocol and developed the questionnaire. All authors read the initial manuscript, revised it, and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Renato de Filippis,
Magna Graecia University, Italy

REVIEWED BY

Giovanna Ricci,
University of Camerino, Italy
Uma Suryadevara,
University of Florida, United States

*CORRESPONDENCE

Sara Nooraeeen
nooraeeen.s@iums.ac.ir;
sara_nooraeeen@yahoo.com

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The COVID-19 pandemic and mental health in pregnant women: A review article

Niloufar Arzamani¹, Shiva Soraya², Fatemeh Hadi¹,
Sara Nooraeeen^{1*} and Mahdiah Saeidi²

¹Mental Health Research Center, School of Behavioral Sciences and Mental Health, Iran University of Medical Sciences, Tehran, Iran, ²Research Center of Addiction and Risky Behaviors, Department of Psychiatry, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

A rapid spreading of the COVID-19 virus in recent years had a great impact on every single aspect of life and the world faced with unexpected and unpredictable crisis in both physical and mental condition. As with any crisis, vulnerable individuals like pregnant women were the concern of societies. Several physiological and psychological changes occur during pregnancy which put individuals in a risk of mental health problems. During the outbreak of the COVID-19, pregnant women have experienced more psychological stresses, fear, anxiety, and depression. The prenatal mental distresses and psychiatric disorders may cause poor compliance, reduce help-seeking behaviors, and neglect to take the follow up screening visits and risk of harm for mother and others. Addressing the mental health in pregnant women is crucial to prevent the consequences. The purpose of this narrative review was to investigate the available literature on the impact of the COVID-19 pandemic on mental health in pregnant women and provide some recommendations to improve mental health in them. It also shed some light on providing mental health services for women during pregnancy and can be used by health professionals and policymakers.

KEYWORDS

pregnancy, COVID-19, mental health, anxiety, depression

Introduction

In late December 2019, a novel infection has been reported in Wuhan, China. The COVID-19 spreads rapidly around the world. On January 12, 2020, the World Health Organization (WHO) announced the coronavirus disease 2019 (COVID-19), as a global pandemic with ultra-rapid mortality and morbidity rate (1). High transmission rate among people and the absence of proper knowledge about the nature of the pathogenesis, lack of concise and comprehensive treatment and approved vaccines make governments impose mandatory public health policies, mobility restrictions, and stay-at-home orders to reduce the transmission. Prolonged social and physical distancing and uncertainty about the future and multitude changes that the COVID-19 brings, leads to distresses and affect mental health and quality of life (2, 3). Mental health crisis during the COVID-19 pandemic brings a multitude of

psychological distresses and emotional burdens, and people faced unexpected fear and anxiety about their future and family members' physical condition. Exacerbation of depressive symptoms, obsessional thoughts, compulsive behaviors and other pre-existing psychiatric disorders, a sharp rise in domestic violence has been reported during the pandemic. Meanwhile, pregnant women as vulnerable individuals and their mental health is a public health priority and needs special consideration during the crisis (4–8).

Pregnancy is a unique maternal experience with both blessings and distress. The rapid hormonal changes in women's bodies put them in an emotionally unstable situation and they faced more fear, anxiety, and mood changes (9–14). There is an increased risk for anxiety and depression during pregnancy, and they are more susceptible to depressive disorder with peripartum onset (15, 16). Although the risk of COVID-19 infection is not more in pregnant women, the fear of getting infected among them is high (17).

Past medical and psychiatric history, genetic predisposition, lack of proper family support, prenatal complications, and stressful life events may affect the prenatal mental health. It has been widely investigated that the endocrine system has a key role in different changes during pregnancy and influence on behavioral and affective status of pregnant women (18).

Depressive symptoms in pregnancy have been linked to the dysregulation of cortisol production. High levels of maternal cortisol affects fetus' health (19). The prevalence of generalized anxiety disorder (GAD) in pregnant women has been reported 3–4 times greater than in the general population during the COVID-19 pandemic. Studies had shown that the rate of anxiety and depression among pregnant women during the COVID-19 pandemic had raised (20). A review article reported that the anxiety and depressive symptoms were highly prevalent, affecting 58–72% of pregnant women during the COVID-19 pandemic (20).

