

# SPORTS AND ACTIVE LIVING DURING THE COVID-19 PANDEMIC

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# SPORTS AND ACTIVE LIVING DURING THE COVID-19 PANDEMIC

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# Editorial: Sports and Active Living During the Covid-19 Pandemic

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## Editorial on the Research Topic

### Sports and Active Living During the Covid-19 Pandemic

In early January 2020 some concerning news reached the world regarding a newly detected coronavirus (soon classified as Covid-19) in Wuhan, China, which led to serious illness and great risk of death (Taylor, 2021). The highly infectious virus spread rapidly and on 11 March 2020, the World Health Organization (WHO) declared a pandemic. By the end of that month, a large part of the world had imposed “lockdowns” with diverse restrictions on social life to control the spread of the virus and to protect national medical systems (World Health Organization, 2020). By the end of June 2020, Covid-19 had caused at least 500,000 deaths worldwide, and brought nations to a halt, in work, education, travel, recreation, and sport (Fund, 2020).

In this Research Topic, we focus on “Sports and Active Living During the Covid-19 Pandemic,” with particular reference to the unprecedented global shutdown. As editors, in our call for papers, and in planning and developing this Research Topic at the height of the pandemic in 2020, we appreciated the impacts of Covid-19 on sport and active living were complex, profound, and highly uneven. Sport mega-events, leagues, tournaments, and fixtures were postponed or canceled. The biggest casualties were the Tokyo 2020 Olympic Games, the 2020 European Championships in men’s football, numerous world championships or “major” events in many other sports (such as golf, tennis, and Formula 1 motor racing), and the world’s most popular sport leagues. Gyms, fitness centers, rehabilitation centers, and sport clubs were closed, in many cases permanently due to the loss of participants and income. The closure of schools and educational centers required physical education classes to be suspended or delivered in alternative ways, including online. Sport-related businesses faced bankruptcy, or “went under,” with employees in the sport, exercise and leisure sectors losing their jobs. At the same time, while online fitness and exercise training boomed and are now listed as the top trend of fitness in 2021 (Thompson, 2021), the loss of access to fitness facilities or exercise spaces has had huge health and well-being consequences for individuals and diverse populations.

Although Covid-19 has had a global impact, with many nations following the same general path in terms of lockdowns and social distancing, it has affected different population groups, nations, and regions in different ways with different intensities. The disproportionate impact on marginalized and vulnerable populations made Richard Horton describe the situation as a *syndemic* as opposed to a pandemic (Horton, 2020). This has particularly impacted the global South, with progress on eradicating extreme poverty and development being pushed back decades (Yadav et al., 2020; Rasul et al., 2021). In the global North, people who are older, with underlying health conditions, socio-economically disadvantaged, or from ethnic minority backgrounds, have been most adversely affected by Covid-19, and have had fewer opportunities to engage in outdoor

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physical activities. Some nations have had several weeks of social distancing, and even curfew, with substantial impacts on lifestyle behaviors, health and well-being, and negative effects on clubs and organizations in sport and outdoor life. For individuals with severe illnesses due to Covid-19 infections, there will be long-term uncertainties about the potential role of exercise with respect to rehabilitation.

The global impact of this pandemic is mirrored in the scale and the transnational reach of our Research Topic, on Sports and Active Living during the Covid-19 Pandemic. The Research Topic has attracted 33 individual articles, which reflects the global urgency and critical importance of this area of academic inquiry. Four of the Frontiers journals participated in this Research Topic: *Frontiers in Sports and Active Living*, *Frontiers in Psychology*, *Frontiers in Physiology*, and *Frontiers in Nutrition*. This registers the multidisciplinary significance of the Research Topic. A total of 139 authors from 19 countries representing Africa, Asia, Europe, Oceania, North America, and South America contributed. The resulting papers address both general and specific sports (football/soccer, cycling, golf, rugby, boxing, and tennis), occupational activity, leisure-time activity, and rehabilitation. The population groups which are covered include athletes, exercise professionals such as personal trainers, children and adolescents in homeschooling, students, the older adults, clinical populations, and people with disabilities. The editorial team of this Research Topic seeks to acknowledge that most of these papers were written and submitted during the first phase of the pandemic (May to July 2020), at a time when several of us were balancing our academic work with other requirements and responsibilities such as homeschooling, working from home, and isolating and social distancing in line with different national regulations in force during that period.

## THE RESEARCH TOPIC ARTICLES: FIVE MAIN AREAS OF RESEARCH

The 33 papers in this Research Topic cover a vast range of sports, areas of active living, themes and issues, and nations and regions. Notwithstanding this diversity, here we identify five broad (and often overlapping) areas of research within these articles with respect to the impacts of Covid-19 on sport and active living.

First, a major area of interest for several papers relates to the impacts of Covid-19, and in particular the consequences of lockdowns on physical fitness, activity, and exercise regimes (Kaur et al.; López-Valenciano et al.; Kim et al.; Pedersen et al.; Zinner et al.; Roberts et al.; Girardi et al.). For example, Kaur et al. found in their study of “fitness freaks” that after initial periods of “negative situational perception,” the participants found motivation to exercise at home. Kim et al. identified constraints—such as time, money, and “work-leisure conflicts”—that could adversely affect participation of some people in physical activities during the pandemic. Research also examined the Covid-19 consequences for elite-level or well-trained sport participants (Pedersen et al.; Zinner et al.; Roberts et al.; Seshadri et al.; Fox-Harding et al.). Zinner et al. also disclosed how for elite canoeists and kayakers, the Covid-19 lockdown led to less

training, shorter training sessions, more strength-based training, and more sleep and rest.

Looking beyond athletes and participants, the Covid-19 lockdowns had profound impacts for those on the supply side of the sport, physical activity, and fitness industries. Wright et al. examined the consequences of Covid-19 lockdowns for one “active lifestyle entrepreneur” who was forced to re-evaluate his deep personal and occupational commitments to this sector. Bratland-Sanda et al. studied how Covid-19 restrictions had affected personal trainers in Norway. They found that the lockdowns had generally led to drops in client numbers, income, working and living conditions, and vitality, with women more adversely impacted.

A second area of research inquiry for several papers centered on organizational responses to Covid-19, and their impacts on training and fitness (Roberts et al.; Washif et al.). For example, Washif et al. examined the effects of “quarantine” training camp with world-class athletes. Their findings pointed to a host of benefits, notably in regard to training, nutrition, mental and physical health, and sleep behavior, that were afforded by quarantine camps compared to the players’ lockdown experiences. Seshadri et al. examined the physical effects of post-lockdown returns to elite-level competitive sport, with reference to injury rates in men’s football’s German Bundesliga. They found that returning players were more than three times as likely to pick up injuries, especially muscle injuries, compared to before the Covid lockdown. Finally, Mota et al. draw our attention to how sport governing bodies need to adjust some of the laws and structures within sports in response to the impacts of Covid-19. Specifically, they highlighted the need for more substitutions in football (soccer) to be permitted, particularly due to the more congested fixture schedules and the likely risk of injuries after the lifting of restrictions on sport.

Third, a large volume of research was focused on the impact of Covid-19 on sport participation and physical activities of specific population groups, particularly those that are relatively marginalized or vulnerable in different societies (Kamyuka et al.; Roe et al.; Frahsa et al.; Lozano et al.; Bruinvels et al.; Grant et al.). Kamyuka et al. highlighted how social restrictions due to Covid-19 had adversely affected the physical activities of people with disabilities, notably by increasing perceived isolation and mental ill health. In their study of schoolchildren, Roe et al. found that home-schooling during Covid-19 had distinct impacts on physical activity. Students who were more active were older and tended to be more involved in schoolwork more generally, while parents indicated their unease with greater levels of sedentariness among their children. In regard to studies of older adults (Frahsa et al.; Grant et al.), Frahsa et al., for example, examined the promotion of physical activity in nursing homes during the pandemic and found that this service needed to be more fully embedded within the organizational structures of these settings. Moreover, Covid-19 has highlighted significant gender divisions and inequalities in sport contexts (Lozano et al.; Bruinvels et al.). Lozano et al. examined how in the context of football in Argentina, Covid-19 had exacerbated inequalities; they recommended a range of ways in which these divisions should be addressed, particularly with regard to better resources

and recognition. Dixon et al. turn our attention to the “sport for development” (SfD) sector, which uses sport as a development tool primarily in developing and marginalized communities. In examining an SfD agency in Kenya, they found that, for participants, the impending Covid-19 pandemic was bringing some clear problems and challenges (such as restricted activities or home difficulties), but also had some positive aspects (such as family time or rest). Finally, in their opinion piece on youth sport, Kelly et al. contend that Covid-19 represents a “watershed moment” which raises a host of considerations, along methodological, contextual, and practical lines, that need to be addressed by scholars and practitioners in this field. We would argue that such insights apply not only to youth sport, but to all domains of sport and active living. For this area of research, Sorbie et al. provided a data report on golf-related engagement in 1,273 golfers during quarantine restrictions in May 2020. In accordance with the ideal of open science, these data are made available for other researchers to explore.

A fourth realm of research related to the media and communication aspects of sports and active living during the pandemic. Some contributors examined the role of online training tools among different types of athletes, such as cyclists and boxers (Moreno-Tenas et al.; Tjønndal). For example, in their investigation of cyclists in Spain, Moreno-Tenas et al. found that the use of online training tools during Covid-19 confinements served to increase the training frequency of these sport participants. Giulianotti and Collison used a structuralist theoretical approach to identify the key themes and narratives in how the UK mass media reported on sport with respect to Covid-19, often in tried-and-tested ways, for example by claiming to act in the public interest while running regular exposé stories on sport celebrities. Godefroy explored the role of social media in shaping public physical activity during the pandemic, specifically with respect to Instagram influencers.

A fifth area of research related to how Covid-19 impacted on the mood, coping, and well-being of sport participants (Turner et al.; Ronkainen et al.; Sorbie et al.; Xiang et al.; Wright et al.). Positively, Turner et al. disclosed that among middle-aged and

senior tennis players in Australia, there was a decrease in the time that was spent on playing and training, but the “emotional well-being” of the participants was not adversely impacted. Xiang et al. and found Wright et al. that different types of physical activity had beneficial impacts on the mental health and well-being of young people during the pandemic.

## CONCLUDING COMMENTS

As we write, we are now in May 2021, and the WHO has registered more than 150 million infections and more than 3 million deaths due to Covid-19 (World Health Organization, 2021). Thanks to the massive efforts of researchers from all over the world, we know more about how we can prevent infections, about the psychosocial consequences of lockdowns and social distancing, and most importantly, about the different efficacies of diverse vaccines. More than 1 billion vaccine doses have been administered globally, and this vaccination rate provides optimism with regard to ending the pandemic. At the same time, Covid-19 has forced us to think about the risks of future pandemics or other global shocks, and how we may be better positioned to withstand their impacts in all areas of social life.

This Research Topic has provided us with a wide range and depth of knowledge on how the initial part of the Covid-19 pandemic impacted upon many areas of sport and active living. Further research in this area is essential. Follow-up studies will advance our knowledge of the medium- and longer-term impacts of Covid-19 on sports and active living. Moreover, the diverse research provided by this Research Topic, and by further scholarship, will leave us in a stronger position to understand, and to withstand, the impacts of these future, inevitable global challenges.

## AUTHOR CONTRIBUTIONS

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# Data Report: Golf-Related Engagement During COVID-19 Quarantine Restrictions (4–12th May 2020)

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## INTRODUCTION

As a result of the COVID-19 pandemic caused by SARS-CoV-2 coronavirus, Governments around the world aimed to suppress the spread of the disease by applying various forms of quarantine (stay at home) restrictions. For example, according to the regulations set by the United Kingdom (UK) Government on 23rd March 2020, individuals should only leave their home to; shop for basic necessities, any medical need, travelling to and from essential work, and to perform one form of exercise per day (United Kingdom Government, 2020a). In particular, exercising was restricted to individuals being alone or with members of their household (United Kingdom Government, 2020a). These quarantine restrictions created unprecedented disruption to individuals' social, family, and work lives.

As a consequence of these restrictions being put in place, all sports events and recreational activities such as soccer, tennis, bowls, and golf were suspended (Parnell et al., 2020; United Kingdom Government, 2020a). With these quarantine restrictions in place, there is a significant risk emerging that concerns the potential decline in physical activity and sports-related activities, which in turn can have a detrimental effect on physical and mental health (Chekroud et al., 2018). It is well-publicised that there are various health and well-being benefits resulting from the participation in physical activity and sports-related activities (Bo Andersen et al., 2000; Saxena et al., 2005; O'Donovan et al., 2010) and, in turn, there are potential health and well-being implications as a result of the quarantine restrictions (Ricci et al., 2020). Specifically, these restrictions could be detrimental to many physiological and psychological risk factors such as coronary heart disease, obesity, stress, social isolation, negative emotions, and sleep quality (Ellingson et al., 2018; Lippi et al., 2020a,b). During the quarantine restrictions, it has been recommended that individuals partake in home-based physical activities such as aerobic exercise using a stationary bike, bodyweight strength training, dance-based exercise, and active gaming in order to counteract the negative physical and mental side effects of the pandemic (Hammami et al., 2020). With sports and recreational activities suspended, the previously outlined physiological and psychological risk factors may be increased for individuals who habitually practiced sports activities prior to restrictions (Lippi et al., 2020a).

Unlike many other sports, golf provides opportunities for individuals to complete golf-related activities within their home environment. For example, with limited golf equipment (e.g., golf clubs and balls), many golfers are able to practice full golf swings and full golf shots, as well as chipping and putting skills, all of which contribute to a large proportion of the game of

golf (Keogh and Hume, 2012). Active gaming at home can also provide golfers with opportunities to practice golf-related activities. This active gaming during the quarantine restrictions has been previously recommended and endorsed by Hammami et al. (2020). There are many physical and mental health benefits of completing these golf-related activities including balance control (Sell et al., 2007; Tsang and Hui-chan, 2010; Gao et al., 2011), muscle function (Martinez Bustelo et al., 2016), and strength and flexibility (Sell et al., 2007). In addition, performing these skills during the quarantine restrictions may also provide opportunities to reduce sedentary time, which has during normal living, previously been associated with reduced cardiovascular risk factors (Young et al., 2016) and improvements in mood, stress, and sleep quality (Ellingson et al., 2018). It has been recommended that sedentary time for adults should be <7.5 h per day (Ku et al., 2018). In addition to physical golf activities, the use of technology also provides opportunities for individuals to engage in other activities such as listening to golf-related audio files, watching golf tournaments on television, and/or receiving coaching sessions online. These golf-related activities can provide individuals with a continued sense of belonging in relation to their sporting community, which can therefore provide potential well-being benefits that have been previously linked to the sport (Belanger et al., 2013; Murray et al., 2017; Sorbie et al., 2020).

As a result of restrictions to suppress the spread of the COVID-19 pandemic, and the unique opportunities that golf provides, this data report presents demographical details and golf-related activities that were performed during a period of quarantine (4–12th May 2020). In turn, these data can be used to compare golf-related activities across the different demographics.

## METHODS

Data collection commenced after the project received Institutional Ethical approval, at which point the survey was published online between the 4 and 12th of May 2020. The survey was closed on the 12th May 2020 as a result of many golf courses in the UK re-opening on the 13th May 2020 (United Kingdom Government, 2020b). At the onset of data collection, the UK population had been under consistent movement restrictions for 42 days (6 weeks). The instructions for participants completing the survey were as follows: “You are being invited to participate in a 2-min survey assessing your golf activities during the Covid-19 lockdown (restricted movement to reduce day-to-day contact with other people) period. In order to be eligible for the study you must consider yourself as a social, amateur or professional golfer who participates in golf for recreational or competitive purposes. You must also be aged 16 or over. By completing this survey, you are providing consent for your anonymous data to be stored for a period of 10 years within a secured server and be used for research purposes. Participation is completely voluntary and you can withdraw from the study at any point without giving any reason.” All golfers provided informed consent before completing the survey. Following this, golfers were provided with a set of questions relating to their demographics and golf experience: age, gender, country

of residence, occupation, working status (during the period of quarantine), golfer status (professional golfer, golfer holding a handicap index, and social golfer), golf handicap index (if applicable), if they were playing on outdoor golf courses (during the period of quarantine; and if so, for how long), and how many rounds of golf they completed during 2019. Secondly, golfers were provided with a set of questions relating to golf-related activities during the period of quarantine: number of times physical golf skills outdoors (e.g., golf shots and chipping into a golf net) were performed; number of times physical golf skills indoors (e.g., chipping and putting) were performed; number of times physical conditioning exercises related to golf sessions (e.g., strength and conditioning programmes, gym programmes related to golf) were performed; number of times physical virtual reality golf skills (e.g., virtual reality golf games) were performed; number of times golf-related games (e.g., golf games on a console or mobile) were performed; number of times golf was viewed on television or any device (e.g., repeats of tournaments, golf shows/movies); number of times online golf tutorials (e.g., engaging with coaching videos on social media) were viewed; number of times golf related podcasts, audiobooks, or radio shows were listened to; number of times golf-related reading materials (e.g., magazines, books, journals) were engaged with; and any other golf-related activities that were performed during the period of quarantine. For the golf-related activity questions, golfers were provided with a 5-item response scale; 0 times, 1–9 times, 10–19 times, 20–29 times, and 30+ times (see <https://data.mendeley.com/datasets/pnvv34cm37/draft?a=d80312a3-8588-413b-8eb1-473f007679b2>).

## DATASET

The dataset includes 1,273 golfers [the descriptive data below is reported as percentage (%) or mean  $\pm$  standard deviation]. Within the dataset, 87% of the golfers are male and 13% are female, aged  $53 \pm 16$  years. 95.2% of the golfers reside within the UK, 2% in the United States of America, 1.2% in Ireland, 0.5% in Canada, 0.3% in Australia, 0.2% in Gibraltar, 0.1% in Germany, 0.1% in France, 0.1% in the United Arab Emirates, and 0.3% did not answer. As a result of COVID-19, 19% of the golfers are working, 27% of golfers are working from home, 32% of the golfers are not working and 22% of the golfers are retired. In terms of golfer status, 93% hold a golf handicap index ( $15 \pm 8$  golf handicap index), 5% are social golfers, and 2% are professional golfers. At the time of the data collection, 33 golfers were playing golf on outdoor courses. During 2019, the golfers completed a total of  $70 \pm 52$  rounds of golf.

**Table 1** reports the number of times golf-related activities were engaged in during quarantine restrictions (4–12th May 2020) by country of residence, golfer status, gender, and working status as a result of COVID-19. Total and stratified sample sizes are indicated.

## Strengths and Limitations

The present dataset has several strengths: it was conducted with 1,273 golfers over an 8 day period; the dataset is representative to the numbers of registered golfers, including

**TABLE 1 |** The number of times golf-related activities were engaged in during COVID-19 quarantine restrictions (4–12 May 2020) by country of residence, golfer status, gender, and working status as a result of COVID-19.

		Category	Outdoors	Indoors	Conditioning	VR	Games	TV/Device	Online	Podcasts	Reading
Country (N = 1,269)	Australia (n = 4)	0	3	3	2	4	4	1	2	3	2
		1–9	1	0	1	0	0	2	1	0	2
		10–19	0	0	1	0	0	0	0	1	0
		20–29	0	0	0	0	0	1	1	0	0
		30+	0	1	0	0	0	0	0	0	0
	Canada (n = 6)	0	3	1	2	4	3	0	2	2	1
		1–9	1	3	4	2	2	4	3	4	3
		10–19	0	1	0	0	0	1	1	0	0
		20–29	1	0	0	0	1	0	0	0	1
		30+	1	1	0	0	0	1	0	0	1
	France (n = 1)	0	0	0	0	0	0	0	0	0	0
		1–9	0	0	0	0	0	1	0	0	1
		10–19	1	0	1	0	0	0	0	0	0
		20–29	0	1	0	1	1	0	0	0	0
		30+	0	0	0	0	0	0	1	1	0
	Germany (n = 1)	0	0	1	1	1	1	0	0	0	1
		1–9	1	0	0	0	0	1	1	1	0
		10–19	0	0	0	0	0	0	0	0	0
		20–29	0	0	0	0	0	0	0	0	0
		30+	0	0	0	0	0	0	0	0	0
	Gibraltar (n = 2)	0	2	2	2	2	2	1	2	2	2
		1–9	0	0	0	0	0	1	0	0	0
		10–19	0	0	0	0	0	0	0	0	0
		20–29	0	0	0	0	0	0	0	0	0
		30+	0	0	0	0	0	0	0	0	0
	Ireland (n = 15)	0	5	12	8	15	15	5	5	10	9
		1–9	5	1	4	0	0	4	6	3	5
		10–19	0	1	1	0	0	2	2	2	0
		20–29	1	0	1	0	0	1	0	0	0
		30+	4	1	1	0	0	3	1	0	1
	United Arab Emirates (n = 1)	0	1	1	1	1	1	0	1	1	0
		1–9	0	0	0	0	0	1	0	0	1
		10–19	0	0	0	0	0	0	0	0	0
		20–29	0	0	0	0	0	0	0	0	0
		30+	0	0	0	0	0	0	0	0	0
	United Kingdom (n = 1,214)	0	536	730	659	1,115	978	352	423	947	603
		1–9	343	242	202	55	111	446	430	196	477
		10–19	121	95	118	16	61	229	167	38	65
		20–29	45	25	75	5	15	70	59	13	29
		30+	166	118	158	17	48	114	131	18	37
	United States of America (n = 26)	0	4	9	7	21	19	8	8	11	4
		1–9	8	8	7	4	4	11	8	7	14
		10–19	5	3	3	1	0	3	5	6	6
		20–29	2	3	5	0	1	0	2	1	0

(Continued)



TABLE 1 | Continued

		Category	Outdoors	Indoors	Conditioning	VR	Games	TV/Device	Online	Podcasts	Reading
Golfer status ( <i>N</i> = 1,267)	Professional ( <i>n</i> = 22)	30+	7	3	3	0	2	4	3	1	2
		0	6	6	5	21	16	4	4	9	7
		1–9	6	6	1	1	3	7	9	9	8
		10–19	4	3	7	0	3	9	3	1	5
		20–29	0	1	1	0	0	0	2	2	0
	Golfer with handicap index ( <i>n</i> = 1,186)	30+	6	6	8	0	0	3	4	1	2
		0	516	712	631	1,089	963	340	415	915	569
		1–9	334	234	212	55	105	440	420	194	480
		10–19	118	94	118	14	52	216	165	45	66
		20–29	47	28	77	6	18	71	57	12	30
	Social golfer ( <i>n</i> = 59)	30+	169	116	147	17	48	117	126	19	39
		0	32	40	44	51	42	21	24	50	44
		1–9	17	13	4	5	9	27	19	8	15
		10–19	6	3	3	3	6	8	6	1	0
		20–29	1	0	1	0	0	1	3	0	0
Gender ( <i>N</i> = 1,269)	Female ( <i>n</i> = 160)	30+	3	2	7	0	2	2	7	0	0
		0	85	112	94	148	148	81	87	137	84
		1–9	44	31	20	9	9	58	55	18	67
		10–19	12	8	17	2	3	14	10	4	6
		20–29	6	5	8	0	0	5	3	0	1
	Male ( <i>n</i> = 1,109)	30+	12	4	21	0	0	2	5	1	3
		0	470	649	587	1,016	877	287	358	841	538
		1–9	314	222	196	52	108	413	394	193	436
		10–19	115	92	110	15	58	220	165	43	66
		20–29	43	23	73	5	17	67	59	14	29
Working status as a result of COVID-19 ( <i>N</i> = 1,264)	Working ( <i>n</i> = 244)	30+	166	120	141	17	49	120	130	17	38
		0	105	143	137	214	173	57	65	182	122
		1–9	68	54	55	17	37	93	77	35	96
		10–19	29	11	24	6	21	49	49	14	11
		20–29	8	3	9	0	3	18	18	6	6
	Working from home ( <i>n</i> = 347)	30+	34	32	18	6	10	26	34	6	9
		0	133	197	184	325	276	77	105	243	171
		1–9	115	69	56	13	28	137	136	79	138
		10–19	36	36	30	4	17	81	48	15	21
		20–29	15	12	28	1	9	21	21	2	4
	Not working ( <i>n</i> = 398)	30+	46	33	48	2	17	30	37	8	13
		0	175	225	199	361	314	116	138	299	189
		1–9	104	78	65	20	42	142	142	78	157
		10–19	37	38	52	6	17	66	47	13	26
		20–29	14	9	25	3	5	23	18	3	12
Retired ( <i>n</i> = 275)	30+	68	46	57	8	20	51	51	5	14	
	0	137	193	158	259	256	114	132	248	134	
	1–9	71	50	40	11	10	100	92	18	113	

(Continued)

TABLE 1 | Continued

	Category	Outdoors	Indoors	Conditioning	VR	Games	TV/Device	Online	Podcasts	Reading
	10–19	26	14	21	1	6	37	31	5	13
	20–29	12	5	18	2	1	10	5	3	8
	30+	29	13	38	1	2	14	15	1	5

Category: Number of times golf-related activities were engaged in; Outdoors: During the lockdown period, how many times have you performed physical golf skills outdoors (e.g., golf shots and chipping into a net)?; Indoors: During the lockdown period, how many times have you performed physical golf skills indoors (e.g., chipping and putting)?; Conditioning: During the lockdown period, how many times have you performed physical conditioning exercises related to golf sessions (e.g., strength and conditioning programmes, gym programmes related to golf)?; VR (VR, virtual reality): During the lockdown period, how many times have you performed physical virtual reality golf skills (e.g., Wii, VR golf games)?; During the lockdown period, how many times have you performed golf related games (e.g., golf games on a PlayStation, Xbox, Switch, iPad or mobile)?; TV/Device: During the lockdown period, how many times have you watched golf on TV or any device (e.g., repeats of tournaments, golf shows/movies)?; Online: During the lockdown period, how many times have you watched online golf tutorials (e.g., engaging with coaching videos on Twitter, Facebook, YouTube)?; Podcasts: During the lockdown period, how many times have you listened to golf related podcasts, audiobooks or radio shows?; Reading: During the lockdown period, how many times have you engaged with golf related reading materials (e.g., magazines, books, journals).

age (Sorbie et al., 2020), gender (Lange, 2019), and golf handicap index (Golf Care, 2016); the dataset provides insights into what golf-related activities were performed during an unprecedented period of restricted movement; within the dataset participant demographics were collected, which may be useful for further analysis, replication, and extensions of the current research (i.e., age, gender, country of residence, occupation, working status at the time of data collection, golfer status, golf handicap index, golf-related activities, and completion date/time); and the data were collected during a narrow time period (4–12th May 2020) and after a prolonged period of quarantine, which reflected similar conditions for the majority of the dataset [following the closure of the survey (12th May 2020) many golf courses in the UK were permitted to reopen (United Kingdom Government, 2020b)].

The present dataset has some limitations: it only relates to the sport of golf; the dataset only presents golf-related activities that were performed during a period of quarantine restrictions (4–12th May 2020); and the dataset is only representative across limited countries and golfer status (i.e., a high percentage of the golfers are from the UK and are golfers holding a golf handicap index).

## Possible Research Paths

The dataset provides insights into the golf-related activities that were performed, and the frequencies in which they were performed, during a period of quarantine restrictions (4–12th May 2020). The dataset can be filtered according to age, gender, country of residence, occupation, working status at the time of data collection, golfer status, golf handicap index, golf-related activities, and completion date/time. Following this, the dataset can be used to compare golf-related activities across the different demographics and other data included within the dataset. For example, the dataset can provide insight into differences in golf-related activities between multiple occupations, specific working status' during COVID-19, or different golfer status'. This could enable researchers to gain an understanding of golfers' habits dependant on their status during a period of quarantine (4–12th May 2020).

In future research, the present dataset could also be used to provide recommendations if there were to be another move

toward quarantine restrictions during the current pandemic, or even future pandemics. Furthermore, the dataset could be used to compare golf-related activities with other datasets (e.g., tennis-related activities) collected during quarantine restrictions. The dataset could also be used for future reports that provide insight into physical and sport-related activities that were being conducted during the quarantine restrictions.

## DATASET DESCRIPTION

The data in the present report have been deposited in the Mendeley repository and are freely accessible through the following link: <https://data.mendeley.com/datasets/pnvv34cm37/draft?a=d80312a3-8588-413b-8eb1-473f007679b2> under the name: "Golf-related engagement during COVID-19 quarantine restrictions, 4–12th May 2020." The dataset has been stored in a Microsoft Excel (Version 2016) format, has been anonymised throughout and any identifiers have been removed.

## DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The name of the repository and accession number can be found in the article.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Abertay University. 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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**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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# “I Trust in Staff’s Creativity” — The Impact of COVID-19 Lockdowns on Physical Activity Promotion in Nursing Homes Through the Lenses of Organizational Sociology

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**Objectives:** The health-enhancing benefits or regular physical activity (PA) reach into old age. With the emergence of the coronavirus disease of 2019 (COVID-19) pandemic and the associated national lockdowns and restrictions, nursing home residents were restrained from being physically active. In our study, we aimed to assess the impact of the COVID-19-related restrictions on PA promotion in nursing homes from an organizational-sociological lens.

**Methods:** We collected data in eight nursing homes in Germany. Data collection included (i) semistructured interviews focusing on COVID-19-related restrictions and their effects on nursing homes from the home administrators’ perspectives; (ii) open-ended surveys with nursing home staff and relatives focusing on daily routines and contact restrictions; and (iii) collection of documents such as care concepts, mission statements, and weekly activity plans. We analyzed all data with a reflexive thematic analysis approach.

**Results:** We identified three stages of COVID-19-related changes in nursing homes that impacted PA promotion, as follows: (1) external closure and search for emergency control, (2) organizational adaptations to create a livable daily life in the internal environment, and (3) slow reintegration of interactions with the external organizational environment. Document analysis revealed that PA promotion was not part of decision programs or internal staff work descriptions. Rather, PA promotion was delegated to external service providers. The assignment of PA promotion to external providers was not structurally anchored in decision programs, which makes PA promotion not sustainable, particularly during unforeseen events that limit access to the organization. During the pandemic, executive staff believed in internal staff to buffer competencies with regard to PA promotion. Thus, executive staff often considered PA promotion relevant, even during the pandemic, but thought that PA promotion is a task that can be fulfilled by unqualified but motivated internal staff.

**Conclusion:** While our study participants showed a high level of coping-capacity belief, it remains unclear which long-term impacts of COVID-19 on PA promotion in nursing homes are to be expected. At the practice level, executive staff in nursing homes that aim to promote PA within their organization should become aware that PA promotion needs to be incorporated into organizational structures to be implemented and continued in challenging times such as in a pandemic.

**Keywords:** organizational theory, organizational culture, long-term care, COVID-19, physical activity, daily activity

## INTRODUCTION

### Background

Physical activity (PA) has widely been acknowledged as a decisive behavior to promote health. The health-enhancing benefits of regular PA reach into old age; even small doses of activity can bear positive effects. Despite being a substantial contributor to biopsychosocial well-being and healthy aging, PA tends to be limited in institutions for older people: nursing home residents show low levels of PA and a high prevalence of sedentariness (Barber et al., 2015; Lotvonen et al., 2017). The lack of PA increases the risks of muscle atrophy (Gennuso et al., 2013), falling (Bean et al., 2002), depression (Lampinen et al., 2000), social isolation (Shankar et al., 2011), and, thus, premature mortality.

With the emergence of the coronavirus disease of 2019 (COVID-19) pandemic in the early spring of 2020 and the associated national lockdowns and restrictions, nursing home residents were restrained from being physically active. Worldwide, public health authorities established behavioral guidelines for nursing homes on regional, state, and/or federal levels. By doing so, authorities aimed to protect older people, especially those with chronic conditions and comorbidities, and to decrease the COVID-19-related mortality among those (Dichter et al., 2020; Fallon et al., 2020). In addition, nursing homes tended to have high transmission rates due to their infrastructural and organizational set-ups, such as shared bathroom facilities and common living areas and low readiness when it comes to infection control measures (Davidson and Szanton, 2020). In order to decrease the risk of infection and to protect residents, social and environmental regulations were implemented in several countries worldwide, including the lockdown of nursing homes for both visitors and residents.

This paper will analyze the impact of COVID-19 on PA promotion in a sample of nursing homes in the German state of Baden-Württemberg. In the state of Baden-Württemberg, the lockdown lasted from mid-March to the beginning of May 2020 (State Government of Baden-Württemberg, 2020a; 2020b). The lockdown included the prohibition of visits by relatives and service providers (e.g., hairdressers, physiotherapists, pastoral workers, etc.), restrictions to leave the institution (except for urgent doctor's appointments), and the limitation of group activities as well as everyday activities such as walking the floors or going for a walk outside of the home (State Government of Baden-Württemberg, 2020c).

Although such restrictions aim to protect those at the highest risk for severe illness resulting from the new virus, the restrictions also bear potential health risks through reinforcing isolation, physical inactivity, and sedentary behavior. When staff shield residents in their rooms, they also restrict residents' autonomy and impose mental and physical harms (Gordon et al., 2020). Measures of isolation may be exceptionally challenging for residents with cognitive impairments such as dementia or walking with purpose (Fallon et al., 2020; Gordon et al., 2020). Consequently, Dichter et al. (2020) argue for providing residents with opportunities for walking and spending time outdoors as well as meeting, i.e., seeing and talking, with relatives in accordance with infection management regulations.

The executive and nursing staff play a major role when deciding on the opportunities for residents to be physically active during the lockdown, because the staff are responsible for their protection. To which extent the nursing staff can contribute to the physical activation of residents in times of COVID-19-related restrictions, is unknown by now. The nursing staff are in the epicenter of the pandemic and must put political regulations into practice. On the one hand, nurses have to adapt to changes in care practices and develop hygiene concepts. On the other hand, they are affected by the pandemic themselves: while nursing practices have become increasingly difficult due to the restrictions, institutions are understaffed due to quarantine and staff's sick leaves (Fallon et al., 2020; Oliver, 2020). Executive staff perceive an increase in challenges and concerns during the COVID-19 pandemic, as recent data shows (Hower et al., 2020). Executive staff are concerned about potential infections of residents and staff, insecure about how to proceed in case of an infection, how to acquire protective gear such as masks or cloths, and, not least, how to deal with the increased workload due to hygiene-related education or reduced support from relatives (Hower et al., 2020). Hence, the problems of decreased PA opportunities for residents are probably not very high on management's priority list.

By now, researchers have not yet collected data on the impacts of the COVID-19-related restrictions on PA promotion in nursing homes. Due to the assumption that such impacts concern the entire organization, we take a broader perspective in our research, beyond individual attitudes and experiences. For our perspective, we use an organizational theoretical lens (Lewin, 1951; Luhmann, 2000; Schein, 2017) to assess the impact of COVID-19 lockdowns on PA promotion. This lens allows us to look at the organizational set-up of nursing homes when it comes



to not only PA promotion in general but also to PA promotion in times of the COVID-19 pandemic.

## Theoretical Framework

From the perspective of the sociology of organization, the analytical focus is not on the motives or attitudes of people who are employed in the organization (in our study management or caregivers) or use its services (residents or relatives). The organizational sociological focus rather is on the analysis of decision-making on the basis of institutional arrangements, such as collective values, routines of action, and work roles, and also conceptual beliefs or cultural systems (cf. Powell and Dimaggio, 1991; Colignon, 2007). From a system-theoretical perspective, “organizations emerge and (...) reproduce (themselves) when decisions are communicated (...). Everything else—goals, hierarchies, opportunities for rationality, members bound by instructions, or whatever else has been regarded as a criterion of organization—is secondary and can be regarded as the result of the decision-making operations of the system” (Luhmann, 2000 p. 63). Decisions in organizations are based on the so-called decision premises, i.e., specific basic decisions of the organization about subsequent decisions. They form the structure of the organization and give direction to further decisions (cf. Luhmann, 2000 p. 86). Luhmann differentiates three types of decision premises: decision programs (purpose and conditional programs), communication means<sup>1</sup>, and personnel decisions.

Purpose programs are directed toward the purpose of the organization and describe specific future expectations (e.g., differentiated into short- and long-term goals), the fulfillment of which requires the use of certain means (ideally differentiated in orientation toward alternative scenarios). With regard to PA promotion in nursing homes, purpose programs guarantee a sustainable anchoring of PA offers in the organization. If organizational statutes do not include PA promotion as a goal, it is ultimately left to the commitment of individuals whether PA takes place or not (cf. Thiel and Meier, 2004; Rütten et al., 2009).

Conditional programs are if-then specifications that are stored in the organization mostly in written form, usually *via* statutes or protocols (Luhmann, 2000, p. 275). An organization's conditional programs stipulate that the occurrence of a certain, predetermined event requires a further decision. For our analysis, conditional programs are important in such a way that, ideally, for certain events, such as a pandemic, certain procedures for how to act are stipulated. Hence, if there are no guidelines on how to deal with PA promotion in the event of a lockdown in nursing homes, then the promotion of PA during this period is not guaranteed (even if it is written down as an organizational goal), but rather inevitably depends on the commitment of individuals.

Communication means in organizations can be described as a system of specification and distribution of organizational tasks. In such a network, competencies that ensure the acceptance

of decisions are mutually coupled in both horizontal and vertical directions (Luhmann, 2000). The professional and hierarchical competencies that can be distinguished in this way are symbolized by jobs that each have specific tasks to fulfill which are written down in job descriptions (cf. Thiel and Mayer, 2009). Sustainable PA promotion in nursing home depends on whether the organization has assigned this task to a certain position in the staff appointment scheme. If this is not the case, it cannot be expected that nursing homes offer PA programs for the residents, not even if the executive and the nursing staff regard PA promotion as relevant.

Personnel decisions in organizations aim to allocate people to posts after the best possible suitability has been established (Luhmann, 2000). This requires specific criteria that guide the recruitment decision and (because recruitment alone does not guarantee a high degree of fitness between person and tasks) a permanent monitoring by the organization. Hence, personnel decisions should ensure that the recruited person fits with the organization-specific requirements and the requirements are not exposed to arbitrary individual influences. In our case, this means that even if PA promotion is anchored in the organization's program, an adequate offer will only be realized if the recruited staff is able to fulfill this task adequately. Conversely, people with competencies in PA promotion can compensate for the lack of corresponding structural guidelines, provided they have sufficient time.

Besides the formal structure of an organization, organizations are characterized by sets of *undecidable* decision premises, the so-called organizational culture (Luhmann, 2000). Undecidable decision premises are expressed as traditions, common values, and informal rules on how to deal with each other. Schein (2017) distinguishes three levels of organizational culture: (1) artifacts as visible and feelable phenomena, including the organizational *climate* with observable yet difficult to decipher behavior routines and rituals, (2) espoused beliefs and values (such as strategies and routines, philosophies and shared goals), and (3) basic assumptions and values that can be considered as an organization's informal code of conduct that determines behaviors and perceptions in an unconscious and taken-for-granted way.

The organizational culture is more or less a diffuse collective idea of what characterizes the organization at its core. Organization members take it for granted and seemingly understands it without having to be expressed (Luhmann, 2000 p. 243f.). The organizational culture, despite its indeterminacy, is highly binding, since it defines “the usual,” i.e., what is capable of consensus, referring to the history of the organization (Luhmann, 2000, p. 245). We assume that nursing homes that have the collective idea of being a healthy, activity-promoting organization will more likely attempt to promote PA during the lockdown.

Organizational culture is of particular importance as modern organizations, including nursing homes, have to deal with often contradictory requirements in their everyday lives in terms of maintaining organizational effectiveness and legitimacy. Organizations solve this problem by granting everyday operations a certain independency from the formal

<sup>1</sup>In German, the original term is “Kommunikationswege,” which also could be translated as “communication channels” or “communication paths.” Since this term describes a vertical and horizontal network structure which attributes organizational tasks to positions, we think that the term “communication means” is less misleading.

structure. In other words, while they legitimize organization operations through the formal structure, they carry out effective operations on the informal level independently of the formal structure (Dimaggio and Powell, 1983; Colignon, 2007). Due to the fact that the COVID-19 pandemic caused change effects in organizations, our focus will also be on the process of organizational change. A classic model for the explanation of organizational change was created by Lewin (1951). In his three-stage model of organizational change, he differentiates between unfreezing, transition, and refreezing. At the first stage, organizations tend to be unaware of impacts or the need for change. At the second stage, organizations tend to challenge the status quo and realize the need for change. At the third and final stage, organizations sustain changes and integrate new values, beliefs, and practices, also reflected in an adaption of structures.

In this paper, we aim to address the following main questions:

(1) *How do nursing homes react to COVID-19-related restrictions?*

With this question, we want to find out to which extent the Corona pandemic leads to an organizational change.

(2) *How has PA promotion changed during the pandemic?*

Thereby, we want to analyze the handling of COVID-19-related restrictions with regard to PA from the perspective of organizational sociology. This question comprises three subquestions:

(a) To what extent is PA promotion an organizational goal in nursing homes and how is PA affected by COVID-19-related restrictions?

In this regard, we ask whether PA-related organizational goals exist and, if yes, what relevance they have within the purpose programs of the nursing homes. Thereby, we also want to figure out whether PA promotion is part of the organization culture in nursing homes.

(b) How do the executive and nursing staff perceive PA-related impacts due to the COVID-19 pandemic, and how do they react to these impacts?

With this question, we want to figure out whether nursing homes have PA-related conditional programs to react to organizational restrictions or to what extent the response to such restrictions depends on the initiative of individual members of the organization only.

(c) Who is responsible for organizing PA activities during the COVID-19 pandemic?

This question focuses on the attribution of PA promotion to positions *via* communication means. Furthermore, we analyze to which extent the personnel can compensate a potential lack of structural guidelines for the promotion of PA. In this regard, we are also interested in whether caretakers are aware that inactivity can cause severe health-related problems for residents.

## METHODS

### Setting

This study took place within a larger project, the Verhältnisorientierte Bewegungsförderung und individuelle Bewegungsberatung im Setting 'Altenwohnheim' – ein biopsychosoziales Analyse- und Beratungsprojekt (BaSAlt)

study on PA promotion and counseling in nursing homes (funded by the German Federal Ministry of Health 2019–2022, grant no. ZMVII-2519FSB114). Data collection (document analysis, observations, photovoice, and interviews) had started 2 months before the COVID-19-related lockdown. After the nursing homes had been closed off, we adapted our study design to also cover the impact of the lockdown on PA in nursing homes.

Due to the exploratory nature of our study, we aimed to include a broad range of different nursing home settings. Thus, we used a maximum-variation sampling strategy regarding location, number of nursing places, and number of staff members, volunteers, and sponsors. Outpatient homes and geriatric rehabilitation centers were excluded. When selecting our final sample, we also attached importance to the nursing homes' stance on PA promotion. Here, we aimed to include both homes that regularly offered PA promotion programs before the pandemic and others that did not. During initial selection interviews, we discussed the conditions for participation in the project with the home management, which led to the exclusion of two homes due to time constraints during the COVID-19 pandemic.

The final sample consists of eight nursing homes in the Federal State of Baden-Württemberg in Germany. Nursing homes vary regarding their environmental contexts, responsible bodies, and organization forms, as well as capacity, and the composition of the resident populations. Three nursing homes are located in an urban area and five in more rural areas. We included homes from four different non-profit carriers. The participating nursing homes provide between 33 and 59 residents' places. The number of residents with a maximum level of care needs that equals 4 in the German healthcare system varies between 13 and 31 in the participating nursing homes.

Ethical approval for the study was granted by the Ethics Committee of the Faculty of Economics and Social Sciences at Eberhard Karls University Tübingen (no. AZ A2.5.4-096\_aa). The Ethics Committee granted an amendment to acknowledge adaptations of the study design (assessment procedure and instruments, inclusion of digital elements in assessments and counseling, safety measures to be taken to minimize the risk of COVID-19-spreading).

The collection and storage of personal data takes place in accordance with the European Data Protection Basic Regulation (DSGVO) and in coordination with the data protection officers of the institutions involved. Data is treated confidentially and processed pseudonymously. Prior to the COVID-19-related lockdown, home managers and staff were informed about the study. All participants gave written informed consent to participate in the study.

## Data Sources

### Interview Data

In the first week of the lockdown, we informed the nursing home management that we would like to contact them monthly *via* telephone to assess the current status at their nursing home. The timing of these telephone interviews was adapted to relevant changes in the regulations of the country and state. In these semistructured interviews, we focused on COVID-19-related

changes in the daily routines of nursing home staff and residents, the number of people suffering from an infection, the availability of protective equipment such as masks, and the general mood among staff members and residents. A semistructured interview guide was developed in such a way that COVID-19-related restrictions and their effects on nursing homes could be evaluated from the home administrators' perspectives. During the telephone interviews, the interviewer wrote down the answers of the home administrator in bullet points. Additional notes were supplemented from memory, immediately after the interview.

We conducted semistructured telephone-based qualitative interviews with  $N = 12$  executive staff (nursing home managers, care services managers). We interviewed  $N = 10$  female and  $N = 2$  male executive staff, with professional backgrounds in nursing, social work, and rehabilitation therapy. Their mean length of occupation in this position was 3.5 years, with a range of 1 to 10 years. Their mean age was 42 years ranging from 31 to 54 years. Each executive staff completed at least one semistructured telephone interview between March and June 2020. Interviews lasted between 10 and 25 min. DA conducted all interviews. She is a sport scientist with expertise in PA promotion in aging populations and had established trust and relationships with the staff of participating nursing homes. She had presented the overall BaSAIt study and the goals prior to COVID-19-related restrictions and had conducted, among other data collection, systematic observations in the nursing homes.

### Open-Ended Surveys

We developed an open-ended written survey to include the perspectives of staff, relatives/significant others, and external service providers. For staff, the survey covered aspects such as COVID-19-related restrictions on work, changes in daily routines, and the implementation of the contact restrictions issued by the BMG. With relatives of residents and external service providers, we mostly focused on the issue of contact restrictions. Eight weeks after the COVID-19-related lockdown, we sent the open-ended survey in paper-pencil format to three nursing homes that had agreed to participate in this data collection. A total of 66 surveys were handed out, 44 were returned to us, 24 filled out by staff, and 20 surveys by external partners (significant others/relatives, external service providers).

### Documents

During the first week of the lockdown, we asked the home management for documents that describe purpose and conditional programs of the nursing homes, such as care concepts and mission statements. In order to figure out the attribution of tasks to positions *via* communication means, we also asked for management plans and weekly activity plans of the nursing homes. The weekly activity plans included information on how often homes offered PA such as fall prevention or stool gymnastics. By comparing weekly activity plans before the lockdown with the information obtained during the lockdown, we were able to assess the impact of COVID-19 on PA opportunities for home residents.

## Data Analysis

We analyzed the data consisting of written materials from the telephone interviews, answers from the open-ended written surveys, and documents with a reflexive thematic analysis approach (Braun and Clarke, 2006, 2019). We started data analysis with the MAXQDA software (version 2018.2) already during data collection to identify new angles as well as unclear issues and adapted subsequent interviews accordingly.

We employed both a deductive and inductive approach to data analysis. DA (background in PA promotion in aging populations) mainly coded the data. AF and AT (backgrounds in organizational sociology and health promoting settings) conducted the analysis, together with DA. Deductively, we used an organizational theory perspective to analyze how nursing homes dealt with the impact of COVID-19-related restrictions. To assess the role PA promotion played in the homes before the pandemic, we screened the general documents of the homes regarding decision programs (i.e., care concepts, mission statements) and the premises regarding the specification and distribution of organizational task, the so-called communication structures (management plans, and weekly activity plans of the nursing homes). For this purpose, we applied a keyword search, using terms related to PA (e.g., movement, activity, mobilization, fall prevention, stool gymnastics etc.).

Inductive data analysis of the interview materials involved repeated reading of the material to obtain an overall picture. In a subsequent step, the data was coded, and potential themes were developed. These theme candidates were then checked in relation to the coded extracts and the overall data set (Braun and Clarke, 2006). This stage in the analytic process was followed by a preliminary definition of themes and subthemes based on analyses and interpretations of the entire data set.

In a subsequent step, the data was coded and potential themes were developed. These theme candidates were then checked in relation to the coded extracts and the overall data set. We used multiple triangulation (regarding data sources, time, space or concrete case, and persons) to allow us to create a thick description and establish trustworthiness and rigor of findings (Smith and McGannon, 2018). To increase rigor, we held repeated peer debriefings among DA, AF, and AT, acting as critical friends (Smith and McGannon, 2018), as well as with other coauthors to discuss analysis, preliminary themes, and interpretation of themes.

For interpretation of themes, we conducted both a descriptive manifest and a more comprehensive latent analysis (Graneheim and Lundman, 2004; Graneheim et al., 2017), the latter to seek patterns that could explain the statements and observations from an organizational theory perspective.

## RESULTS

In the following sections, we first give an overview on the stages of COVID-19 restriction measures. In a second step, we will present data on the question to which extent the impact of COVID-19 on PA promotion is manageable against the background of given organizational structures. In a third step, we analyze



which role the organizational culture plays in the management of COVID-19 effects on PA promotion. Thereby, we also present which strategies to counteract the impact of COVID-19-related restrictions on PA promotion do executive and nursing staff consider particularly promising.

## Organizational Stages in Consequence of COVID-19-Related Restrictions

Against the background of Lewin's model of organizational change (Lewin, 1951), we identified three stages of COVID-19-related changes in nursing homes that impacted PA promotion: (1) external closure and search for emergency control, (2) organizational adaptations to create a livable daily life in the internal environment, and (3) slow reintegration of interactions with the external organizational environment.

### Stage 1—External Closure and Search for Emergency Control

During the first stage of COVID-19-related restrictions, the Federal Ministry of Health and the state-level health authorities issued a complete ban of access to nursing homes, except for medical emergencies. This ban had a great impact on PA promotion. Due to the restrictions, volunteers and external service providers, such as physical therapists or trainers, were no longer granted access to the nursing homes to provide their services.

Relatives and significant others were also no longer able to access the homes to meet residents. In order to stay in contact, they had to use phone calls, very limited options for video-based meetings, or window conversations if possible.

Concerning the internal environment, nursing homes aimed to adapt their routines to meet COVID-19-related regulations. Apart from shared meals, such as lunch and dinner, group activities were canceled or relocated to take place outside, on terraces, with distance control. In addition, when a resident developed COVID-19 typical symptoms, all residents were isolated and joint activities were canceled. Concerning group activities, most homes had delegated PA promotion to external service providers, which resulted in group activities to drop-out of the focus of attention and reorganization. Therefore, most PA-related opportunities were canceled during this stage.

### Stage 2—Adaptations to Create a Livable Daily Life in the Internal Environment

During the second stage, residents were no longer allowed to leave the nursing homes. Group activities of any kind were prohibited. While the official restrictions by health authorities appeared to be stricter than in stage 1, the nursing homes became more active in adapting their daily routines to make the daily life more livable.

To make the daily life more livable again, nursing staff took over parts of the activities that had been offered by external service providers in the past. Executive staff reached out to significant others and the broader community to interact with residents *via* special events, such as balcony concerts and Easter greetings in various forms. While these attempts increased external social interactions of residents, the

internal interactions were still limited: regulations concerning distance-keeping measures, the wearing of facemasks, and contact limits had to be strictly followed. In addition to that, residents' activity radius was further limited to their room surroundings, which led to both restlessness and sedentary behavior.

*Residents who previously had taken active walks started to lose their physical condition and walking security. Residents with dementia increasingly become restless [staff 1, open-ended survey comment]*

In response to the continuation of the lockdown, further tightening of the restrictions and—relating thereto—prolonged inactivity of residents had visible effects not only regarding mobility patterns but also concerning mood-related expressions among residents. Nursing homes reacted and adapted their hygiene concepts to allow PA within clearly defined contexts: activities were carried out at distance in the courtyard. At the same time, staff acknowledged that those activities would not meet the same intensity and quality as organized offers by external providers would.

*In the living areas, attempts are being made to realize PA offers at a distance, but even this is not satisfactory. The added value is questionable if things such as fall prevention and gymnastics had previously been possible and now only very light and limited activation is possible [executive staff 1, interview].*

In addition to group-based activities, both nursing staff and executive staff went for individual walks with residents in the nursing homes' premises, particularly to meet the need to move among residents with dementia.

### Stage 3—Reintegration of External Environment

In the third stage, restrictions started to be loosened, particularly regarding the interaction with the external environment. With the reintegration of the external environment into the internal organizational environment, nursing homes had to deal with multi-fold organizational and logistical challenges. Each visitor had to be screened and residents had to be brought to the designed meeting areas. Meeting areas had to be disinfected after each visit and contacts had to be traced.

*A little busy at the moment, because visits are allowed again, but with that also increased organizing effort. Scheduling, cleaning, resident transport everything takes place in the cafeteria [executive staff 2, interview].*

Residents were again allowed to leave nursing homes but had to wear masks inside their nursing home in the following 2 weeks, which appeared to be particularly challenging for residents with cognitive impairment or respiratory illness. Visits were allowed again, though limited to certain areas within the nursing homes, with advance notice and in compliance with the hygiene concept. Consequently, visits

of external service providers were permitted again. Service providers could offer group activities, in compliance with hygiene with regulations such as distancing, ventilation, and contact limitations. However, this opening did not extend to PA promotion. Physical activities such as outdoor walks with significant others or volunteers, for example, still could not be realized.

## Impact of COVID-19 on PA Promotion-Related Formal Organizational Structures

### Lack of Formalization and Internal Delegation of PA Promotion

Document analysis revealed that PA promotion already before the COVID-19 pandemic had generally not been an element of decision programs, such as nursing care concepts and mission statements. While PA promotion also did not appear as an explicit task in internal staff work descriptions, it was mentioned in weekly activity plans. Here, mostly external service providers, such as physiotherapists or volunteers, offered group activities once or twice a week. In this sense, external providers functioned as proxies for internal positions. However, due to the fact that this assignment of PA-related tasks to external providers was not structurally anchored in decision programs, they were not sustainable but vulnerable to unforeseen events that would limit resources or, like in the case of the COVID-19 pandemic, would limit access to the homes.

Once the COVID-19 restrictions came into place, the external providers could not enter the nursing homes anymore. As a consequence, in the second stage of restrictions, nursing home staff started to take over PA promotion efforts.

*I trust in staff's creativity. [nursing home manager1, interview]*

However, in most nursing homes, staff did not have an official mandate to do so. The general practice was rather to hand PA promotion over to day-care workers and nursing staff, in the hope that they would resolve the matter to everyone's satisfaction.

*Day care workers and nursing home staff are trying to buffer everything. [executive staff 3, interview]*

The belief in staff to buffer competencies and apply creativity indicated that nursing home managers and executive staff thought PA promotion to be a task that could be fulfilled even if there was a lack of qualifications. Accordingly, the mental models of the executive staff regarding the promotion PA could be considered the main reason why PA promotion was not structurally anchored in decision premises.

After a while, some nursing homes adapted their strategies. They tried to continue the pre-COVID-19 weekly activity plans and delegated its execution to nursing staff.

*Group mentoring is taken over by staff. [nursing home management 2, interview]*

*We still try to keep residents active, in small groups of maximum 8 people or in individual activities seasons. [nursing home management 1, interview]*

*If activities are offered, then only in small groups and not across stations. [nursing home management 3, interview]*

The handing-over of PA promotion, however, did not happen in a clearly specified manner. Rather, personal knowledge and engagement of the nursing staff to promote PA promotion appropriately, was considered a functional equivalent to professional expertise trust by the executive staff<sup>2</sup>. This belief gave rise to a number of challenges: first, given the high fluctuation in nursing home staff, a lack of structurally fixed assignment of tasks to positions might result in a lack of sustainability, particularly if new staff had no knowledge or clear order to buffer activities that were usually offered by external providers. Second, to rely on the nursing staff to solve the problem would come to its limits if mistakes or refusal to perform the duties revealed that staff did not have the necessary knowledge, creativity, or level of personal engagement to execute PA promotion in a form and quality as external providers would have done.

PA promotion during the lockdown was not only hindered by an unspecific transfer of PA promotion to positions that normally have other functions but also characterized by a lack of monitoring of execution. The executive staff were aware of the additional workload linked to this delegation. They perceived it to be manageable to keep the residents as active and mobile as possible, without controlling whether this hand-over was working or not.

*Staff has to take on extra responsibilities, but it seems to work so far. [nursing home management 2, interview]*

This lack of organizing and monitoring of PA does not mean that PA promotion was not considered relevant. On the contrary, in some nursing homes, executive staff took over PA-related tasks by taking residents for walks on the premises to relieve nursing staff from this extra workload. Over time, the focus on residents' needs and well-being became even more important, as shown by attempts of executive staff to shift the workload focus from documentation of residents' status to activities for residents' well-being. The fact that documentation was considered unimportant is further proof that the quality of the implementation of PA promotion is basically rather a random product than the result of organizational planning.

*The well-being of the residents is our top priority. Documentation? Only what is important for the public health department. [home management 4, interview]*

<sup>2</sup>This is similar to the practice how tasks are assigned to persons in voluntary organizations (see Thiel and Mayer, 2009).

## Sticking to Formalized Mealtimes and Set-Ups Provides Room for PA and Social Interaction

*At the moment, group activities, such as lunches, are still possible, but most of the other activities are unfortunately canceled. [executive staff 1, interview]*

For the executive staff, adherence to formalized mealtimes and set-ups provided a daily structure to allow social contacts despite regulations for physical distancing. In addition, shared meals offered one of the few opportunities for PA since lunches and dinners tended to be served in an area separated from residents' rooms. Hence, the residents were at least forced to leave their room and make their way to the dining rooms.

*Daily structure will be as preserved as possible. Dinners will be held together. [nursing home management 4, interview]*

The relevance of shared meals for both staff and residents became even more visible when this activity had to stop due to isolation measures to be taken in case of COVID-19-like symptoms. Staff reported that the isolation measures, following from such a suspicion, affected all residents, which turned out to be a multi-fold challenge, not only concerning food supply but also concerning the overall logistical workload.

*Four days of complete isolation from all residents was the nightmare, both logistically and food-wise. [nursing home management 1, interview]*

On the other hand, shared meals also provided room and time for other activities, such as mobilization or individual walks, to take place. Isolation also led to one-to-one activation in the residents' individual rooms. In this sense, isolation provided the chance to mobilize the residents inhouse just because many other activities, particularly group activities, were not possible.

*In some cases, instead of group activations, there were one-on-one activations in residents' rooms. Apart from that, I didn't notice much. [staff 9, open-ended survey comment]*

## Impact of COVID-19 on PA Promotion-Related Organizational Culture Organizational Climate—the Relevance of Informal Services of the External Environment

Some visitors compared the COVID-19-related restrictions in nursing homes to an imprisonment, with all entailed consequences.

*There is a lack of social contacts. The last straw to which the residents cling is no longer available. A condition that is no longer sustainable. A comparison with an old people's prison is not far off. [significant other 1, open-ended survey comment]*

These pessimistic descriptions of the situation reflected that staff's efforts to make the nursing homes livable environments during the lockdown were not visible for residents' significant

others. Instead, officially communicated COVID-19-related restrictions (e.g., prohibition of visits or limited time and numbers of contacts) suggested that the institutions were exclusively concerned with the prevention of infections and less with residents' psychological and social well-being. From an outsider perspective, this was obviously difficult to accept.

*The situation is not satisfactory for the visitors. [significant other 2, open-ended survey comment]*

Being no longer able to enter the homes, significant others perceived only very limited "snapshots" of the daily life inside the organization, because daily routines and additional efforts of the nursing staff to activate the residents could not be observed during quarantine. This was also the case during stage 3, when significant others were still exposed to strict controls and time limits. For example, residents had to be picked up and brought to their relatives by the nursing staff, which also made it impossible for visitors to gain an insight into everyday life within the nursing homes.

The significant others' perception of the organizational climate as an only functionally oriented system was strongly influenced by the idea that significant others were the residents' only social contacts. They did not perceive interactions between residents or with nursing staff as social contacts or those interactions were not at outsiders' center of attention during COVID-19-related restrictions.

*It is filled with much sadness. Much contact is no longer possible. We miss our mother. It's almost impossible to know how she's doing. It's all about feeling and physical contact. [significant other 4, open-ended survey comment]*

In this context, the rule to wear a mask often appeared to be perceived less as a medical necessity than as an amplifier to residents' isolation.

*It is an adjustment, as social contacts are enormously limited. Wearing the protective mask is uncomfortable. As a single person, there is a sense of loneliness. [significant other 3, open-ended survey comment]*

## Organizational Climate—Immense Workload Must Be Managed by Informal Arrangements

Most executive and nursing staff believed their organization to be able to cope with the new situation by mobilizing additional efforts. However, staff also emphasized that the pandemic had created a whole series of new tasks that had not been foreseen in any way. From the perspective of the nursing staff, a fundamental problem was that the exclusion of visitors led to a shift of responsibility regarding the residents' well-being. Given the importance of providing emotional support to residents for their well-being, nursing staff stressed that they now had to take on this important task themselves.

*We must "catch" the residents. [staff, open-ended survey comment]*

In this regard, informal organizational routines were considered a relevant factor. According to the nursing staff, the organizational climate, typically is characterized by a constant lack of time. This was particularly noticeable in the time of the pandemic when additional burdens already resulted from the necessity to comply with hygiene regulations.

*Work becomes more exhausting when wearing a mask, more breaks are needed. [staff 4, open-ended survey comment]*  
*Additional workload caused by room isolation of the residents. [staff 5, open-ended survey comment]*  
*Increased workload due to compliance with hygiene regulations. [staff 6, open-ended survey comment]*

Lack of time affected all areas of responsibility in nursing homes during the COVID-19 pandemic: care work for residents, group activities that had to be taken over from external providers, the consideration of COVID-19-related regulations in their work, and juggling work-life balance due to consequences of COVID-19 restrictions, such as home-schooling duties and childcare responsibilities in times of facility closure. A staff member summed up the time-responsibility dilemma during the lockdown very succinctly with the following statement:

*Little time → take care of many residents. [staff 3, open-ended survey comment]*

A basic problem was, according to the nursing staff, that the additional work caused by the pandemic had to be dealt with on the basis of already scarce existing time resources. This was attributed to a considerable extent to given organizational routines, which did not change through COVID-19-related restrictions but remained as (bad as) before.

*Time management has not changed due to Corona, it is as bad as before. [staff 8, open-ended survey comment]*

The statements of the nursing staff indicated that the “weaknesses of formalized decision premises could not be absorbed by informal arrangements.” Considering that the division of labor and the delegation of tasks had already been underdeveloped before the pandemic, the employees were forced to improvisatory solve the newly emerging tasks. This was also true regarding the integration of PA into the daily routine.

### Organizational Climate—Mobilization Is Key, PA Not So Much

The PA-related organizational climate, as part of the culture of the organization, mirrored a diffuse collective idea of the importance of PA within the nursing homes. Our analyses show that PA was, in principle, regarded as very important for the residents' well-being. Thereby, staff were less concerned about the biological health of the residents than about the psychosocial strains that went along with the COVID-19-related isolation.

*(We) started going outside this week with individual residents to avoid camp fever, wearing masks and so on. [staff 2, interview]*

Apart of this, PA promotion equated individual mobilization only.

*In some cases, instead of group activations, there were one-on-one activations in residents' rooms. Apart from that, I didn't notice much. [staff 9, open-ended survey comment]*

In this context, the lack of formal regulations for PA promotion became obvious once again. By entrusting PA promotion solely to the nursing staff without saying exactly what should be done, any activation was largely limited to aspects that were considered important under the terms of the training of nurses. Individual mobilization was a basic part of the nurses' education and training and was accordingly described as one of the main foci during their daily care routines. Mobilization usually encompassed activities such as getting residents out of bed daily and promoting daily activities, such as tooth-brushing. For the nursing staff, PA promotion during the pandemic primarily was to integrate elements of physical therapy into mobilization routines.

However, some elements of individual mobilization, particularly outdoor walks, were used to substitute missing physical elements of patient-centered care. Patient-centered care was considered a core organizational goal in some nursing homes. According to nursing staff, these informal substitutes seemed to make closeness and physical contact possible. However, the replacement of lost physical interaction only partially was feasible due to the regulations on physical distancing.

*Furthermore, outdoor walks are again possible, with a relative at a distance and a nurse. On the terrace in the garden, contact with relatives has been made all the time again. Nevertheless, the kind of volunteers and the usual closeness with hugging is missing. Not only for the residents also for the staff. [nursing home management 5, interview]*

Taken together, staff and significant others mentioned several times that the potentially positive benefits of broader PA promotion at physiological, psychological, and social levels of health and well-being. With regard to the pandemic, they also highlighted examples of negative effects associated with current levels of inactivity in the nursing homes, such as physical decline, fatigue, mood swings, or depression.

*Physical decline with increased risk of falling. [staff 11, open-end survey comment]*

*Very, very much, the residents are extremely tired, after small activations they already say they are tired. Their movements are massively restricted. [staff 10, open-ended survey comment]*

*In some cases, after the long quarantine period, residents are somewhat more 'immobile', not only physically. So much that worked before Corona does no longer work or only to a limited extent. [significant other 5, open-ended survey comment]*

*I can observe a mental and physical breakdown process in my mother. She moves much slower and her thinking and speech performance has decreased. The lack of closeness and physical contact, as well as the activity, she has stopped. It paralyzes her*



*joy of life and leads to depressive attacks. [significant other 6, open-ended survey comment]*

*Residents' physical activity radius is much smaller than normal. This leads to more interaction between dementia patients, which does not lead to any positive interactions, but rather to cabin fever. [executive staff 1, interview]*

However, this knowledge of the need for and benefits of PA promotion did not automatically lead to a change of nursing staff's code of conduct. Rather than explicitly incorporating PA promotion as part of the nurses' formal routines, both executive and nursing staff solely externalized this task to external service providers, leaving open the time, scope, and frequency of such measures.

*It's now possible that the physiotherapist will come to our home. That means there are sports/activities twice a week. [nursing home management 5, interview]*

## DISCUSSION

### Organizational Coping With the COVID-19 Pandemic

Our study analyzed how COVID-19 restrictions impacted PA-related organizational structures in a selected sample of nursing homes in Germany. We identified three different stages in which the staff had to deal with pandemic-related restrictions. These stages cover external closure and search for emergency control, internal adaptation to make daily life livable in the internal environment and, later on, adaptations to reintegrate the external environment.

At first glance, our findings suggest that the reactions of staff members to COVID-19 restrictions follow Lewin's stage model of organizational change (Lewin, 1951). During the first stage, nursing homes seemed to be very insecure in how to address COVID-19 restrictions, unaware of potential progress toward change or counteracting impacts. During the second stage, nursing homes responded to make the internal environment livable again by buffering the external contacts and activities that had been lost due to restrictions. During the third and final stage of organizational change, some changes within staff's mental models could be observed, for example, with regard to the relevance of PA for residents' biopsychosocial well-being. This phase is still in development, given the continuously changing challenges of the ongoing pandemic.

From the perspective of our organizational sociological framework (Luhmann, 2000; Thiel and Meier, 2004; Rütten et al., 2009; Thiel and Mayer, 2009), however, nursing homes could not sustainably respond to the Corona pandemic in the matter of PA promotion due to their structural conditions. During the lockdown, nursing homes were particularly challenged with contradictory requirements in their daily routines in terms of maintaining organizational effectiveness and legitimacy (cf. Dimaggio and Powell, 1983; Colignon, 2007). Nursing home do not only lack PA-related decision programs but also appropriate

communication means. PA promotion only is a marginal element of organizational routines. Since PA promotion is not explicit part of purpose programs, such as mission statements part and care concepts, PA at best is mostly a side-effect of activities that have different goals. Since the pandemic was unforeseeable, there had also been no conditional programs on how to compensate for activities "in motion" that would be eliminated by the lockdown. The analysis also shows that given communication means in nursing homes, such as management plans and weekly activity plans, had even before the pandemic not included the formalization and delegation of tasks related to the promotion of PA. Herein, our findings are in line with other research on effectively managed information and communication as decisive organizational factors to implementing change in healthcare settings (Li et al., 2018).

The lacking division of labor regarding PA promotion therefore resulted in an immediate stop of PA-related activities. The attempts to reorganize PA promotion were accordingly slow. Finally, typical personnel decisions in nursing home primarily focused on the aspect of patient care. This is understandable, as it cannot be expected that nursing staff are educated in terms of residents' appropriate physical activation. Accordingly, tasks related to PA promotion are normally outsourced to external providers and could not be entirely substituted by the nursing staff during the lockdown.

Our analyses of the organizational culture in nursing homes showed that the organizational climate in the institutions studied is characterized by an informal demand for patients' mobilization and social integration. However, it turned out that the understanding of mobilization was less that of "getting the patient moving," but rather moving the (rather passive) patient around in a one-to-one interaction between caretakers and residents. Due to the collective belief that there was a lack of time resources in practically every respect, the organizational climate in the nursing homes was not favorable to broader PA promotion, particularly against the background of restrictions linked to the COVID-19 pandemic. Our findings reflect those of other studies in this respect. Heavy workloads, insufficient staffing on care routines, and lack of dedicating staff to implement specific activities, decrease the chances of those activities to be performed (Li et al., 2018).

The nursing homes tried to solve these challenges by carrying out effective operations on the informal level independently of the formal structure. Nursing staff took over responsibility for physically activating residents because they realized negative effects of physical inactivity, but this assumption of responsibility came about of the discretion of the staff members themselves. Those staff members acted as "champions" within their organizations (Li et al., 2018). Hence, nursing homes reorganized work and informally delegated PA-related tasks to nursing staff to counteract perceived negative effects of physical inactivity among residents. Nonetheless, the executive staff were aware that those attempts could not meet the amount, intensity, and quality of PA that had been offered by external providers prior to the COVID-19 pandemic.

Contribution to the Research on the Impact of COVID-19 on PA in Nursing Homes Given the acuteness of this study, the body of research that already has addressed COVID-19 impacts on nursing homes from an organizational sociological perspective is very limited; this is even more true when it comes to impacts on PA promotion in nursing homes. However, our findings appear to echo studies' findings on nursing care systems during COVID-19 which were based on a different theoretical perspective. Hower et al., for example, found out that the German nursing care system had already been at the limit of its capacity prior to the pandemic and that COVID-19 posed an additional challenge and burden on the system (Hower et al., 2020). They concluded that the demand posed on nursing staff for compensation of Corona-related restrictions went beyond physical care, but also included tasks such as quality control and documentation, compensation of staff shortage, or reorganization of social contacts and interactions with significant others *via* videoconferences or window visits (Hower et al., 2020). At the same time, their study came to similar conclusions as ours, namely that the personnel radiated a lot of optimism with regard to their coping abilities with the dynamically changing internal and external environments.

Our study did not explicitly consider the perspective of residents, apart from their function as service recipients. Nevertheless, our findings relate to the results of other studies that included interviews with residents. For example, although nursing home can be considered the residents' "hub of life" (Fänge and Ivanoff, 2009), those residents who are affected by (in our case, Corona-related) restrictions and regulations do not have a stake in how to address or counteract the impacts of those restrictions, why being a nursing home resident often goes along with a loss of self-determination and agency (Goffman, 1961; Hauge and Heggen, 2008).

Since early summer 2020, some states in Germany, such as Baden-Württemberg, where our study took place, have already partly taken back contact restrictions. Visiting regulations in nursing homes have been eased in order to counteract social isolation. However, as shown in our study, these relaxations are accompanied by many uncertainties and do not necessarily follow elaborated conditional programs. On the contrary, additional hygiene measures are installed to prevent an increased risk of infection. The volatility of the pandemic makes it necessary to constantly weigh up risks of infection and social isolation—for residents, as well as for relatives and caregivers. Consequently, any opening results in additional burden at the organizational and logistical level. Against this background, it remains to be seen how long the executive and nursing staffs retain their belief in the organizational coping skills of the institutions we investigated.

## Study Strengths and Limitations

The following limitations and strengths should be considered when interpreting the results of this study. Our goal was to contribute to a more nuanced understanding and theory-based explanation how nursing homes cope with the impacts of

COVID-19 restrictions on PA promotion within the institutions. Against the background of constantly changing conditions, the results should be regarded as time and context specific. In line with the theoretical perspective of this paper, we focused only on the organizational perspective. There had been two reasons for excluding the residents' voice. First of all, we did not get access to the residents during the lockdown; therefore, it was not manageable to interview them. The lockdown prevented on-site interviews; interviews by phone or video-conference formats were not feasible due to technical issues (lack of Internet access in the homes) or residents' conditions (hearing/cognitive impairments). Furthermore, residents represent, from an organizational sociological perspective, the internal environment of the organization. In other words, they are recipients of the organization's services and thus do not reflect the perspective of the organization itself. In principle, it would have been very interesting to examine the extent to which the needs of the residents correspond to the perception of their needs by the organizational roles. However, since—on the one hand—this question was not at the core of our analysis and—on the other hand—access to the residents was not possible anyway, we excluded this aspect from this study.

Residents' voice and agency will play an important role in the main BaSAlt study (Thiel and al., submitted). Thereby, we will conduct photovoice documentation and analysis as well as focus groups with residents to identify their perceptions of options for and barriers to PA promotion (Thiel, Sudeck, Nieß, Eschweiler, Altmeier and Haigis, submitted).

We are convinced that our findings provide important insights into how care institutions deal with unforeseen events that lead to a rescheduling of everyday routines. This is particularly true in view of the fact that that our findings are consistent across the researched homes. This enables us to identify strengths and weaknesses in organizational routines when it comes to PA promotion in general and under unforeseen circumstances.

A limitation of our study is that although we analyzed a theoretically sound sample of nursing homes, we could only research those which had agreed to participate in the main BaSAlt study on PA promotion in nursing homes prior to the COVID-19 pandemic. Thereby, a response rate of 2/3 for the distributed written surveys appears to be at a rather good level, especially given the challenges and restrictions linked to the COVID-19 pandemic. Nevertheless, the situation in the nursing homes investigated might be significantly different from those who had chosen not to apply to participate in the BaSAlt study. We assume that the nursing homes investigated have both a particularly motivated and well-organized personnel.

## Practical Implications

This study has implications for practice and policy. At practice level, executive staff in nursing homes should become aware that sustainable, effective PA promotion needs to be incorporated into organizational structures,

such as mission statement, care concepts, job descriptions, and weekly activity plans. To be able to respond with unforeseen crises, such as the COVID-19 pandemic, nursing homes should also develop conditional programs, more precisely, “if-then guidelines,” that provide strategic orientation for the continuation of relevant practices in critical situations.

At a policy level, the study implicates a need to negotiate resources between care-centered and bureaucratic activities in nursing homes. Increasing organizational, logistical, and bureaucratic demands linked to a challenge such as the COVID-19 pandemic will ultimately lead to losses in care-centered activities if not compensated for. PA promotion, as a by-sided activity, will be among the first activities to be lost—even though in the long run it might result in deteriorating biopsychosocial effects.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study can be requested via e-mail to the corresponding author.

## ETHICS STATEMENT

Ethical approval for the study was granted by the Ethics Committee of the Faculty of Economics and Social Sciences at Eberhard Karls University Tübingen (no. AZ A2.5.4-096\_aa). The Ethics Committee granted an amendment to acknowledge adaptations of the study design (assessment procedure and instruments, inclusion of digital elements in assessments and counseling, safety measures to be taken to minimize the risk of COVID-19-spreading). The collection and storage of personal data takes place in accordance with the European Data Protection Basic Regulation (DSGVO) and in coordination with the data protection officers of the institutions involved. Data is treated confidentially and processed pseudonymously. Prior to the COVID-19-related lockdown, home managers and staff were

informed about the study. All participants gave written informed consent to participate in the study.

## AUTHOR CONTRIBUTIONS

AT, GS, AN, GE, and AF contributed to the conception and design of the overall BaSAlt study. AF, DA, HGra, and AT contributed to the concept and design of the substudy for this paper. DA, HGro, and AF collected data. DA, AF, and AT analyzed data. AF and AT wrote the first draft of the manuscript. DA, HGro, and JJ wrote sections of the manuscript. All authors contributed to critical manuscript revision, read, 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/fspor.2020.589214/full#supplementary-material>

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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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# Youth Sport and COVID-19: Contextual, Methodological, and Practical Considerations

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## INTRODUCTION

One of the growing concerns among youth sport stakeholders is how the COVID-19 pandemic will shape youth sport development. Given the novelty and rapidly changing nature of these events, the impacts on development are not yet clear. Thus, to gain a deeper understanding of the impact of this crisis, it is crucial for researchers and practitioners to examine the effects on youth development at different timescales. Although we are seeing immediate changes in the activities, social dynamics, and settings that are influencing youth's real-time experiences, questions remain regarding its influence on short-, and long-term developmental outcomes (Kelly et al., 2020). Moving forward, we will need to be cognizant of how this watershed moment will shape youth sport development for months and years to come. As such, this opinion article will focus on exploring potential contextual, methodological, and practical considerations that may be relevant as we navigate through these uncertain times. Further, we hope to encourage researchers and practitioners to embrace this as an opportunity to critically reflect and evaluate the existing practice of youth sport.

## CONTEXTUAL CONSIDERATIONS

Since sport is an activity involving skill and physical exertion, whereby an individual or team gather to compete against each other for the purpose of enjoyment and performance, this moment is perhaps the first-time key stakeholders in youth sport have been required to engage in virtual provisions. Through this shift from face-to-face to virtual sport, we have also gained a new perspective of our social dynamics: the colliding of our sport and personal selves. Coaches, parents, and athletes are now seeing each other's homes, families, and pets in an unprecedented manner. We are also seeing the tensions that can arise from the collision of these multiple roles. As researchers and practitioners, we need to recognize that tensions between these roles are inevitable and that they are the result of an important fact: youth sport coaches, officials, administrators, parents, and athletes (amongst others) are all people beyond the sport environment.

It is thus more important than ever to adopt a person-centered approach, in which we recognize and value the roles and responsibilities of youth sport stakeholders beyond the sport context. At the centerpiece of this person-centered approach lies the athlete-centered focus on the child and their development. Refining and redefining social dynamics in youth sport provides an opportunity for us to ensure that interpersonal adult actions and interactions support the growth and experience of youth. It would thus be beneficial to document and share the ways key stakeholders are adapting

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during this time (e.g., supporting youth-led activities, aiding with technology and virtual sport sessions, researching strategies to safely engage in sport activities), so that we can continue to foster quality relationships between parents, coaches, and youth sport organizations.

One of the unique aspects of COVID-19 is its global scale. Youth sport around the world is being affected by this pandemic. However, each person's experiences are shaped by several contextual factors (e.g., demographics, country, cultural norms). For example, different countries (e.g., the UK vs. the USA vs. Sweden vs. South Korea), experienced different degrees of lockdown and accompanying restrictions on youth sport and physical activity, different levels of popular support for social distancing measures, as well as different timescales and protocols for return to play. Furthermore, although sport is a popular activity among youth all over the world, organizational structures can vary from country to country depending on the resources that are available (e.g., human, natural, and capital). As such, we need to ensure our research, programmes, and policies reflect this diverse representation of experiences and cultures.

A range of socioeconomic and cultural inequalities have been magnified during the COVID-19 pandemic (Evans et al., 2020). For example, Power et al. (2020) explain how COVID-19 has worsened inequalities between privileged and disadvantaged groups in the UK system of food supply and distribution. Furthermore, Laster Pirtle (2020) illustrates how racial capitalism is a fundamental cause of the ethnic and socioeconomic inequities presented during the COVID-19 pandemic in the USA. More specifically, the author uses the over-representation of black deaths reported in Detroit, Michigan, due to COVID-19 to portray the racial inequalities that are embedded throughout our societies.

As such, we also need to acknowledge how this pandemic will disproportionately affect segments of the sport community. Indeed, this crisis has shined a light on several of the cracks that have always existed in the sport system. Inequities based on gender, age, socioeconomic status, and level of ability, have all been exacerbated by this situation. As such, there is a significant risk for “Matthew effects” (Merton, 1968), which relates to the common notion of “the rich get richer and the poor get poorer.” These effects highlight that those with initial advantages based on gender, age, socioeconomic status, and level of ability, may be similarly advantaged during this crisis. For example, families with higher levels of income and job security may be more likely to live and work in settings that are conducive to both physical distancing and sport participation. These families may also be better able to withstand the detrimental effects of COVID-19 on the global economy and may be poised to re-engage with the youth sport system when sports resume. Thus, as we navigate this crisis, it will be important to ensure that steps are being taken to account for and address the inequities in our sport communities.

## METHODOLOGICAL CONSIDERATIONS

To develop programmes and policies to effectively facilitate positive outcomes during these unique circumstances, it will

be crucial for researchers and practitioners to work together. The effects of this pandemic are being experienced in real-time. As such, researchers and practitioners will need to find creative ways to engage with each other to ensure that we are getting the right information, to the right people, in the right format, at the right time. To achieve this, we can embrace new ways of collaboration, such as harmonized data collection and rapid approaches to knowledge development, synthesis, and dissemination. We can also embrace the value of diverse perspectives and methodological approaches. The number of articles being published on COVID-19 is growing each day. However, we need to find ways of applying that knowledge in real-world settings. Finding ways to quickly synthesize these findings into practical tools that can be used to improve the quality of youth sport will be pivotal. As we move forward, it will be important for researchers and practitioners to develop new ways of capturing the immediate, short-, and long-term effects of this pandemic.

To sufficiently enhance our understanding of the impact of COVID-19 on youth sport development during these timescales (e.g., immediate, short-, long-term), the access to and feedback from key stakeholders (e.g., athletes, parents, coaches, administrators) employed in real-world settings is crucial. For instance, although we subjectively offer key considerations, without the knowledge and collaboration with sports clubs and organizations, the implications of COVID-19 on youth sport will remain inconclusive. Further, since COVID-19 has affected youth sport on a global scale, extensive participant recruitment for large sample sizes will also be required to offer a broad representation and not presume individuals as homogeneous. A potential solution to this issue is the creation of international research groups to explore the implications of COVID-19 on youth sport.

Indeed, in light of this, the authors have collectively begun to collaborate with multiple sports clubs and organizations across the world, to generate a large database for the impending “(Re)Imagining Youth Sport: The COVID-19 Lockdown” project (BCU, 2020). This project is a 3-phase examination of the current and future effects of the COVID-19 pandemic on youth sports in society, targeted at youth sport parents, coaches, and administrators worldwide. Phase 1 is currently underway and involves an online international survey of three key stakeholder groups (i.e., youth sport parents, coaches, and administrators; currently at ~500 responses from 18 countries across six continents). Phase 2 involves virtual one-on-one qualitative interviews with all three stakeholder groups to explore survey participants' responses in greater depth. Phase 3 will involve a 6-month follow-up online survey to examine participants' experiences as youth sport is gradually re-introduced. Taken together, the three phases of the project are framed as a practically-oriented needs assessment to inform future real-world knowledge mobilization efforts by youth sport organizations and their supporting communities. To this end, the project attempts to address two guiding research questions:

- 1) *How are youth sport stakeholders experiencing the removal of Organized youth sports due to the COVID-19 pandemic?*

2) *How, and to what degree (if at all), do these stakeholders want and need youth sports to be different when they return after the pandemic?*

Utilizing a range of survey and interview approaches, this study was designed not only to gather and examine multiple perspectives on the past and future of youth sport but also to prompt parents, coaches, and administrators to leverage this opportunity to reflect on, reimagine, and plan for a “new and improved” youth sport experience. As such, the authors welcome any interest from parties around the world wishing to collaborate and enhance this database further in pursuit of this goal. We would also like to acknowledge a number of other researchers are similarly exploring related issues. For example, in the USA (though not an exhaustive list), Dr Jennifer Agans at Pennsylvania State University (Vest Ettekal and Agans, 2020), Dr Tim McGuine at the University of Wisconsin (WSN, 2020), and Dr Travis Dorsch at Utah State University (Project Play, 2020), are all leading collaborative research projects examining aspects of COVID-19 and youth sport.

## PRACTICAL CONSIDERATIONS

Return to play provisions are at the top of organizational agendas during this unprecedented time (Pierce et al., 2020). As such, developing a safe return is paramount in the immediate future to ensure young athletes are not exposed to the spread of COVID-19 (see, for example, Department for Digital Culture Media Sport, 2020). Indeed, by feeling safe, sport environments can promote exploration, creativity, and a sense of security (Lerner et al., 2000; NRCIM, 2002). In addition, when sport was forced to shut down, we were faced with an uncomfortable reality. While beloved by millions, sport is not “essential.” Perhaps being confronted with this truth may enable us to keep sport in perspective. Safety and family do not have to be incompatible with sport success. We thus must strive to create better activities, social dynamics, and settings that foster all three to facilitate greater positive youth development outcomes.

As highlighted throughout this opinion, COVID-19 will have important implications for nearly every facet of the youth sport system, with changes to sport system becoming inevitable. It is also important to acknowledge that these changes may carry significant practical, financial, and health costs for youth sport stakeholders. As such, programmes and policies should focus on minimizing these secondary effects of this crisis and ensure we are creating safe and equitable youth sport environments. To achieve this goal, it may be useful to draw upon existing evidence-based recommendations for facilitating development in sport. In 2016, Côté and Hancock proposed 10 recommendations for designing youth sport programmes (Côté and Hancock, 2016). These recommendations included prioritizing sport activities that emphasize fun and short-term rewards, facilitating play-based and youth-led activities, and limiting the length of season and travel requirements. By drawing upon such recommendations, researchers, and practitioners can develop programmes and policies that will be relevant and beneficial both now and in the future.

Interestingly, many of these recommendations may be applicable within the COVID-19 context. For instance, this crisis offers an opportunity to shift our focus from practice-based, adult-led activities to play-based, youth-led activities, as well as restricting travel and promoting a cost effective approach, to focus on the quality of youth’s immediate sport experiences. Previous research suggests that an increased accumulation of youth-led activities, such as deliberate play, can positively influence athletes’ long-term participation, performance, and personal development (e.g., Côté and Erickson, 2015). Furthermore, youth-directed, practice-oriented activities, such as “spontaneous practice” in which young people independently engage in self-directed sport activities with skill improvement as the primary objective, may be particularly salient under lockdown conditions (Kelly et al., 2020).