Pregnancy has a significant physiological, psychological, and biochemical effects on women's life. Addressing the importance of mental health during pregnancy is crucial for the mother's wellbeing, and reaching the neurodevelopmental milestone of the infant (21).

In this review we conducted systematic searches of the literature in order to address the pregnant women's mental health during the COVID-19 pandemic and deliver some recommendations to improve their mental health.

Search strategy and selection criteria

This narrative review study was conducted using related articles available in valid English scientific databases such as PubMed, Scopus, Web of Science, and Google scholar, which were published from 2020 to 2022. The keywords were (((COVID*[Title]) OR

(Coronavirus[Title])) AND ((pregnant*[Title]) OR (perinatal[Title]) OR (maternal[Title]) OR (pre labor[Title])) AND ((mental[Title/Abstract]) OR (Anxiety[Title/Abstract]) OR (worry*[Title/Abstract]) OR (depression *[Title/Abstract]) OR (fear[Title/Abstract]))).

There was a total of 278 articles identified from all database searches after duplicates were removed. The articles were initially screened through application of the inclusion criteria to research titles and then to abstracts. Inclusion criteria were evaluation the mental health during pregnancy and in the time of COVID-19 pandemic. After evaluation of selected articles, a general conclusion was made based on the provided information (Figure 1).

Mental health during the COVID-19 pandemic

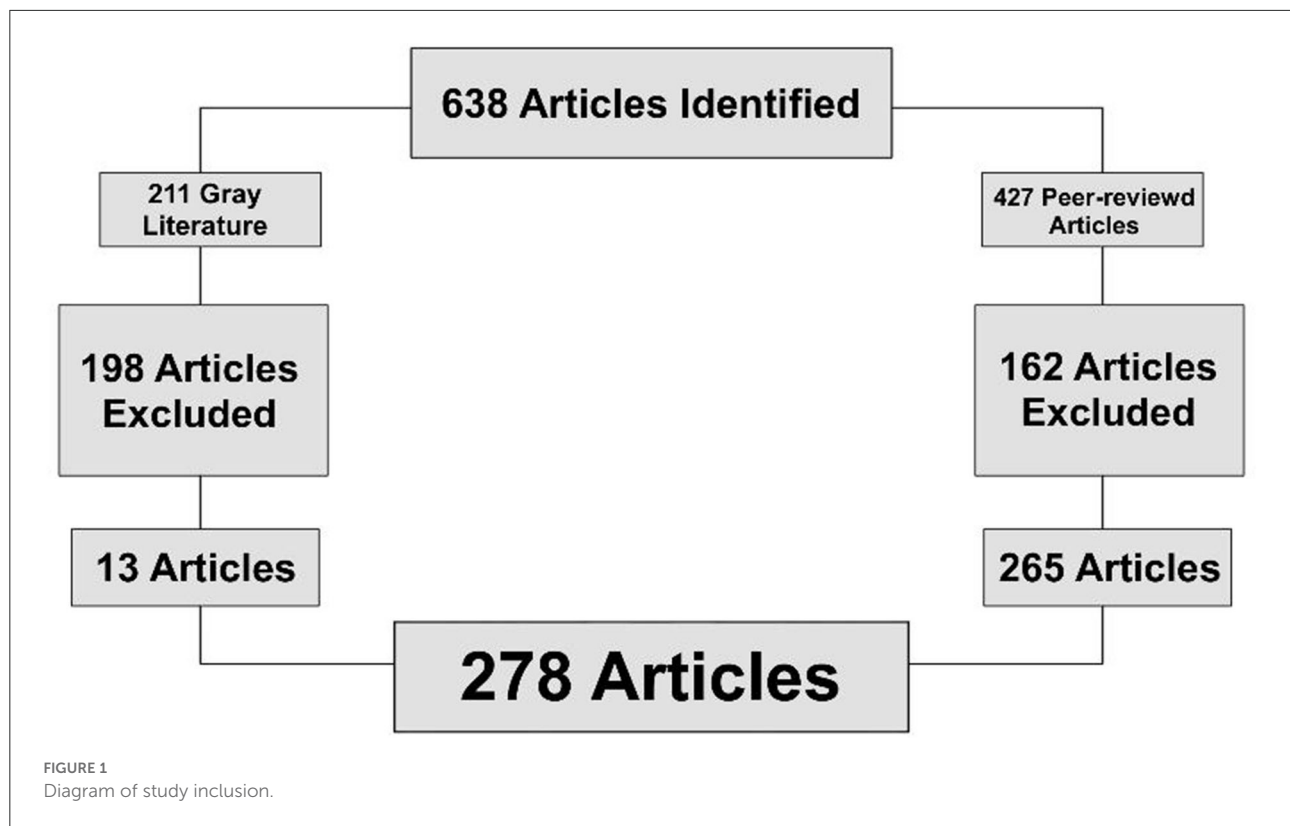
The effects of the COVID-19 pandemic on mental health have various aspects. The novel COVID-19 pandemic, brings uncertainty about the future, lack of effective treatment and high mortality rate of the disease collapsed the health care systems and there was a shortage in access to mental health services.