In an ideal world, members of the youth sport community will continue to engage in youth sport throughout this crisis and into the future (Drummond et al., 2020). However, we need to acknowledge the potential challenges and difficulties of this crisis. For example, recent studies highlight how fears and uncertainty regarding COVID-19 can negatively influence psychological well-being, including anxiety, depression, and social isolation (e.g., BCU, 2020; ESPN, 2020; WSN, 2020). Further, our motivation or opportunity to participate in youth sport may be negatively affected by COVID-19. Because of this crisis, youth sport athletes, coaches, parents, and organizations may need to step back or dropout of sport for a time. Thus, throughout the lifecycle of this pandemic, we need to provide support and opportunities for individuals to get involved or re-engage with youth sport in the immediate, short-, and long-term. By providing such opportunities, we can positively influence the development of current and future youth sport participants.

## CONCLUSION

The unique circumstances surrounding COVID-19 offer an opportunity to reflect on existing youth sport provision. What defines a “real” sport? What are those key ingredients needed for sport to occur? Sport systems can often be resistant to change because this “is how we’ve always done it.” Now is the time to challenge that approach. Sports are not naturally occurring phenomenon—they are created by people. As such, they can be changed by people. We can choose to adapt sports to meet the needs of those who want to participate. More specifically, we can change what and how we engage in youth sport activities, how we interact with peers, coaches, parents, and communities, and the environments where we engage in sport. This leads us to perhaps the most important question: if we cannot make these changes now, then when?

## AUTHOR CONTRIBUTIONS

AK and JT wrote the opinion article with the assistance of KE and SP. All authors contributed to the article and approved the submitted version.

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# Detraining Effects Prevention: A New Rising Challenge for Athletes

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## INTRODUCTION

The newly discovered coronavirus (SARS-CoV-2) has caused an infectious disease of pandemic proportion called coronavirus 2019 disease (COVID-19). The absence of an effective vaccine for the COVID-19 disease has led many National and International authorities to take some prompt strict measurements to reduce the risk of infection, including closing non-essential activities and forcing individuals to stay at home. Accordingly, several sport events have been canceled and/or postponed and, hundreds of thousands of amateur and professional athletes worldwide have abruptly been forced to train at home. As a consequence, athletes had to face an unprecedented and relatively long-term reduction or cessation in their training routine along with a substantial cutting of their physical daily activities. Such changes may result in a significant decay of the quantity and worsening of the quality of training stimuli, making athletes exposed to some potential levels of detraining (i.e., “partial or complete loss of training-induced anatomical, physiological and performance adaptations”; Mujika and Padilla, 2000b) and to increased risks of injury. Thus, sport scientists, coaches and exercise physiologists worldwide had to deal with a novel challenge consisting in how to minimize potential detraining effects induced by home confinement.

Detraining prevention can be defined as a set of physical training strategies aimed at limiting and/or counteracting detraining effects. The prevention of detraining processes is a fairly new concept, which so far has mainly been addressed in the field of occupational physiology. For instance, a large body of literature has focused on understanding strategies used to counteract detraining processes associated with prolonged exposure to microgravity in astronauts (Hargens et al., 2013; Hackney et al., 2015). Some studies have also investigated the effects of reduced training stimuli on physical performance in athletes (Neufer, 1989; Rietjens et al., 2001; García-Pallarés et al., 2009, 2010; Ormsbee and Arciero, 2012; Joo, 2018). However, these are limited and controversial and they can only provide indirect information on detraining prevention strategies. For example, whereas 21 days of training-stimuli reduction (continuous and intermittent endurance training, 3 days/week) seem to counteract detraining effects (Rietjens et al., 2001), impairments on endurance performance, resting metabolic rate, body weight and composition have been found following 35–42 days of light-moderate exercise (<6.0 METS, 3 days/week) (Ormsbee and Arciero, 2012). Moreover, the training strategies used in these studies are often non-compatible with home-based-training settings as athletes might not have easy access to specific tools/equipment and sport facilities. Yet, the most effective training frequency, volume and intensity as well as exercise modalities to use for preventing detraining are still unknown. Therefore, considering the lack of a COVID-19 vaccine and the possibility that similar home-confinement scenarios would present again, identifying the most effective strategies to minimize detraining effects represents a current

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priority. To help with this purpose, this brief report illustrates the potential morphological, physiological and functional changes induced by home-confinement. Additionally, specific issues associated with injured athletes have also been discussed.

## POTENTIAL MORPHOLOGICAL, PHYSIOLOGICAL AND FUNCTIONAL CHANGES DUE TO COVID-19-INDUCED DETRAINING

To identify an optimal detraining prevention strategy, it is important to determine the main detraining-induced morphological, physiological, and functional adaptations. Training cessation leads to changes in  $\text{VO}_{2\text{max}}$  during both short- ( $\leq 4$  weeks) and long-term ( $\geq 4$  weeks) periods (Mujika and Padilla, 2000a,b). Reductions in  $\text{VO}_{2\text{max}}$  seem to be progressive and proportional to individuals' fitness level (Mujika and Padilla, 2000a,b). However, although the  $\text{VO}_{2\text{max}}$  magnitude is often considered an indirect marker of endurance capacity, its changes may not directly be correlated to endurance performance alterations. For example, it has been found that expansions in blood volume can partially reestablish  $\text{VO}_{2\text{max}}$  losses following a period of training cessation; nonetheless, this manipulation was not able to compensate for endurance performance decrements (Coyle et al., 1986). Moreover, 4 weeks of training cessation have been shown to decrease performance during a time to exhaustion test (TTE) without affecting  $\text{VO}_{2\text{max}}$  in well-trained endurance athletes (Madsen et al., 1993; Pedlar et al., 2018). Impairments in endurance performance have also been found during 12–35 days of training cessation in both running and cycling incremental tests (Coyle et al., 1986; Houmard et al., 1992, 1993), a Yo-Yo intermittent-test (Joo, 2018), a 3,000-m running time trial (Pereira et al., 2016) and a cycling TTE (Madsen et al., 1993).

At the muscle level, the relatively short half-life of mitochondrial proteins ( $\sim 1$  week) (Hood, 2001) may cause decrements in mitochondrial function and capacity after a short period of training cessation. In line with this, decrements in muscle oxidative capacity (Coyle et al., 1985; Gjøvaag and Dahl, 2008) and reductions in mitochondrial enzyme activities (Coyle et al., 1985; Wibom et al., 1992) have been found after few days/weeks of training cessation. Non-systematic changes have been observed in glycolytic enzymes quantity and activity (Mujika and Padilla, 2001) whereas, reductions in muscle capillary density have been reported after 4–8 weeks of training cessation (Klausen et al., 1981).

Training stimuli cessation and the consequent decline in plasma volume, which may occur after 2 days of inactivity (Thompson et al., 1984; Cullinane et al., 1986), lead to a reduced cardiac preload, which in turn triggers a series of rapid morphological and functional cardiac remodeling (Martin et al., 1986; Spence et al., 2011; Pedlar et al., 2018). In line with this, impairments in maximal cardiac output ( $Q_{\text{max}}$ ) have been found after 12 days of inactivity due to a 10% decrement in exercise stroke volume and 4% increment in maximal heart rate (Coyle et al., 1984). Similar results have also been

observed following a period of training cessation and head-down tilt bed rest during both maximal (Coyle et al., 1984; Pedlar et al., 2018) and submaximal exercise (Coyle et al., 1986; Capelli et al., 2008). Such reductions in  $Q_{\text{max}}$  are critical as they may highly contribute in declining the maximal oxygen delivery capacity.

Training cessation can also markedly affect the volitional force-generating capacity of human skeletal muscles, which is the result of an interplay of neural and morphological factors including muscle cross-sectional area, muscle architecture, muscle fiber type, tendon properties and neural drive to the spinal-motor pool (Bosquet et al., 2013). It has been reported that all these physiological factors involved in volitional force-generation mechanisms can be affected by 8–12 weeks of training cessation, with maximal muscle force decrements predominantly caused by neural alterations in the initial weeks of training cessation and by morphological ones when the period of inactivity exceeds several weeks (Bosquet et al., 2013). For instance, a significant decline in maximal isometric force ( $\sim 7.5\%$ ) in subjects accustomed to strength training has been found after 8 weeks of training stoppage. Interestingly, this force decrement was coupled with decreases ( $\sim 5\text{--}12\%$ ) in maximal electromyographic activity reflecting a precocious reduction of muscle activation (Häkkinen and Komi, 1983). In another study from the same group, marked declines in strength performance ( $\sim 12\%$ ) were accompanied by a reduction in the FT/ST muscle fiber area ratio (from 1.11 to 1.04), likely as a result of a tendency toward higher oxidative muscle fiber populations, as well as by a reduction of muscle mass after 8 weeks of training cessation, i.e., muscle atrophy (Häkkinen et al., 1981). Longer periods of detraining (12 weeks) were also accompanied by substantial decreases of the mean muscle fiber areas of both fiber types (Häkkinen et al., 1985). In line with these studies, muscle atrophy and other detraining-induced morphological changes in muscle fiber distribution and architecture (Coyle, 1988) and/or FT cross-sectional area (Bangsbo and Mizuno, 1988; Allen, 1989; Amigó et al., 1998) have been consistently reported in more recent investigations for athletes of different disciplines such as endurance runners, cyclists, soccer and rugby players, following 3–8 weeks of training cessation. Conversely, despite novel evidences have arisen from bed rest studies showing that chronic inactivity induces muscle denervation and damage to the neuromuscular junction (Narici et al., 2020), the understanding of training-cessation-induced neural changes, particularly at the single motor unit level is still limited. Moreover, prolonged exposure to mechanical unloading may also cause impairments in tendon structures and properties (Frizziero et al., 2016) as well as at the soft-tissue level (e.g., articular capsule, cartilage, ligaments, synovium). Specifically, compromised tendon reactions to a load application (Frizziero et al., 2016; Paoli and Musumeci, 2020) and a dramatic decrement in cartilage lubrication and nutrition (Castrogiovanni et al., 2019) in response to inactivity have been recently documented. Taken together, the rate at which these morphological and physiological remodeling adaptations occur underlines the importance of movement and exercise to preserve not only the integrity of the muscles, but also of the neural

circuits upstream, tendons and joint structures in situations of reduced-training stimuli and mechanical unloading, such as the COVID-19 home confinement.

Regaining a pre-detraining status is also essential for athletes. As effective training programs do, reconditioning training programs also need to match training principles (Garber et al., 2011). The time required to recover pre-detraining neuromuscular and cardiorespiratory levels may highly vary among athletes on the base of several factors, including time of training stimuli cessation or reduction, amount of individual detraining-induced effects, individual fitness levels and sport-specific requirements. For instance, following 20 days of bed rest,  $\text{VO}_{2\text{max}}$ ,  $\text{Q}_{\text{max}}$ , blood plasma volume and heart volume values were recovered after a reconditioning training program ranging from few days to 55 days, where longer periods seem to be required for trained compared to untrained individuals (Saltin et al., 1968). While cardiovascular values may recover in few days (Saltin et al., 1968), longer training periods might be required to regain pre-detraining levels of muscle oxidative capacity and function (Skattebo et al., 2020). Due to the heterogeneity effects of detraining and training, it is extremely important to perform a battery of sport-specific tests aimed at evaluating the individual detraining status for planning an effective and safer return to sport activities. Sports-specific tests should also be performed to check the efficacy of the reconditioning training program. Importantly, all the stakeholders (e.g., coaches, athletes and medical staff) need to be involved for planning effective and safer reconditioning training programs before, during and after the process itself.

## INJURED ATHLETE DURING THE COVID-19 ENFORCED QUARANTINE

A particular case that undoubtedly needs to be considered is the injured athlete in both early and latest rehabilitation and reconditioning stages. In such specific population, the focus of a detraining prevention program shifts from the pursuit of counteracting detraining effects, to the pursuit of finding the best home-based recovery strategy. Indeed, in addition to the potential morphological and physiological detraining effects due to the COVID-19 home confinement, injured athletes might also struggle against detrimental effects associated with the injury itself and with a potential insufficient and/or inappropriate home-based rehabilitation and reconditioning. Although no clear evidence has been provided on this topic, the scientific community suggests insufficient and/or inappropriate rehabilitation and reconditioning stimuli as the main determinants of injury recurrence (Kyritsis et al., 2016). This is particularly relevant for those athletes who suffered from musculoskeletal injuries and needed to readapt either damaged soft-tissues or muscles to loading through a proper neuromuscular rehabilitation.

Injured athletes at their very early stages of rehabilitation may need special attention. The unpredicted closure of sport therapy clinics worldwide could indeed have prevented athletes from optimally tackle the initial impairments related

to a musculoskeletal injury. For instance, athletes with reconstructed anterior cruciate ligament would experience an initial inflammatory process on the knee with related pain and swelling, which in turn would cause a substantial inhibition of the quadriceps muscle and an associated dramatic deficit in muscle strength (Rice and McNair, 2010). With the aim of reducing pain and re-establishing knee joint homeostasis, clinicians and health professionals typically strive to fix these issues immediately after surgery and thereby to ensure a progressive joint loading and muscles strength reconditioning in the following stages (Dingenen and Gokeler, 2017). The impossibility to go through these fundamental steps and the absence of adequate professional support, may delay the recovery process and cause long-term problems (e.g., impaired quadriceps function, neuromechanical alterations and compensation strategies) which, in turn, may prevent athletes from returning to their pre-injury physical conditions, and increase the risk of a second knee injury (Hewett et al., 2013). Similarly, also injured athletes in the latest rehabilitation phases would delay their return to sport. This happens because of the impossibility to provide adequate training stimuli aimed at re-gaining sport-specific fitness levels (Buckthorpe, 2019). For all these reasons, the adoption of proper home-based training protocols is pivotal to avoid a delayed or unsafe return to sport. However, recommending potential detraining prevention strategies for injured athletes is extremely challenging as they may vary according to the type and time of injury, individual responses to injury and different external factors (e.g., home setting and equipment availability).

## CONCLUSION

The COVID-19 pandemic and the consequent forced home confinement have risen a new challenge in the field of sport and exercise sciences, which consists in how to limit and counteract detraining effects among athletes. Training cessation has been shown to negatively affect physical human performance, but very little is known about the effects of training stimuli reduction. Moreover, exceptional situations such as in the case of the COVID-19 enforced quarantine might lead to inadequate rehabilitation and reconditioning programs in injured athletes, which in turn might be translated in a delayed and/or unsafe return to sport. However, researchers have never considered the need of investigating detraining effects prevention yet. Considering the current lack of a COVID-19 vaccine, the strict rules that several countries worldwide are still adopting to stop this pandemic, and the possibility that similar extreme situations would present again, future research in this field is certainly required.

## AUTHOR CONTRIBUTIONS

MG, AC, SN, CG, and CC contributed to conception and design of the study. MG wrote the first draft of the manuscript. AC, SN, and CG wrote sections of the manuscript. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work in ensuring that questions related to the

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# The Impact of the German Strategy for Containment of Coronavirus SARS-CoV-2 on Training Characteristics, Physical Activity and Sleep of Highly Trained Kayakers and Canoeists: A Retrospective Observational Study

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**Aim:** To characterize the impact of the German strategy for containment of Coronavirus SARS-CoV-2 (social distancing and lockdown) on the training, other habitual physical activity, and sleep in highly trained kayakers and canoeists.

**Method:** During the 4 weeks immediately prior to and following the beginning of the German government's strategy for containment of Coronavirus SARS-CoV-2 on March 23, 2020, 14 highly trained athletes ( $VO_{2peak}$ :  $3,162 \pm 774$  ml/min; 500-m best time:  $117.9 \pm 7.9$  s) wore a multi-sensor smartwatch to allow continuous assessment of heart rate, physical activity, and sleep duration.

**Result:** In comparison to before lockdown, the overall weekly training time and the average length of each session of training during the lockdown decreased by 27.6% ( $P = 0.02$ ;  $d = 0.91$ ) and 15.4% ( $P = 0.36$ ;  $d = 0.36$ ), respectively. At the same time, the number of sessions involving specific (i.e., canoeing and kayaking) and non-specific (i.e., running, cycling) training, respectively, did not change ( $P = 0.36$ – $0.37$ ;  $d = 0.34$ – $0.35$ ). The number of sessions involving strength (+17.4%;  $P = 0.03$ ;  $d = 0.89$ ) or other types of training (+16.7%;  $P = 0.06$ ;  $d = 0.75$ ) increased during the lockdown with 2.8–17.5% more training time involving a heart rate <60%, 82–88, 89–93, or 94–100% of individual peak heart rate ( $HR_{peak}$ ) ( $P = 0.03$ – $0.86$ ;  $d = 0.07$ – $1.38$ ), and 4.3–18.7% less time with a heart rate of 60–72 or 73–83%  $HR_{peak}$  ( $P = <0.001$ – $0.026$ ;  $d = 0.44$ – $2.24$ ). The daily duration of sleep was ~30 min (6.7%) longer during the lockdown ( $P < 0.001$ ;  $d = 1.53$ ) and the overall time spent lying down was 17% greater ( $P < 0.001$ ;  $d = 2.26$ ); whereas sitting time (−9.4%;  $P = 0.003$ ;  $d = 1.23$ ), the duration of light (15 min; −7.3%;  $P = 0.04$ ;  $d = 0.83$ ), and moderate (−18.6%;  $P = 0.01$ ;  $d = 1.00$ ) physical activity other than training (−9.4%;  $P = 0.22$ ;  $d = 0.00$ ) were all lower during lockdown.

**Conclusion:** The present data revealed that following the German lockdown for containment of the Coronavirus SARS-CoV-2, highly trained kayakers and canoeists spent less overall time training each week (−27.6%) with, on average, shorter training sessions (−15.1%) and less light-to-moderate physical activity outside of training. Moreover, they performed more strength training sessions per week, and all engaged in more training at intensities  $>82$  and  $<60\%$  of  $HR_{peak}$  and spent longer periods lying down and sleeping during the lockdown.

**Keywords:** COVID-19, coronavirus, pandemic (COVID-19), remote monitoring, training intensity distribution, wearables, wearable technology

## INTRODUCTION

On January 30, 2020, the World Health Organization (WHO) declared the outbreak of COVID-19 (coronavirus disease) to be a public health emergency of international concern. Countermeasures to reduce the risk of infection include improved hygiene, social distancing, and forbidding large social gatherings such as sport events. Indeed, nearly all international and national athletic competitions, including the 2020 Olympic games, have been postponed.

More specifically, as of March 23, 2020, the official regulations for containment of Coronavirus SARS-CoV-2 in Germany included prohibition of group gatherings, including closing of training facilities (e.g., sports halls, gyms, swimming pools, etc.) for organized sports. This abrupt change has forced athletes and coaches to adopt different training strategies in preparation for competitions hoped to be held in late summer. At the same time, in contrast to other parts of the world (e.g., Spain and Italy), the German strategy allowed individuals to exercise without the direct (i.e., face-to-face) assistance of coaches and without using indoor training facilities.

As mentioned earlier (Sarto et al., 2020), when athletes, especially those who are welltrained, are confined to their homes, their individual beneficial cardiorespiratory and neuromuscular adaptations to various types and extents of physical activity are likely to be lost, at least to some extent (Mujika and Padilla, 2000). In elite athletes such adaptations, as well as offtraining behavior (in particular habitual physical activity) and sleep (Sperlich and Holmberg, 2017), are key determinants of performance. Most athletes who normally engage in frequent and intense training are likely to be forced to alter these determinants during the lockdown. The manner and degree to which these alterations take place are presently unknown.

Here, we retrospectively examine the effects of the present pandemic situation in Germany on the intensity and duration of training, other types of physical activity, sleep, and certain physiological characteristics related to the performance of elite kayakers. For this purpose, we compare data collected with sensors during 4 weeks prior to and 4 weeks during the lockdown.

## METHODS

### Participants

The key anthropometric, physiological, and performance characteristics of the highly trained flatwater sprint kayakers (four men and eight women) and canoeists (two men) who participated are summarized in **Table 1**. To ensure anonymity, we present age groups and body mass index instead of the exact age, body mass, and height.

Six are presently members of the German Development Team and eight of the West-German Regional Team, and they all compete at least at the highest national level in Germany. All procedures were preapproved by the institute's ethics committee and conducted in accordance with the Declaration of Helsinki. In addition, after being informed in detail about the risks, benefits, and procedures of this study, all participants and their legal guardians provided their written consent for participation.

### Observation

During the entire 4 weeks prior to and after the announcement on March 23, 2020, of the strategy for containment of Coronavirus SARS-CoV-2 by the German government, all participants wore a multi-sensor smartwatch (Polar M430, Polar OY, Kempele, Finland) that collected data on their heart rate during each training session and other physical activities, as well as data on the duration of sleep and duration of sleep. Eight weeks before the lockdown, all of the athletes underwent routine diagnostic tests of performance, including incremental testing designed to determine peak oxygen uptake ( $VO_{2peak}$ ) and heart rate ( $HR_{peak}$ ). All testing on-water took place on official regatta courses in North-Rhine Westphalia, Germany, venues on which some of the international canoe sprint championships, as well as the World Cup series organized by the International Canoe Federation (ICF) were held.

### Training Modes and Their Documentation

All kayakers and canoeist recorded their type (e.g., kayaking, running, cycling, etc.), duration, distance, and intensity of training, as well as information on days off and illness or injury using their smartwatch. These diaries, which were immediately uploaded to the Polar Server, were checked by the coaches and cross-checked by the research team for plausibility. After completion of the study, all data were exported as .tcx files for analysis.

**TABLE 1** | The sex, age, body mass index, discipline (C = canoe, K = kayak), personal best times\*, and peak oxygen uptake before lockdown (\*best competition time from season 2019; n.d. = not determined).

P-ID	Sex	Age group (yrs)	Body Mass Index (kg/m <sup>2</sup> )	Discipline	Personal best time* (s)			% Of world best time			Peak oxygen uptake (ml/min)
					200 m	500 m	1,000 m	200 m	500 m	1,000 m	Before lockdown
1	male	Under 18	24.3	C	<44.0	<117.9	<260.8	85.2	88.1	85.3	4,161
2	male	Under 18	23.5	C	<47.4	<124.5	<287.6	79.1	83.4	77.4	3,519
3	male	Under 18	24.1	K	<40.3	<106.8	<243.4	83.1	89.3	83.3	3,436
4	male	Under 18	22.5	K	n.d.	<108.9	<240.6	n.d.	87.5	84.2	4,326
5	male	Under 23	23.1	K	n.d.	<103.0	<221.5	n.d.	92.5	91.5	4,485
6	male	Under 18	22.8	K	<42.8	<116.0	<235.5	80.1	82.1	86.1	3,686
7	female	Under 18	23.6	K	<45.0	<122.5	n.d.	84.4	87.0	n.d.	2,402
8	female	Under 18	23.3	K	<48.8	<124.4	<270.3	77.8	85.7	84.6	2,410
9	female	Under 18	22.0	K	<45.4	<120.8	<264.6	83.7	88.2	86.5	2,481
10	female	Under 23	25.1	K	<43.2	<115.9	n.d.	88.0	92.0	n.d.	2,970
11	female	Under 18	20.4	K	<50.0	<131.4	<279.6	76.1	81.1	81.8	2,741
12	female	Under 18	20.3	K	<46.9	<122.5	n.d.	81.0	87.0	n.d.	2,190
13	female	Under 18	21.9	K	<46.6	<119.6	n.d.	81.6	89.1	n.d.	2,554
14	female	Under 18	24.0	K	<49.8	n.d.	n.d.	78.0	n.d.	n.d.	2,905
Mean ± SD		17.1 ± 1.9	22.9 ± 1.4		45.6 ± 2.9	117.9 ± 7.9	255.8 ± 22.0				3,162 ± 774

All training sessions were divided into four different modes, namely: (i) Kayaking/Canoeing in a kayak/canoe or on an ergometer; (ii) other kinds of *Endurance* training, such as running, cycling, swimming, etc.; (iii) *Strength* and resistance training either with machines or weights or against body mass; and (iv) Other: stretching, stability training, etc.

## The Distribution of Training Intensity

Training intensity was divided into five zones on the basis of heart rate (Seiler, 2010), which was monitored during each session of training by a chest belt that communicated with the athlete's smartwatch. This allowed calculation of the time spent in each intensity zone for subsequent analysis.

## Assessment of Physical Activity (PA) and Sleep Duration

Since extensive concomitant daily physical activity may improve responses to endurance training (Hautala et al., 2012), physical activity when the participants were not training was also monitored continuously by the multisensory device (Polar M430) worn on the wrist for the entire experimental period, being removed only for charging. The reliability of the Polar M430 under such free-living conditions has been validated and its suitability to report changes in physical activity over time (Henriksen et al., 2019). Comparison of the algorithm utilized to assess sleep time with polysomnography in adolescents revealed that the former underestimates slightly but less than many accelerometers designed for research purposes (Pesonen and Kuula, 2018). We employed established classifications (Tremblay et al., 2017) by dividing the data collected into sedentary [i.e., lying and sitting with <1.5 metabolic equivalent of task (MET)], light (1.5–3 MET), moderate (3–6 MET), or vigorous

(>6 MET) energy expenditure (in min·d<sup>-1</sup>) utilizing the Polar Online Software.

## Evaluation of VO<sub>2peak</sub> and Body Mass Index

The incremental test protocol involved 4 × 1,500 m trials on-water at 70, 80, and 90% of HR<sub>peak</sub>, as well as an all-out effort. All athletes were members of the Canoe Federation and therefore highly experienced in performing this type of protocol.

The heart rate utilized here was based on the HR<sub>peak</sub> determined previously by the Western German Canoe Federation using this same protocol. The 30–45 s that elapsed between successive steps was required for sampling capillary blood from the earlobe. All participants received continuous visual feedback concerning their heart rate (averaged every second) from a monitor (Polar Wear Link System and Polar V800 Heart Rate Monitor, Polar Electro OY, Kempele, Finland) mounted directly in front of them on the boat or ergometer. At all points, the strokerate was self-selected.

Oxygen uptake was monitored continuously with an open-circuit breath-by-breath analyzer (MetaMax 3B, Cortex Biophysik, Leipzig, Germany), employing standard algorithms to compensate for the time delay between gas consumption and the signal. This analyzer was calibrated prior to each test with both 15.8% O<sub>2</sub> and 5% CO<sub>2</sub> in N<sub>2</sub> (Praxair, Düsseldorf, Germany); that is, concentrations that cover the range of expected fractional concentrations of O<sub>2</sub>. The volume sensor was calibrated with a precision 3-L syringe (Cortex Biophysik, Leipzig, Germany). VO<sub>2</sub> was averaged every 30 s during the test and the highest value considered to be VO<sub>2peak</sub>.

## Statistical Analysis

The data used to calculate the MET values were processed with the Python analysis toolkit “pandas” (1.0.3) available for the



**TABLE 2 |** Numbers of training sessions, overall training time and duration of each session during the 4 weeks prior to and the initial 4 weeks of lockdown.

	Week before lockdown				Week during lockdown				Mean				
	−4	−3	−2	−1	1	2	3	4	Before lockdown	During lockdown	%-Difference	P	d
Overall training time (min)	858 ± 248	656 ± 448	1,511 ± 842	804 ± 476	855 ± 545	800 ± 393	567 ± 233	548 ± 485	957 ± 379	693 ± 158	−27.6	0.02	0.91
Duration of each session (min)	62 ± 24	61 ± 24	91 ± 74	78 ± 22	65 ± 21	76 ± 19	58 ± 9	52 ± 16	73 ± 40	62 ± 18	−15.1	0.36	0.36
<b>Number of training sessions</b>													
-specific endurance (canoeing and kayaking)	5.9 ± 1.8	3.9 ± 1.7	5.9 ± 1.8	4.0 ± 2.2	5.4 ± 1.6	5.8 ± 1.6	4.9 ± 1.1	4.9 ± 2.5	4.9 ± 1.1	5.2 ± 0.5	+6.1	0.36	0.35
-non-specific endurance (running, cycling etc.)	1.9 ± 1.0	1.6 ± 1.0	1.9 ± 1.0	2.5 ± 1.3	2.0 ± 1.4	1.9 ± 0.8	2.0 ± 1.0	1.8 ± 1.2	2.0 ± 0.4	1.9 ± 0.1	−0.05	0.37	0.34
-strength	2.4 ± 1.0	2.6 ± 1.4	2.2 ± 1.4	2.2 ± 1.3	3.6 ± 1.3	2.7 ± 1.4	2.4 ± 1.2	2.2 ± 1.6	2.3 ± 0.2	2.7 ± 0.6	+17.4	0.03	0.89
-other*	2.3 ± 1.5	1.5 ± 0.7	1.5 ± 0.9	2.2 ± 1.5	2.3 ± 1.8	2.0 ± 1.6	2.7 ± 2.0	1.7 ± 1.1	1.8 ± 0.4	2.1 ± 0.4	+16.7	0.06	0.75

\*Including stretching, basketball, mobility training, indoor sports, and other indoor activities.

**TABLE 3 |** The mean percentage of the total training time each week spent in each intensity zone during the 4-weeks periods prior to and at the beginning of the lockdown.

% of peak heart rate	Week before lockdown				Week during lockdown				Mean				
	−4	−3	−2	−1	1	2	3	4	Before lockdown	During lockdown	%-Difference	P	d
%-time 94–100	1.6 ± 1.4	5.2 ± 8.3	2.7 ± 3.3	4.8 ± 5.3	2.1 ± 2.4	4.4 ± 6.6	4.9 ± 4.8	3.7 ± 3.3	3.6 ± 1.7	3.7 ± 1.2	+2.8	0.86	0.07
in zone 89–93	6.7 ± 5.0	4.2 ± 5.8	7.0 ± 9.5	4.9 ± 8.0	9.2 ± 12.7	8.6 ± 7.4	5.6 ± 3.7	3.4 ± 2.8	5.7 ± 1.4	6.7 ± 2.7	+17.5	0.23	0.47
82–88	10.2 ± 6.0	9.6 ± 7.6	11.3 ± 10.0	8.0 ± 5.6	8.2 ± 5.5	10.3 ± 7.9	13.7 ± 12.7	10.8 ± 8.5	9.8 ± 1.4	10.8 ± 2.3	+10.2	0.18	0.53
73–82	22.6 ± 11.9	20.6 ± 17.0	24.8 ± 14.0	26.0 ± 16.6	18.2 ± 10.7	18.2 ± 11.5	19.0 ± 12.9	21.1 ± 11.7	23.5 ± 2.4	19.1 ± 1.4	−18.7	<0.001	2.24
60–72	28.2 ± 13.8	23.1 ± 11.3	26.4 ± 13.0	27.2 ± 11.4	25.6 ± 15.5	24.2 ± 13.2	22.1 ± 11.7	28.7 ± 11.9	26.2 ± 2.2	25.1 ± 2.8	−4.2	0.26	0.44
<60	34.0 ± 13.2	40.9 ± 18.2	29.8 ± 12.1	31.8 ± 18.9	39.7 ± 11.2	38.9 ± 14.1	36.9 ± 20.4	34.3 ± 15.1	34.1 ± 4.8	37.4 ± 2.4	+9.7	0.03	1.38

Python programming language (3.8). In addition, utilizing the Statistica software package for Windows® (version 7.1, StatSoft Inc., Tulsa, OK, USA), Student's paired *t*-test was applied to identify potential differences between the sedentary time and light, moderate, and vigorous physical activity on weekdays and weekend with an alpha of  $p < 0.05$  being considered statistically significant. Moreover, the effect size, Cohen's *d*, (Cohen, 1988) was calculated for all variables with the thresholds for small, moderate, and large effects set to 0.20, 0.50, and 0.80, respectively (Cohen, 1988). Medium or large effect sizes associated with insignificant *p*-values were considered to indicate tendencies.

## RESULTS

## Training Sessions

The number of different training sessions (canoeing or kayaking, strength, endurance, other), the overall training time, the average duration of each session, and the days without training prior to and during the lockdown are summarized in **Table 2**.

The overall training time per week and average duration of each session were 27.6% and 15.4% lower, respectively, during the lockdown. The number of sessions involving specific (i.e., canoeing or kayaking) and non-specific (i.e., running, cycling) training remained similar during both periods. The number of sessions involving strength or other types of training (e.g., stretching) was 17.4% and 16.7% higher, respectively, before the lockdown began.

## The Distribution of Training Intensity

The fractions of the total training time spent in each intensity zone are summarized in **Table 3** and illustrated in **Figure 1**.

Prior to the lockdown 2.8–17.5% more training time involved heart rates <60, 82–88, 89–93, and 94–100% of individual  $\text{HR}_{\text{peak}}$ , with 4.3–18.7% less training time involving heart rates of 60–72 and 73–83% of individual  $\text{HR}_{\text{peak}}$ .

### Sedentary Time, Time Spent Doing Other Physical Activities, and Duration of Sleep

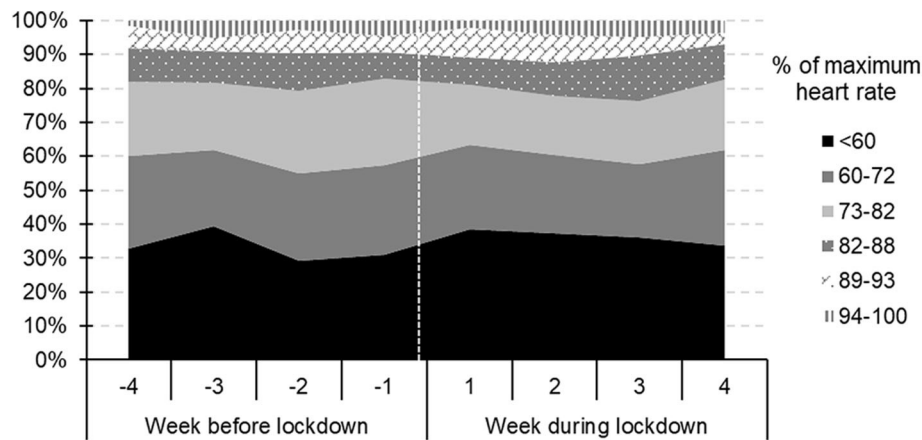
Overall, the average daily duration of sleep was  $\sim 30$  min (6.7%) longer during the lockdown (see **Table 4** and **Figure 2**). The average time spent lying down was 106 min (17%) greater during the lockdown, while the time spent sitting was 34 min (9.4%) lower. In addition, the times spent performing light (15 min = 7.3%) and moderate (11 min = 18.6%) physical activity all became shorter once the lockdown was put in place.

## DISCUSSION

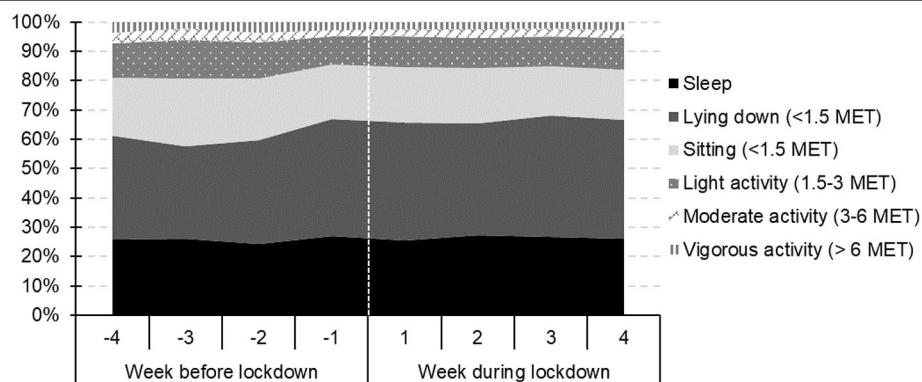
In light of the potential influence of the corona lockdown in Germany on the physical status of elite athletes, this observational study compared the training, other habitual physical activities, and sleep duration of well-trained and elite kayakers and canoeists during the 4-week periods immediately before and after this lockdown was put in place (Sarto et al., 2020). The major changes associated with the lockdown were as follows:

**TABLE 4** | Mean duration (in minutes) of sleep, sedentary time and time spent doing other physical activities during the 4-week periods immediately before and after the start of the lockdown (MET = metabolic equivalent of task).

Activity	Week before lockdown				Week during lockdown				Mean				
	-4	-3	-2	-1	1	2	3	4	Before lockdown	During lockdown	% Difference	P	d
Sleep	460 ± 39	452 ± 60	419 ± 65	470 ± 82	464 ± 78	504 ± 47	481 ± 96	476 ± 41	451 ± 22	481 ± 17	+6.7	<0.001	1.53
Lying down (<1.5 MET)	632 ± 93	547 ± 105	613 ± 135	701 ± 160	725 ± 159	703 ± 144	752 ± 174	736 ± 197	623 ± 63	729 ± 21	+17.0	<0.001	2.26
Sitting (<1.5 MET)	351 ± 72	402 ± 88	366 ± 99	322 ± 126	342 ± 108	346 ± 129	305 ± 141	312 ± 121	360 ± 33	326 ± 21	-9.4	0.003	1.23
Light activity (1.5-3 MET)	208 ± 54	230 ± 70	213 ± 74	170 ± 66	191 ± 57	190 ± 60	184 ± 83	196 ± 80	205 ± 25	190 ± 5	-7.3	0.04	0.83
Moderate activity (3-6 MET)	67 ± 25	72 ± 27	57 ± 17	38 ± 24	43 ± 21	53 ± 22	48 ± 25	48 ± 26	59 ± 15	48 ± 4	-18.6	0.01	1.00
Vigorous activity (>6 MET)	66 ± 20	36 ± 24	65 ± 32	48 ± 29	48 ± 19	47 ± 11	42 ± 22	53 ± 36	53 ± 14	48 ± 5	-9.4	0.22	0.48



**FIGURE 1 |** The proportions of the total training time each week spent in the different intensity zones during the 4-week periods prior to and at the beginning of the lockdown.



**FIGURE 2 |** The proportional duration of sleep, lying down and sitting, and physical activities other than training during the 4-week periods immediately before and after the start of the lockdown (MET = metabolic equivalent of task).

- 1) Overall training time per week and the average duration of each session decreased by 27.6% and 15.4%, respectively.
- 2) Our athletes performed 17.4% more strength training and 16.7% more sessions of other types of training each week.
- 3) There was no change in the number of specific and non-specific sessions of training, respectively.
- 4) The mean portion of the total training time spent at <60, 82–88, 89–93, or 94–100% of maximum heart rate was 2.8–17.5% greater and 4.3–18.7% lower at 60–72 or 73–83% of the individual  $HR_{peak}$ , respectively.
- 5) On average, each athlete slept  $\sim 30$  min (6.6%) longer.
- 6) On average, 17% more time was spent lying down, whereas the times spent sitting (–9.4%), or performing light (–7.3%) or moderate (–18.6%) physical activity other than training were all lower.

Typically, the long-term strategy used by athletes to prepare for competition involves periods of exercise (usually 2–4-week mesocycles) varying in their amount, intensity, and frequency. Here, we analyzed two 4-weeks periods during the Spring preparation

by kayakers and canoeists (usually lasting from the beginning of February to the end of April). Our findings indicate that the German strategy for the containment of the Coronavirus SARS-CoV-2 (which allowed individual activities outdoors) reduced the overall time during which elite kayakers trained each week by  $\sim 25\%$ , with an average of 15.4% decrease in the duration of each training session.

Among our athletes, this reduction was probably related to changes in training due to the lockdown. The coaches immediately altered training schedules so that underage athletes did not train onwater alone, and all boat houses were closed in order to avoid group gatherings, which meant that some athletes had no access to their boats at the beginning of the lockdown. At this point in the season, a reduction in overall training time is unusual. Nonetheless, it is clear that our German kayakers and canoeists did not reduce their training stimulus significantly during the initial period of lockdown, as suspected earlier (Sarto et al., 2020), still averaging  $693 \pm 158$  min of training per week. It would be interesting to compare this result to the impact of stricter containment of Coronavirus SARS-CoV-2 (e.g.,

remaining indoors with no specific endurance training) enforced by certain other countries on the training of elite athletes. In contrast, other countries such as Sweden enforced less strict measures to contain Coronavirus SARS-CoV-2 and we might hypothesize that in these countries the seasonal preparation (besides international traveling) was not heavily influenced.

Interestingly, the numbers of specific and non-specific training sessions before and following the lockdown were similar, indicating that our group of athletes made use of the opportunity to engage in specific endurance training. Overall, the kayakers and canoeists performed more sessions of strength training per week, although our approach does not allow characterization of the type of strength training they engaged in.

Our present investigation focused on the effects of the German lockdown only during the initial 4 weeks, that is for a relatively short period of time. It remains to be determined whether the impact on long-term preparation for national championships and/or qualification for international championships might differ. The observation that the kayakers and canoeists trained to a greater extent at intensities of  $>82$  and  $<60\%$  of  $HR_{peak}$  during the lockdown were related to the highly unusual situation; such changes and especially the reduction in training time were certainly not considered desirable by the coaches.

Adequate sleep exerts an important impact in connection with the optimization of both the physical and cognitive performance of elite athletes, as well as in reducing the risk of injury (Charest and Grandner, 2020). Our athletes slept  $\sim 30$  min (6.6%) longer each day during the German containment (i.e., 8 h rather than 7.5 h). Previous reports indicate that Olympic athletes sleep less (6.5–6.8 h) than the 8 h recommended daily (Leeder et al., 2012; Lastella et al., 2015). There are a number of possible explanations as to why our athletes slept more during the lockdown: (i) they may have adopted less rigorous morning training schedules (Sargent et al., 2014; Gupta et al., 2017); (ii) the German containment strategy significantly reduced international travel obligations and opportunities; (iii) they engaged to a greater extent in home-schooling and -office; (iv) the stress and anxiety related to upcoming qualification events were no longer present (Erlacher et al., 2011; Juliff et al., 2015), or (v) some athletes may have developed some forms of depression due to social distancing and lack of prospects. Unfortunately, the monitoring methodology we employed does not allow assessment of the quality of sleep (sleep latency and efficiency).

Interestingly, the overall time spent lying down each day (including sleep) was 17% (+106 min) greater, while the sitting time decreased by 9.4% during the lockdown, indicating more time for passive recovery. The potential reasons for the longer time spent lying down are similar to those mentioned above for the longer sleeping time.

The finding that the extents of light (−7.3%), moderate (−18.6%), and vigorous (−9.4%) physical activity other than training were lower during the lockdown is not surprising, since all types of social activity (commuting, social interactions in larger groups, etc.) were limited drastically by the German strategy for containment of Coronavirus SARS-CoV-2. Overall,

our group of athletes were more active than other groups in the population-based studies (Hagstromer et al., 2007, 2010; Hansen et al., 2012).

## Methodological Considerations

Some methodological considerations/limitations associated with the current observational investigation need to be acknowledged: (i) since the overall observation period involved only 4 weeks before and 4 weeks during the initial phase of lockdown, our findings cannot easily be generalized to more extensive periods of lockdown; (ii) compared to other investigations where pre-planning was possible, the number of our participants is relatively small. Nevertheless, under these very special circumstances, we were gratified to be able to include a relatively large number of athletes performing at a high level; (iii) our findings on the impact of the German strategy for containment of Coronavirus SARS-CoV-2 cannot necessarily be extrapolated to the situation in other countries; and, finally, (iv) our present findings are not necessarily valid for German athletes engaged in other types of sports (e.g., indoor and/or team sports), which may have experienced substantially different infrastructural and organizational consequences.

Furthermore, even though monitoring free movement by the Polar M430 has been shown to be reliable and may be suitable for characterizing changes in physical activity with time (Henriksen et al., 2019), accelerometers worn on the wrist might exaggerate or underestimate the level of activity. As also mentioned above, comparison of the algorithm utilized to assess sleep time with polysomnography in adolescents revealed that the former underestimates slightly but less so than many accelerometers designed for research purposes (Pesonen and Kuula, 2018).

Here, we were fortunate to be able to monitor important aspects of training characteristics, other physical activity, and sleep duration and with a smartwatch. Although other, more sophisticated methodologies can be utilized to assess these components of daily living in greater detail, the rapid development of the Covid-19 pandemic did not allow us to employ other approaches. Nonetheless, our current observations provide interesting insights into the effects of the lockdown on the training, other habitual physical activity, and the time spent sleeping by a group of highly trained German athletes.

## CONCLUSIONS

The data documented here reveal that following the German lockdown for containment of the Coronavirus SARS-CoV-2, highly trained kayakers and canoeists spent less overall time training each week (−27.6%) with, on average, shorter training sessions (−15.1%) and less light-to-moderate physical activity outside of training. Moreover, they performed more strength training sessions per week and all engaged in more training at intensities  $>82$  and  $<60\%$  of  $HR_{peak}$  while spending longer periods lying down and sleeping during the lockdown.



## 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 Department of Sport Science, University of

Würzburg. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

## AUTHOR CONTRIBUTIONS

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

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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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# Sport and the Covid-19 Pandemic: A Structuralist Analysis of Key Themes in the UK Mass Media

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This paper provides a systematic, detailed analysis of UK mass media online reports and narratives on sport and Covid-19 during the main lockdown period over March-May 2020. A “structuralist thematic” approach is utilized to identify and to map systematically the main themes within the mass media. The research is based on reports and narratives on sport-Covid which featured in five leading online UK mass media outlets. The analysis sets out four underpinning statuses or dimensions of sport: the existential, normative, socio-cultural, and political. These dimensions connect directly and, respectively, to four sets of binary opposite media themes on sport during the Covid-19 lockdown: sport as absence/presence, selfish/altruistic, crisis/escape, and threat/solution. Each theme features several types of media report or commentary (which we term “narrative or substantive strands”) on sport-Covid. The paper examines the four binary opposites, and their various types of media report and narrative, in detail. It concludes by discussing the theoretical contributions and substantive findings from the study, and some areas for future research.

**Keywords:** sport, COVID-19, mass media, structuralist analysis, thematic approach

## INTRODUCTION

The Covid-19 pandemic had an extraordinary impact on world sport, leading to the almost complete shutdown of sports clubs, events, tournaments and businesses, and to the freezing of a global sporting industry valued at over US\$500 billion (Business Research Company., 2019). These extreme processes occurred in March-May 2020, during the initial mass spread of the pandemic in Europe and North America, as national governments and the international community implemented, in the words of the International Monetary Fund, a “Great Lockdown,” in the attempt to contain and control the spread of the virus.

In the UK, the pandemic led to the cancellation of many leading sport competitions such as the men’s European Championships and various national and regional leagues in football, the Wimbledon tennis tournament, the men’s Open golf championship, the Grand National in horse-racing, the London and other city marathons, and the Oxford-Cambridge University boat race. Protracted postponements also arose in men’s and women’s football, rugby union, and international tours in cricket, golf, tennis, and other sports. At everyday level, UK sport also effectively closed down, with gyms, sport halls, swimming pools, golf courses, and other sport-related venues and facilities being shuttered.

UK sport lockdown measures were put in place as the national government struggled to manage an unfolding disaster in public health. In the main 2-month period (27 March–29 May) of Covid-19's mass spread, during which the UK lockdown also mostly occurred, over 63,000 “excess deaths” were recorded nationally, and the UK was placed second on international mortality measures with respect to the virus<sup>1</sup>.

In regard to academic literature on Covid-19 and sport, it is too early to provide any substantive overview and analysis of published work in this field, particularly research that draws on social scientific perspectives. Published academic work thus far has largely focused on the direct health, social, and organizational impacts of Covid-19 on sport, such as the suspension or cancellation of elite sport events and activities, and debates on their future resumption; how best to provide professional support for elite-level athletes during the lockdown; and, the role of physical exercise and activities in maintaining health and well-being during quarantine (Corsini et al., 2020; Gallego et al., 2020; Jiménez-Pavón et al., 2020; Mohr et al., 2020; Muñoz and Meyer, 2020; Schinke et al., 2020; Toresdahl and Asif, 2020).

One aspect of the sport-Covid relationship that is unlikely to receive much systematic academic investigation involves mass media coverage of the issue. This relative lack of interest may be understandable given the pandemic's pressing impacts in these other fields. However, any continuing lack of research into mass media coverage of the sport-Covid nexus represents a potentially significant academic lacuna for at least four reasons. First, the mass media is a highly important research domain in its own right, as it has become increasingly central to sport, particularly in the intensified globalization and commercialization of elite-level sport, since the early 1990s. Second, during the Covid-19 pandemic and the ensuing lockdowns, the mass media sought to play crucial roles across the public sphere, notably in communicating government instructions and strategies, and scientific advice, to diverse audiences, and also spotlighting the unfolding social disaster that was occurring particularly in hospitals and care homes in the UK context. Third, as we discuss here, the mass media were highly active in seeking to frame and to narrate the sport-Covid interrelationship. This work included disseminating information on changes to the sporting calendar; reporting on the virus's impacts on the sporting world; and, advancing diverse opinions and analyses on how sport was and should be responding to the pandemic. Fourth, at the same time, mass media organizations were required to make large adjustments to their own structures and activities, due to the closure or postponement of so many sporting events, upon which so much of their work, content and revenues are reliant.

This paper therefore seeks to address this research gap by advancing the first systematic, detailed social scientific analysis of mass media reports and narratives on sport and Covid-19. It also contributes more broadly to the growing body of research on the social impacts of Covid-19 on sport. To do so, we utilize a “structuralist thematic” approach in order to

identify and to map systematically the main themes of media content vis-à-vis sport and Covid-19 during the main lockdown period in the UK. In turn, the paper develops a theoretical framework and substantive research findings—encapsulated later in **Table 1**—which may be transferred and applied to undertake further social scientific studies of diverse issues and processes in regard to sport, media or different social crises, in other national or transnational contexts, or in other historical epochs.

In the following, we begin by outlining the methods used herein for gathering data from online UK mass media and for deploying the structuralist thematic approach for data analysis. We then turn to the substantive part of the paper, which sets out the main themes and types of media report or commentary within each of the four binary oppositions. We conclude by outlining several theoretical contributions and substantive findings from the study, and areas for future research.

## METHODS

### Online UK Mass Media

The research for this paper was based on a qualitative investigation of the main themes in the UK mass media with regard to sport and the Covid-19 pandemic. Data was collected mainly during the full UK lockdown period from five leading UK mass media websites: *The Guardian*, *The Telegraph*, *Daily Mail*, *Sun*, and BBC online. These outlets represent a broad sample of UK online mass media: *The Guardian* and *The Telegraph* are leading UK “broadsheet” newspapers with left-of-center and right-of-center respective political standpoints; the *Daily Mail* is a UK high-circulation “middlebrow” tabloid; the *Sun* is the UK's leading mass-market “red-top” tabloid newspaper; and, the BBC is the UK's leading national broadcaster with a strong online presence. One recent survey indicated that these were the five most popular news websites in the UK<sup>2</sup>. While the online media content covered a wide range of sports, most of this material concentrated on men's elite-level football, particularly the English Premier League, which represents the most newsworthy and heavily reported area of UK sport<sup>3</sup>.

The main full UK Covid-19 lockdown period ran from 26 March to 11 May 2020<sup>4</sup>. Lockdown measures initially announced by the UK government on 23 March came into effect 3 days later; imposed for an initial 3 weeks, these measures were extended for a further 3-week period. To reduce the risk of sudden mass unemployment, the UK government introduced a business “furlough” scheme, whereby employees unable to work during the lockdown could be retained by their companies rather than

<sup>1</sup>See <https://www.theguardian.com/society/2020/jun/09/excess-deaths-in-uk-under-coronavirus-lockdown-pass-63,000>; <https://www.ft.com/content/6b4c784e-c259-4ca4-9a82-648ffde71bf0>

<sup>2</sup>See <https://www.statista.com/statistics/376297/news-sites-ranked-by-unique-audience-in-the-uk/> The order here was BBC, *Sun*, *Daily Mail*, *The Guardian*, *The Telegraph*.

<sup>3</sup>The accessibility of all online reports referred to in this paper was checked and confirmed on 26 June 2020.

<sup>4</sup>Lockdown measures during this period required people in the UK to stay at home; avoid all “unnecessary journeys or social contact” beyond their households; take only one form of outdoor exercise each day; leave home only for “essential shopping or medical needs”; avoid traveling to work unless “absolutely necessary”; and, when interacting with people from outside of their household, maintain social distancing of at least two meters.

**TABLE 1** | Framework of mass media content on sport and Covid-19.

Statutes or dimensions of sport	Binary opposite themes	Narrative or substantive strands
Existential	Sport as absence	Closure, contraction, contract
	Sport as presence	Reminiscence, anticipation
Normative	Sport as selfish	Exploitative, irresponsible, obscene, evasive
	Sport as altruistic	Welfare, solidarity
Socio-cultural	Sport as crisis	Economy, time, social divisions, infection
	Sport as escape	Nostalgia, compensation, repudiation
Political	Sport as threat	Catalyst, violator
	Sport as solution	Conformist, adapter, mobiliser, and booster

made redundant, with the state paying 80% of wages up to £2,500 per month. On 10 May, the government announced plans to ease the lockdown and reopen parts of society, including encouraging workers in construction and manufacturing to return to work, and lifting restrictions on outdoor exercise<sup>5</sup>.

Elite-level sports in the UK had initially moved at different speeds into initial suspension and then lockdown. In football, the Arsenal-Manchester City Premier League fixture for 10 March was postponed, but the Liverpool-Atletico Madrid Champions League match was played a day later, with 52,000 fans in attendance, including 3,000 from Spain. Two days later, UK professional football was suspended, and other sporting postponements and cancellations followed. However, the 4-day Cheltenham horse-racing festival was staged across 10–13 March and attended by an estimated 150,000 spectators. The IOC's 2020 Olympics boxing qualifying tournament in London, running from 11–24 March, also continued albeit behind closed doors.

## Structuralist Thematic Approach

The data was analyzed using what is termed here as a “structuralist thematic” approach, which combines core structuralist and thematic methodological precepts. In this study, the approach had four main interlocking strands.

First, reports and commentaries on sport and Covid-19 in the relevant UK mass media outlets over the lockdown period were gathered. These reports and commentaries were analyzed inductively with a view toward gradually differentiating and classifying this material, to produce several emerging content themes. The aim was not to generate themes strictly according to basic quantitative criteria, such as the relative frequency of their occurrence in media content. Instead, the concern was to register the broad range and variety of themes in the media reports and commentaries.

<sup>5</sup><https://www.theguardian.com/world/2020/may/10/uk-coronavirus-lockdown-what-has-boris-johnson-announced>

Second, we focused on generating themes that are “ideal typical” in the Weberian sense (Weber, 1949). According to Weber (1949, p. 90) definition (emphasis in original):

An ideal type is formed by the one-sided *accentuation* of one or more points of view and by the synthesis of a great many diffuse, discrete, more or less present and occasionally absent *concrete individual* phenomena, which are arranged according to those one-sidedly emphasized viewpoints into a unified *analytical* construct (*Gedankenbild*).

In this context, the ideal types encapsulated specific underlying thematic perspectives (“unified analytical constructs”) on sport vis-à-vis the Covid pandemic. As we explain further below, each ideal-type theme contains several types of story or commentary (“narrative or substantive strands”) which were identified within the online mass media content.

Third, we utilized a structuralist approach to map these ideal-typical themes in a relational way. More specifically, this structuralist approach enables the meanings of these themes to emerge dyadically, through sets of “binary opposite” relations. The use of binary oppositions in social scientific analysis has an extensive multidisciplinary history, having been pioneered by the structural linguistics of de Saussure (1916/2011), and developed subsequently in the structural anthropology of Lévi-Strauss (1963/1967). In sociology, binary or polar opposites are principally associated with structural approaches, such as the structural-functionalism of (Parsons, 1960; see, for example, his “pattern variables”), the systems theory of (Luhmann, 1984/1995; see his use of binary codes), or Bourdieu (1980/1990) structuralist analyses of “logics of practice.” Often, these structuralist dualisms refer to deep cultural, ontological or universal categories. For example, Bourdieu (1980/1990, p. 215) brilliant structuralist analysis of the social ontology of the Kabyle people in northern Algeria is rooted in many fundamental categorical dualisms, such as hot/cold, day/night, dry/wet, outside/inside, and right/left.

Dualisms have been central to the analytical frameworks of many social scientists, perhaps most obviously in fundamental structure/agency debates across the philosophy of social science, as well as in diverse sociological approaches, such as Durkheim (1893/1997) on mechanical/organic solidarity or Tönnies (1887/2001) on social *gemeinschaft/gesellschaft*. More recent examples are provided by the centrality of dualisms in influential theories of globalization, such as Robertson (1992) on the particularism/universalism binary, or Ritzer (2003) on the “glocalization” / “globalization” couplet.

Structuralist and dualist theoretical frameworks all highlight how the meanings of different concepts (or themes or ideal-types) are inextricably bound to, and reliant upon, their opposites or antonyms. Competitive sport is replete with these binary oppositions—win/lose, team-mate/opponent, home/away, score/miss, fair/foul, and so on—which underpin the logics and meanings of sport participation. Structuralist and system-theory approaches which emphasize these binary codes have been used in diverse ways in the sociology of sport, for example in the study of



football fan identities (e.g., Giulianotti, 1991, 2002) or in various applications of Luhmann's theoretical *oeuvre* to sport (Wagner et al., 2010).

Fourth, this structuralist thematic approach, in line with the broader structuralist perspective *per se*, is not focused on diachronic social processes, such as tracing the trajectories or the undulating interplay of these themes over time. The emphasis instead is on identifying and mapping the logics and binary relations of the ideal-type themes that underpinned UK mass media coverage of sport during the Covid-19 lockdown.

## MASS MEDIA, SPORT, AND COVID-19: FOUR BINARY OPPOSITES

The structuralist thematic analysis of UK online mass media content on sport and Covid-19 yielded a theoretical framework that is encapsulated in **Table 1**.

To explain this framework, the first column features four deep underlying categorical statuses or dimensions of sport: the existential, normative, socio-cultural, and political. These represent the structural foundations of any domain of sport, and not just the specific area of mass media reports on sport-Covid 19. In this specific area, the four underlying categorical statuses or dimensions connect to four binary oppositions, which are premised upon eight ideal-typical themes. The four binary oppositions center on sport as absent/present, selfish/altruistic, crisis/escape, and threat/solution. Crucially, in each of these binary oppositions, the first theme is a negative one, in which sport is absent, selfish, in crisis, or a threat; the second theme is a positive one, in which sport is present, altruistic, an escape, or a solution. Each ideal-typical theme has several narrative or substantive strands that relate to prominent types of media report, commentary or storyline. It is important also to note the relationships between the categorical statuses of sport and the specific binary opposites: thus, the existential status of sport relates to the absence/presence dualism; the normative status to selfish/altruistic; the socio-cultural status of crisis/escape; and, the political status to threat/solution.

A concise comment is required on the originality of these concepts and overall theoretical architecture. The original aspects here comprise: the overarching theoretical framework that is **Table 1**; the combination of the four categorical statuses or dimensions within that model; and, the eight ideal-typical themes, four binary opposites, and 24 narrative or substantive strands that have been identified within the mass media reports and contents. Each of the four categorical statuses or dimensions is widely used across social science; however, our identification of each dimension with respect to the mass media reports and contents is also original.

The eight themes, four dimensions, and 24 strands are intended to encapsulate the breadth of all sport-Covid mass media narratives that were identified and subjected to inductive thematic analysis. However, two brief caveats are required on the extent to which this represents the "full story" in terms of mass media content and the development of the theoretical framework. First, during the initial gathering of data, some

possible media stories were discounted on the grounds that their discussions of sport and/or Covid-19 were relatively minor. Second, we recognize that future analyses of media content by other researchers may lead to the generation of further themes, dimensions, binary opposites, and strands. Such critical developments of analytical frameworks are standard processes in theory-building.

We turn now to set out in some detail the four binary opposites, and their eight ideal-typical themes, before providing some concluding comments.

## Sport as Absence/Sport as Presence

The first binary opposition is a fundamental one—centered on the existence of sport—and appears here as the "base" dualism upon which the other couplets are founded.

### Sport as Absence: Closure, Contraction, Contract

Inevitably, the most conspicuous media theme related to the absence of sport, which harbored several strands relating to issues of closure, contraction, and contract.

A very large volume of coverage was given to the *closure* of elite sport leagues and competitions, both in the UK and internationally. By the start of the UK lockdown, online media were providing checklist reports on how different sports—such as football, rugby union, rugby league, tennis, golf, netball, and marathon races—had been suspended or shut down<sup>6</sup>. Some reports highlighted the historical exceptionality of these measures, with sports events such as Wimbledon being called off for the first time in peacetime<sup>7</sup>. Additional focus was directed to the shuttering of sport clubs, golf courses, gyms and betting shops at everyday level<sup>8</sup>.

Second, the actual volume of sport content in online media, and in the wider sport-media system, *contracted* very sharply as event cancellations and postponements took effect. While there was a lack of daily sport events on which to report, general sport analysis and opinion articles also declined, with little scope for standard background news stories, such as on football player transfers and managerial sackings. Sport analysis and opinion columns, written by leading sport-writers or top former athletes, were also absent or reduced in scale.

Third, online media reports also focused on the absence of sport content in the wider media, particularly television networks, and on the subsequent *contractual* implications for consumers as well as sport clubs and federations. Pay-TV networks such as Sky and BT Sport, whose whole business model was premised on entire television stations devoted to live sport, lost almost all of this crucial content during the lockdown, and sought to plug this gap temporarily with documentaries and old highlights. The online news narrative here centered on

<sup>6</sup>See for example <https://www.telegraph.co.uk/sport/0/coronavirus-cancelled-premier-league-six-nations-london-marathon-2020-postponed/>; <https://www.bbc.co.uk/sport/51605235>

<sup>7</sup><https://www.dailymail.co.uk/sport/sportsnews/article-8175005/Coronavirus-UK-Wimbledon-tennis-CANCELED-time-World-War-II.htm>

<sup>8</sup>See for example <https://www.thesun.co.uk/news/uknews/11261387/are-gyms-closed-due-to-coronavirus-puregym-fitness-first-and-virgin-active-updates/>; <https://www.bbc.co.uk/sport/golf/52018267>

protecting the contractual rights of pay-TV consumers: several stories focused critically on how Sky and BT Sport had refused to offer paying customers refunds for subscriptions which had been sold on the promised provision of live sport content<sup>9</sup>. Subsequent reports pointed to the possibility of consumers suspending their subscriptions until live sport action, particularly in English Premier League football, was able to return<sup>10</sup>.

### Sport as Presence: Reminiscence and Anticipation

At the other end of this continuum, the theme of sport's *presence* was manifested in two main ways. This occurred not with respect to the present, but instead, somewhat paradoxically, with regard to the past and looking back (reminiscence), and to the future and looking forward (anticipation).

First, sport memories and nostalgia were prominent, as sport media activated and recycled old sporting material to fill emptied television schedules and webpages. The BBC were candid on their approach: as its Director of Sport, Barbara Slater, stated, "In these unprecedented and difficult times we are delighted to bring some of the most incredible sporting events from years gone by to our audiences over the next few months" (*The Guardian*, 2 April 2020)<sup>11</sup>. In this vein, online media turned to *reminiscence* articles and "as live" coverage of sport events. For example, *The Guardian* initiated a regular column, "My Favorite Game," in which contributors reminisced on their best sporting experiences; the newspaper also ran "minute-by-minute" live-style text reports on classic sport events, such as the 1978 Scotland-Netherlands World Cup football fixture, the 1986 and 1996 Masters golf tournaments, and the 1977 Grand National in horse-racing<sup>12</sup>. BBC Sport's website adopted a similar approach by streaming films of old sport events. The deaths of former footballers Peter Bonetti and Norman Hunter in this period inspired more vivid, poignant content, with reminiscences on their epic matches, notably the notoriously violent Chelsea-Leeds United FA Cup final replay in 1970<sup>13</sup>.

Second, there was substantial *anticipation* of the "grand return" of sport, particularly English Premier League football. This wide-ranging narrative took a variety of angles, including: speculation on the projected dates of sporting return, and how player or athlete training and subsequent events would be staged; concerns for the safety of participants whether in training or competitive activities; disputes between various competitors, clubs and sport governing bodies over how sport competitions might be altered to enable their completion, for example with football matches contested in neutral stadiums; reports on how post-Covid sports were being staged in other locations, such as

Bundesliga football in Germany, or horse-racing in Hong Kong, and what lessons might be drawn for the UK; and, the economic imperatives for elite sport leagues to return in order to protect their income from television<sup>14</sup>. Overall, this diverse anticipation of sporting return provided a long-running, shifting narrative in media coverage of sport throughout the lockdown.

### Sport as Selfish/Sport as Altruistic

The second couplet—centered on the normative aspects of sport—relates to the binary themes of sport as selfish and as altruistic.

#### Sport as Selfish: Exploitative, Irresponsible, Obscene, Evasive

The "sport as selfish" theme was underpinned largely by wider public and political arguments on sport's extensive commercialization in recent decades, with the perceived resulting tendency to prioritize commercial interests over social, welfare, and ethical issues. Four main critical strands were prominent in online media reports and analyses.

First, several sport clubs were accused of *exploitative* and greedy industrial practices as the lockdown took effect. English Premier League clubs were the most common target, reflecting a regular media unease over the perceived excessive commercialism among its owners and financial leaders. For example, Mike Ashley—owner of Newcastle United and the Sports Direct merchandise company, whose business practices often attracted political condemnation and public protests—was criticized for initially seeking to keep his retail stores open during the lockdown, then allegedly pressing staff into working despite their being classified as "furloughed" (non-working)<sup>15</sup>. Other football clubs such as Tottenham Hotspur and, in particular, Liverpool, were heavily criticized for placing staff on furlough, to avoid their billionaire owners incurring salary costs<sup>16</sup>.

Second, some sport governing bodies were criticized for their attempts to continue staging events and tournaments despite the pandemic. The IOC were criticized as "*irresponsible*" by some boxing federations after the Olympic boxing tournament was continued as the pandemic took hold, with the result that

<sup>9</sup><https://www.thesun.co.uk/sport/football/11170011/sky-sports-refund-coronavirus-bt-sport/>; <https://www.thesun.co.uk/sport/football/11197598/sky-sports-customers-fuming-subscriptions-coronavirus/>; <https://www.dailymail.co.uk/sport/sportsnews/article-8112803/Sky-Sports-BT-refunds-coronavirus.html>

<sup>10</sup>See <https://www.dailymail.co.uk/sport/othersports/article-8133947/How-pause-Sky-Sports-subscription-FREE-amid-coronavirus-outbreak.html>

<sup>11</sup>See <https://www.theguardian.com/sport/2020/apr/02/bbc-summer-sport-nostalgia-coronavirus-lockdown>

<sup>12</sup>See [https://www.theguardian.com/sport/sport/\\$tone/minutebyminute](https://www.theguardian.com/sport/sport/$tone/minutebyminute)

<sup>13</sup>See <https://www.theguardian.com/football/live/2020/mar/21/chelsea-v-leeds-united-1970-fa-cup-final-replay-live?page=with:block-5e74a87f8f088d7575597188>; <https://www.bbc.co.uk/sport/football/52416192>

<sup>14</sup><https://www.bbc.co.uk/sport/football/52326617>; <https://www.dailymail.co.uk/sport/sportsnews/article-8287775/Bundesliga-return-15-German-government-gives-green-light.html>; <https://www.bbc.co.uk/sport/horse-racing/52698288>; <https://www.telegraph.co.uk/sport/2020/04/10/scientists-warn-crowds-sporting-events-may-not-return-august/>; <https://www.telegraph.co.uk/football/2020/04/29/police-will-call-football-season-fans-try-gather-watch-games/>; <https://www.dailymail.co.uk/sport/football/article-8260747/Here-dates-fans-diary-officials-plot-football-return-COVID-19-lockdown.html>; <https://www.thesun.co.uk/sport/football/11484857/arsenal-return-training-own-pitch-coronavirus/>; <https://www.theguardian.com/football/2020/may/08/neutral-venue-plan-has-no-rationale-says-former-football-police-commander-premier-league-fans>; <https://www.dailymail.co.uk/sport/cricket/article-8270277/Moeen-Ali-believes-coronavirus-crisis-drastically-better-cricket-return.html>

<sup>15</sup><https://www.thetimes.co.uk/article/ashley-eats-humble-pie-after-row-with-staff-public-and-government-p5927k25s>; <https://www.theguardian.com/business/2020/may/03/sports-direct-managers-accuse-firm-of-making-them-work-on-furlough>

<sup>16</sup><https://www.dailymail.co.uk/sport/football/article-8191989/Coronavirus-Wealthy-owners-Liverpool-Spurs-Newcastle-excelled-selfish-stakes.html>; <https://www.thesun.co.uk/sport/football/11327925/liverpool-place-staff-furlough-coronavirus/>

some participants contracted Covid-19<sup>17</sup>. The IOC leadership attracted further protests from many athletes and some sport federations for delaying the seemingly unavoidable decision, to postpone the Tokyo 2020 Olympics<sup>18</sup>. Cheltenham festival organizers also faced criticism for staging their event as the pandemic took hold<sup>19</sup>.

Third, the rationale for the proposed return of English Premier League club football came under scrutiny. Criticisms here centered on the essentially financial motives for the return—the risk of losing £750 million in contracted television money—rather than prioritizing more important factors such as the safety of players and fans, the integrity of sporting competition, or broader support for and protection of the NHS<sup>20</sup>. The initial English football plan, to recommence fixtures on 30 April during lockdown, was castigated as “*obscene*” by Oliver Holt, a prominent UK sportswriter, in the context of a national health emergency:

All that April 30 date did was reinforce the worst opinions of the Premier League: that it is a league in denial; a league so bloated with cash that it is out of touch with reality and that it deludes itself that, while hospitals and their staff fight against the pandemic and the body count rises, the public harbor a desire to return to its stadiums<sup>21</sup>.

Similar accusations of greedy or obscene commercial priorities were directed toward the controllers of non-league football in England, in allowing games to take place, and Formula 1 in seeking to stage the Australian Grand Prix as the global pandemic intensified<sup>22</sup>.

Fourth, a related aspect here involved demands for highly paid sport stars not to *evade* their responsibilities, and to contribute to the national effort by accepting pay cuts. The UK’s Minister for Health, Matt Hancock, and other commentators argued that highly rewarded football players should follow this course of action<sup>23</sup>.

### Sport as Altruistic: Welfare and Solidarity

At the other side of this continuum, the theme of sport’s altruism and social responsibility was advanced in two main ways. First, as sport events were called off, and as the lockdown took effect,

UK sport officials were reported as stating that their priorities lay with the health and *welfare* of athletes and the wider public rather than with any other concerns. In men’s rugby union, clubs emphasized their commitment to give their players the best possible support and resources during lockdown<sup>24</sup>. The Women’s Netball Players’ Association launched a mental health campaign early in the pandemic, to support athletes who had been forced to suspend their work and were also facing the threat of salary freezes<sup>25</sup>.

Second, the *solidarity* of sport stars in fund-raising, donations, and social support was given significant discussion. In men’s football, this included fund-raising initiatives such as the “#PlayersTogether” campaign, in support of front-line NHS workers, which also represented a pointed response to government ministers and media commentators that these stars were not “doing their bit”<sup>26</sup>. The voluntary work of athletes was also highlighted, such as the Welsh rugby union international Jamie Roberts, and Olympic medallist Gail Emms, in working to support the National Health Service (NHS)<sup>27</sup>.

### Sport as Crisis, Sport as Escape

The third couplet—centered on the socio-cultural aspects of sport—concerned sport’s double-edged relationship to Covid-19: as a site of crisis, ensnared by the pandemic; and, as a site of escape, where the pandemic could be side-stepped.

### Sport as Crisis: Economy, Time, Social Divisions, Infection

In regard to crisis, four intersecting strands were evident in online media reports on how sport was a site of emergency in the midst of the pandemic. First, the devastating *economic* impact of the pandemic on sport as well as in other areas of the global economy was accorded substantial media coverage. Again, elite men’s football attracted substantial focus, with the Premier League under pressure to complete the season of 92 remaining fixtures, or face the loss of television revenue estimated in some reports as totalling up to £1.5 billion<sup>28</sup>. Yet the most significant crises were faced by much smaller and more modest sport federations. Several leading sport governing bodies were reported as facing “meltdown,” with a combined “£740 million financial black hole”; cricket alone faced losses of around £380 million (*The Telegraph*,

<sup>17</sup><https://www.dailymail.co.uk/sport/olympics/article-8153837/Turkish-Boxing-Federation-slams-irresponsible-IOC-two-boxers-contract-coronavirus.html>

<sup>18</sup><https://www.theguardian.com/sport/2020/mar/25/tokyo-2020-olympics-thomas-bach-donald-trump-coronavirus-delay>

<sup>19</sup><https://www.dailymail.co.uk/sport/racing/article-8234987/Racing-chief-hints-early-return-despite-sport-facing-criticism-staging-Cheltenham-Festival.html>

<sup>20</sup><https://www.thesun.co.uk/sport/football/11291528/prem-clubs-season-restart-may-coronavirus/>; <https://www.bbc.co.uk/sport/football/52630497>; <https://www.theguardian.com/sport/2020/mar/14/sport-coronavirus-empty-schedules-football>; <https://www.theguardian.com/football/blog/2020/apr/25/finishing-premier-league-season-pointless-football>

<sup>21</sup>See <https://www.dailymail.co.uk/sport/football/article-8163369/OLIVER-HOLT-Premier-League-NHS-100m-use-pay-agents.html>

<sup>22</sup><https://www.theguardian.com/sport/2020/mar/14/sport-coronavirus-empty-schedules-football>; <https://www.thesun.co.uk/sport/motorsport/11155713/lewis-hamilton-coronavirus-fl-australia/>

<sup>23</sup>See <https://www.bbc.co.uk/sport/football/52142267>; <https://www.telegraph.co.uk/football/2020/03/27/premier-league-players-may-forced-take-50-per-cent-pay-cuts/>

<sup>24</sup>See <https://www.telegraph.co.uk/rugby-union/2020/03/27/harlequins-helping-players-physical-social-mental-health-lockdown/>;

<sup>25</sup><https://www.telegraph.co.uk/netball/2020/03/25/netball-players-association-launches-coronavirus-mental-health/>

<sup>26</sup>See <https://www.telegraph.co.uk/football/2020/03/25/premier-league-stars-back-campaign-raise-100000-local-communities/>; <https://www.bbc.co.uk/sport/england/52037307>; <https://www.dailymail.co.uk/sport/sportsnews/article-8188885/Coronavirus-Wayne-Rooney-slams-Matt-Hancock-claims-players-turned-scapegoats.html>; <https://www.dailymail.co.uk/sport/football/article-8234539/Premier-League-players-together-initiative-raises-4MILLION-NHS-launch.html>; <https://www.thesun.co.uk/sport/football/11358506/premier-league-captains-donation-nhs-coronavirus/>; <https://www.dailymail.co.uk/sport/sportsnews/article-8206389/Stars-stepped-help-coronavirus-pandemic.html>

<sup>27</sup><https://www.bbc.co.uk/sport/rugby-union/52205287>; <https://www.thesun.co.uk/sport/11670791/gail-emms-coronavirus-olympic-volunteer/>

<sup>28</sup><https://www.thesun.co.uk/sport/football/11591621/premier-league-clubs-tv-money-broadcastersgle-coronavirus/>



5 May 2020)<sup>29</sup>. A particular concern centered on women's sports, which had made substantial progress in recent years, but faced being to the fore in any financial cutbacks<sup>30</sup>.

Second, a continuing story centered on the unfolding devastation wrought by the pandemic on sporting *time*; that is, on the sporting calendar. Regular media updates followed on how a steady stream of major events—such as the 2020 Olympics, the 2020 men's football European championships, the Six Nations rugby championship, and further international tournaments in cricket, golf, rugby league, tennis, athletics, baseball, Formula 1 motor racing, and other sports—had been canceled or given long-term postponement<sup>31</sup>.

Third, the pandemic exposed and exacerbated *social divisions* within sport and wider society. There was substantial political, scientific and media focus on Covid-19's threat to specific population groups, particularly with respect to higher mortality levels according to age (older people), disability, gender (male), ethnicity (BAME groups), and those with underlying health conditions; and, on how disadvantaged communities were struggling to manage during the lockdown<sup>32</sup>. In sport, there was significant focus on Covid-19's threat to BAME athletes, who constituted a relatively high proportion of elite-level performers, particularly in football, and the greater risks faced by these stars during any proposed return to training and competition<sup>33</sup>. Another focus was on how, at everyday levels, women had been adversely affected by the lockdown, for example through drops in their levels of physical activity and exercise<sup>34</sup>.

Finally, media stories also focused on those in the sporting world who had endured viral *infection*. The most extreme cases involved victims who had died from the virus, such as the former Leeds United and England footballer, Norman Hunter, the Italian Olympic runner Donato Sabia, and the former Real Madrid President, Lorenzo Sanz<sup>35</sup>. A more common set of stories centered on contemporary athletes and coaches, particularly within team contexts, who had been diagnosed positive and were required to manage the virus<sup>36</sup>.

<sup>29</sup><https://www.telegraph.co.uk/sport/2020/05/05/sports-darkest-hour-740m-black-hole-governing-bodies-budgets/>

<sup>30</sup><https://www.dailymail.co.uk/sport/sportsnews/article-8341739/Womens-sport-left-lockdown-Fears-cuts-teams-fold-livelihoods-lost.html>

<sup>31</sup><https://www.telegraph.co.uk/sport/0/coronavirus-cancelled-premier-league-six-nations-london-marathon-2020-postponed/>; <https://www.bbc.co.uk/sport/51605235>

<sup>32</sup><https://www.theguardian.com/world/2020/apr/22/why-are-people-from-bame-groups-dying-disproportionately-of-covid-19>; <https://www.telegraph.co.uk/news/2020/04/29/over-50s-should-kept-coronavirus-lockdown-measures-longer-say/>; <https://www.dailymail.co.uk/health/article-8303307/Vulnerable-Britons-stripped-social-care-Covid-19-lockdown.html>

<sup>33</sup><https://www.dailymail.co.uk/sport/sportsnews/article-8336853/PFA-calls-research-coronavirus-affects-BAME-stars.html>; <https://www.theguardian.com/sport/2020/may/08/shock-fear-and-unease-loom-over-bame-athletes-before-return-to-action-covid-19>

<sup>34</sup><https://www.telegraph.co.uk/sport/2020/04/30/women-disproportionately-impacted-fall-activity-levels-lockdown/>

<sup>35</sup><https://www.theguardian.com/sport/2020/apr/08/italian-olympic-800m-finalist-donato-sabia-dies-of-coronavirus-aged-56>; <https://www.telegraph.co.uk/football/2020/03/21/former-real-madrid-president-lorenzo-sanz-dies-contracting-coronavirus/>

<sup>36</sup><https://www.bbc.co.uk/sport/football/52605961>; <https://www.bbc.co.uk/sport/rugby-union/52325189>

## Sport as Escape: Nostalgia, Compensation, Repudiation

At the other side of this continuum, some focus was given over to sport as escape, in terms of evading the impacts of Covid-19. Three key aspects of this theme centered on nostalgia, compensation and repudiation.

First, as noted earlier, sporting reminiscences within the media offered a collective psycho-cultural escape from the lockdown, enabling viewers and readers to revel in the *nostalgia* of classic moments from the pre-Covid sporting era.

Second, some media attention turned to *compensatory* forms of sport involvement. Particular focus was on how e-sports were reportedly “booming” in popularity, as sport audiences sought competitive if simulated sport participation during the lockdown<sup>37</sup>. Virtual and actual sports were bridged by stories that some sport stars during the lockdown were engaged in e-sport competitions, such as various tennis stars competing in a virtual Madrid Open, or Joe Frazier vs. Lennox Lewis in online boxing<sup>38</sup>. Elite-level darts was most successful in combining actual and virtual formats, as competitors played in their own homes, while being connected over livestream broadband video links. The initial competition was complicated by a weak wifi connection at the home of former world champion, Gary Anderson, which disrupted his participation<sup>39</sup>.

Third, reports focused on how some nations had *repudiated* global public health guidance, ignoring the pandemic, and continuing to stage sporting competitions as well as other substantial public gatherings. The most extreme example was provided by Belarus, where President Alexander Lukashenko refused to cancel any events, and highlighted his commitment to these policies by participating in an ice-hockey match<sup>40</sup>. As sport events across the world went into lockdown, the Belarus national men's football league also continued to stage fixtures<sup>41</sup>.

## Sport as Threat, Sport as Solution

The fourth dualism—centered on the political aspects of sport—related to online media coverage of sport as a threat and as a potential solution to the pandemic.

### Sport as Threat: Catalyst and Violator

There were two main strands to the theme of sport as a potential threat to health and well-being. First, the role of sport as a *catalyst* for spreading the virus was given significant focus. As noted earlier, at elite level, attention turned to two specific events: the Cheltenham horse-racing festival (10–13 March), attended

<sup>37</sup><https://www.telegraph.co.uk/technology/2020/04/08/boom-esports-fans-try-fill-void-left-decimated-sporting-schedule/>; <https://www.theguardian.com/sport/2020/apr/11/esports-ride-crest-of-a-wave-as-figures-rocket-during-covid-19-crisis>

<sup>38</sup><https://www.dailymail.co.uk/sport/sportsnews/article-8203991/Andy-Murray-virtual-Madrid-Open-month-bid-raise-money-coronavirus-pandemic.html>; <https://www.telegraph.co.uk/formula-1/2020/03/20/formula-1-replace-postponed-races-virtual-grand-prix-series/>; <https://www.bbc.co.uk/news/technology-52049893>

<sup>39</sup><https://www.bbc.co.uk/sport/darts/52654017>

<sup>40</sup><https://www.bbc.co.uk/sport/av/52094552>

<sup>41</sup><https://www.telegraph.co.uk/news/2020/04/22/belarus-denies-danger-coronavirus-outbreak-football-matches/>



by around 150,000 people; and, the Liverpool-Atletico Madrid Champions League fixture (11 March). Some reports pointed toward spikes in local mortality rates 20–35 days after these events, leading to calls for expert inquiries into their actual health impacts<sup>42</sup>.

Sport-related holidays and other social activities at everyday level were spotlighted as potential catalysts for spreading the disease. Some of the earliest potential Covid-19 infections of UK citizens—including the possible UK “patient zero”—were traced to the Austrian skiing resort of Ischgl, where après-ski parties were reported to have afforded an ideal environment for viral diffusion<sup>43</sup>.

A second aspect to the sport-as-threat theme related to how sport might *violate* government instructions on social behavior during the Covid-19 lockdown, with the potential for the infection spreading across the wider population. This media storyline tapped into a classic media narrative, centered on exposés of the misbehavior of sport stars. Thus, for example, football players were criticized for “flouting” social distancing rules by training together, and rugby players for meeting socially<sup>44</sup>. More salacious stories followed, for example on one men’s football player who reportedly hosted a sex party a day after his social media post had urged people to practice social distancing<sup>45</sup>.

### Sport as Solution: Conformist, Adapter, Mobiliser, Booster

At the other side, the theme of sport as a potential social solution during the pandemic carried four main strands. First, sport’s *conformity* was highlighted, in following or offering support for government instructions and scientific guidance during the pandemic. Under lockdown conditions, the public were advised to take sporting exercise in open spaces, for example cross-country running and mountain-biking<sup>46</sup>. As the prospective return of elite-level sport was discussed, sport federations, clubs, and athletes were advised on how training could begin, while maintaining social distancing along with the deep-cleaning of sport facilities and equipment<sup>47</sup>.

Second, the *adaptations* of elite-level sport, in protecting against the virus during returns to action, were given substantial coverage. These measures included the extensive testing of potential participants for Covid-19, and the staging of events

“behind closed doors” (sometimes known as “ghost games”) in sports such as horse-racing, football, golf, and cricket<sup>48</sup>. In elite men’s football, substantial interest centered on so-called “ghost games” in which stadiums and venues were emptied of all spectators. Meanwhile, elite sport leagues and clubs put in place safeguarding and support systems in order to protect players and staff, and to advance the prospect for a smooth return to action. Athletes and other staff who contracted Covid-19 were self-isolating at home, usually with mild symptoms<sup>49</sup>.

Third, at everyday level, the importance of sport and physical activity for *mobilizing* the nation, to keep the public fit during and after lockdown, was given prominence. There was substantial media guidance on effective home fitness regimes, while linking to workouts available on social media, such as those offered by celebrity trainers such as Joe Wicks<sup>50</sup>. The UK government was also pressed to permit gyms and other fitness sites to reopen, in part to tackle potential rises in obesity which in turn could increase the risk of Covid-19 infections becoming more serious<sup>51</sup>.

Finally, the role of elite-level sport, and in particular English men’s football, as a *booster* for the national mood was spotlighted. At the pandemic’s outset, some sport commentators argued that the future return of football “could bring some joy back to the nation”<sup>52</sup>. The England cricket captain—the Irishman, Eoin Morgan—commented that, “Playing cricket again, even behind closed doors, would help boost the nation’s morale”<sup>53</sup>. Later, as the UK government assessed easing the lockdown, foreign secretary Dominic Raab commented that the return of sport would “lift the spirits of the nation”<sup>54</sup>.