Social support has an important role in individual's sense of belonging. Stigma toward psychiatric disorders, cause distortion in perceiving the reality and isolate the stigmatized individuals (22).

Mandatory public health policies, quarantine and mobility restrictions during the COVID-19 pandemic isolate individuals with mental disorders. Stigma and poor social support, fear of being infected and experience its complications, put pregnant women with psychiatric disorders in a vulnerable situation during the COVID-19 pandemic and they faced more social withdrawal. It affects their help-seeking behaviors and delayed in getting proper diagnosis and treatments (23).

Prolonged quarantine and social distancing, rapid and inevitable changes in the cultural and spiritual rituals cause excessive frustration, poor sleep hygiene and develop maladaptive behaviors to overcome existing stress like excessive cigarette smoking and alcohol consumption, lead to feelings of anger, discomfort, despair and a dramatic rise in domestic violence rate (24–26).

Studies showed the correlation between depressive symptoms and the COVID-19 diagnosis. People feel conflicted about following the preventive protocols and experienced complicated ambivalent state, prolonged duration of the quarantines and socioeconomic instability reduced compliance to effective preventive behaviors, which play a significant role in restricting the spread of disease, and studies have emphasized the importance of mental health in preventive behaviors (27, 28).



Mental health in pregnancy and postpartum

The COVID-19 pandemic had a great negative impact on the utilization of maternal mental health. Even under the best of circumstances, women may be notably susceptible to mental health disorders, pregnant and postpartum women during the crisis experience more depressive and anxiety symptoms (29).

Barriers to accessing medical health care services during the COVID-19-pandemic, fear of infected from the health care systems, transportation difficulties, stigma and social labeling, lack of personal protective equipment (PPE), long waiting times at hospitals, lack of proper medication and treatment plan to treat the COVID-19 patients, and no available data about the safety of the medications and vaccine on pregnant women and their possible side effects on fetus (30).

Kingston et al., reported that stigma, lack of knowledge, and prefer to home remedy to decrease their symptoms instead of referring to clinics are major barriers that decrease the help-seeking behaviors (31).

Maternal psychiatric symptoms may adversely affect obstetrical outcome and development of the offspring. Changes in appetite and malnutrition, poor self-care and poor preventive behaviors to protect herself from trauma, self-injurious behaviors, death wish and suicidality may increase. Although,

dysregulation of Hypothalamic-Pituitary-Adrenal (HPA) Axis during pregnancy contribute to the stress-related psychological and physiological responses like elevations of the cortisol level, Corticotropin-releasing hormone (CRH), catecholamines have been correlated to blood flow and may lead to low birth weight, preterm delivery, long term cognitive-behavioral neurodevelopmental effects on offspring, poor weight gain during pregnancy and prenatal complications (32–34).

Economic pandemic effects

Regarding the undeniable relation between social security, economic status, and community health, many people have become more vulnerable to the mental health problems than before, especially those with the lower socioeconomic situation and they are at a higher risk of having symptoms of depression and anxiety. The COVID-19 pandemic is not only a public health crisis but also has profound multidimensional effect on every aspect of society, especially in developing countries. Governments, businesses and individuals have been pushed to adapt rapidly. It puts the world in a “real economic freeze” state. Studies have reported that individuals who experienced economic shocks during the COVID-19 pandemic, were more likely to face mental health problems. Individuals with lower socioeconomic status and poor problem-solving

styles and insufficient coping mechanisms are at a greater risk of experiencing depressive and anxious symptoms (35).