## DISCUSSION AND CONCLUSION

In this paper, we have utilized a “structuralist thematic” approach to organize and to analyse UK online mass media coverage of sport during the Covid-19 lockdown. The analytical framework and substantive findings are summarized in **Table 1**. The analysis is anchored in four underpinning statuses or dimensions: the existential, normative, socio-cultural, and political statuses of sport. These dimensions connect directly to four sets of binary opposites that feature a total of eight

<sup>42</sup><https://www.telegraph.co.uk/global-health/science-and-disease/revealed-three-uk-sporting-events-may-have-led-coronavirus-death/>; <https://www.theguardian.com/sport/2020/apr/21/experts-inquiry-cheltenham-festival-coronavirus-deaths>

<sup>43</sup><https://www.telegraph.co.uk/global-health/science-and-disease/uk-patient-zero-east-sussex-family-may-have-infected-coronavirus/>; <https://www.bbc.co.uk/news/world-europe-52384572>; <https://www.dailymail.co.uk/news/article-8154067/UKs-patient-zero-Sussex-worker-50-caught-coronavirus-Austrian-ski-resort-party-bar.html>

<sup>44</sup><https://www.telegraph.co.uk/football/2020/04/21/spurs-forced-remind-players-social-distancing-guidelines-serge/>; <https://www.theguardian.com/sport/2020/may/07/saracens-apologize-after-billy-vunipola-and-teammates-break-lockdown-rules-rugby-union>

<sup>45</sup><https://www.thesun.co.uk/sport/11329263/kyle-walker-sex-party-coronavirus-lockdown-hookers-man-city/>

<sup>46</sup><https://www.bbc.co.uk/news/uk-england-51943531>

<sup>47</sup><https://www.bbc.co.uk/sport/52652893>

<sup>48</sup><https://www.dailymail.co.uk/sport/football/article-8287831/Premier-League-horse-racing-return-regular-testing-conducted-says-Matt-Hancock.html>; <https://www.telegraph.co.uk/football/2020/05/11/sporting-events-behind-closed-doors-return-june-boost-project/>; <https://www.telegraph.co.uk/sport/2020/05/18/ghost-stadiums-prove-professional-sport-needs-audience/>; <https://www.dailymail.co.uk/sport/sportsnews/article-8260281/Coronavirus-UK-Premier-League-estimates-300-people-needed-match.html>

<sup>49</sup><https://www.bbc.co.uk/sport/cricket/51915496>; <https://www.thesun.co.uk/sport/football/11182427/footballers-self-isolation-gyms-keeping-fit/>; <https://www.theguardian.com/football/2020/mar/28/eight-west-ham-players-in-self-isolation-with-mild-coronavirus-symptoms>

<sup>50</sup><https://www.dailymail.co.uk/femail/article-8167269/Revealed-Effective-home-workout-complete-lock-down.html>

<sup>51</sup><https://www.telegraph.co.uk/news/2020/05/08/pm-urged-allow-gym-reopening-exercise-wonder-drug-coronavirus/>

<sup>52</sup><https://www.dailymail.co.uk/sport/football/article-8132771/Coronavirus-UK-Gary-Neville-says-festival-football-bring-hope-joy-outbreak.html>

<sup>53</sup><https://www.thesun.co.uk/sport/11305330/eoin-morgan-england-cricket-coronavirus-hope/>

<sup>54</sup><https://www.bbc.co.uk/sport/52552667>

themes: sport as absence/presence, selfish/altruistic, crisis/escape, and threat/solution. Each theme features several narrative or substantive strands that are associated with particular types of sport-Covid media report or commentary.

To conclude, we wish to make three sets of observations which relate, respectively, to the substantive themes within the model, as set out in **Table 1**; to the use of the model in future research; and, briefly, to broader substantive and theoretical insights on sport and the mass media which follow from the paper.

To begin, we consider the substantive themes within the model; three main points might be made here. First, it is evident that the negative themes within the model—which present sport as absent, selfish, in crisis, or a threat—tend to relate to economic and health questions, and to portray sport as having an excessive self-importance. Thus, for example, there is significant focus on Covid-19's crippling impacts on sport's finances, and on the excessive self-interest of some leading sport figures, clubs, and governing bodies in thinking of their commercial concerns when responding to the crisis.

Second, the positive themes—that present sport as present, altruistic, an escape, and solution—tend to be associated with its psychological and social benefits. These positive themes also point to key sport stakeholders being relatively humble, or appreciative of their secondary importance in the midst of crisis. Thus, for example, online media reports included focus on how sporting reminiscences, esports, and the anticipation of sport's return, were evident during the lockdown, potentially offering some escapist, compensatory, or morale-boosting benefits for individuals and social groups during the crisis. Media reports also spotlighted sport's contribution to the “greater good” in terms of fund-raising, voluntary work, and other forms of social support.

Third, there is a further, underlying difference between the positive and negative themes within the binary oppositions, and their respective narrative or substantive strands in mass media coverage of sport/Covid. Negative substantive strands tend to highlight the mundane impacts and material realities of the pandemic in relation to sport: the closure or contraction of sport, its economic and temporal shocks, its intensification of social divisions, and its role in catalyzing viral transmission, for example. Positive substantive strands have a markedly different tone and emphasis, in highlighting critical responses and alternative social arrangements, particularly in the imaginings of such arrangements within media narratives on sport and Covid-19. Thus, for example, there are reminiscence, nostalgia, and anticipation in imagining sport, in past and future; and, sport's role in shaping new societal ways forward, in terms of welfare, solidarity, mobilization, and boosting public morale. Future research into mass media discourses on crisis situations, whether in sport or in other social fields, might investigate further these differences between negative and positive strands in media content.

We turn now to address more fully the second concluding issue, on how future research on the model may be developed. Four main points arise here. First, the overall model provides the basis for further systematic research into mass media narratives with respect to sport or other social fields, such as in the arts, consumerism, industry, travel and tourism, and the academic

world. This research may focus on context of Covid-19, or other transnational lockdowns such as during the First and Second World Wars, or other global shocks such as the 2008 financial crisis. It may also be internationally comparative, for example by exploring how mass media in other parts of the world have reported on sport during the Covid-19 lockdown.

Second, future sociological research on any sporting domain may be underpinned analytically by the underlying statuses of sport—the existential, the normative, the socio-cultural, and the political—which have been set out here. For example, the various research fields of sport and the mass media, spectator cultures and identities, athlete migration, the governance and management of sport, the sport for development sector, and sport, physical activity, and health, are all domains in which the existential, normative, socio-cultural, and political dimensions of sport are in place. Accordingly, these latter four statuses may provide the analytical starting-points for research in these fields.

Third, future research may also be guided by the eight themes within the binary oppositions, and their respective substantive strands. Again, there is particular scope here for comparative research, for example in examining how the mass media from outside the UK have reported on sport-Covid, and what similar or differing types of binary opposition and substantive strand may be identified within this non-UK media content.

Fourth, in theoretical terms, there is certainly scope for the model to be further developed in ways that have been precluded here by the pressures of brevity. From a structuralist perspective, one future focus may relate to the binary oppositions, and specifically to the intermediary points between these dualisms. This focus would involve research into the thresholds, liminal spaces, and transitional zones of each dualism; and, into the special “rites of passage” that would mark any movements between one polarity and the other. Hence, to pick one example, in relation to the sport as selfish/altruistic couplet, research might examine media reports and commentaries that moved between these two themes, and explore what may serve to catalyze any shifts in media emphasis from “sport as selfish” to “sport as altruistic” and vice-versa over time. A further diachronic aspect may be added by examining the substantive strands of media reports, to explore how, for example, media discourses move between positive and negative substantive strands; what patterns may be identified in these movements between particular strands; and, what factors tend to influence these shifts in emphasis.

Finally, we turn to explore some broader substantive and theoretical issues on sport and the media. While these broader issues are generally beyond the scope of the paper, three emergent points may be forwarded. First, the research here does highlight how, amidst the huge national shock of the Covid-19 pandemic lockdown, much of the mass media reverted to long-established, tried-and-tested storylines, narratives, and discourses. These included the implicit claims of media outlets to be acting in the public interest by promoting collective solidarity, public health and welfare, and issues of national concern; and, media stories and opinion pieces which featured exposés and trenchant criticisms of sport celebrities and authorities.

Second, there are also clear indications of how the mass media outlets examined here—the UK's leading newspapers and broadcasters—position themselves pragmatically within the wider multi-platform media and communication environment, alongside for example online outlets, social media, and gaming and e-sports. This pragmatism is demonstrated most obviously by the very extensive online news presence of the five media organizations in this study. It is also highlighted by how these media behemoths co-exist with and draw upon these other media platforms, for example through engaging with social media content or reporting on e-sport activities.

Third, the mass media narratives point to the potential utility of postmodern social theories for examining key aspects of the sport-Covid and media interface. Particularly relevant aspects of postmodern social theory here relate to the focus on the virtual world and the deconstruction of social categories<sup>55</sup>. In the sport-Covid context, these postmodern aspects are evidenced by, for example, media emphasis on televised, online, and other “virtual” forms of sport, rather than “actual” sport attendance; and, how

<sup>55</sup>For a discussion of postmodern social theories in relation to sport, see Giulianotti (2015).

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athletes turned to e-sports due to the cancellation of “real” sport events. These insights on postmodern trends in sport media fit with other studies which highlight how fans move into other categorical roles—as producers, participants, and broadcasters—within contemporary sport (Andrews and Ritzer, 2018; Majumdar and Naha, 2020; Sturm, 2020). They also remind researchers of the creative possibilities and enduring value of particular social theories—such as postmodernism or structuralism—for examining contemporary transformations in social fields such as sport and the media.

## 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

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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# The Influence of COVID-19 Lockdown Restrictions on Perceived Nutrition Habits in Rugby Union Players

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The global outbreak of COVID-19 has led to governments and local authorities implementing nationwide lockdowns in an attempt to encourage social distancing and minimize the spread of the virus. Only essential businesses have been able to remain open, with non-essential businesses and activities either closing or restricting services. With no group training sessions allowed, canceled matches, an inability to work and the closure of eating establishments, Rugby Union players have experienced disruption to their daily lives. Two surveys were distributed among Rugby Union athletes to explore (1) the influence of COVID-19 lockdown restrictions on Rugby Union players' nutrition and training habits and (2) how nutrition habits in New Zealand Rugby Union players change after lockdown restrictions were lifted. In total, 258 respondents completed Survey 1 (84.1% male, 26.4% professional/semi-professional). Of the respondents, 58% indicated they lived with family during lockdown. Total food intake was reported to be higher in 36% of respondents. Fruit and vegetable intake was lower (17%) and packaged/convenience food intake higher (26%) in a minority of respondents. In total, 106 respondents completed Survey 2 (84.9% male, 34.0% professional/semi-professional). Of the respondents, 72% prepared and 67% purchased their own food. Less than half of respondents consumed high-protein food more than twice daily either during or following lockdown. Compared to during lockdown, motivation to train and exercise was greater in 58% of respondents following lockdown. Dietitians and nutritionists within clubs provided most of the nutrition knowledge to athletes however other unreliable sources were identified, such as social media and family members. The ongoing pandemic has presented significant challenges for athletes concerning training and nutrition habits and the current study provides some insight into these. Coaches and performance staff should ensure athletes receive appropriate nutritional and training support whilst being aware of the unique demands the individuals' may face.

**Keywords:** COVID-19, Rugby Union, athlete, nutrition habits, training, social distancing measures

## INTRODUCTION

COVID-19 is a novel strain of coronavirus that can cause severe acute respiratory distress. It is spread via droplets generated by sneezing, coughing or talking and is therefore easily transmitted between humans. COVID-19 was declared a global pandemic by the World Health Organization on 11th March 2020 (1) and measures have been implemented by governments and local authorities to



minimize the spread of the virus. These measures include social distancing (aiming to keep people from different households separate unless required) and rigid hygiene protocols (wearing masks when out in public, regular washing and sanitizing of hands and surfaces). The implementation of these guidelines has since resulted in global travel bans and restrictions on engaging in activities deemed “non-essential.”

In New Zealand, Alert Level Four lockdown restrictions were enforced between 25th March 2020 and 27th April 2020, with businesses that aren’t deemed essential (e.g., supermarkets, pharmacies) forced to close. Between 27th April 2020 and 13th May 2020, Alert Level Three was enforced in New Zealand which brought around some changes (e.g., fast food establishments could operate a take-away service only) however gatherings of more than 10 people from different households was not permitted. Following the reduction to Alert Level Two on 13th May 2020, which allowed for most restaurants, businesses and activities to resume provided appropriate contact tracing, social distancing and hygiene rules were enforced, most people were able to resume habitual activities. On 8th June 2020, Alert Level One meant no restrictions were enforced in New Zealand with the exception of border entry being strictly controlled to allow only citizens and permanent residents entry following a 2 week quarantine.

Organizations and individuals involved in sport and physical activity have experienced significant restrictions due the COVID-19 social distancing measures. Sporting events at all levels, from schools and clubs to large international events such as the 2020 Olympic Games, have been canceled or postponed. This has resulted in organized training sessions being deemed non-essential with many athletes forced to reduce their training volume drastically. Additionally, stresses related to illness and health, economic uncertainty and prolonged social isolation may lead to unfavorable or additional mental health outcomes in athletes (2, 3).

Engaging in regular physical activity has been encouraged (4) although social distancing guidelines may affect team and contact sports. Although some athletes are able to continue training and preparing for competition, sports requiring physical contact face additional issues surrounding training preparation. Rugby Union is a combative sport and the high incidence of players engaging in physical contact in the form of tackles, rucks, mauls, and scrums (5) thus social distancing guidelines have particular relevance to collision-based team sport athletes. Rugby Union athletes have been unable to participate in sport-specific activity during lockdown restrictions, which vary from country to country. Strict lockdown measures restricting access to habitual training environments and contact with other players mean coaches and practitioners are faced with challenges regarding developing or maintaining essential attributes required by Rugby Union athletes (lean mass, strength, power, speed, agility, sport-specific skills, decision-making ability) (6).

Not only have training and competition been affected by COVID-19, lockdown restrictions are likely to have influenced athletes’ perceived nutrition habits. Nutrition habits can be defined as “the habitual decisions of individuals or group of people regarding what foods they eat” (7). For example, habitual

eating patterns will have changed significantly with the closure of eating establishments and food delivery services. Furthermore, stressors as a direct result of COVID-19 lockdown restrictions may result in unfavorable food choices (8). Additional challenges associated with monitoring nutrient intake during lockdown are likely to be encountered by clubs due to less direct contact with nutrition professionals. It is vital athletes receive the appropriate nutritional support during lockdown as an abrupt return to training and play once restrictions are lifted may result in increased risk of injury (9) and it is likely good dietary habits may alleviate this (10, 11).

Numerous surveys have been distributed across different populations and countries to identify the effect of COVID-19 lockdown measures on dietary patterns (12, 13) however no data has been reported in Rugby Union athletes. The purpose of this study is to explore (1) the influence of COVID-19 lockdown restrictions on Rugby Union players’ nutrition and training habits and (2) how nutrition habits in New Zealand Rugby Union players change after lockdown restrictions were lifted.

## METHODS

The research instruments consisted of two surveys administered via an online survey-hosting website (Survey Monkey, Palo Alto, CA, USA). Within human ethics research regulations, this study was deemed to be low risk. All participants granted informed consent prior to commencing any of the surveys.

The first survey, entitled “Nutrition & Training Habits in Rugby Union Players – COVID-19 Lockdown” was administered from April 19th 2020 to May 22nd 2020, during which full lockdown restrictions were enforced in New Zealand and many countries globally. Initially, management staff and/or coaching staff from Rugby Union teams located in New Zealand, Australia and the United Kingdom were approached via e-mail. The purpose of the survey was explained, and management staff were asked to distribute the survey web link to their players. The survey consisted of 30 questions organized into three sections—general information, nutrition and training.

The second survey, entitled “Post-Lockdown Nutrition & Training Habits in Rugby Union Players” was administered from 2nd June 2020 to 2nd July 2020. The survey consisted of 28 questions. Management staff from Rugby Union teams in New Zealand were approached via e-mail due to the complete relaxation of lockdown restrictions. An information page was presented prior to the survey and consent was gained via a consent statement and check box.

Descriptive analysis of results are presented as percentages (%) of responses.

## RESULTS

For a full breakdown of Survey 1 and 2 questions and responses, please see **Supplementary Materials**. Relevant results will be discussed in the subsequent sections.

### Survey 1

Relevant results will be discussed in this section.



In total, of the 314 survey link clicks, 258 respondents (82% total) completed Survey 1. Demographics for the survey respondents are presented in **Table 1**. The respondents were 18–25 years of age (59.7%), male (84.1%) and living in New Zealand (92.2%). Only 26.3% of respondents reported playing at either a semi-professional or a professional level, with amateur players representing competitive club level or academy teams. Living with family accounted for 58.5% of responses. During lockdown, 39.2% of respondents indicated their motivation to train was lower than usual, with 32.6% reporting no change in motivation levels and 28.3% stating motivation to train had increased during lockdown.

Most respondents reported consuming breakfast daily (63.2%), eating 2–3 meals (67.1%) and 1–2 snacks (63.6%) per day. Respondents reported that a family member was most likely to purchase their food during lockdown (42.6%). Whilst 44.6% of respondents prepared their own food and meals, family members (23.6%) and a combination of people (23.3%) (the respondent and others in the household) were also involved in the food/meal preparation process.

Total food intake was reported to be greater during lockdown in 35.7% of respondents. During lockdown, 16.7% of respondents' fruit and vegetable intake was lower than before lockdown, with the remainder indicating their intake was either the same or higher than before the restrictions. Packaged/convenience food intake was lower in lockdown for 41.9% of participants.

Nutrition knowledge in respondents was primarily from a dietician or nutritionist associated with the club (61.6%) however coaching staff (25.2%), teammates (27.1%), family members (30.6%), the internet (31.1%) and social media also contributed. When asked about the frequency of consumption of complete high-protein foods, 49.2% of respondents reported greater than two daily feedings. Respondents who consumed no dietary supplements during lockdown consisted of 53.3% of total responses.

## Survey 2

In total, of the 112 survey link clicks, 106 respondents (95% total) completed Survey 2. Demographics for the survey respondents are displayed in **Table 1**. Respondents were 18–25 years old (66.0%) and male (84.9%). In total, 34.0% of respondents perform at a semi-professional or professional level. Most respondents reported living with family (33.0%) or flatting in shared accommodation (31.1%). Motivation to train and exercise was greater in 59.5% of respondents compared to during lockdown.

As with Survey 1, most respondents reported daily breakfast consumption (72.6%), eating 2–3 meals (51.9%) and 1–2 snacks (71.7%) per day. The vast majority of respondents purchased (67.0%) and prepared their own food and meals (71.0%). Eating out at takeaways, cafes and restaurants at least once per week was reported in 45.3% of respondents, with 8.4% indicating their frequency of eating out was  $\geq 3$  times weekly.

Dieticians or nutritionists associated with the club provided 68.9% of respondents nutrition knowledge, with coaching staff (26.4%), teammates (33.0%), family members, the internet (31.1%) and social media (22.6%) again contributing.

Consumption of  $\leq 1$  complete, high-protein food source daily was reported by 50.9% of respondents. No supplement use was reported in 32.1% of respondents.

## Comparison Between Survey 1 and Survey 2

To compare results between surveys, responses from athletes located in countries other than New Zealand were filtered out. Relevant results are displayed in **Figures 1–8** as comparisons between results presented by amateur players and semi-professional/professional players.

The relaxation of lockdown restrictions caused a change in living situations. Living with family accounted for 58.5% of responses during lockdown compared to 33.0% following lockdown, and flatting in shared accommodation accounted for 10.1% of responses during lockdown and 31.13% after lockdown (**Figure 3**). Following lockdown, the responses indicate a shift to athletes becoming more self-reliant and both purchasing (67.0% compared to 38.0%, **Figure 2**) and preparing (71.7% compared to 44.6%, **Figure 1**) their own food and meals. Post-lockdown, respondents reported a much higher motivation to train (57.9%) compared to during lockdown (28.7%) (**Figure 4**).

Most respondents reported no change in nutrition habits from during lockdown to post-lockdown (50.9%) whilst 35.9% indicated that their nutrition habits were better (**Figure 6**). Additionally, total food (44.3%, **Figure 5**), fruit and vegetable (53.8%, **Figure 7**) and packaged/convenience food (45.3%, **Figure 8**) was reported to be the same following lockdown.

## DISCUSSION

The purpose of this study was to explore (1) the influence of COVID-19 lockdown restrictions on Rugby Union players' nutrition and training habits and (2) how nutrition habits in New Zealand Rugby Union players were affected by the relaxation of lockdown restrictions. Nationwide lockdowns are unprecedented and as such no data is currently available describing how the combinations of (1) disruption to daily life (2) inability to train and eat habitually and (3) stress due to the global pandemic may have influenced these factors in athletes.

### During Lockdown

The majority of responses indicated that their food intake during lockdown either remained the same or increased. Whilst the long-term implication of COVID-19 lockdown restrictions on body composition have not been reported, athletes would be wise to reduce total energy intake to reflect the reduction of physical activity (14). Many respondents engaged in regular training sessions (89.4% reported completing  $\geq 3$  sessions per week) however the shift from habitual practices likely resulted in a large reduction in daily energy expenditure. Factors influencing energy expenditure during lockdown in athletes include a requirement to perform training sessions either at home or in local outdoor areas such as parks, a lack of equipment (free weights, machines) and no competition between teammates being present. These factors mean minimal rugby-specific training sessions were performed.

**TABLE 1** | Demographic information for survey 1 (during lockdown) and survey 2 (after lockdown).

Question	Groups	During Lockdown	After Lockdown
		N (%)	N (%)
Age	<18 years	14.3	17.9
	18–25 years	59.7	66.0
	26–35 years	21.3	16.0
	>35 years	4.7	0.00
Sex	Male	84.1	84.9
	Female	15.1	15.1
	Prefer not to say	0.8	0.00
Country of Residence	New Zealand	92.2	100.0
	Australia	3.5	0.0
	United Kingdom	4.3	0.0
How would you describe your living situation before lockdown restrictions were enforced?	Alone	2.3	–
	With a partner	13.2	–
	With family (parents, siblings, etc.)	36.8	–
	With family (partner, children, etc.)	9.7	–
	With friends	4.7	–
	Flatting	26.4	–
	Other	7.0	–
How would you describe your current living situation?	Alone	1.9	2.8
	With a partner	13.2	17.9
	With family (parents, siblings, etc.)	58.5	33.0
	With family (partner, children, etc.)	9.7	2.8
	With friends	3.9	7.6
	Flatting	10.1	31.1
	Other	2.7	4.7
How would you best describe your level of play?	Professional	9.0	17.0
	Semi-professional	17.3	17.0
	Amateur	73.7	66.0

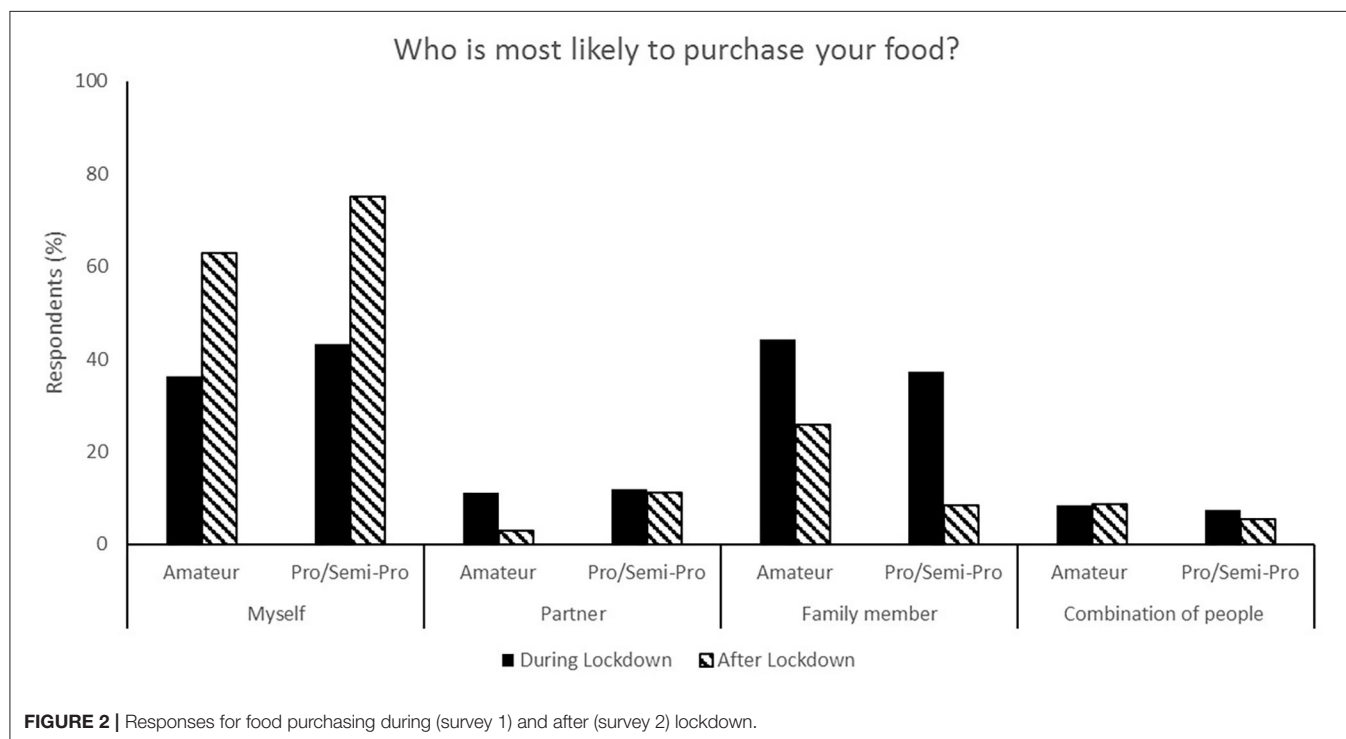
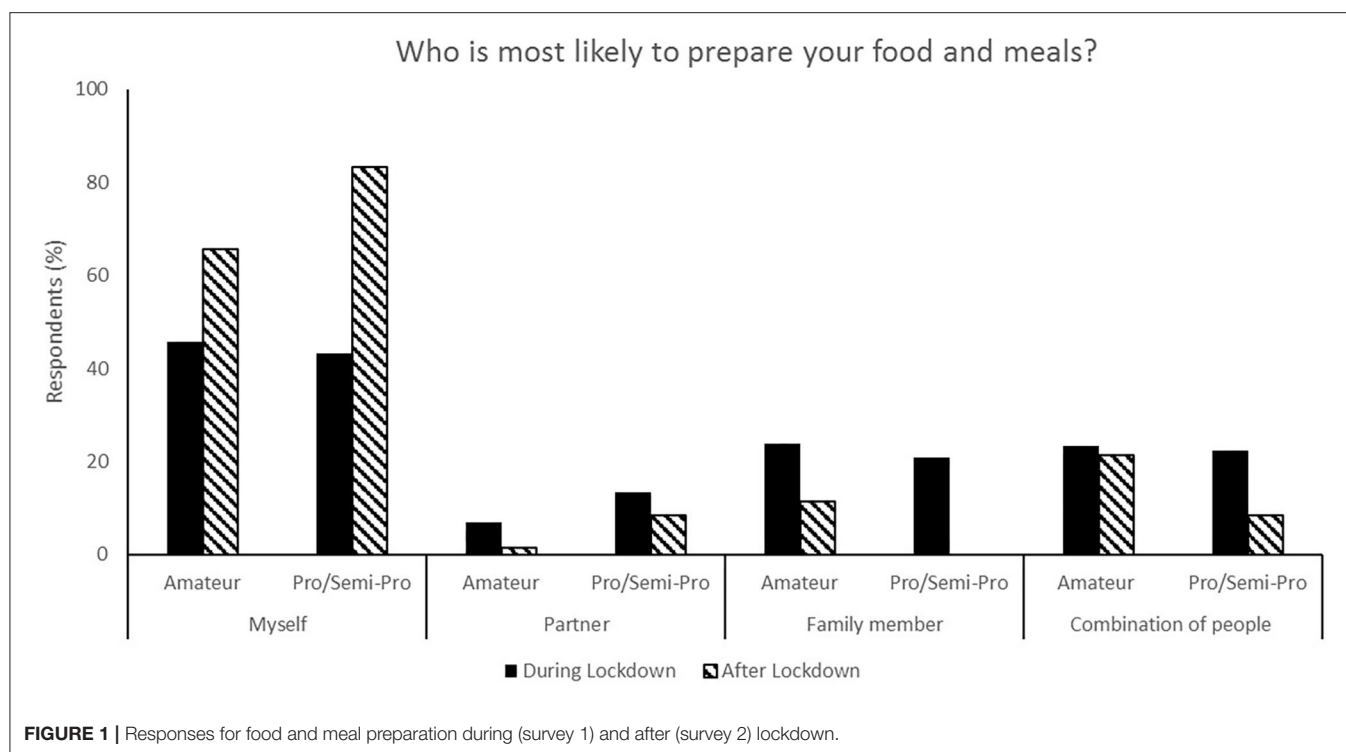
The temporary closure of restaurants, fast food outlets, cafes and bars may have resulted in better food choices in athletes. Most respondents indicated that fruit and vegetable intake during lockdown either remained the same or increased from pre-lockdown. Additionally, packaged and convenience food intake either remained the same or was lower during lockdown. These contrast with general population surveys distributed during COVID-19 lockdown restrictions, with one third of 1097 Polish respondents not consuming fresh fruit or vegetables on a daily basis (13). In a global survey distributed through 35 research institutions, respondents reported eating in an unhealthier pattern along with consuming more snacks and meals when COVID-19 lockdown restrictions were enforced (15).

Ingesting adequate protein (1.2–2.0 g.kg.d) (16) is an important factor in ensuring lean mass retention. When inadequate dietary protein is consumed, negative protein balance can result in muscle protein catabolism, adversely affecting muscle mass and function (17). In Survey 1, only 43.9% of respondents reported consuming a whole-food, high biological value protein source more than twice daily, which

may not be optimal for retaining lean mass during a prolonged lockdown period.

During lockdown, most of respondents implied they consumed no dietary supplements. High heterogeneity exists in the evidence-base surrounding dietary supplement use among athletes and prevalence recorded between studies is variable (18). Additionally, consultation with a nutrition professional should occur to consider the benefits and risks involved with consuming certain supplements (19). Nonetheless, consumption of certain supplements may be beneficial for athletes provided training, nutrition and recovery habits are sound (20). Due to the additional stressors of the lockdown, supplement use may not have been a priority for athletes.

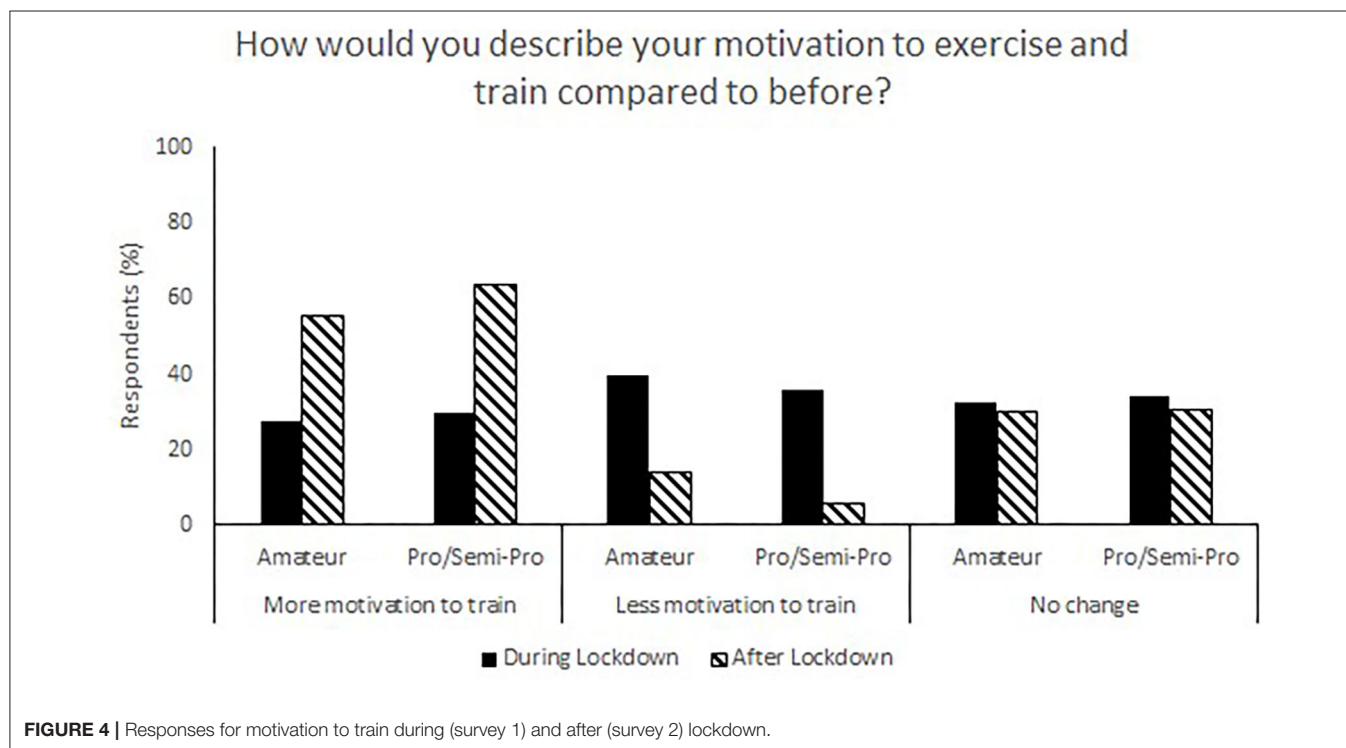
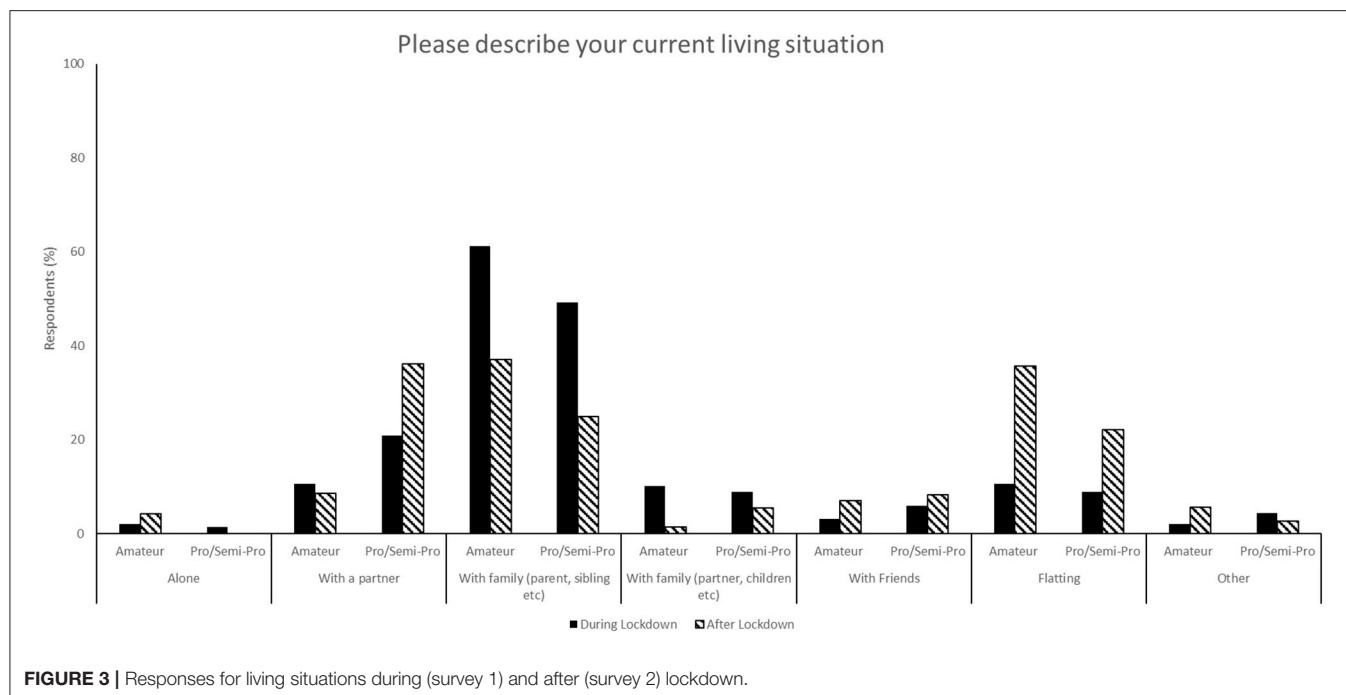
Protein supplementation is a beneficial strategy for athletes to reach daily requirements (21). Whilst protein intake is recommended to primarily come from whole foods, whey and casein are of a high quality, and consumption is considered safe and convenient (16). With most survey respondents reporting consuming a high-protein food source  $\leq$  once



daily, this may be a useful strategy for athletes to minimize the detrimental effects of a reduction in training volume, a lack of appropriate equipment and limited rugby-specific training (6).

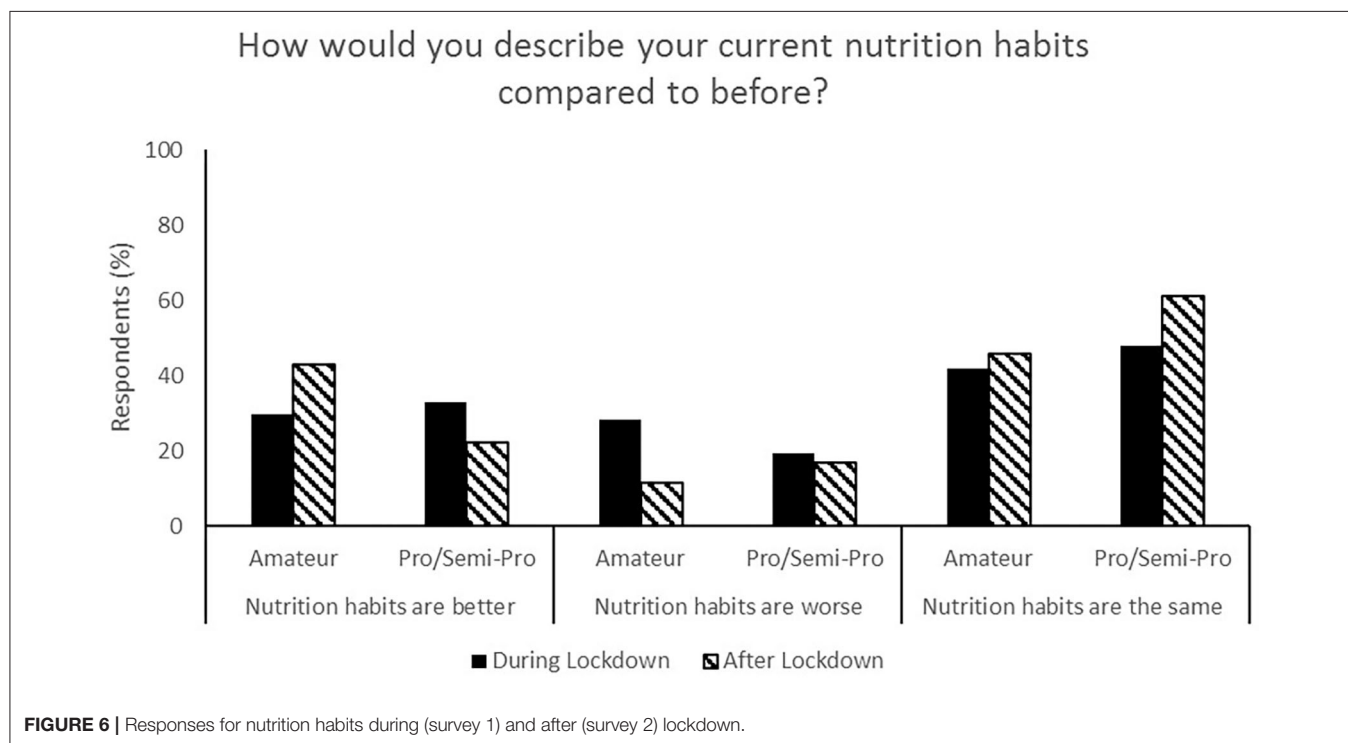
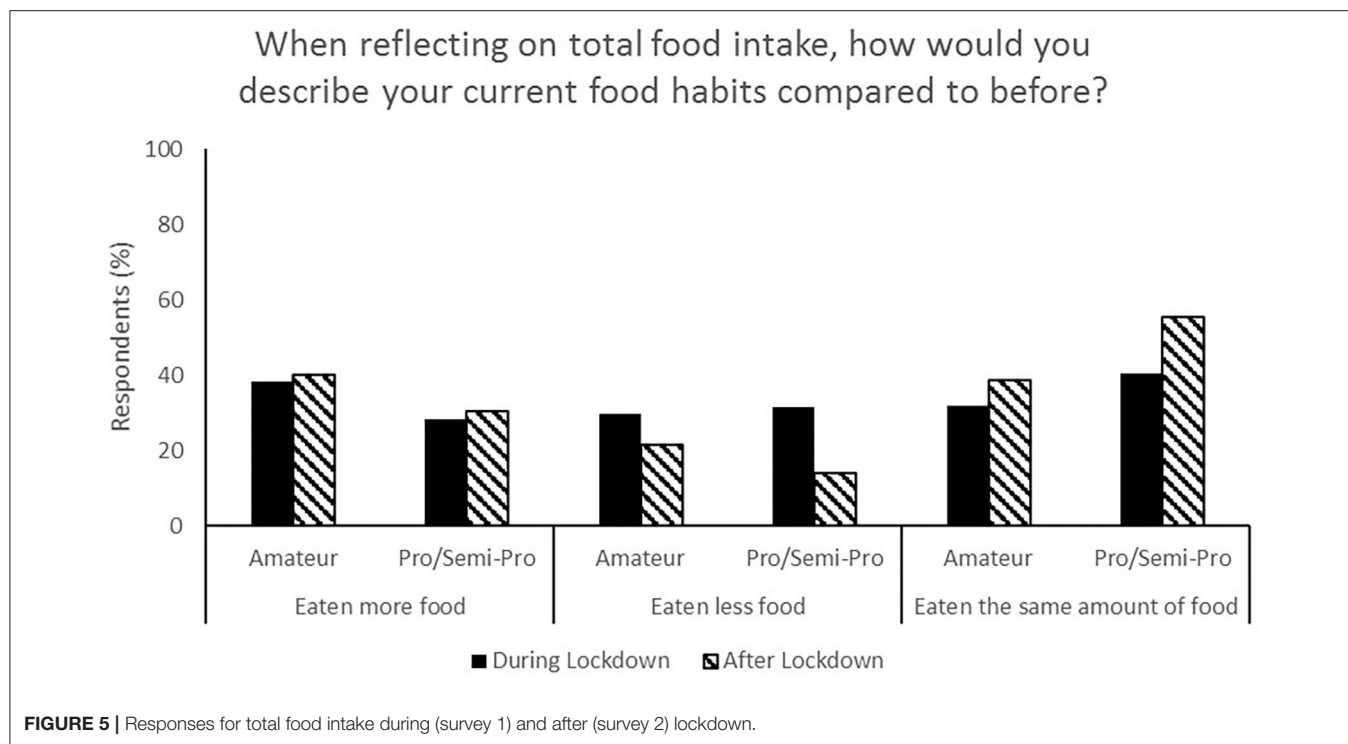
## Post-lockdown

As many athletes appeared to return to the family home for the lockdown period, there would likely be a greater reliance and/or sharing of responsibilities surrounding nutrition. Following



lockdown, those staying with family appeared to decrease and those flatting in shared accommodation increased. Therefore, there was a large shift in respondents indicating becoming more self-reliant, with a large number of athletes reporting purchasing their own food and preparing meals themselves. Reliance on others to prepare and cook meals can be a major barrier to

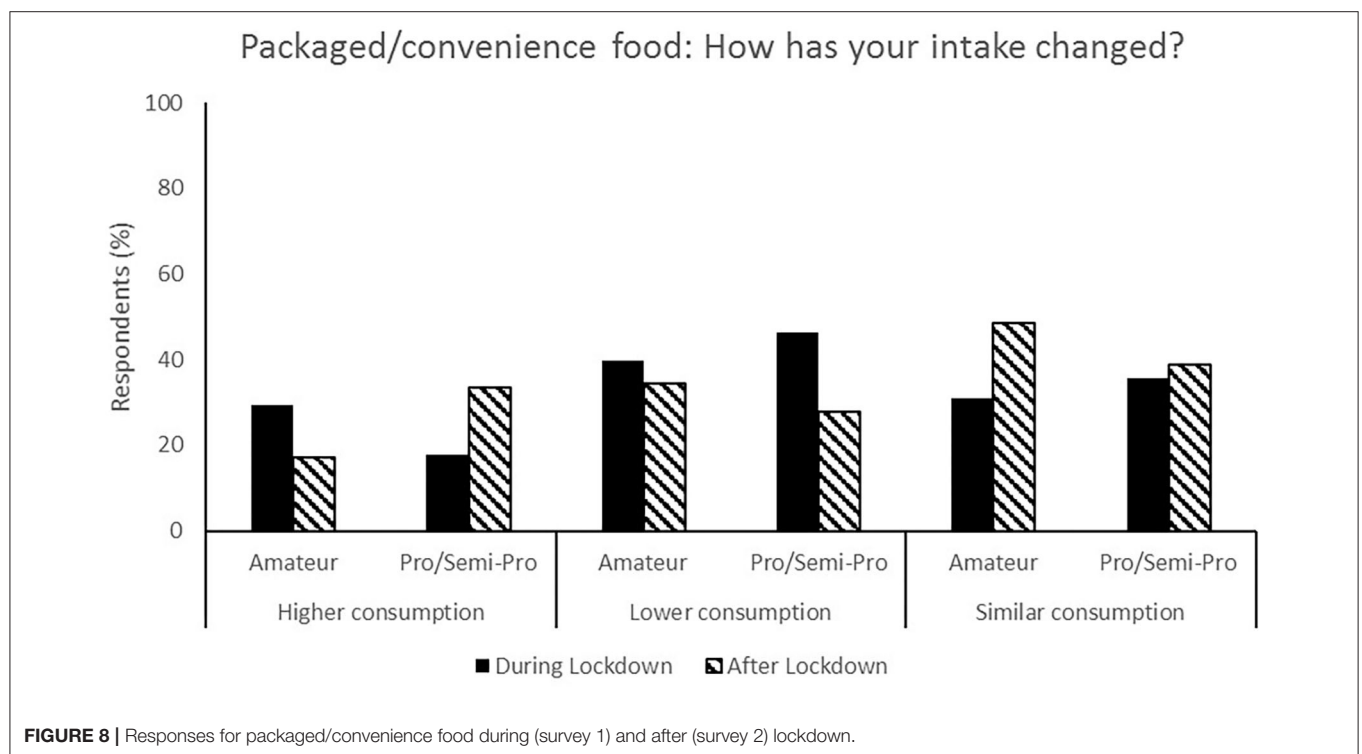
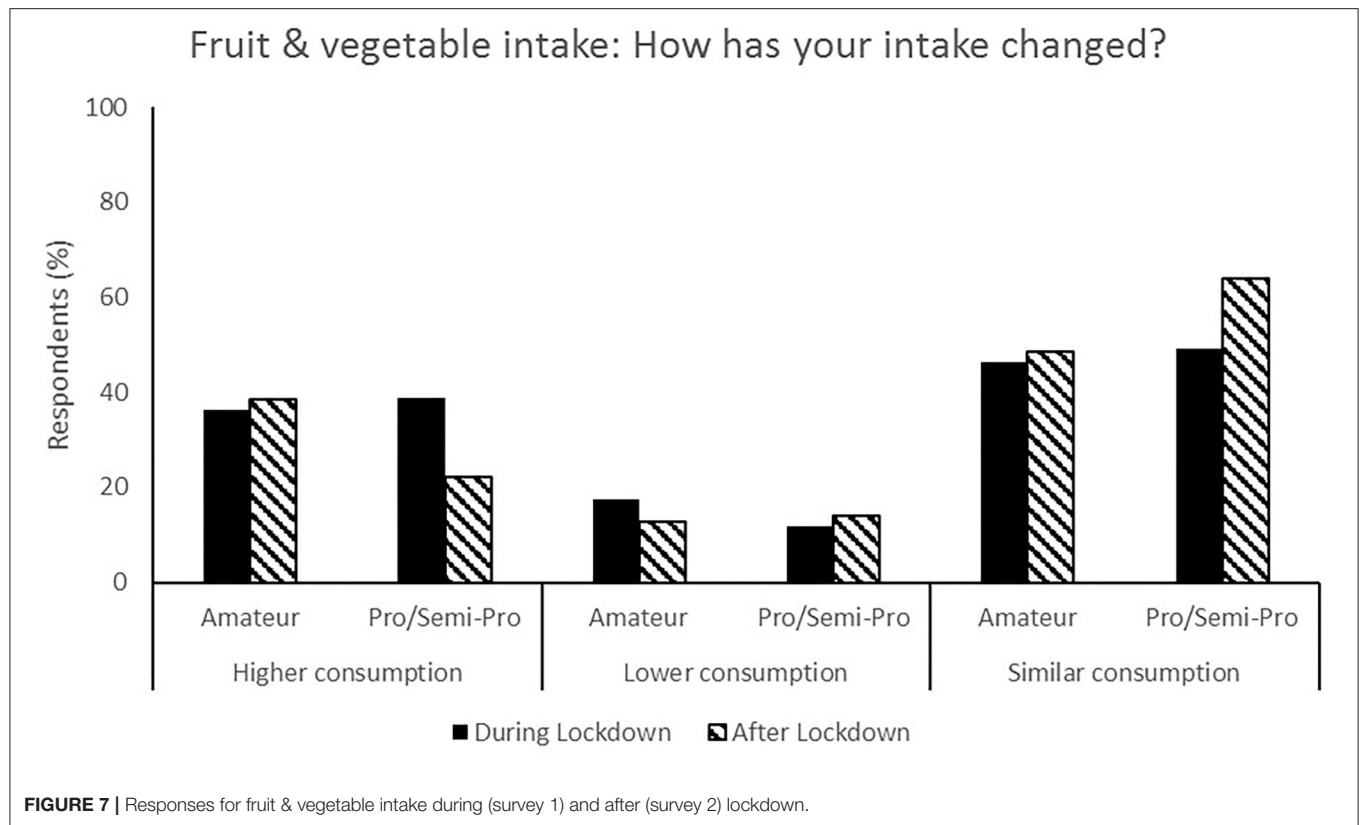
healthy eating in athletes when those preparing meals do not possess appropriate sports nutrition knowledge. Furthermore, athletes cooking/shopping skills and cost can present further challenges in athletes at all levels of play (22). These factors should be considered by sports dietitians/nutritionists when aiming to improve athletes' nutrition knowledge and food intake.



Sports nutrition knowledge in respondents from both surveys appeared to mainly come from dietitians or nutritionists associated with the clubs however a large number also reported other sources including other individuals (coaching staff, teammates, family members) or through seeking it themselves

(internet, social media). Many coaches provide nutrition advice to athletes however these individuals do not often possess the appropriate level of knowledge required to do so (23). Teammates and family members who have not received appropriate training can provide incorrect and potentially





harmful information. Additionally, it is important that athletes are aware of the possibility of unreliable information being presented through digital channels (24).

Fast food outlets, cafes and takeaways were able to re-open following the relaxation of lockdown restrictions in New Zealand. A number of athletes reported eating out on >3 occasions weekly. Eating out can indeed be incorporated into an optimal diet for an athlete however it is important for these individuals to be aware of how to make appropriate choices. Increased frequency of fast-food consumption is associated with poorer diet quality, perhaps due to displacement of appropriate food choices (25). Less frequent food preparation and more frequent fast food consumption are associated with poorer diet quality, however time-restraints are a major influence on these factors (26). As most respondents identified as amateurs, it is likely these athletes also had full-time obligations in the form of work and/or studies. Furthermore, the social aspect of being involved in a team may outweigh focusing on eating for optimal performance, recovery and health in amateur athletes (27).

Unsurprisingly, most athletes indicated their motivation to exercise and train was higher once lockdown restrictions were relaxed. The physical and aggressive nature of the game, on and off-field interactions with teammates and feelings of achievement and success are some of the factors previously reported to increase participation motivation in elite female Rugby Union athletes (28). Lockdown restrictions would indeed cause major disruption to all of these factors. Additionally, the closure of habitual training facilities (clubhouses, gyms) and stressors associated with the pandemic are likely to have influenced athletes' motivation to train during lockdown.

Respondents of both Surveys 1 and 2 reported consuming high biological-value protein sources from whole foods less than once per day. These responses may indicate a lack of knowledge of the importance of regular protein consumption throughout the day for athletes. As with during lockdown, athletes concerned with maximizing lean mass and strength gains are recommended to consume a minimum of 1.6 g.kg.d spread evenly across at least 4 meals of 0.4 g.kg (29–31). Although athletes during lockdown will be experiencing different levels of exercise stimulation (lack of resistance training equipment, minimal rugby-specific training) which likely resulted in reductions in lean mass, strength and skill adequate protein consumption may allow for a faster return to pre-lockdown body composition and performance levels. Minimizing lean mass catabolism is also an important factor in reducing injury risk when Rugby Union training and match play resumes, with the development of the muscle tissue important for withstanding external forces associated with collision sport play (6).

## Limitations and Conclusion

A major limitation of the present study is that the accuracy of the responses cannot be verified. Due to the anonymous nature of the online surveys distributed for this study, responses may not truly indicate how a respondent feels. Additionally, the nature of the questions means accurate results are difficult to obtain (for example, asking participants whether their

food intake has changed as a result of lockdown measures) and information on macronutrient intake other than protein was not requested. Furthermore, respondents may not answer truthfully due to the additional stressors resulting from COVID-19, such as economic struggles, feelings of isolation or health worries.

Participants were not asked to describe the nature of training sessions performed during lockdown, which presents another major limitation. It is likely that the implementation of lockdown measures would adversely affect resistance training and sport-specific training in athletes. With no access to commercial gym equipment, athletes are required to make use of limited equipment they may have at home or potentially none at all. If inadequate resistance training is performed, changes associated with muscle disuse such as lean mass and strength loss and increased fat mass may rapidly occur (32). It has been suggested that low-volume and low-intensity contractions are adequate at stimulating muscle protein synthesis and preventing muscle wasting (33). Resistance training protocols utilizing bands and bodyweight exercises have previously demonstrated efficacy in promoting lean mass gains in healthy older individuals (34) however this is not likely to be enough to maintain strength in Rugby Union athletes. Indeed, athletes are unlikely to have access to the equipment required to perform key exercises for developing or maintaining maximal strength (multi-joint resistance exercises such as squats and deadlifts) (35) at sufficiently heavy loads ( $\geq 75\%$  1-repetition maximum) (36). For optimal performance and injury prevention, Rugby Union athletes are expected to possess high levels of strength and power whilst engaging in high metabolic training volumes and rugby-specific sessions (37) and re-building these attributes before competitive matches resume will be crucial. Most respondents indicated they completed at least three training sessions per week however no information was gathered as to the nature of these sessions and as such, the ability of the respondents to offset muscle disuse wasting cannot be predicted.

In conclusion, the COVID-19 pandemic and associated restrictions to encourage social distancing and delay the spread of the virus have presented significant challenges for athletes of all levels and disciplines. Appropriate nutritional and training support may assist athletes retain adequate performance, lean mass, strength and cardiorespiratory fitness during lockdown scenarios however no data is currently available to support this. Coaches and performance staff can assist athletes by promoting greater protein intakes and feeding frequency, encouraging safe supplement use and keeping players engaged in interesting training sessions that can be completed from home. Staff must also be aware of the challenges athletes may be facing, related or unrelated to the ongoing 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

CR, NG, and SS contributed to the development and distribution of the survey materials and edited the manuscript. CR drafted the

manuscript. All authors contributed to the article and approved the submitted version.

## ACKNOWLEDGMENTS

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fnut.2020.589737/full#supplementary-material>

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# Physical Fitness and Exercise During the COVID-19 Pandemic: A Qualitative Enquiry

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The COVID-19 pandemic has brought this fast-moving world to a standstill. The impact of this pandemic is massive, and the only strategy to curb the rapid spread of the disease is to follow social distancing. The imposed lockdown, resulting in the closure of business activities, public places, fitness and activity centers, and overall social life, has hampered many aspects of the lives of people including routine fitness activities of fitness freaks, which has resulted in various psychological issues and serious fitness and health concerns. In the present paper, the authors aimed at understanding the unique experiences of fitness freaks during the period of lockdown due to COVID-19. The paper also intended to explore the ways in which alternate exercises and fitness activities at home helped them deal with psychological issues and physical health consequences. Semi-structured telephone interviews were conducted with 22 adults who were regularly working out in the gym before the COVID-19 pandemic but stayed at home during the nationwide lockdown. The analysis revealed that during the initial phase of lockdown, the participants had a negative situational perception and a lack of motivation for fitness exercise. They also showed psychological health concerns and overdependence on social media in spending their free time. However, there was a gradual increase in positive self-perception and motivation to overcome their dependence on gym and fitness equipment and to continue fitness exercises at home. Participants also tended to play music as a tool while working out. The regular fitness workout at home during the lockdown greatly helped them to overcome psychological issues and fitness concerns.

**Keywords:** COVID-19, physical fitness, exercise, lockdown, gym workout

## INTRODUCTION

The COVID-19 pandemic is a massive global health crisis (Bavel et al., 2020) and rapidly spreading pandemic (Bentlage et al., 2020) of recent times. As compared to the earlier pandemics the world has witnessed, the current COVID-19 pandemic is now on the top of the list in terms of worldwide coverage. This is the first time the whole world is affected simultaneously and struck strongly in a very short span of time. Initially, the death rate due to COVID-19 was around 2%, which has now increased to around 4–6% (World Health Organization [WHO], 2020). The statistics does not look so severe, but the total number of cases and the rate at which these cases are



increasing day by day make the situation alarming. Exponential growth in COVID-19 cases has led to the isolation of billions of people and worldwide lockdown. COVID-19 has affected the life of nearly each person around the world. The difference between personal or professional lives has narrowed due to work-from-home instructions, and people's lives are revolving around these two due to the lockdown. People have also been pondering over a vital concern at home, i.e., the importance of their health and fitness.

Although imposing lockdown or quarantine for the population has been one of the widely used measures across the world to stop the rapid spread of COVID-19, it has severe consequences too. Recent multinational investigations have shown the negative effect of COVID-19 restrictions on social participation, life satisfaction (Ammar et al., 2020b), mental well-being, psychosocial and emotional disorders as well as on sleep quality (Xiao et al., 2020), and employment status (Ammar et al., 2020d). Announcement of a sudden lockdown of all services and activities, except few essential services, by the authorities has resulted in a radical change in the lifestyle of affected people (Jiménez-Pavón et al., 2020) and has severely impaired their mental health, which has been manifested in the form of increased anxiety, stress, and depression (Chtourou et al., 2020). The sudden changes in people's lifestyle include, but are not limited to, physical activities and exercise. Ammar et al. (2020a) have reported that COVID-19 home confinement has resulted in a decrease in all levels of physical activities and about 28% increase in daily sitting time as well as increase in unhealthy pattern of food consumption. Similar results are also reported by other researchers (Ammar et al., 2020c; de Oliveira Neto et al., 2020) as well. Although these abrupt changes have influenced every individual, many people who were regularly following their fitness activities in gyms, or in the ground, or other places before the lockdown have been affected intensely. Closure of fitness centers and public parks has forced people to stay at home, which has disturbed their daily routines and hampered their fitness activities. While compulsion to stay at home for a long period of time poses a challenge to the continuity of physical fitness, the experience of hampered physical activities, restricted social communication, uncertainty, and helplessness leads to the emergence of psychological and physical health issues (Ammar et al., 2020a,c). Varshney et al. (2020) have found that psychological problems are occurring in adults while adjusting to the current lifestyle in accordance to the fear of contracting the COVID-19 disease. However, effective coping strategies, psychological resources, and regular physical exercise can be helpful in dealing with such health-related problems during the COVID-19 pandemic (Chtourou et al., 2020).

It is important to note that physical activities (PA) and exercise not only maintain physical and psychological health but also help our body to respond to the negative consequences of several diseases such as diabetes, hypertension, cardiovascular diseases, and respiratory diseases (Owen et al., 2010; Lavie et al., 2019; Jiménez-Pavón et al., 2020). In a recent review of 31 published studies, Bentlage et al. (2020) concluded that physical inactivity due to current pandemic restrictions is a major public health issue that is a prominent risk factor for decreased life expectancy and

many physical health problems (Jurak et al., 2020). Exercise is shown to keep other physical functions (respiratory, circulatory, muscular, nervous, and skeletal systems) intact and supports other systems (endocrine, digestive, immune, or renal systems) that are important in fighting any known or unknown threat to our body (Lavie et al., 2019; Jiménez-Pavón et al., 2020).

Regular physical activity, while taking other precautions, is also considered effective in dealing with the health outcomes of the COVID-19 pandemic (Chen et al., 2020). Researchers from the University of Virginia Health System (Yan and Spaulding, 2020) suggests that regular exercise might significantly reduce the risk of acute respiratory distress syndrome, which is one of the main causes of death in COVID-19 patients. Exercise and physical activities have important functions for individuals' psychological well-being as well (Stathi et al., 2002; Lehnert et al., 2012). There is sufficient literature to show that exercise can play a vital role in the promotion of positive mental health and well-being (e.g., Mazyarkin et al., 2019). However, when health promotion activities such as sports and regular gym exercises are not available in this pandemic situation, it is very difficult for individuals to meet the general WHO guidelines (150 min moderate to mild PA or 75 min intensive PA per week or combination of both) (cf. Bentlage et al., 2020). Amidst this pandemic-related restriction (home confinements and closed gyms, parks, and fitness centers), how people cope up and find ways to continue their physical fitness remains an important question.

## Rationale for the Present Research

Since the onset of this disease, people have been confined to their homes, which has not only resulted in various psychological health issues but also challenged their physical fitness and health (Ammar et al., 2020a,b,c,d; Chtourou et al., 2020; Xiao et al., 2020). Although this pandemic situation has led to the unexpected cessation of almost all the outside routine activities of all the individuals, it has profoundly hampered the physical activities of fitness freaks (those who regularly go to the gym for their physical fitness), as gyms and other such places have been shut down due to the lockdown. However, studies addressing the issues of fitness freaks, who used to spend a significant amount of time for regular workout in order to maintain their physical fitness, health, and appearance, seem to have found no place so far in the literature in relation to the current pandemic situation. Supposedly, the unique experiences of such people, their health issues, and the ways in which they have dealt with these issues during the COVID-19 pandemic have remained underexplored.

Also, it is well-known that the COVID-19 pandemic has made it difficult for people to adequately maintain their normal physical activity patterns at home (Ammar et al., 2020a). There are plenty of studies that have addressed the impact of COVID-19 on physical activities of the general public (Ammar et al., 2020a,b,c,d; Chtourou et al., 2020; Xiao et al., 2020), demonstrated the significant decrease in physical activities and exercise patterns, and illustrated its ill effects on physical and mental health status. There is also a growing body of literature that suggests strategies to encourage people to be involved in home-based exercises and fitness activities (Ammar et al., 2020a,b,c,d; Chtourou et al., 2020;

de Oliveira Neto et al., 2020). However, all these studies were conducted in the earlier phase of the pandemic. There is a lack of studies investigating the way in which people have dealt with the problems arising from the COVID-19 pandemic and subsequent lockdown/home confinement. In fact, it would be interesting to explore how and to what extent people were able to follow and benefited from the workout at home advices. Therefore, the present research aims at understanding people's unique experiences during the period of lockdown due to COVID-19 and exploring the ways in which regular exercise engagements helped them deal with the psychological and physical consequences of home confinement.

## METHODS

In order to gain a rich and extensive understanding of experiences into people's lives during this pandemic and their efforts to maintain a healthy lifestyle, a qualitative approach was adopted for the study. We used Interpretive Phenomenological Analysis (IPA) to delve into the participants' perceptions and to provide a close picture of the participants' unique experiences during the lockdown period.

### Participants

A homogeneous sample of 22 participants was selected for this study. The criterion-based purposive sampling technique was used to identify and select the participants. We first contacted the gym owners/trainers and sought their consent to help us in the conduction of this study. Upon consent, we requested them to provide us with the details of their regular gym members who continuously go to the gym and do fitness exercises for at least 6 months prior to the imposed lockdown. Once the list was generated, the prospective participants were then connected by phone, were explained the purpose of the study, and were requested for their consent to participate. Those who consented for their inclusion in the study were then asked some questions based on the pre-decided inclusion and exclusion criteria for the study. On the basis of this information, those participants who met the inclusion criteria (i.e., those who were continuing fitness workout in their home or hostels and were following strict home confinement measures during the COVID-19 pandemic and subsequent lockdown) were further contacted and requested to provide an appointment for a telephone interview.

### Inclusion and Exclusion Criteria for the Participants

The participants meeting the following criteria were included in the study:

- Individuals aged 18 years or older.
- Individuals with no known history of physical and/or psychological illness.
- Individuals who were doing regular gym workout for the last 6 months or more for at least 45 min daily before COVID-19.

- Individuals who were completely dependent on gym exercise for their physical fitness.

However, individuals meeting the following criteria were not included in the study:

- Individuals who were irregular or occasional gym visitors.
- Individuals who were practicing other physical exercises besides gym workout.
- Individuals with any physical and/or psychological conditions or individuals on any kind of medication.

**Table 1** presents the demographic and exercise characteristics of the participants included in this study.

### Procedure

The purpose, importance, and relevance of the study were explained to the participants, and informed consent was obtained for their participation. All the participants were assured of the confidentiality of their responses and identity. Upon consent, the participants were requested to share their convenient time for a telephone interview. Semi-structured telephone interviews were conducted to explore the exclusive experiences of the participants with regard to their physical fitness during the lockdown. An interview schedule composed of non-directive, open-ended questions was prepared. There was no fixed order of questions; they were modified and re-modified as per the flow of the conversation with each participant. Some of the main questions prepared for the semi-structured interviews included "What is your perception of this situation we are currently living in?," "What is your lockdown experience?," "How frequently you used to go to gym for exercise before the lockdown was imposed?," "How do you manage exercise at home?," "What is your exercise schedule now?," "What changes did you perceive in yourself during this lockdown?," "How are you coping with this lockdown?," "Did you experience any psychological issue

**TABLE 1 |** Demographic characteristics of the participants.

Variables	Variable levels	Characteristics
Gender	Male	20
	Female	2
Age (in years)	Minimum	19
	Maximum	34
	Mean age	26.5
Occupation	Student	6
	Homemakers	1
	Working professionals	11
	Entrepreneur	2
	Unemployed	4
Marital status	Single	19
	Married	2
	Separated	1
Living status	Living alone	7
	Living with family	15
Socioeconomic status	Middle class	18
	Higher class	4

during this period of time?,” “How do physical exercises help in combating the crisis you are facing?,” “What background aid do you use while exercising at home?,” “What is the need to use such aids while exercising?,” “How does fatigue impact you when you exercise during the lockdown?,” “What is the importance of proper sleep in following a regular schedule of exercise during this lockdown?,” “Do you miss your gym mates?,” “Do you feel you share an identity with your fellow gym mates?,” etc. Additional probing questions were also added as the need occurred during the individual interviews. In addition questions were also asked to understand the differences between their pre and during COVID-19 lockdown fitness exercise patterns (see **Table 2**). All the interviews were conducted in the native language of the participants in Hindi and English. With due permission from the participants, the interviews were recorded. The interview time duration range was between 20 and 30 min. All the interviews conducted in Hindi were transcribed and then translated in English by the researchers. The translated interviews were then proofread by a native English speaker for correctness and consistency.

## ANALYSIS AND RESULTS

All the recorded interviews were transcribed. These transcripts were then analyzed using the Interpretative Phenomenological Analysis (IPA) framework to identify the participants' experiences of lockdown, their alternative choice to continue their fitness routine, and its impact on their health. A stepwise progression method was used to analyze the data. At first, the researchers read the transcripts many times to get a deeper understanding of the experiences as described by the participants. In order to gain as close an understanding of the data as possible, the researchers listened to the audio recordings of the participants while reading the transcribed data.

In the following step, the attempts were made to transform the transcripts into a conceptual framework that was deeply connected to the participant's original verbatim in order to identify emergent themes (see **Table 3**).

After identifying the emerging themes, the transcripts were read again so as to cluster these emergent themes together according to their similarities at the basic level. In this process, some themes emerged as the broad themes under which subthemes were incorporated. The major themes and subthemes that emerged in the analysis are presented in **Table 3**.

**Table 3** presents six major themes describing the experiences of participants with regard to the COVID-19 pandemic and their efforts to maintain a healthy lifestyle. The following section discusses each of these themes and its subthemes along with the relevant excerpts from participants' experiences.

### Psychological Health Issues

Almost every participant reported facing psychological health issues linked to the COVID-19 pandemic and subsequent lockdown. Participants experienced frustration, anxiety, fear, and stress. For example, participant 11 reported,

“I am experiencing frustration daily for spending my 24 by 7 time at home, looking at same faces and am not allowed to go anywhere. Anxiety of work and its upcoming scenarios tickle my mind a lot. What if I have to do my job virtually for a lifetime? . . . . . Like that. And especially experiencing a fear of losing my ever charming personality, the economic status of family, no wages or less wages, fewer opportunities in future, job shift, health care of my family.”

The closure due to the pandemic has created a state of uncertainty about an individual's own future as well as about the future of the family and community, which in turn is being reflected in terms of psychological states of frustration, anxiety, fear, and stress.

Individuals stuck at their homes without a clearly defined routine and work are not able to prioritize their work schedules, resulting in the experience of unexplained laziness and fatigue. Participant 7, for example, reports that

“Physical fatigue has reduced as there is no physical load or fixed working hours, but the mental fatigue and mental pressure has increased manifolds. Worries have increased. Spare time is more than what was required and due to this lethargy has increased. Frustration level is going up.”

The monotonous and closed life cycle of one confined to one's own home has also resulted in extreme disturbances of one's sleep cycle. For example, Participant 5 reports,

“Sleep a lot, a lot!! Just imagine I have been sleeping 10 to 12 hours after the lockdown. My sleep pattern was set earlier due to office, but it is disturbed now in the absence of a routine. I have virtual meetings now also, but if the meeting is to start at 10, I would get up at 9.40, wash my face and attend the meeting. After that I feel like taking a nap again. I sleep for 8 hours wake up and exercise in the morning, but I have the liberty to be flexible with my time. seriously I am craving for gyms to open, my trainer to keep a check on me, scold me, I really want complete sleep and a routine.”

It is therefore evident from these examples that the onset of the COVID-19 pandemic has resulted in the experience of psychological problems characterized by frustration, anxiety, fear, and stress. The sleep–wake cycle is interrupted, leading to a state of laziness and mental fatigue.

### Lack of Motivation for Fitness

The closure of gyms and other fitness activity centers, including sports stadiums, morning walk parks, etc., and the heightened psychological health issues have resulted in the lack of fitness motivation. For example, participant 1 reports,

“See, ultimately due to the shutdown of gym during this pandemic, my rhythm has been disturbed, you are getting it? I have had a tight schedule always due to my profession but each evening I used to hit the gym daily. . . . . I mean, that zeal is gone, . . . . . now also I am getting time in the evening but then also I am unable to ask myself to work out because that gym environment is gone, the gym

**TABLE 2 |** Pre- and during COVID fitness exercise information of the participants.

Fitness routine	Levels	Before COVID	During lockdown March 25th to May 30th, 2020	Lost lockdown (limited restrictions, complete gym closure) June 1st to July 31st, 2020
Variables	Frequency	Daily	3–4 days a week	5–6 days a week.
	Hours (Daily)	1–3.5 h	1–1.5 h	30 min to 1 h
	Type of exercise	Endurance training, strength training, static stretching	High-intensity workout with available equipment or substitutes at home, rope jumping, yoga	Yoga, meditation, walking, jogging, High-intensity workout with available equipment or substitutes at home
	Place of exercise	Gym	Home	Home and park
	Dependence on any other physical fitness exercises	No	Yes	Yes
	Social media accounts active	WhatsApp, Facebook	Facebook, Instagram, WhatsApp, YouTube, IMO, Telegram, Hangouts	Twitter, Facebook, Instagram, WhatsApp, YouTube, IMO, Telegram, Hangouts

people as you would see other fellows at gym, that would motivate you, their body gives you an inspiration that how he or she is that fit, they motivate you, here I share an identity with them, I find those people as source of my motivation to physical exercise, those people give you so much morale and now that is lost totally, I literally crave for that.”

The motivation for fitness is not only internal but also external. People are motivated when they observe others doing fitness activities. Gym mates and their physique work as motivating factors for individuals to engage in a regular and routine gym activity. Participant 10 said in frustration that,

“Almost all gone, . . . . .the motivation is the most ruined thing today, . . . . .talking about my workout, I have been hitting the gym since I was 22. . . . ., Imagine how much that space motivated me, I miss that, my pals there. . . . ., not because we are friends or something, see gym doesn’t provide you an environment to make pals or something as people change their gyms and many a thing but, they give you a lot of competition, you become jealous of their appearance and later that workout that space becomes your habit, I miss that, say like anything, but still I am trying.”

It is evident from the above statement that a lack of motivation for fitness was due to the home confinement and lack of presence of others. The presence of others engaged in a similar activity not only creates a sense of shared identity but also is a source of healthy competition and thus motivation.

### Change of Perception

As the days progressed, individuals learned to respond to the pandemic in a more constructive and positive manner. Their perception for the situation remained the same (negative), but their perception toward themselves started to change. They started believing that even though they could not change the situation, they could do the same for their own self to deal with the situation. Participant 2, for example, commented on the situation and said,

**TABLE 3 |** Major themes and subthemes that emerged from the interviews indicating participants’ experiences during the COVID-19 pandemic.

### Major themes

#### Psychological health issues

Having frustration, stress, anxiety, and fear  
A trend of laziness and mental fatigue  
Change in sleeping pattern

#### Lack of motivation for fitness

The role of gym mates  
The role of gym environment

#### Change of perception

Negative situational perception  
Positive self-perception

#### Shifting focus on substitutes of gym workout and equipment

Shift on yoga and meditation  
Shift on high-intensity workouts  
Shift on alternatives of heavy weights

#### Social media dependence

As a medium to get updated  
To overcome the monotonous daily schedule  
Increases the amount of sitting  
Lack of emotional attachment  
Platform to know virtual fitness techniques and influencers

#### Favorable attitude toward music as a tool

Used to focus on exercises  
An aid that provides distraction from home setting  
Creates one’s own world, where there is no COVID-19

“Ah! Talking about the situation we are living in, it is so unprecedented, anything can happen anytime, though I am less stressed as compared to the date the lockdown was announced, I perceive this whole situation is so terrible, worst. . . what is this happening, you just tell me, wake up in fear and sleep in fear. I wonder when this is going to end.”

However, upon asking about her/his own self, s/he added

“You know this COVID has done only one thing right, that is, you know giving me immense time to work on myself,



which otherwise I always overlooked. Though I went to gym for my physique only but never gave time to my thoughts, skills, etc. So when talking about changes in myself or perception of self, I would say changes come under three categories in me- first physical, that is appearance, personal, like I will quote enjoying every bit of time. Who knows I am next. I now celebrate life, and finally social changes in myself, as I have got time to work on my communication skills, talking on virtual platforms and sense of oneness or say unity, as I am locked down in hostel and we guys do every deed and task on our own without family, standing together.”

Similarly participant 22 summarized the situation as

“(Laughing), Seriously! The Virus is making a joke on us, truly this is the worst of situations I can ever imagine, I am so negative about the situation we are in, I am in... everyone in... you know how stressful it is for me to know that I am unable to practise. You know as a clinician how hard it is to be like this. Though I am still a student but think likewise, harsh situation madam, extra precautions for everything, negative, too much negative. This time would be a memorable time for generations; sorry my tone has become louder I am kind of in agony, all credits to this so called CORONA.”

S/he, however, further commented that

“my experience throughout the past few months in this Corona Era is so negative but myself-perception or I would say how I am taking myself now from earlier has meaningfully changed now. You know, I am someone who is giving time to myself, exploring my hobbies, giving time to leisure, learning kitchen skills, learning new dishes, becoming a chef besides being a dentist you know. So, for me, myself, I am so positive with regards to myself.”

It is therefore evident that increased experiences with an initial unfamiliar situation initiate the coping mechanisms within an individual, which is reflected in the changed perception of their own self, and reappraisal of the situation in a more positive manner.

### Shifting Focus on Substitutes of Gym Workout and Equipment

With the positive change in perception, individuals started to think about their normal routine and tried to find ways to substitute their normal activities. They started trying to shift their exercises from gym to other available places and using alternatives to gym equipment for their fitness activities. The statement of participant 20 indicated how shifting from gym-based exercises to yoga practices was an effective alternative for coping with the habitual compulsion for gym exercises.

“Since I get a pace back again for my physical fitness in this lockdown, I have made a shift to yoga, especially the power yoga in the morning time. I prefer doing meditation as well. Earlier I never used to practise the same but now I have

seen videos of some asanas good for health, I am following them and practising them. It's a shift for peace I guess. I tried something new and found my gym addiction could be controlled or moderated by taking out time for yoga and meditation even after COVID.”

Similarly, participant 17 reported her/his shift to high-intensity workouts at home.

“See, as you might know not everyone has exercise equipment at home which we used to have in gym. So, I prefer those exercises which require less or zero weights say jumping jacks, skipping.”

After resuming motivation, in order to stay physically active and fit, participants actively engaged in the process of finding alternatives to their routine physical exercise equipment. Participant 14 reported shifting to alternatives to heavy weights

“I personally was too much dependent on equipment to exercise in the gym. Now there is no option left because even online, the 5 and 10 kg weights are out of stock, And, nearby stores are either closed or you can't go out. So, for me it was tough but I searched the internet, the social media, talked to fitness experts and used some 'JUGAAD' at home. So, they are using buckets, big water bottles and skipping ropes. I had 10 kg iron rods of water pipeline spare at my home, I am using that and these are helpful and I guess need of the hour.”

### Social Media Dependence

One of the major shifts in the individuals' lives during this pandemic was the increased social media dependence. As a result of social distancing, people were spending more time online to virtually connect with others and stream entertainment. In the backdrop, the COVID-19 pandemic led to an increase in the time spent on social media that helped people kill time. Participant 12 reported the benefits as well as the drawbacks of this social media dependence.

“Social-media is a mixed feeling platform. I mean at one hand it keeps me updated with the happening around; the facilities promised by the government; and... it keeps me connected with the world. But on the other, it irritates me a lot, a lot of misinformation creates a worry in you. So yes, there is a dual objective of this social media.”

However, participant 4 viewed this increased dependence on social media as an effective strategy to break the silence and to overcome the monotonous days.

“Our life has given us so much time . . . . ., I mean I have so much spare time but besides that, I have a monotonous schedule every day, so social media keeps me busy, for example, web series suggestion and reviews, movies suggestion and reviews, video games, etc. Also, on the one hand, I do not get bored as one day I am learning some planting technique at home through media, the other day something to cook, some family or friend sharing his/her recipe, hobby ideas, craft ideas, writing, etc. Physical

workout schedule helps me a lot. I am doing one thing useful at a time, and that keeps me busy.”

Similarly, participant 3 reported that

“Definitely social media has impacted my sitting schedule as I am just sitting for a long span of time, say while eating or talking to family. I am sitting scrolling YouTube, Facebook, WhatsApp, Instagram, one post after the other. It has become my habit now. I feel like I will only watch a single video or only this news but I end up spending 1 to 2 hours scrolling and watching. Seriously, it's a habit now, but I am glad that workout is something I do in my schedule, which is so productive, and I really feel good about myself because of the physical fitness.”

However, participant 21 pointed out the experience of lack of emotional attachment, sympathy, and support resulting from the content consistently served by social media.

“Social media is full of content which reveal crime stories, life matters, relationships, suicides, etc. at a large scale. So many movie clips, videos, web series show a lot of crime, aggression or say anything on that. So, I feel now-a-days emotionally detached to any relationship, friendship or even to my family. If I receive their call, I would say yes okay fine, no further interest in how they are dealing or what they are experiencing. And if they ask I would say, so what, I am not a kid anymore. I lead my life you lead yours, definitely social media is making me someone I never used to be. In fact, my sister has become the same, though she is living with the family under the same roof. Earlier I was so sensitive to any suicide or crime. If I heard of that I would cry or be sad. I used to feel the pain of the victim. Now, I hear a story for real and I am like, yeah part of life, or you pay for deeds like that. No sympathy left I guess, so detached.”

However, what was more important was that social media was seen to be helping individuals in maintaining their daily fitness routines by providing them alternative fitness tools and techniques, the virtual company of other fitness freaks, and by helping them back, influencing others and getting influenced by others. Participant 6 reported that

“Social media has lots of side effects, but a good effect of it now-a-days for a gym freak like me is that social media provides videos of trainers, and other freaks working out at home or hostels. I can know now virtually how to maintain a schedule. They are sharing their experience, they are influencing me a lot, I am trying my best, and workout is helping me a lot.”

### **Favorable Attitude Toward Music as a Tool**

Many participants also reported the use of music as an aid while exercising. Participant 7 reported that

“I have two schedules of exercise. If working out in the morning, I prefer soothing music, like that of birds chirping, or instrumental jazz. And if I am exercising in

evening, I want to listen to EDM, that is electronic dance music, I have made a playlist of computerised music and listen to that in evening. I prefer music because it takes you to another world, which is needed the most now (exclaimed!) It creates an environment like that of a gym in my head, or say, I imagine I am in the gym, as I cut off all the surrounding voices.”

Similarly, participant 9 reported that

“I just love to have old-country music while I am exercising. It is a kind of genre of songs, the old country one, and sometimes I love random numbers of songs. It is needed because you can say it lets me focus, helps me to calm down. Also, when I am locked at home, it actually provides me a world free of distractions, just my own world, where there is no corona. Music is ultimate fun. If there is no music available I will not workout, because workout makes me happy and I really want to exercise effectively and enjoy it too.”

It is, therefore, evident that music is an important supporting tool that helps individuals relax and enjoy their original routine even when they are working out at home. Music is a powerful tool that recreates the same environment that participants used to have during their gym exercise times.

## **DISCUSSION**

The COVID-19 pandemic has brought major upheaval in the life of every individual across the globe. It has hampered the day-to-day activities of almost all individuals including those who depend on gyms for their physical fitness routine. The present study was conducted with individuals for whom going to the gym was a routine activity so as to explore their experiences in terms of their perceptions of the pandemic situation and their ways of coping with COVID-19-induced uncertainties and health issues.

The findings of this study not only are consistent with a range of studies that have reported psychological health issues due to the COVID-19 pandemic and subsequent lockdown (Hawryluck et al., 2004; Ammar et al., 2020a,b,c,d; Chtourou et al., 2020; de Oliveira Neto et al., 2020; Shigemura et al., 2020; Varshney et al., 2020) but also go beyond those to suggest that, with time, individuals learn to adopt to situations in healthy and positive ways. Participants reported experiencing a significant change in their sleeping pattern, unexplained laziness, and mental fatigue, and having a general feeling of fear, anxiety, stress, and frustration due to home confinement, which impacted their motivation to find alternate ways to continue fitness exercises.

Other factors found responsible for the lack of fitness motivation were the absence of gym partners and the lack of gym environment, which were also considered as potential sources of gym motivation in earlier studies (Sonstroem and Morgan, 1989; Sonstroem and Harlow, 1994; McAuley et al., 2000; Fox, 2003; Tamur, 2014). It is important to note that, being a social entity, people like the company of others and feel connected to each other. This feeling of connectedness is found to be associated with

various psychological constructs such as persistence, motivation, self-esteem, self-efficacy, and physical as well as psychological health (Scully et al., 1998; Proctor et al., 2011; Haslam et al., 2015; Begun et al., 2018). The absence of this feeling of connectedness that people were used to experiencing in a gym environment probably was one of the reasons for the lack of motivation for home exercise.

The findings of the study also indicated that although the participants' perception of the pandemic situation was negative initially, their self-perception gradually improved toward a positive one, as they realized that they had enough time to look after themselves. Rauthmann et al. (2015) reported that environment and behavior, if different from the usual, lead to a negative situational perception. However, with an increase in time available to devote to oneself, perceptions change in a positive direction (Karagiannidis et al., 2015). Such a change in perception is likely to promote the process of self-approval and find effective ways to deal with the current situation.

In the present study, a shift from the gym workout and fitness equipment toward substitutes is clearly visible during the latter part of the lockdown. After the initial confusion and passive wait for things to normalize, participants accepted the reality and started thinking about alternatives to exercises related to heavy gym equipment. Some of the alternatives listed by them included switching to yoga and meditation (National Center for Complementary and Integrative Health, 2020), high-intensity workout at home, and lifting heavy buckets, big water bottles, and skipping. All these alternative arrangements not only helped individuals maintain their daily exercise routine but also contributed to their physical and mental health (Jiménez-Pavón et al., 2020; Nicol et al., 2020). In fact, the American College of Sports Medicine had recommended 150–300 min of aerobic exercise per week and two sessions per week of moderate-intensity muscle strength exercises for people to be physically active during the COVID-19 pandemic (Joy, 2020).

The mixed impact of social media usage and listening to music during exercise was also observed in this study. Results clearly indicate that participants found social media to be an effective medium to keep themselves up to date about the pandemic situation and to overcome the monotony of home confinement. Apart from this, participants also experienced a lack of emotional attachment, as face-to-face interaction during the said period was missing. This encouraged participants to use social media to get connected to people as well as to witness their regular activities, which they were missing otherwise. Several studies in the past have argued that social support boosts motivation for training and can increase up to 35% more adherence to a physical exercise program (Rhodes et al., 2001) and that it can be an additional strategy to make exercise events more interactive and less dissociated from afferent body responses (heart rate, breathing), which in turn results in more positive training experience (Kravitz and Furst, 1991; Pridgen and Grogan, 2012).

Social media was also used as a platform to know about virtual fitness techniques and opportunities for online training for physical exercise. Ammar et al. (2020d) demonstrated 15% higher use of Information and Communications Technology (ICT)

during the COVID-19 confinement duration, which indicates higher use of social media and app use for home-based fitness activities (Tate et al., 2015; Ammar et al., 2020a).

Furthermore, participants also found that listening to music was an effective aid to keep themselves engaged as they exercised. This also supports the finding that music helps people to continue their fitness workout for a significantly longer period of time (Thakare et al., 2017). A series of studies have shown that music creates an ergogenic effect during physical and cognitive performance and is linked to heightened motivation and engagement and lower levels of stress, anxiety, and depression (Chtourou et al., 2015). In their recent meta-analytic review Terry et al. (2020) have concluded that listening to music during physical activity boosts positive affective valence and results in improved physical engagement and enhanced physiological responses. It is therefore clearly evident that listening to music while doing physical exercise during the current pandemic has enabled people to focus on the exercise without any distraction from the home setting and has enabled them to create their own world, where there is no COVID-19.

To conclude, the findings of the study indicate that the perceptions and social media habits of fitness freaks, who were hitting gyms for a regular workout before the lockdown, were greatly impacted by the COVID-19 pandemic. They also experienced psychological health issues during the initial phase of the pandemic. However, they gradually changed their dependence on gym-based workout and switched to alternative exercises that helped them greatly to restore their mental and physical health.