Physical health impacts

During the pandemic, individuals experienced fear about their own and others' health; uncontrolled concerns about the consequences of disease and death of the loved ones and its unknown impacts on their children's future life that increased feeling perpetually overwhelmed and frustrated. According to a study, 83.3% of pregnant women were worried about their close family member's health, 66.7% were concerned about their older children, and 63.4% were concerned about their fetuses (36).

Forty seven percent of pregnant women reported they experienced extreme fear of their fetus structural damage following the COVID-19, and increased risk of cesarean section, low birth weight and preterm birth in pregnant women with COVID-19. A study compared pregnant women admitted to the intensive care unit (ICU) with healthy pregnant women. Preterm delivery was higher in women who were diagnosed or suspected of COVID-19 disease (19).

Social impact

Social communications play an important role in sense of wellbeing and enhancement of mental health (10, 21). Quarantine suddenly cut off social communication, daily activities, and access to resources that usually make life easier such as mental health services. This issue has led to the 24-h presence of family members at home. As well, the closure of care centers and schools, and distance education forced parents to take care of their children all the time at home (20, 37). The cancellation of family gatherings and the impossibility of going on holidays and religious ceremonies, birthday parties, and other occasions make concern and cause a feeling of loneliness which is accompanied by a loss of motivation and a sense of peace due to being away from supportive circles (37).

Quarantine policies

Following the government's policies to control the spread of the disease, mandatory public health policies, mobility restrictions, and stay-at-home orders to reduce the transmission had been implemented in many countries. In-person meetings were diminished and the virtual meetings and use of various social media became common. Internet Rumors and misinformation during the COVID-19 Pandemic cause confusion and misunderstanding and was positively associated with anxiety (23). Nanjundaswamy et al., reported that 40.68% of pregnant women complained about social media messages during the COVID-19 pandemic (38).

Recommendations to improve mental health in pregnancy

Providing accurate information

In time of crisis, lack of accurate information from the official authorities raised prevalence of stress-related emotions during the COVID-19 pandemic and brings uncontrollable confusion, mistrust and anxiety (39). In a study comparing pregnant women undergoing treatment for COVID-19 and women without the disease, depression and anxiety scores in both groups showed significant increase during the peak of the spreading, which significantly decreased after the publication of official and accurate information about this disease through reliable sources. Governments must control the spread of pandemic news and prevent the diffusion of misinformation and gossips. By building a bridge between research and academia toward society, policy makers could achieve to solutions to the COVID-19 Misinformation Prophylaxis (23, 26).

Physical activity by observing health protocols

The role of physical activity on mental health is undeniable especially during pregnancy. Regular exercise reduces anxiety symptoms in pregnant women. Women who had at least 150 min of moderate exercise per week experienced less anxiety and depression compared to others (40, 41). Therefore, arrangements should be made so that pregnant women can exercise indoors or outdoors. Exercise at home can be done using TV shows, training videos, and sports apps and the importance of it should be advocate by healthcare providers (42, 43).

Keep in touch with friends and relatives

At the beginning of the epidemic, the rules of "social distancing" were announced, which was later replaced by the word "physical distancing", because the importance of maintaining social relationships despite being far away is crucial in strengthening the quality of life and mental health. Interruption of interpersonal relationships lead to physical, emotional, and mental dysfunction (32). Making regular phone or video calls to family, friends, or co-workers can play an important role in reducing anxiety and loneliness and enhance sense of belonging. Partner Support During Pregnancy must be considered. Supportive partner relationship may contribute to have a great impact on maternal and infant wellbeing (44).

Social support systems and crisis lines

Proper and comprehensive social support reduces the long-term harmful effects of the COVID-19 pandemic during pregnancy. Constructing user-friendly crisis hotlines and publicizing reliable and scientific facts can play a role in reducing harmful thoughts and maladaptive behaviors (45).

Providing medical services and follow-up for pregnant women with chronic diseases

There is evidence that mental health problems are more common among pregnant women who have chronic diseases. Regarding the lack of proper access to follow-up services in patients with chronic disorders and the consequences of not receiving necessary care, it is important to provide telephone or online health services to answer individual's questions and provide them with the medical services and psycho educate them to reduce their worries and anxieties (46).

Early diagnosis and treatment

It is important to diagnose psychiatric disorders as soon as possible. Symptoms of psychiatric problems and red flags should be declared to pregnant women during routine prenatal visits and an effective screening system must be created to detect at risk individuals. Prenatal care should contain mental health services and provide these for all pregnant women by telephone or online contact or home visit.