## Implications and Future Suggestions

The present study shows that despite the initial experience of anxiety and fear and the lack of motivation to engage in physical exercise at home, fitness freaks were able to shift to home exercises and were greatly supported by social media uses and listening to music. One could argue that this study only included fitness freaks who find it difficult to detach themselves from physical activities for a long time, and this was probably the reason for their shift to home-based exercises. However, there is no doubt that the findings of this study have demonstrated that if performed regularly, physical exercise has the potential to mitigate the ill physical as well as psychological effects of the COVID-19 pandemic. The findings of this study, therefore, could be extended to the common public to also persuade them to engage in physical fitness exercises, which would result not only in a better physical health but also in an enhanced psychological health and well-being. The findings of this study strengthen the recommendations made by researchers and organizations (for details see Chtourou et al., 2020; World Health Organization [WHO], 2020) to engage in home-based exercises (including, but not limited to, aerobic activities, balance and flexibility exercises, and muscular strength and endurance training) for about 150–180 min per week; to use social media, music, and/or similar techniques to increase adherence to physical exercises; and to practice dancing and yoga to reduce stress, anxiety, and depression, and even improve the quality of sleep (Chennaoui et al., 2015; Chtourou et al., 2015). It is also noted that one should

start physical exercise and its alternatives in a progressive manner and must adhere to his/her fitness levels for choosing the amount and intensity of these exercises.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

All procedures followed in this study were in accordance with the APA's ethical standards and with the Helsinki Declaration

of 1964 and its later amendments. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

HK, TS, and YA conceptualized the study. HK and TS prepared study protocols. HK collected data, conducted initial data analysis, and wrote the first draft. TS, SM, and YA finalized data analysis, reviewed, and commented on the draft manuscript. HK, TS, SM, and YA contributed to the preparation of the final draft. All authors contributed to the article and approved the submitted version.

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# #Quarantineworkout: The Use of Digital Tools and Online Training Among Boxers and Boxing Coaches During the COVID-19 Pandemic

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The purpose of this article is to explore the use of online training strategies and digital tools amongst coaches and athletes in boxing clubs during the COVID-19 pandemic and the subsequent shutdown of organized sport. A digital qualitative research strategy was applied to boxing clubs, boxers, and boxing coaches in Norway. A total of 46 official clubs, athletes, and coach pages on Facebook were followed from 12th March to 30th June 2020, resulting in a sample of 78 social media posts (texts, photos, and videos). A content analysis approach was used for the material. The results show that the use of digital tools amongst the studied Norwegian coaches and boxing clubs varied in frequency and form during the spring of 2020 (COVID-19 shutdown). For them, the most frequent use of digital instruments was to communicate internally and externally about the COVID-19 situation, national rules and guidelines. The material demonstrated that online training strategies varied between different constellations of three specific factors: (1) synchronized (live-streamed) online training and unsynchronized online training (at home training videos and programmes), (2) publicly published online training that was only accessible through digital registration, and (3) free online training and online training that was only available to paying members. For the athletes in the material, the most frequent content was social media posts for self-promotion purposes. Additionally, several of the athletes expressed that they struggled to cope with and manage the training at home during lockdown, and that they deeply missed training and competing as usual.

**Keywords:** digital technologies and sport, digitalization and digital transformation, digital tools and volunteer sport clubs, athletes and social media, COVID-19 and sports, digital qualitative research in sport, boxing and technology

## INTRODUCTION

The COVID-19 pandemic of 2020 is the first time since World War II that organized sport has ground to a halt and athletes have been unable to compete internationally (Pedersen et al., 2020). In the spring of 2020, elite and grassroots sports were shut down around the world in order to contain the coronavirus and prevent it spreading. Global sports mega events, such as the Tokyo 2020 Summer Olympic Games, were cancelled and postponed until 2021 (IOC, 2020a). In the case of boxing, the 2020 AIBA Youth Women's and Men's World Championships and multiple annual national and transnational championships, such as the England Boxing National Amateur Championships and the Nordic Boxing Championships (AIBA, 2020), were cancelled. The qualifying events for Tokyo 2020 have been postponed to 2021 (IOC, 2020b), and a European qualifier tournament that

was scheduled to run from March 14 to 24 was cancelled after only 2 days of competition, leaving the slots for the Olympic Games in 2021 unfilled.

Due to the pandemic, sports that were once part of daily life for athletes around the world have been cancelled for an indefinite period. After several months of cancelled competitions, closed sporting facilities, national government restrictions, and social distancing requirements, regions have now slowly begun to reopen sports facilities and allow some organized sports to re-engage in their core activities. However, organized sport is still a long way from being “back to business” as usual, and sports like boxing—that cannot be practised without extensive full-body contact—are subject to the harshest restrictions for the simple reason that it is not possible to practise full-contact sports competitively and maintain the required social distance. In other words, while organized sports in general have been seriously affected by the COVID-19 pandemic, boxing and other full-contact sports are likely to experience longer periods of shutdown and more severe restrictions than non-contact sports.

As the time of writing this article COVID-19 is an ongoing pandemic. The consequences of the pandemic and the subsequent shutdown of sport in society are still uncertain. Some research in the field of sports medicine has also raised concerns about the impact of the coronavirus disease on athletes' health. For instance, Baggish et al. (2020) argue that due to the restrictions on training and competition, the resumption of competitive sport will mean challenges in ensuring the cardiac safety of the millions of athletes worldwide. Similarly, Paoli and Musumeci (2020) highlight that long-term detraining, as in this forced COVID-19 stop, leads to a decline in maximal oxygen consumption (VO<sub>2</sub>max), a loss of endurance capacity and a loss of muscle strength and mass. According to Paoli and Musumeci (2020), these factors will significantly increase the risk of injury amongst elite athletes. Although these concerns are valid, little research has been done on how the shutdown of sport during the COVID-19 pandemic has affected the training habits of athletes in different sports and different socio-geographical locations. Have athletes simply ceased to train and engage in sport during the lockdown? Or have they adapted to the situation and developed new training strategies? More specifically, how has the pandemic impacted the use of digital tools and digitalization in sport? How do athletes use digital training strategies, such as participation in online training, during lockdown? This article aims to shed light on these issues by analysing the use of digital tools in Olympic boxing during the COVID-19 lockdown.

Specifically, the research question guiding this study is: *How have boxers, boxing coaches, and boxing clubs made use of digital tools and online training strategies during the COVID-19 lockdown?* This question is explored by means of a qualitative analysis of social media content (Facebook) on the topic of the COVID-19 shutdown of organized sport in Norway and novel digital training strategies (pictures, videos, and texts) published by Norwegian boxers, boxing coaches, and boxing clubs. Like most social sports-related phenomena this research question could easily be explored through a multitude of methodological approaches, such as qualitative interviews or a quantitative survey. Social media content analysis was chosen as a strategy

for this study mainly because during the COVID-19 lockdown, Norwegian boxing clubs began, for the first time, to promote online training activities. In most cases, the use of such novel digital tools was announced on the social media accounts of clubs and coaches. Since some coaches and clubs advertised open online training free for anyone to join, this content appeared as unique data to gain insight into the use of digital tools among boxers, boxing coaches, and boxing clubs during the COVID-19 pandemic. On an initial screening of the most common social media platforms used by athletes and coaches (Twitter, Facebook, Instagram, Tik Tok, Snapchat), Facebook stood out as the platform with the most diverse public (official) accounts. That is, boxers, boxing coaches, and boxing clubs were all represented on Facebook. On the other social media platforms, the same athletes (as on Facebook) could be identified but fewer coaches and club accounts were available for analysis.

In the following, I present a brief summary of previous research on digitalization and the use of digital tools in organized sport. This is followed by a description of my material and methodological approach. Thirdly, the results are presented and discussed in relation to findings from previous studies about the use of digital tools in sport.

## ANALYTICAL FRAMING

In order to examine the use of digital tools and online training strategies amongst boxers, boxing coaches, and boxing clubs in Norway during the COVID-19 lockdown, I combine previous research on digital tools and digitalization in sport with the theoretical concepts of path dependence/path disruption and critical junctures in an attempt to understand how individuals, groups, and organizations respond to unexpected change (exogenous shocks) and the potentially lasting consequences of critical external events.

### Technology, Digitalization and the Use of Digital Tools in Sport

Digitalization has become, and continues to be, a vital component in all realms of life, of which sport is no exception. Throughout the years, sports organizations have seen advances in fields such as sports medicine and injury prevention (Ventresca, 2019; Rigamonti et al., 2020), performance monitoring and measurement (Miah, 2017; Johnson, 2020), fan interaction and communication (Hinck, 2019), and sports equipment (Balmer et al., 2012). Digital tools increasingly shape workflows in sports organizations (Torres-Ronda and Schelling, 2017) and provide a wide range of applications for organizational development, including administration, internal and external communication, administration and improved control of training and competition processes (Ehnold et al., 2020). For instance, coaches and athletes communicate via digital platforms and video-conferencing, grassroots sports clubs advertise their activities on social media, and high performance sports teams make decisions about how to develop their brands further based on computer-generated algorithms. Some scholars have illustrated how digital technologies create novel challenges for

sports organizations. These include online bullying and virtual maltreatment of athletes (Kavanagh et al., 2019), sexism toward female sports fans (Radmann and Hedenborg, 2019), and social inequality of access to digital tools (Tjønndal, 2021). Despite the deep impact of digital technologies on sport, research on the use of digital tools in organized sports is still rare and dispersed.

Much of the literature on digital tools and digitalization has focused on professional sports clubs and analysed the implementation and application of digital technologies in high performance sport. Hence, the use of digital technologies for opening up new target groups and marketing opportunities has been examined in some detail, including sports fans use of mobile apps and online platforms (Kang, 2015; McGillivray and McLaughlin, 2019; Qian et al., 2019), elite athletes use of social media platforms (Geurin-Eagleman and Burch, 2015; Chawansky, 2016), resistance to digitalization in elite sport (Trabal, 2008; Tjønndal, 2020), social media activities and corporate communication (Waters et al., 2010; Yan et al., 2018) as part of sports clubs' branding strategies (Watkins and Lewis, 2014; Bertschy et al., 2019), and online educational and administrative resources for sports organizations (Sellitto et al., 2016; Strachan et al., 2016). A notable exception to the literature on technology and digitalization in professional sports is Ehnold et al., 2020 study of voluntary sports clubs and their use of digital tools. Ehnold et al. (2020) conducted an online survey of voluntary sports clubs in Austria and Germany ( $n = 787$ ) with the aim of identifying and describing their digital use behaviour. The statistical analyses of Ehnold et al. (2020) showed that 93.7% of the surveyed sports clubs reported using digital instruments for internal and external communication. The second most reported use of digital tools was "to report membership data to federations" (82.1%). Their findings thus indicate that at present digital instruments in voluntary sports clubs are primarily used for internal/external communication and conventional administrative tasks. Furthermore, Ehnold et al. (2020) identified goals of success in competitive sports and cooperation with other institutions as two promoting factors for how voluntary sports clubs use digital tools. Additionally, the sports clubs with a high proportion of volunteers with administrative tasks used digital tools more frequently. However, according to Ehnold et al. (2020), the strongest restriction on the use of digital instruments can be observed in voluntary sports clubs that report that "digital processes do not fit with club culture" and when the organization does "not have a clear strategy for the digitalization of our club."

While Ehnold et al. (2020) do not discuss specific digital tools [such as smartphone applications (apps), online forums, or social media platforms], some studies have explored the use of certain digital tools in sports organizations. Rigamonti et al. (2020) argue that the ever-increasing number of apps used in sport and fitness contexts are marketed to a diverse audience, which means that the myriad of apps that are available provide useful information for health conscious individuals (Higgins, 2016) and dedicated professional athletes (Peart et al., 2019) alike. Specifically, Rigamonti et al. (2020) illustrate how app-based diagnostics solutions have the potential to improve concussion screening in elite sport. Similarly, van Tuyckom (2021) examines

how the development of an app, as a co-creation between participants, public sector stakeholders, and voluntary sports clubs, can support prolonged sport participation among socially vulnerable youth in Bruges, Belgium.

Some critical studies of increased digitalization and the use of digital tools in sport have been carried out. Peart et al. (2019) argue that the validity and reliability of the performance and health data collected through sport and fitness apps is often unknown. Peart et al. (2019) acknowledge the potential of mobile apps to collect data in the sports field, but advise athletes and practitioners to exercise caution when using them because not all apps are developed based on research. In another critical study of smartphone apps, Rist and Pearce (2016) tested the hypothesis that apps could improve athletes' engagement in mental training programmes. To test this hypothesis, they recruited 46 male adult athletes in professional Australian Rules football to participate in their study. The players were randomized into three groups to use one of three apps over a 4 week period. Their results showed that player engagement was noticeably reduced in all three groups with compliance falling, compared to initial participation levels (before using the apps). Hence, they concluded that smartphone apps do not improve compliance with mental training programmes or significantly improve outcomes among athletes.

Finally, some research suggests that social and demographic factors, such as gender, social class, and ethnicity, affect the use of health- and sports-related wearable digital technologies. In a study of undergraduate students use of wearable devices, Pan et al. (2019) found that men were more likely than women to use wearable technology. Similarly, in a study of gender and digital games, Crawford (2005) found that women were a lot less likely than their male peers to play digital games, and when they did played them less frequently. Pan et al. (2019), on the other hand, found no significant relations between wearable device use and social class standing or academic status. In contrast to the findings of Pan et al. (2019), the findings of a study of Australian youth indicated that there was a strong link between technology use and social class (North et al., 2008). Although the youths had similar access to digital technologies at home and at school, and similar knowledge of these technologies, their practices varied according to their social background. The youths whose parents were highly educated and were in high status occupations used technology more frequently and diversely than other youths (North et al., 2008).

## Path Dependence and Critical Junctures

In the literature on path dependence, there is a general notion that previous occurrences will shape how an individual, group, or organization develops over time. One of the classic definitions of the term was proposed by Sewell in 1996, where path dependence is described as events where "*what happened at an earlier point in time will affect the possible outcome of a sequence of events occurring at a later point in time*" (1996: 262–263). However, Nilssen (2019a) 2019b argues that as Sewell (1996) definition is relatively open, the concept of path dependence is sometimes used in an unnuanced way, where perspectives on path dependence are so vague that they boil down to



arguments along the lines of “history is of significance” (Nilssen, 2019a). Nevertheless, in general, theories of path dependence do argue for the importance of timing and sequence, departing from similar conditions, many possible outcomes, and extensive impact from relatively minor and (seemingly) insignificant events at a later date (Pierson, 2000).

A common perception of path dependence is that the impact of an early course of action will be as good as irreversible, i.e., that early path-shaping choices can lead to critical moments in social, organizational or political development (Collier and Collier, 2002). Pierson (2000) emphasizes that it is not only large-scale events or decisions that can have an extensive impact on groups of people or organizations, but also that seemingly small and contingent events can affect them if the timing is right. Specifically, Pierson (2000) outlines a list of four key features that define path-dependent (or path-disruptive) processes: (1) many possible outcomes (a wide range of outcomes are possible), (2) contingent context (small events can have an extensive and lasting impact if they happen at the right time), (3) timing and sequencing (when an event occurs is significant), and (4) organizational delay (when a process has been initiated, positive resolution centred on one specific option can result in this option being dominant, and, consequently, the one chosen. The selected option will then later be resistant to change).

Pierson's list of defining features of path dependence/path disruption shares several features with Collier and Collier (2002) framework of critical junctures. Here, a critical juncture is defined as “a period of significant change, which typically occurs in distinct ways in different countries (or in other units of analysis) and which is hypothesized to produce distinct legacies” (Collier and Collier, 2002: 29). Similar to the theory of path dependence, the framework of critical junctures also explains why some events or decisions have a lasting impact (if they do not have a lasting impact, they are not critical). These theories share a common feature—they both emphasize timing and context as important for the result, so that when the critical juncture occurs, the consequences will be significant and difficult to reverse.

Critical junctures are understood as incidents that are beyond the control of the individual, organization or local government, with the potential to notably influence and change practices (Salamonsen, 2015). In other words, critical junctures can act as catalysts for path disruption. Commonly, critical junctures are viewed as occurrences caused by exogenous factors (Nilssen, 2019a). In other words, critical junctures are unexpected events that catalyse an unpredictable window for action and/or change.

## MATERIALS AND METHODS

This article is based on an inductive approach to qualitative inquiry. Methodologically, the data derives from a digital research strategy. According to Bundon (2016:356), digital research in the sports sciences can be described as research strategies that “include the use of digital tools to collect data and the collection of digital data.” Bundon (2017) also highlights that digital qualitative research methods include explorations of

public and private cyberspaces, researcher participation and non-participation in online spaces, as well as analyses of authored published work and anonymous online data. Following Bundon (2016) 2017 methodological approaches, the exploration of the use of digital tools and online training strategies by boxers, boxing clubs, and boxing coaches presented in this article is based on data from public cyberspaces, with non-participation from the researcher in the online spaces, and analyses of authored published works.

## Sample

The data consists of Facebook posts of Norwegian boxers, boxing coaches, and boxing clubs published between 12th March and 30th June 2020. 12th March was set as the earliest publication date for social media content included in the sample because this was when the Norwegian Boxing Federation (NBF) officially shut down all national boxing activities due to the COVID-19 pandemic (NBF, 2020).

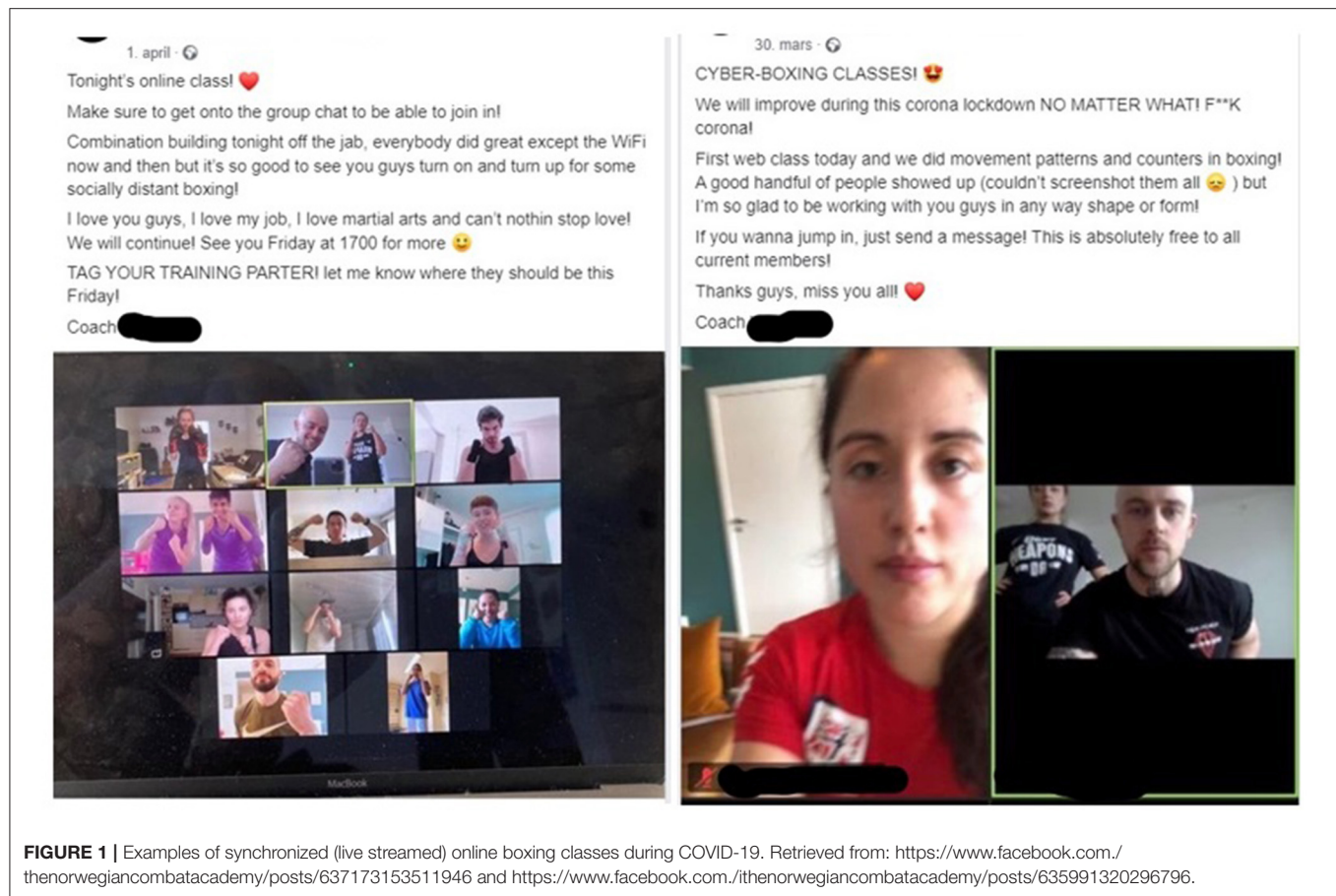
To determine the sample, I followed all the official Facebook pages of Norwegian boxing clubs, coaches, and boxers registered with NBF during the COVID-19 lockdown of boxing in the spring of 2020 (as indicated above, from 12th March to 30th June). I only included social media posts relating to public and official athletes, coaches, and club pages in my material. While Facebook was the selected social media platform for the data collection, many athletes and clubs re-posted material from other social media accounts (such as Instagram and TikTok), or linked to content on other platforms, such as YouTube, Zoom, or blogs. The search for material was limited to posts that included the topics online training and the use of digital tools to manage the COVID-19 lockdown. This strategy resulted in a sample of 78 social media posts from Norwegian boxers, boxing coaches, and clubs for analysis (see **Appendix I** for a complete list of the data material). In accordance with national ethical guidelines for internet research (NESH, 2019), in the cases in which I present photos (screenshots) from the material (see **Figures 1–3**), verbal and written consent was collected from the athletes and coaches concerned. The names of the boxing clubs, coaches, and athletes in the photos presented in **Figures 1–3** have been removed to protect the participants' identities at much as possible. They could not be anonymized completely, though, in that the figures contain photos of individuals.

The sample consists of different types of texts. The main body of texts in the sample are Facebook updates written by the athletes and coaches themselves. Many of these include photos, videos, and links to other social media accounts. An overview of the sample with links to each social media post is provided in **Appendix I**. At the time of the data collection, all the social media posts (including videos) were publicly available online.

## Analysis

The material was analysed using a qualitative content analysis approach (Vaismoradi et al., 2013). Content analysis uses a descriptive approach in both the coding and interpretation of the data. When analysing, categorizing and coding the material, my aim was to describe the characteristics and content of each social media post (texts, photos, videos) by examining





**FIGURE 1 |** Examples of synchronized (live streamed) online boxing classes during COVID-19. Retrieved from: <https://www.facebook.com/thenorwegiancombatacademy/posts/637173153511946> and <https://www.facebook.com/thenorwegiancombatacademy/posts/635991320296796>.

“who says what, to whom and with what effect” (Bloor and Wood, 2006). Using this approach, the analysis of the material resulted in three distinct themes, which are highlighted in the results section of the article: (1) online training strategies to manage the COVID-19 pandemic shutdown, (2) digital tools as a means of communication and administration, and (3) self-promotion, awareness, and motivational content. Most of the texts included in the study were originally published in Norwegian. The description of the texts and the quotations from them have been translated from Norwegian to English by the author.

As the coding and analysis of the data was done solely by the author, this part of the research process raises some validity issues. As Eggebo (2020) argues, when multiple researchers engage in qualitative analysis collectively, it enables a more creative analytical process and strengthens the validity of the presented findings. Multiple researchers working collectively with qualitative analysis might strengthen validity as Eggebo (2020) suggests, although I would argue that this is only true to a certain extent. There are limitations to how collective analysis can strengthen analytical validity. Notwithstanding, doing qualitative analysis as an individual endeavour, as I have done in this study, is potentially a limitation of the analytical process. Moreover, it is not the goal of this study to generate the best possible validity, but to generate new insights into

a novel research field—the use of digital tools by boxers, boxing coaches, and clubs during the COVID-19 pandemic of 2020.

## RESULTS

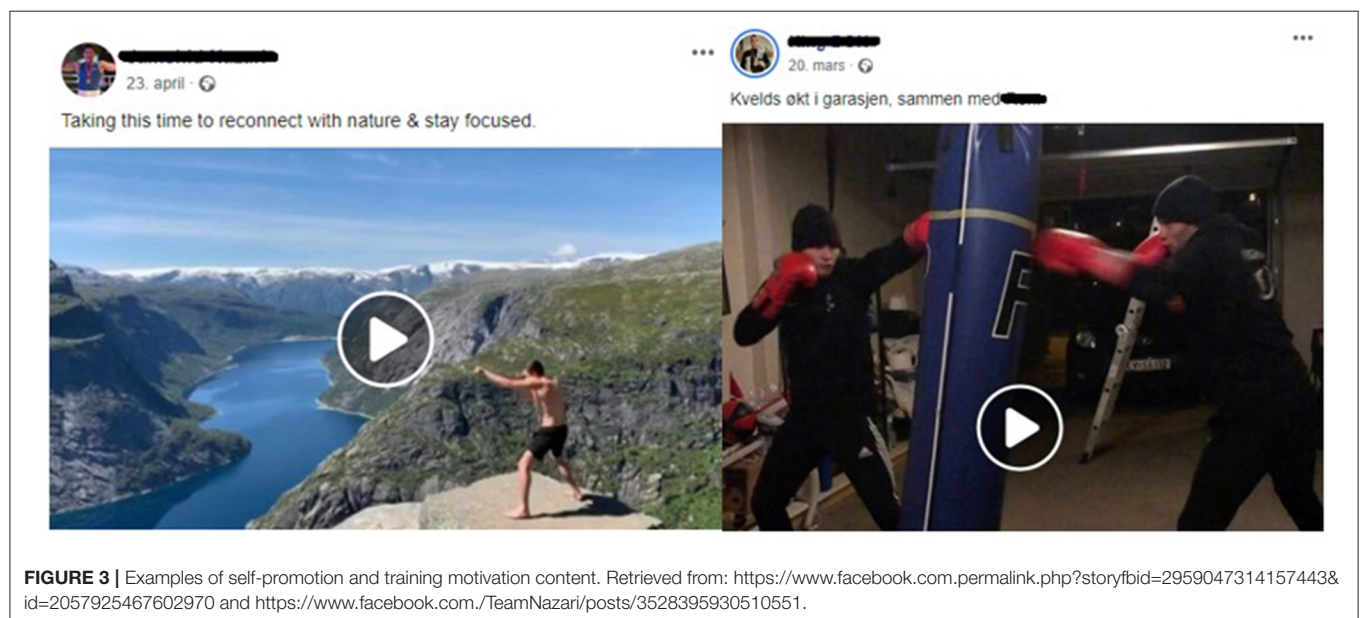
A total of 46 official (public) Norwegian boxing clubs', coaches', and athletes' Facebook pages were followed daily during the period 12th March to 30th June 2020. During this period, 23 of the 46 Facebook pages posted content relating to COVID-19, online training, and the use of digital tools. From these 23 Facebook pages, a total of 78 social media posts were identified, consisting of texts, photos, and video material. The analysis of the content in these posts is presented below, organized according to the three topics identified in the content analysis: (1) online training strategies, (2) self-promotion, awareness, and motivational content, and (3) digital tools, communication, and administration.

### Online Training Strategies

Only two of the athletes' Facebook pages analysed in the material posted content relating to online training strategies during the COVID-19 lockdown (see Bernard Angelo Torres and Alexander Hagen in **Appendix I**), while several of the boxing clubs' and coaches' pages posted content on the topic of



**FIGURE 2** | Examples of unsynchronized online boxing classes during COVID-19. Retrieved from: <https://www.facebook.com/romerikebokseklubb/posts/2528531147463732> and <https://www.facebook.com/moldekameratene/posts/2527852790768664>.



**FIGURE 3** | Examples of self-promotion and training motivation content. Retrieved from: <https://www.facebook.com/permalink.php?storyfbid=2959047314157443&id=2057925467602970> and <https://www.facebook.com/TeamNazari/posts/3528395930510551>.



online training. In the material, there are notable differences in strategies between the boxing clubs and coaches when it comes to online training. These differences relate to three different factors: (1) synchronized (live-streamed) online training and unsynchronized online training (via home training videos and programmes), (2) publicly published versus accessible training through registration, and (3) free online training and training sessions available only to paying members.

A common strategy amongst the boxing clubs and coaches was synchronized (live-streamed) boxing trainings using digital platforms such as Zoom and Microsoft Teams (for empirical examples, see for instance The Norwegian Combat Academy and Bodø Bokseklubb in **Appendix I**). Two examples of synchronized online training found in the material are presented in **Figure 1**.

While some boxing clubs (**Figure 1**) arranged online synchronized training exclusively for members of the specific club, others used Facebook to post links to live-streamed training sessions that were open to anyone interested in participating (for empirical examples in the material see Bodø Bokseklubb in **Appendix I**). The boxing clubs and coaches that limited synchronized online training sessions to paying members/athletes via digital sign-up services argued that this was a necessary safety precaution (see Oslo Bokseklubb in **Appendix I** for example). On the other hand, boxing clubs and coaches that chose to make their synchronized trainings publicly available promoted this strategy as a way of recruiting new members to the club when the COVID-19 lockdown was over (see for instance Romerike Bokseklubb in **Appendix I**). As Bodø Bokseklubb stated in its Facebook event for digital boxing training: “This is an open access boxing training session available for anyone who would like to train boxing and condition at home during the COVID-19 lockdown. The digital training session is free and you do not have to be a member of Bodø Bokseklubb to participate” (see Bodø Bokseklubb in **Appendix I**).

Some boxing clubs and coaches chose to post unsynchronized online training videos for home boxing and condition training during the COVID-19 shutdown of organized sport (see **Figure 2**, and Moldekameratene Bokseklubb and Romerike Bokseklubb in **Appendix I**). In the material, these videos feature technical drills and condition exercises that parents can do together with their children (youth boxers), and conditioning exercises that do not require any sport/exercise equipment (**Figure 2**). Some boxing clubs posted new training sessions and videos as often as every other day. One of the boxing clubs described this online training strategy in this way: “We want all our members and followers to keep training, even if we are temporarily closed because of the COVID-19 virus! Therefore, we will be posting training sessions that you can do at home without any equipment” (translation from **Figure 2**).

## Coping With Lockdown: Self-Promotion, Awareness and Motivational Content

Among the boxers who posted COVID-19 related content on their Facebook pages during the lockdown of Norwegian boxing, the most common were self-promotional and motivational photos, videos, and texts. Many of the boxers in the material

posted photos and videos from their “#*quarantineworkout*” in their homes, or outside in their neighbourhoods (**Figure 3**), with motivational quotes such as “*Even if we have to stay at home these days, we can still do workout. There’s lots of training we can do inside our home #stayhome #socialdistancing #COVID19*” (see Bernard Angelo Torres in **Appendix I**). Additionally, several boxers posted content expressing their struggles with not being able to go to the boxing gym, and that they missed training and competing. There are many examples of this in the material, with statements such as “*I’m making the best of these trying times*” (see Anniken Holthe Boxing in **Appendix I**) and “*I can’t wait to be back in the ring*” (see Bernard Angelo Torres in **Appendix I**). Some of the boxers’ Facebook pages also contained posts with content that was meant to raise awareness of the COVID-19 virus, encouraged people to “*Follow national guidelines, take care of yourself and your loved ones*” (see Simen Nysæther in **Appendix I**) and reminded fellow boxers that “*health and safety always comes first*” and to “*stay safe*” (see Anniken Holthe Boxing in **Appendix I**).

Motivational content was also common amongst the boxing clubs and coaches in the material (see for instance Jessheim Bokseklubb in **Appendix I**). In particular, many clubs posted videos of members doing boxing workouts at home, applauding their efforts with captions like “*Our coaches and athletes are getting COVID-19 creative!*,” “*The boxing gym has been swapped with garages, basements, living rooms, neighbourhoods, and forests, but we endure!*,” “*Only the imagination can stop our amazing athletes*,” “*We are boxers. We adapt and overcome!*.”

While many athletes posted content expressing how much they missed boxing, some boxing clubs and coaches posted content that raised awareness of their club’s condition during the lockdown, and the need for members to keep paying their membership fees. One of the coaches in the material expressed it in this way:

This is a scary time. I thank you all from the bottom of my heart for keeping your payments running, I know it is a hard time and I am of course working closely with those who have hard economic times but the gesture of continuing your payments is literally the ONLY thing keeping the boxing gym in business. This gym is the result of over 14 years, half a life of work and it means the world to me, it IS me! So I cannot thank you enough for keeping this new and vulnerable gym open! Next week we will be taking online classes on ZOOM on Monday, Wednesday and Friday at 17.00 and will run for 40 minutes. We’ve gotta stay active and we’ve gotta stay sharp!

One of the clubs went as far as giving away “corona gifts,” consisting of skipping ropes and other boxing exercise equipment that could be used at home, to boxers who continued to pay their membership fees during the shutdown (see Moldekameratene Bokseklubb in **Appendix I**).

## Digital Tools, Communication, and Administration

The boxing clubs’ and coaches’ most frequent use of digital tools was Facebook and social media as a platform for communication and administration. All the boxing clubs and

coaches in the analysed material (**Appendix I**) used digital tools for communication and/or administration purposes during the COVID-19 lockdown in the spring of 2020. Most commonly, clubs and coaches used social media to repost the guidelines and rules from NBF and the Norwegian Olympic and Paralympic Committee and Confederation of Sports (NIF) on the COVID-19 pandemic.

When boxing clubs were allowed to host socially distanced (2 m distance between participants) training sessions outdoors for a limited number of athletes (at first in groups of 5 and later in groups of 20), many boxing clubs and coaches started using digital tools to administer boxers signing up for training sessions to make sure they adhered to the national COVID-19 guidelines (see for instance Oslo Bokseklubb in **Appendix I**).

## DISCUSSION AND CONCLUSION

First of all, it is clear that the use of digital tools by boxers, boxing coaches, and clubs has varied greatly during the COVID-19 lockdown in the spring of 2020. Some clubs and coaches only posted 1–2 updates with information that the boxing gym would be closed until further notice, while others hosted live-streamed training sessions every other day for months. Hence, the use of digital tools and online training strategies has varied both in frequency and form.

All the boxing clubs in the analysed material used digital tools for internal and external communications, as well as for administrative tasks related to the management of members in accordance with national COVID-19 guidelines for organized sport. These findings are consistent with previous findings on the use of digital tools in voluntary sports clubs in Austria and Germany (Ehnold et al., 2020). In their studies, Ehnold et al. (2020) found that sports clubs with a high proportion of volunteers with administrative tasks used digital tools more frequently. This may explain why some boxing clubs made use of online training strategies and others only used digital tools for necessary communications during the COVID-19 lockdown. However, the currently available data does not enable me to determine whether this is the case here. That some boxing clubs and coaches only used digital tools for necessary communications (e.g., to post that the boxing gym was closed due to the COVID-19 pandemic) could also be interpreted as a form of resistance to digitalization in sport, as explored in a few previous studies (Trabal, 2008; Sellitto et al., 2016; Tjønndal, 2020). As Trabal (2008) found, coaches are more likely to resist technological innovation than athletes. Sellitto et al. (2016) argue that many sports organizations do not use digital tools because they do not have the expertise to exploit them productively. This may also be the case for the boxing clubs and coaches making limited use of digital tools and online training strategies during the shutdown.

The boxers included in the material mainly used digital tools for self-promotion during the COVID-19 pandemic shutdown. This finding is consistent with those in the studies undertaken by Geurin-Eagleman and Burch (2015) and Chawansky (2016). Specifically, Geurin-Eagleman and Burch (2015) show that male and female athletes use social media to build their personal brand and for brand management. This is also the case here, as many

athletes posted content thanking their sponsors for supporting them during the COVID-19 crisis (see for instance Camilla Johansen, Mindaugas Gedminas and Bernard Angelo Torres in **Appendix I**). However, Geurin-Eagleman and Burch (2015) also found that female athletes were more likely to share photos of themselves than their male counterparts, and that the photos were mainly taken in private settings. This is not the case in this study, though, as most boxers (both male and female) posted photos and videos of their “#stayhome #quarantineworkout” from home. It may be that these findings diverge from that of Geurin-Eagleman and Burch (2015) due to the lockdown situation. Pan et al. (2019) found that in their sample, men were more likely to use digital technologies than women. In my sample there are also more men than women. However, the majority of the sample consists of posts from boxing clubs and coaches. Furthermore, boxing is a male dominated sport (Rana, 2017; Tjønndal, 2019), which means there more males than females are involved. Hence, the data that is analysed here is limited in terms of examining how gender influenced the use of digital tools in sport during the COVID-19 pandemic. This is also the case for influences of other social and demographic factors, such as income, academic background, and social class. Pan et al. (2019) found no link between social class and/or academic background in the use of digital technologies. North et al. (2008), on the other hand, concluded that social class strongly affects how youth use digital technologies. As technology is embedded in relations of power and serves the interest of individuals or institutions, whether for economic or cultural means, it is likely that factors like gender and social class influenced athletes use of digital tools and online training strategies during the pandemic lockdown. In order to examine such differences, more research is needed on this topic. In this context, quantitative surveys and qualitative interviews would be more suited to uncovering potential differences rather than the social media data analysed for this article.

The material demonstrates that many boxing clubs and coaches have increased their use of digital tools during the COVID-19 lockdown. In particular, many clubs have incorporated online training strategies, both live-streamed and pre-recorded videos, which were not offered prior to the national shutdown of organized sport in Norway. This is perhaps not very surprising, given that COVID-19 represents an exogenous shock (or critical juncture) (Collier and Collier, 2002; Nilssen, 2019a 2019b) for athletes, coaches, and clubs. In other words, the pandemic and the subsequent lockdown of society represents a period of significant change and an event that demands action and adaptive skills from athletes, coaches, and sports clubs. From this theoretical perspective (Sewell, 1996; Pierson, 2000), clubs, coaches, and athletes have their set ways of organizing sports practices and competitions (path dependence).

Collier and Collier (2002) state that a feature of critical junctures is that they are often hypothesized to produce distinct legacies, which means that critical junctures can potentially lead to path disruption (i.e., lasting change) (Nilssen, 2019a). However, it remains unclear as to whether the COVID-19 lockdown will contribute to a lasting change in terms of training habits amongst athletes, novel ways of organizing sports activities and competitions for boxing coaches and clubs, or an increased

digitalization of Norwegian boxing clubs. The available data does not enable me to answer such questions, but future research could evaluate the lasting impacts of the COVID-19 pandemic. If boxing clubs and coaches abandon online training strategies once the lockdown is over, and boxing training and competitions resume as normal, it would indicate that even though the pandemic can be characterized as a critical juncture (or exogenous shock), individual and organizational practices in boxing would still best be described as path dependent following the pandemic (Sewell, 1996; Pierson, 2000). In this case, COVID-19 as a critical juncture would not lead to path disruption in boxing practices in Norway. Just as the COVID-19 crisis has forced some clubs and coaches to use digital tools, it is likely that this exogenous shock will in fact lead to path disruption among boxers, boxing coaches, and boxing clubs. According to the previous findings of Ehnold et al. (2020), a likely outcome would be an increase in the use of digital tools by boxing clubs and coaches for the registration and administration of members post COVID-19. However, this remains to be seen, and follow-up studies are needed to explore whether or not the shutdown has contributed to an increased use of digital tools by boxing clubs and coaches.

In the light of the theoretical concepts of path dependence, path disruption and critical junctures (exogenous shocks) (Pierson, 2000; Collier and Collier, 2002), the increased and novel use of online training strategies by Norwegian boxing clubs and coaches during the COVID-19 lockdown can be interpreted and analysed as cases of crisis management in voluntary sports clubs. Studies of innovation in public governance have illustrated that a crisis situation may often inspire innovation in the organization (Nilssen, 2019a,b). It may also be the case for Norwegian boxing clubs and coaches that the COVID-19 pandemic has inspired digital innovation in communication, administration and the organization of training and core activities. It remains to be seen whether these novel uses of digital tools will continue past the COVID-19 pandemic, and will in turn transform the organizational culture of voluntary sports clubs, such as the boxing clubs studied here.

## Limitations

The present study should be read as an early contribution to the limited research topic of digitalization and the use of digital tools in voluntary sports clubs (Ehnold et al., 2020). However, the study has a number of limitations and unexplored perspectives that need to be taken into consideration in further investigations. These are: (1) As there are several validity issues with internet research, a broader data base (both quantitative and qualitative) from other sporting contexts is needed to validate the results and test them for methodological errors such as sample biases. Further research on the use of digital tools and online training in voluntary sports clubs during the COVID-19 pandemic would

help to expand the scope of knowledge. (2) Social media data is just one of several methodological approaches that could be applied to study how boxers, boxing coaches, and boxing clubs use digital tools and online training strategies during a pandemic. Quantitative surveys and qualitative interview data could provide other insights into this phenomenon, and perhaps be better suited to examining how factors such as gender, age, academic background/social class influence the use of digital tools in a crisis situation. (3) The social media platform Facebook was utilized to identify the sample. Previous research has indicated that Facebook might not be the best platform to investigate the use of digital tools amongst athletes and coaches. In their study of elite sports clubs' branding strategies, Watkins and Lewis (2014) found that Facebook was a less popular social media platform than Twitter. Similarly, Chawansky (2016) states that Instagram now has more users than Twitter. Further studies of the content in other platforms may be more appropriate and yield novel insights. (4) The COVID-19 pandemic represents a global crisis that has forced athletes and coaches to manage an unknown situation. The extreme circumstances of the lockdown of organized sport is perhaps an interesting case for the study of the use of digital tools in sport, although on the other hand, it does not represent the everyday life of sports organizations. Hence, it is uncertain as to whether the data analysed here is comparable with findings from previous studies of digitalization and the use of digital tools amongst athletes, coaches, and voluntary sports clubs.

## DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Materials**, further inquiries can be directed to the corresponding author.

## ETHICS STATEMENT

Informed consent was obtained from the sports clubs and individual(s) for the publication of any potentially identifiable images or data included in this article.

## 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/fspor.2020.589483/full#supplementary-material>

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# Relationship of Physical Activity With Anxiety and Depression Symptoms in Chinese College Students During the COVID-19 Outbreak

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**Introduction:** During the COVID-19 outbreak, many citizens were asked to stay at home in self-quarantine, which can pose a significant challenge with respect to remaining physically active and maintaining mental health. This study aimed to evaluate the prevalence of inadequate physical activity, anxiety, and depression and to explore the relationship of physical activity with anxiety and depression symptoms among Chinese college students during quarantine.

**Method:** Using a web-based cross-sectional survey, we collected data from 1,396 Chinese college students. Anxiety and depression were assessed with the Self-Rating Anxiety Scale (SAS) and the Self-Rating Depression Scale (SDS), respectively. The data on physical activity were collected by types of physical activity and the International Physical Activity Questionnaire (IPAQ-SF).

**Results:** During the COVID-19 outbreak, about 52.3% of Chinese college students had inadequate physical activity. The rates of anxiety and depression symptoms were 31.0 and 41.8%, respectively. A high level of physical activity ( $\beta = -0.121$ ,  $P < 0.001$ ) was significantly closely associated with low anxiety, while a moderate ( $\beta = -0.095$ ,  $P = 0.001$ ), or high ( $\beta = -0.179$ ,  $P < 0.001$ ) level of physical activity was significantly closely associated with reduced depression after adjusting confounding demographic factors. Moreover, specific types of physical activity, such as stretching and resistance training, were negatively correlated with both anxiety and depression; doing household chores was negatively correlated with depression.