Destigmatizing

stigmatized individuals might have constant concerns about what others think about them and preoccupied with others' opinion, and this labeling cause distortion that affect stigmatized individual's life in a wide range of activities and everyday interpersonal, occupational and social interactions and manipulate their help-seeking behaviors that cause an avoidance to refer to medical units and use proper medical and social facilities (47).

Providing tele-mental health services

To reduce the risk of transmitting the disease, mental health services are reduced and limited to emergencies. The need to pay attention to newer means of communication and providing telepsychiatry is felt more than ever. In various studies, telepsychiatry has had similar efficacy to face-to-face treatment. It is possible to use teleconsultation services using phone calls, web-based calls, or e-mails (48, 49).

Providing group therapy

Group therapy on sociological and psychological issues is one of the effective ways to reduce the distresses. Sense of being a member of a group, enhance individual's sense of We-ness and it would protect them from social isolation and can strengthen positive habits such as preventive strategies and increase hope and motivation in individuals. Group training provides the ability to transfer an enormous amount of information in a short time (50). Attending in the group activities help people to learn and develop social skills from peers, to increase their confidence

and competence, promotes socialization and communication skills, reduces anxiety and loneliness (51).

Training classes dedicated to the challenges of pregnancy and childbirth

Due to hospital limitations and the need to reduce unnecessary procedures, 21.4% of pregnant women changed their delivery method. Changes in strategies during the pandemic have influenced decisions made during pregnancy. The most important changes have centered on hospital selection, the timing of antenatal care and delivery time, and breastfeeding patterns. These changes indicate the need for related and specialized advice. So, online consults may be a productive replacement to reduce women's stress (52).

Strengthening spiritual behavior

COVID-19 pandemic cause dramatic changes in individual's life and manipulate their belief systems, it is vital to consider spirituality as one of the main components of wellbeing. During the COVID-19 era, people face numerous challenges about illness, grief, regret, shame and mourning have become part of people's lives. Maintaining cultural rituals and spirituality empower people to deal with suffer by giving you a sense of peace, purpose, and forgiveness. Performing thanksgiving and religious rituals can increase resilience and perseverance. These practices increase self-confidence and can improve self-efficacy. Spiritual health can train people to find meaning in daily life and to create a purposeful life, transcendence and provide a sense of security and social structure (53, 54).

Self-care and healthy lifestyle

Regular physical activities, a balanced diet, and healthy sleep habits can improve people's immune systems and increase satisfaction. It is crucial to pay attention to physical and mental health during a pandemic and encourage people to find a creative way to obtain a healthy lifestyle even during the crisis. Poor diet habit and malnutrition is correlate with higher inflammation and oxidative stress which leads to depression in pregnant women during the COVID-19 pandemic (55).

Vaccination

Do COVID-19 vaccines safe during pregnancy?

It is one of the frequently asked questions during the pandemic. At the beginning, the accurate data about the pathogenesis of the virus was unclear and approved vaccine haven't been established, there were a global confusion about the indication of vaccination and its complication and efficiency. The COVID-19 vaccine distribution inequality and barriers to

get proper vaccine for low-income countries, anti-vaccination campaigns raised in some countries, made the confusion worse. After a while American College of Obstetrical and Gynecology (ACOG) declares that pregnant women may be vaccinated for COVID-19. The National College of French Gynecologists and Obstetricians (CNGOF) suggested mRNA vaccines for pregnant women but they shouldn't be in the first trimester, finally it's strongly recommended that the COVID-19 vaccines are safe during pregnancy and vaccination during pregnancy builds antibodies that can help protect the fetus (56–58).

Conclusion

The COVID-19 pandemic caused considerable physical and mental challenges. This issue causes more psychological problems in vulnerable groups. Addressing the mental health of pregnant women is vital because it promotes the wellbeing of the offspring and mother and creates a healthier society. Pregnant women experienced higher levels of anxiety and depression during the pandemic.

The prenatal mental distresses, and psychiatric disorders may cause poor compliance, reduce help-seeking behaviors, and neglect to take the follow up screening visits and risk of harm for mother and others. Addressing the mental health in pregnant women is crucial to prevent the consequences.

The purpose of this narrative review was to investigate the available literature on the impact of the COVID-19 pandemic

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Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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