**Conclusion:** Our findings highlight specific levels and types of home-based physical activities that need to be taken into consideration to protect the mental health of college students during the COVID-19 epidemic.

**Keywords:** COVID-19, physical activity, anxiety, depression, college students

## INTRODUCTION

The coronavirus disease 2019 (COVID-19) outbreak began in Wuhan (Hubei Province, China) in December 2019. It then spread first in China and soon afterward throughout the world. The World Health Organization (World Health Organisation, 2020a) reported that as of July 9, 2020, more than 12 million cases had been confirmed in more than 200 countries and regions. The large-scale epidemic has brought not only the risk of death from the viral infection but also public mental health problems, such as anxiety and depression symptoms, worldwide (Elbay et al., 2020; Huang and Zhao, 2020; Rajkumar, 2020; Vindegaard and Eriksen Benros, 2020). To contain the diffusion of infection, Chinese governments have implemented unprecedented and effective quarantine measures and delayed starting schools. Many healthy college students are being asked to stay at home in self-quarantine, while implementing the emergency policy of “suspending classes without stopping learning.” This means that tens of million Chinese college students are facing challenges in navigating online learning while coping with the stresses of daily life, which are expected to bring a mental health burden. For example, recent studies showed that the prevalence rates of anxiety and depression symptoms were around 24.9 and 9.0%, respectively, among Chinese college students during the COVID-19 outbreak (Cao et al., 2020; Tang et al., 2020). Therefore, psychiatrists and researchers should be aware of these mental health problems and their correlates and should develop measures and implement interventions appropriate for this situation (Liu et al., 2020; Rajkumar, 2020).

Staying at home for prolonged periods of time can also increase sedentary behavior and decrease the levels of physical activity, and may lead to a mental health burden (Hemphill et al., 2020). However, home-based physical activity might be a valuable tool to help individuals remain calm and continue to protect their mental health during home-quarantine. For example, Chen et al. (2020) pointed out that staying active and maintaining regular physical activity may help students recuperate from the mental health problems they experienced while in quarantine during the COVID-19 crisis. Furthermore, WHO has released guidance intended for people in self-quarantine, including practical advice on how to stay physically active and reduce sedentary behavior while at home (World Health Organisation, 2020b). However, previous studies have focused mainly on evaluation of the mental health of college students and the risk factors of anxiety and depression during quarantine (Cao et al., 2020; Odriozola-González et al., 2020; Tang et al., 2020). Little is known about the details of home-based physical activity and its association with reduced anxiety/depression symptoms.

To address these key evidence gaps, in this study, we evaluate the anxiety and depression of Chinese college students during the COVID-19 outbreak and explore the relationship of physical activity with anxiety and depression symptoms. We hypothesized that a certain percentage of college students had inadequate physical activity and would experience depression and anxiety during the epidemic, while special types and levels of physical activity would be associated with reduced anxiety/depressive symptoms.

## MATERIALS AND METHODS

### Participants and Procedure

The target participants comprised Chinese graduate and undergraduate students who were staying at home in self-quarantine and engaging in online learning during the COVID-19 outbreak. We conducted a cross-sectional anonymous web-based survey to collect data from February 25 to March 5, 2020. The questionnaire survey was imported to the web survey platform Chinese Survey Star<sup>1</sup> (Changsha Ranxing Science and Technology, Shanghai, China) and distributed on the WeChat public platform using a snowball sampling strategy. A total of 30 university students and 10 teachers from our university were selected as “original deliverers.” They sent the questionnaire links to WeChat groups of college students. To recruit more participants, the questionnaire links were also distributed among WeChat groups of the respondents’ classmates. Chinese college students were able to access the survey using WeChat and fill out the questionnaire anonymously by clicking the link or scanning the QR code. After participants reach the survey homepage, an online consent form is displayed, before the users see the questionnaire. If the participants have no objection to the survey objective in the consent form, they officially start the survey by clicking the “Next” button, or they exercise their right to cease the survey. This web-based questionnaire was completely voluntary and non-commercial.

A total of 2,343 students from 76 college student WeChat groups were invited to participate in the survey. Finally, 1,421 college students completed the survey, a response rate of 60.6%. Before data processing, we applied a series of exclusion criteria: (1) no clear name given for the college and major; (2) any obvious discrepancy between the level of education (undergraduate or graduate) and school academic system; (3) the same kind of response given to all questions. According to these exclusion criteria, 1,396 questionnaires were considered valid for inclusion in the analysis.

### Ethics Statement

This study was approved by the Human Experimental Ethics Board of Guangzhou Sport University (Approval no. 2020LCLL-004) in accordance with the Declaration of Helsinki. Each participant provided electronic informed consent before seeing the questionnaire. Participants could withdraw from the survey at any moment without providing any justification.

### Measurements

Demographic variables included gender (male or female), age, only child (yes or no), single parent (yes or no), education (undergraduate or graduate), and the number of times focusing on COVID-19 information. The focus on COVID-19 information was measured by the filling in the number of times per day spent on browsing information relating to the COVID-19 pandemic over the previous week. The type of physical activity, physical activity level, anxiety, and depression were assessed as follows.

<sup>1</sup><https://www.wjx.cn/>



## Physical Activity Level

The physical activity level was measured using the short form of the International Physical Activity Questionnaire (IPAQ-SF), which has been validated and recommended as an efficient method to assess physical activity (Craig et al., 2003). Participants reported the frequency and duration of their vigorous and moderate physical activities and walking per week. The metabolic equivalent of task (MET) of vigorous activity is 8.0, that of moderate activity is 4.0, and that of walking is 3.3. According to the official guideline criteria (Sjostrom, 2020) and previous studies (Kim et al., 2019), the participants' physical activity level could be categorized as high, moderate, or low as follows.

(1) Category high: The pattern of activity was classified as high if it met either of the following criteria: (a) vigorous activity at least 3 days in a week achieving a minimum of 1500 MET-min/week, or (b) 7 or more days of any combination of walking, moderate-intensity, or vigorous-intensity activities achieving a minimum of 3000 MET-min/week.

(2) Category moderate: The pattern of activity was classified as moderate if it met any one of the following three criteria: (a) 3 or more days of vigorous activity of at least 20 min per day in a week, or (b) 5 or more days of moderate-intensity activity and/or walking of at least 30 min per day in a week, or (c) 5 or more days of any combination of walking, moderate-intensity, or vigorous activities achieving a minimum of at least 600 MET-min/week.

(3) Category low: Those individuals who did not meet criteria for Categories 1 or 2 were considered to have a low physical activity level.

Additionally, the prevalence of inadequate physical activity was also calculated according to current WHO guidelines (2020b), which recommended that adults engage in at least 75 min of vigorous-intensity physical activity per week, at least 150 min of moderate physical activity, or any equivalent combination of the two.

## Type of Physical Activity

Before conducting the survey, 10 college students and 3 physical education teachers were invited for an interview discussing the most frequent types of physical activity for college students during home quarantine. Finally, we selected 10 common home-quarantine physical activities, including household chores, walking, jumping, running, stretching, resistance training, bodybuilding, yoga, Tai chi, and sports (e.g., football, basketball, volleyball). If an activity was not on the list, it was categorized as "other." Participants were asked: "During past week, in which of the following home-quarantine physical activities or exercises did you participate for at least 15 min (multiple choice)?" The questionnaire included 10 items on specific home-quarantine physical activities and 1 "other" physical activity. Though the activity type "other" is presented, the results are not discussed further because of the mix of different activity types in that category.

## Anxiety and Depression

Zung's Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) were used to assess anxiety and depression symptoms, respectively (Zung, 1965, 1971). Both the

SAS and SDS are composed of 20 items, each of which is assessed using a 4-point Likert scale ranging from 1 (*not at all or a little of the time*) to 4 (*most of the time or all the time*). Higher total scores indicate greater anxiety or depression. The raw score was standardized using the following formula: standard score =  $INT(1.25 \times \text{raw score})$ . A standard scores exceeding 50 indicates that the individual suffers from anxiety or depression symptoms (Zung, 1973; Wang, 1984). Both the SAS and SDS have been demonstrated to have acceptable validity and reliability in the Chinese population (Lee et al., 1994; Tao and Gao, 1994) and have been applied in clinical practice and research for the evaluation of anxiety and depression related to the COVID-19 epidemic (Guo et al., 2020; Liang et al., 2020; Ma et al., 2020).

## Statistical Analysis

All of the statistical analyses were performed with SPSS version 23.0 (IBM Corp., Armonk, NY, United States). According to the research purpose, measurement data were expressed as the mean  $\pm$  standard deviation (SD), while independent sample *t*-tests were used for group comparisons. In the multiple group comparisons, one-way analysis of variance was used. Pearson's correlation was used to examine the association between depression, anxiety, age, and the number of times focusing on COVID-19. Additionally, linear regressions were applied to analyze the relationship of physical activity levels and types with anxiety and depression symptoms. Anxiety and depression scores were used as dependent variables, while physical activity level and type were used as an independent variable. Physical activity level was recoded as two dummy variables (reference group = low level): moderate and high level. Significance levels were set at 0.05, and all tests were two-sided.

## RESULTS

### Participants' Characteristics

A total of 1,396 participant surveys were used in the analysis, including 881 (63.1%) males and 515 (36.9%) females. The mean (standard deviation) age of the participants was 20.68 (1.84) years. Among these samples, 1,314 (94.1%) of participants were undergraduate students, 427 (30.6%) of participants were the only child in the family, and 126 (9.0%) lived in a single-parent family. The mean (standard deviation) number of times focusing on COVID-19 was 3.94 (2.80) per day. Regarding physical activity, the mean (standard deviation) time spent on vigorous activity, moderate activity, and walking was 90.09 (78.53), 133.34 (79.70), and 157.45 (95.31) min/week, respectively. However, 730 (52.3%) of Chinese college students had inadequate physical activity. The overall prevalence rates of anxiety and depressive symptoms were 31.0 and 41.8%, respectively (Table 1).

Analysis of demographic characteristics of anxiety and depression symptoms is displayed in Table 2. Female college students exerted higher SAS scores than male college students ( $P = 0.023$ ). College students who lived in an only child family reported significantly higher SAS scores than those who lived in a non-only child family ( $P < 0.001$ ). Regarding depression symptoms, female college students exerted higher SDS

**TABLE 1** | Characteristics of college students in the sample.

Variable	Total (n = 1396)
Age (years), Mean $\pm$ SD	20.68 $\pm$ 1.84
Gender, n(%)	
Male	881 (63.1)
Female	515 (36.9)
Only child, n(%)	
No	969 (69.4)
Yes	427 (30.6)
Single parent, n(%)	
No	1270 (91.0)
Yes	126 (9.0)
Education, n(%)	
Undergraduate	1314 (94.1)
Graduate	82 (5.9)
The number of times focusing on COVID-19(n), Mean $\pm$ SD	3.94 $\pm$ 2.80
Physical activity (min/week), Mean $\pm$ SD	
Vigorous activity	90.09 $\pm$ 78.53
Moderate activity	133.34 $\pm$ 79.70
Walking	157.45 $\pm$ 95.31
Insufficient physical activity (%)	730 (52.3%)
Anxiety Symptoms, n (%)	
Yes	433 (31.0)
No	963 (69.0)
Depression symptoms, n (%)	
Yes	583 (41.8)
No	813 (58.2)

scores than male college students ( $P = 0.009$ ). Undergraduate students reported significantly higher SDS scores than graduate students ( $P = 0.002$ ).

### Physical Activity Level Factor of Mental Health During COVID-19 Outbreak

Significant differences in anxiety and depression were observed among the three physical activity levels in the comparative analysis (Supplementary Table S1).

The linear regression analyses showed that participants with a high level ( $\beta = -0.121$ ,  $P < 0.001$ ) of physical activity were significantly associated with low anxiety, while a moderate ( $\beta = -0.095$ ,  $P = 0.001$ ) or high ( $\beta = -0.179$ ,  $P < 0.001$ ) level of physical activity was significantly associated with reduced depression after adjusting confounding demographic factors (Table 3).

### Physical Activity Type Factor of Mental Health During the COVID-19 Outbreak

Significant differences in anxiety were observed for two types of physical activities, namely, stretching and resistance training ( $P < 0.01$ ). Meanwhile, significant differences in depression were found for three types of physical activities: household chores, stretching, and resistance training ( $P < 0.001$ ) (Supplementary Table S2).

In the linear regression analyses (Table 4), stretching ( $\beta = -0.082$ ,  $P = 0.005$ ) and resistance training ( $\beta = -0.058$ ,  $P = 0.042$ ) were significantly associated with low anxiety, while household chores ( $\beta = -0.120$ ,  $P < 0.001$ ), stretching ( $\beta = -0.122$ ,  $P < 0.001$ ), and resistance training ( $\beta = -0.131$ ,  $P < 0.001$ ) were significantly associated with reduced depression after adjusting for confounding demographic factors. On closer inspection, household chores were associated with the lowest depression compared with other types of physical activity.

## DISCUSSION

The COVID-19 epidemic has been spreading worldwide, and many citizens have been asked to stay at home in self-quarantine, which is associated with reduced physical activity and increased mental health burden (Hemphill et al., 2020). This study aimed to evaluate the anxiety and depression of college students during the COVID-19 outbreak in China and explore the relationship of anxiety and depression symptoms with physical activity types and levels.

**TABLE 2** | Demographic characteristics influencing anxiety and depression symptoms (mean  $\pm$  SD).

	Anxiety	r/t	P	Depression	r/t	P
Age		0.001	0.984		-0.008	0.761
Gender		<b>-2.28</b>	<b>0.023</b>		0.071	0.943
Male	35.11 $\pm$ 8.33			37.20 $\pm$ 10.04		
Female	36.16 $\pm$ 8.30			37.17 $\pm$ 8.97		
Only child		<b>-3.98</b>	<b>&lt; 0.001</b>		<b>-2.63</b>	<b>0.009</b>
Yes	34.16 $\pm$ 8.20			36.17 $\pm$ 9.47		
No	36.08 $\pm$ 8.33			37.64 $\pm$ 9.71		
Single parent		0.335	0.738		-0.743	0.458
Yes	35.73 $\pm$ 7.748			36.58 $\pm$ 9.458		
No	35.47 $\pm$ 8.391			37.25 $\pm$ 9.678		
Education		1.40	0.162		<b>3.06</b>	<b>0.002</b>
Undergraduate	35.57 $\pm$ 8.39			37.39 $\pm$ 9.66		
Graduate	34.24 $\pm$ 7.27			34.04 $\pm$ 9.09		
The number of times focusing on COVID-19		0.018	0.510		-0.031	0.248

Bold values indicate statistical significance at  $p < 0.05$ .

**TABLE 3 |** Linear regression analyses of the relationships of physical activity level with anxiety and depression symptoms.

Independent variable <sup>a</sup>	Anxiety				Depression			
	$\beta$	<i>T</i>	<i>P</i>	95%CI	$\beta$	<i>t</i>	<i>P</i>	95%CI
Low level (reference)								
Moderate level	−0.012	−0.391	0.695	−1.622 to 1.082	−0.095	−3.221	<b>0.001</b>	−4.096 to −0.995
High level	−0.121	−4.066	<b>&lt;0.001</b>	−3.966 to −1.385	−0.179	−6.071	<b>&lt;0.001</b>	−6.061 to −3.101

<sup>a</sup>Control gender, age, only child, single parent, education and the number of times focusing on information about COVID-19 per day. Bold values indicate statistical significance at  $p < 0.05$ .

**TABLE 4 |** Linear regression analyses of the relationships of physical activity type with anxiety and depression symptoms.

Independent variable <sup>a</sup>	Anxiety				Depression			
	$\beta$	<i>t</i>	<i>P</i>	95%CI	$\beta$	<i>t</i>	<i>P</i>	95%CI
Walking	0.013	0.460	0.645	−0.889 to 1.434	0.017	0.621	0.535	−0.899 to 1.732
Household chores	−0.047	−1.669	0.095	−2.162 to 0.174	−0.120	−4.323	<b>&lt;0.001</b>	−4.238 to −1.593
Jumping	−0.004	−0.135	0.893	−1.537 to 1.339	0.023	0.781	0.435	−0.980 to 2.277
Yoga	0.008	0.270	0.788	−1.583 to 2.087	0.025	0.867	0.386	−1.159 to 2.996
Tai chi	0.012	0.449	0.653	−1.973 to 3.145	0.006	0.226	0.822	−2.564 to 3.231
Bodybuilding	0.037	1.303	0.193	−0.597 to 2.957	0.048	1.702	0.089	−0.267 to 3.758
Running	−0.034	−1.243	0.214	−2.271 to 0.509	−0.031	−1.175	0.240	−2.517 to 0.631
Stretching	−0.082	−2.788	<b>0.005</b>	−2.949 to −0.513	−0.122	−4.237	<b>&lt;0.001</b>	−4.357 to 1.599
Sports	−0.029	−1.083	0.279	−1.998 to 0.577	−0.017	−0.633	0.527	−1.929 to 0.987
Resistance training	−0.058	−2.034	<b>0.042</b>	−2.512 to −0.046	−0.131	−4.650	<b>&lt;0.001</b>	−4.706 to −1.914
Other activities	−0.026	−0.946	0.344	−2.224 to 0.777	−0.004	−0.146	0.884	−1.825 to 1.572

<sup>a</sup>Control gender, age, only child, single parent, education and the number of times focusing on information about COVID-19 per day. Bold values indicate statistical significance at  $p < 0.05$ .

Our findings indicated that the prevalence rates of anxiety and depression in college students were 31.0 and 41.8%, respectively. The results were both higher than the rates (24.9% for anxiety and for 9% depression) found in prior surveys among Chinese college students (Cao et al., 2020; Tang et al., 2020) but within the range (22.6–36.3% for anxiety and 16.5–48.3% for depression) among the general population in China during the same period reported by meta-analysis (Pappa et al., 2020). The inconsistent results may be related to the different psychological scales used and different survey times. First, our survey used the SAS/SDS to measure anxiety/depression symptoms, while other surveys used the Generalized Anxiety Disorder Scale (Cao et al., 2020) and Patient Health Questionnaire-9 (Tang et al., 2020). Thus, the different scales and cut-off scores applied by each survey could yield different results. Second, our survey was conducted in late February and early March, when the government had ordered a nationwide school closure and suggested “suspending classes without stopping learning” from late February 2020. Hence, the challenges for college students came not only from the effect of the virus on their life but also from the use of the new mode of online learning, which may increase anxiety or depression. Our findings also indicated that college students’ anxiety regarding the epidemic was associated with whether they were an only child, while depression during the epidemic was associated with gender, age, education, and only-child status.

This study showed about 52.3% of Chinese college students engaged in inadequate physical activity during the COVID-19

outbreak, nearly more than twice the global prevalence of inadequate physical activity (27.5%) under non-outbreak conditions (Guthold et al., 2018). Novel to our study were our findings of a meaningful association between physical activity level and mental health in Chinese college students during the COVID-19 outbreak, even after adjusting confounding demographic factors, such as gender, age, family background, education level, and the number of times a day focusing on information about COVID-19. College students who engaged in a high level of physical activity had lower anxiety than those who engaged in low levels of physical activity, while individuals who engaged in moderate and high levels of exercise had lower depression than those with a low level of physical activity. These results indicated that the association between physical activity and depression was greater than that between physical activity and anxiety during the COVID-19 crisis, which is consistent with a prior meta-analysis study, indicating that physical activity reduced depression with a medium effect (SMD = −0.5) and anxiety with a small effect (SMD = −0.38) (Rebar et al., 2015). It is plausible that the relationships we found are causal because they are consistent with randomized controlled trials indicating the beneficial effects of physical activity on anxiety and depression (Carek et al., 2011; Rebar et al., 2015), as well as dose-response studies, suggesting that more activity has a greater beneficial effect on mental health (Legrand and Heuze, 2007; Wipfli et al., 2008). Physical activity might reduce anxiety/depressive symptoms through a variety of psychosocial

and biological mechanisms, such as increasing neurotrophic factor (BDNF) and endogenous opioids (endorphins), improving the immune system, or promoting self-esteem (Balchin et al., 2016). Thus, a moderate or high level of physical activity can attenuate the symptoms and consequences of quarantine-induced anxiety/depression through complex and powerful systemic neuroprotective effects.

Regarding physical activity type, our survey showed that among 10 types of physical activity, 2 types of physical activity (stretching and resistance training) were associated with lower anxiety, and 3 types of physical activity (household chores, stretching, and resistance training) were associated with lower depression. This result is inconsistent with a prior survey finding that all of the physical activity types, including social and non-social forms, were associated with lower mental health burden among 1.2 million individuals (Chekroud et al., 2018). The lack of association between all types of physical activity and anxiety/depression symptoms might be related to the fact that college students' activity levels declined during the COVID-19 outbreak. Despite this, we found that college students doing household chores had the lowest depression. The reason might be that household chores, such as family members cooking together, like other social activities, promote resilience to stress and reduce depression (Chekroud et al., 2018). Thus, the prosocial benefits from household chores might contribute an additional benefit for mental health over other types of physical activity, especially during the COVID-19 outbreak. In addition, stretching and resistance training were conducive to reducing both anxiety and depression, which supports the "stay physically active during self-quarantine" recommendation by the Chinese Center for Disease Control and Prevention (2020) and World Health Organisation (2020b).

To sum up, it is important to implement strategies to further increase home-based physical activity when facing necessary social isolation or quarantine. The social networks, videos, and information search sites for health promotion among the general population could be applied to achieve the recommendations of the World Health Organisation (2020b), which suggest "150 min of moderate-intensity or 75 min of vigorous-intensity physical activity per week, or a combination of both."

This study has several limitations: First, it is based on cross-sectional data; thus, causal relationships between physical activity and anxiety/depression symptoms should be interpreted with great caution. Future research may apply a longitudinal or experimental design to validate the causal relationships among these variables. Second, because of the limited resources available and the quarantine, the snowball sampling strategy and online self-report survey were adopted, which might be subject to participation bias, social desirability bias, and shared method variance. Future studies can improve representative samples of Chinese college students, and apply objective methods—such as ActiGraph accelerometers and assessment by mental health professionals—to assess physical activity and anxiety/depression disorder. Third, due to the sudden occurrence of the disaster, we were unable to compare

the differences between college students' physical activity levels and mental health before and after the COVID-19 outbreak. Furthermore, we only listed 10 common home-quarantine physical activities, which may limit the diversity and representativeness of physical activity type. Lastly, information about college students' socioeconomic level, type and size of housing, and frequency and duration of each physical activity type was not reported.

## CONCLUSION

This study found that during the COVID-19 outbreak, about 52.3% of Chinese college students had inadequate physical activity. The prevalence rates of anxiety and depression in college students were 31.0 and 41.8%, respectively. Moderate and high levels of physical activity, as well as specific types of physical activity, such as household chores, stretching, and resistance training, were protective factors against anxiety or depression among the college students. The current study expands the literature on physical activity and mental health during the COVID-19 outbreak and points to the need to promote home-based physical activity to protect the physical and mental health of college students and the general population.

## 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 Human Experimental Ethics Board of the Guangzhou Sport University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

X-HH, MH, and M-QX designed the study and wrote the protocols. M-QX, X-MT, and JS designed and selected the scales. H-YY and X-PZ participated in the data collection. LL undertook the statistical analysis. M-QX wrote the manuscript, which all authors helped revise. All authors contributed to and approved the final manuscript.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2020.582436/full#supplementary-material>



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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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# Recommending Physical Activity During the COVID-19 Health Crisis. Fitness Influencers on Instagram

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Fitness content creators on Instagram used the COVID-19 lockdown period to strongly and frequently recommend physical activity to their followers. These individuals are not professional fitness trainers and their Instagram activity consisted of sharing images that were more about the staging of their bodies than about educational content. However, when fitness clubs in France were forced to close in March 2020 following the government's decision to restrict non-essential movement and activities, influencers changed the images they shared daily to promote fitness training that could be done at home. In comparison, this study also analyses the case of a chain of fitness clubs which offered live fitness sessions online via its Instagram account, in order to manage the repercussions of the forced closure of its establishments. This article reveals some consequences of the temporary lockdown of the fitness training industry in France and questions the new dynamic of online fitness recommendations that was observed during the COVID-19 pandemic.

**Keywords:** instagram, influencers, fitness, COVID-19, social media, platform capitalism, sociology

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## INTRODUCTION

The COVID-19 pandemic has resulted in an unprecedented global upheaval as regards physical activity (Table 1). Major sporting events, such as the Olympic Games have been postponed, access to many public sports facilities has been closed and sports businesses, unable to function normally, face bankruptcy in many cases. This period has also seen the development of physical training at home and online. Through the study of the activity of fitness influencers during this period, and of a chain of fitness clubs that offered live fitness sessions online via its Instagram account, this article reports on the consequences of the shutdown of the fitness training industry in France and questions the new dynamic of online fitness recommendations that was observed during the COVID-19 pandemic.

Recent French sociological research has focused on digital spaces that allow consumers and workers to interact (Beauvisage et al., 2018; Chaves Ferreira, 2018; Jan, 2018; Jourdain, 2018). Different from these media, the social network Instagram, a non-market platform<sup>1</sup>, saw the development of a new way of working (Woodcock and Graham, 2018). The present research uses an ethnographic approach in order to question the boundaries of work in the era of digital platform capitalism (Cardon and Casillia, 2015; Srnicek, 2017; Abdelnour and Bernard, 2018; Abdelnour and Meda, 2019; Woodcock and Graham, 2020), with a particular focus on creators specialized in fitness

<sup>1</sup>This description should be viewed with a critical eye and is criticized by another part of this research project. Although Instagram is not a platform with a sales space, it nevertheless hosts a marketplace. Gradually learning this "self-marketing," influencers on Instagram sell their image to brands.

**TABLE 1 |** The French national regulations on physical activities during the COVID-19 pandemic, between 14 February and 2 June, 2020.**The COVID-19 health crisis in France**

01/09/2020	First official COVID-19-related death in Wuhan, China.
02/14/2020	First death recorded on French soil.
02/25/2020	First French person to die from COVID-19.
03/11/2020	COVID-19 declared to be a pandemic by the WHO.
03/14/2020	French Prime Minister Edouard Philippe announces the closure of all establishments open to the public and deemed “not essential” to the life of the country. Closing of all fitness clubs.
03/16/2020	French President Emmanuel Macron announces travel restrictions in the country. Individual physical activity is allowed but must be “brief.” Moreover, in consultation with other European leaders, the borders of the Schengen area are closed.
03/23/2020	Prime Minister Edouard Philippe announces that individual physical activity is to be limited to 1 h per day within a radius of 1 km (0.6 mile) of the home.
04/07/2020	The Prefecture and City Hall of Paris bans individual fitness activities between 10 a.m. and 7 p.m. in all outdoor public spaces.
05/11/2020	Lockdown is lifted but some restrictions remain in place. Fitness clubs are still closed.
06/02/2020	Reopening of establishments open to the public. Reopening of fitness clubs.

content (or fitness influencers as they are commonly known). It investigates a French fitness center and fitness influencers, keen to find alternative ways of promoting physical activities during the COVID-19 lockdown, such as offering live online fitness instruction. This article identified the different interactions established between how individuals and organizational fitness influencers used Instagram before and during the pandemic.

By identifying their ways of working through and with Instagram, this research shows that influencers’ activity reflects the interplay of production and consumption in their everyday use of online social networks (Ritzer and Jurgenson, 2010). In the same way as the highly commodified and spectacularized world of professional sport, by engaging fans via their Instagram accounts, influencers can open new communication channels with their audience that can be measured and valued as a new commercial opportunity for sponsors (Cave and Miller, 2015).

Moreover, the activity analyzed here cannot be fully understood without recourse to the literature of the sociology of the body. This study reveals that health and fitness issues are at the heart of the practices exhibited on Instagram by fitness influencers (Smith Maguire, 2008). By inciting their followers to work out and by giving them precise instructions within a fun framework, the individuals observed adopted the role of “sports coach,” disseminating health and fitness instruction but without monitoring how they were understood or the way in which their instructions were carried out. In this sense, the qualitative analysis of the content shared by the respondents during the lockdown provides an additional key to understanding

the dissemination of health and fitness recommendations during the COVID-19 pandemic.

The lockdown instigated in response to the COVID-19 crisis forced the fitness influencers studied, who were more used to the staging of their bodies than to the transmission of educational content, to change the images they shared daily on digital social media to include fitness sessions that could be done at home. In the same way, to manage the repercussions of their forced closure, fitness clubs started using social media to broadcast “live” fitness sessions. Far from resembling usual forms of fitness training, the productions by these two types of actors helped to build a new digital space that multiplied incentives to work out.

The primary aim of this study is to present empirical evidence of ways Instagram has been used as a tool to disseminate and encourage sports participation during the COVID-19 pandemic in France. During this period, online physical training content has been more available than ever. Our study shows that the role played by social media and its users during the quarantine can be understood through the notion of “prosumer”.

## METHOD

This article draws on sociological research conducted since 2017 which studies the economic and professional uses of digital social media. An ethnographic approach (Miller, 2011; Luvaas, 2012; Hjorth et al., 2017) to the research was adopted and included fifty semi-structured interviews<sup>2</sup> conducted with influencers on Instagram. An influencer could be selected for the research if he or she was an Instagram user publishing content exclusively dedicated to fitness with at least one commercial partnership with a company. Furthermore, a qualitative analysis was performed of the content shared on Instagram by the influencers encountered, of observations at events featuring influencers and the companies sponsoring them, and of participant observations (Wacquant, 2004) during training sessions organized and led by Facebook and Instagram. Finally, this study also included a quantitative analysis of income received by influencers through certain partnerships. This research context has allowed us to understand the way in which influencers organize and carry out their activity. The approach adopted here focuses more precisely on the consequences related to the shutdown of the fitness training industry in France.

The analysis presented in this paper is based on a corpus of elements (images, videos, texts, comments) collected during the first 6 weeks of the lockdown. For this purpose, after inspecting each of the images and videos published by the respondents during this period, the online textual data<sup>3</sup> was analyzed. Moreover, the number of the influencers’ and gym’s Instagram followers was extracted on the first and last day of lockdown to see if the COVID-19 pandemic had affected their audience.

<sup>2</sup>Each influencer was interviewed once. Semi-structured interviews lasted between 1 and 2 h and a half.

<sup>3</sup>All names in the data presented below are pseudonyms.

## RESULTS

### The Production of New Content on Instagram

Faced with the closure of fitness clubs, which had been until then the setting favored by fitness influencers to build the content they shared online, the individuals observed seem to have given an additional dimension to the health and fitness recommendations they previously shared, which were often no more than the (generally unconscious) advocating of a specific ideal body type on the Internet. The observation of this digital space thus allowed us to understand a new practice developing among individuals who, until that point, had limited the nature of their posts to the staging of their bodies (Détrez, 2002). During lockdown, the fitness influencers observed started teaching physical exercises that could be done at home. Although they were not fitness training professionals, these women and men used the lockdown period to offer a “*special lockdown workout routine*” often containing exercises that did not require “*fitness equipment*.”

“Just because we’re stuck at home doesn’t mean we have to put our fitness on hold! Let’s work out at home, for our physical and mental health, and to prepare that summer body.”<sup>4</sup>

(Excerpt from the Instagram post of Estelle,<sup>5</sup> a French fitness influencer, 2 April 2020)

Fitness recommendations tended to take several forms. First of all, the previously “fixed” and meticulously staged content gave way to more dynamic video content showing the star-Instagrammer working out at home. The training instructions included in the video were only very rarely spoken aloud by the influencer. These short videos (Instagram limits the length of the videos published to 1 min) were, however, often accompanied by written and easily identifiable instructions. Alongside these iconographic supports (videos and photos), the “caption” function provided a space for free expression where an explanation of the instructions could be given so the exercises recommended could be performed correctly. These instructions were clear and gave the name of the exercises, the number of repetitions, the recovery time, and so on.

The lockdown period was also an opportunity for these fitness influencers to make the most of the previously little-used functionalities offered by the platform. Most of the individuals observed started sharing live content. These “lives” (daily, for some) then allowed a new mode of interaction with their followers and helped make physical exercise part of a certain routine. These online events never took the form of a reciprocal exchange between the content creator and his or her followers. Rather, the influencer took on the role of a coach and delivered live fitness sessions, without taking into account the reactions of their viewers. During these live posts, viewers could “comment” on what they were watching and send a message to the person sharing the video. The messages sent appeared in real time on a

scrolling banner at the bottom of the video making it difficult for an influencer in the middle of demonstrating an exercise to take the scrolling messages into account. Semi-structured interviews conducted before the lockdown showed that the majority of respondents were not very comfortable with video staging. They preferred photos, because they felt more “*in control*” of the image they were showing. Although few respondents were willing to put video exercises online before lockdown, it should nevertheless be noted that those who did were almost exclusively men, despite the survey population being predominantly female. Despite being very rarely used prior to lockdown, the “live” function tended to become much more commonly mobilized by the population observed during this period.

“I hope that everything’s okay for you. Like you, I am learning to deal with this harsh reality that is going to become our daily life for the next few weeks! So I’m pleased to officially announce a one-off upcoming ‘fit week’ comprising four sessions. A complete video and the schedule will be released tomorrow with information concerning the sessions. On the program: a live session on YouTube every other day for two weeks. And for the days in between, real-time videos posted online on Instagram. Sessions with and without equipment. Intensive, muscle-building, cardio, stretching and low impact sessions. So that’s two weeks of non-stop training. An adapted and logically designed program to avoid doing any old thing and suffering unnecessary injuries. Let me remind you that these sessions will be sessions in their own right. Information will be given on each one. This is a huge challenge for me but also a great way to continue to have fun on my networks while saying thank-you to you. I look forward to working out with you, my team.”

(Excerpt from the Instagram post of Julie, a French fitness influencer, 18 March 2020).

“Just to remind you that this evening, like almost every day, there’s going to be a big live event at 6:30 pm where I’ll once again take immense pleasure in making you sweat and suffer! The advantage of this lockdown is that we’re all going to be even fitter afterwards, right?”

(Excerpt from the Instagram post of Emma, a French fitness influencer, 1 April 2020)

By gradually incorporating this message into the daily lives of their Instagram followers, these individuals increasingly took on a role as an authority on the subject. By inciting their followers to work out with precise instructions within a fun framework, the individuals observed adopted the role of “sports coach,” disseminating health and fitness instructions but without checking how they were understood or the way in which they were carried out. Some differences were identified when comparing the instructional content of influencers and certified fitness coaches. For example, an influencer might present a fitness session with her dog in which she would execute an exercise using a large sack of dog food instead of weights. On the other hand, the certified fitness coach would insist on the right posture needed to perform the exercise without risk. The instructions of the influencers were less focused on the risks related to the technical correctness of the movements. Moreover, coaches from the fitness chain I studied insisted at the beginning of each training

<sup>4</sup>The quotes from the French fitness influencers were translated from French by the first author.

<sup>5</sup>To guarantee the anonymity of the influencers, the names used in this paper are pseudonyms.



session on the type of public targeted by the nature of the training. For example, they specified that the “sculpt and hard cardio session” was not for “beginners,” “this training [was] for people who are already in good shape, experienced players.” While it is easy to report on the way this message was disseminated, it is difficult at this stage, for these individuals as well as for us, to grasp the real influence of these recommendations (Moreno Pestana, 2016).

“Being stuck at home can be an opportunity to work out and think about one’s health. So here’s my workout to do every day, to feel good and to maintain a regular fitness routine.”  
(Excerpt from the Instagram post of Victoire, a French fitness influencer, 19 March 2020)

“You get to watch Netflix only after you’ve done 100 push-ups (in one or several goes depending on your level) and for those who are in good health and who can. If you want to come out stronger after this virus, you have to be able to do 100 push-ups non-stop. This will give you a minimum amount of daily exercise and a challenge to rise to. Take care of yourselves, and don’t wait to magically get stronger someday – get stronger now!”  
(Excerpt from the Instagram post of Steven, a French fitness influencer, 3 April 2020)

“Lockdown or not, this is the perfect opportunity to take the time to change your habits without the usual evenings out, without tempting dishes in restaurants, and regardless of your pathologies, disorders, diet or age. I will find the exercises that suit you. No excuses. On the contrary, now more than ever is the time to think about your immune system.”  
(Excerpt from the Instagram post of Leslie, a French fitness influencer, 19 March 2020)

The interviews conducted prior to the COVID-19 health crisis underlined the need for informants to “stay active” on Instagram as much as possible. In this sense, almost all of the individuals interviewed published something at least once every other day.<sup>6</sup> While they were deprived of access to fitness clubs, it seems reasonable to hypothesize that the practices described above were not only for educational purposes, but were also part of a strategy to remain visible (Mears, 2011). Indeed, these individuals need to be noticed in order to be contacted by brand names. To this end, influencers have to ensure that they produce regular content (Abidin, 2018). Forced to remain indoors, the staging of their physical fitness at home allowed them to maintain this rhythm.

By relying on wide visibility<sup>7</sup> (Abidin, 2016), the individuals observed here convey a set of aesthetic criteria linked to the image of a muscular body which is staged in such a way as to

<sup>6</sup>Some respondents published up to one image per day and also used the “story” feature that allows content to be shared ephemerally.

<sup>7</sup>The number of followers on Instagram accounts is an indicator of visibility. However, it is very difficult to grasp the real scope of this audience. Furthermore, among these figures, some accounts may have been created from scratch with the sole purpose of inflating this figure, while others may have been created and no longer be consulted. In any case, even if this were to be ignored, the posts shared on Instagram are constrained by an algorithm that limits their distribution. In other words, it seems difficult to fully measure how many people in total received the messages disseminated by the individuals observed.

be presented as an “ideal” (Smith Maguire, 2002). This dominant position on digital social media is usually seized by companies that see these individuals as a means of passing a subtle advertising message. Mobilized during the lockdown around the promotion of physical exercise at home, their bodies were put forward as the guarantees of the quality of the advice given, on a context where they were unable to fully monitor the effect of the exercises recommended. Away from professional training in the medical or sports field, it therefore seems that the legitimacy on which these individuals build their discourse is based on their previously constructed and staged physical appearance.

## Fitness Clubs Forced to Fall Back on Digital Technology

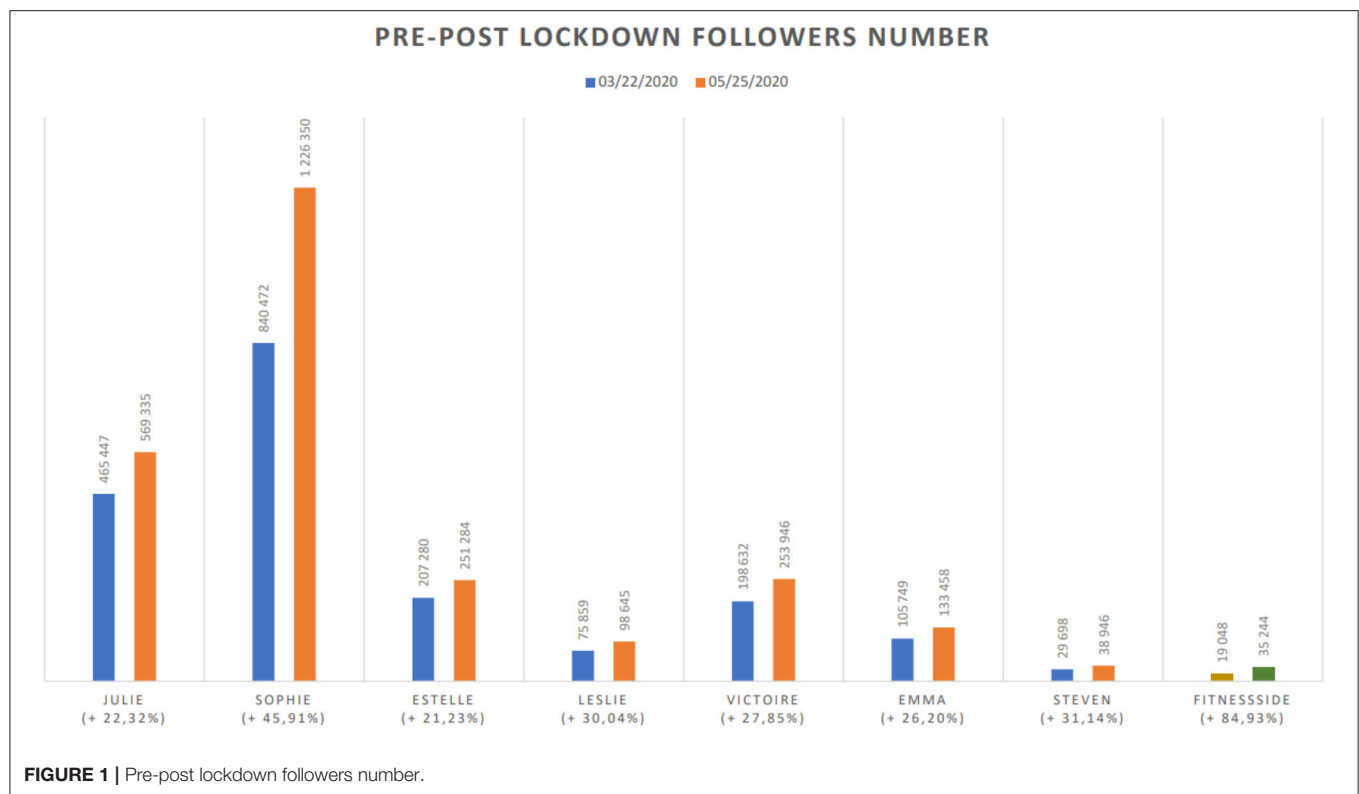
When the French Government prohibited the opening of fitness clubs on 14 March 2020, they were forced to suspend their activities. Confronted with the dissatisfaction of members who were demanding a refund of their membership fees, some brands found digital social media to be a way to create an offer within a certain continuity. Given the economic stakes related to the closure of their establishments (loss of earnings, loss of clients, etc.), some companies started offering a new service free of charge: the posting of live fitness training sessions on Instagram. Among these companies, the FitnessSide<sup>8</sup> chain is a significant case that illustrates how Instagram has become a vector for health and fitness posts and demands during the pandemic.

Faced with the intensification of the number of cases and the progressive closure of certain companies, FitnessSide took a public stance by announcing on Friday 13 March the continued opening of its sports clubs and the adoption of specific measures to deal with the virus. The next day, when Prime Minister Edouard Philippe informed the country that all “*places open to the public that are not essential to the life of the country*” were to be closed, FitnessSide was forced, like all of its competitors, to announce the closure of its sports clubs. At the same time as this closure, the company redirected its clients to the existing My FitnessSideCoach application, presented at the time as “*your best ally to keep you motivated*.” In addition to online training sessions and advice, a message inviting clients to closely follow the brand’s social networks was also sent out. Indeed, 3 days later, the company shared a publication on Instagram with the following text: “*Let’s reinvent the way we move... at home!*”

“When the doors of the sports club, of the ‘temple,’ of our happy ‘second home,’ close... we need to totally reinvent our world. And that’s exactly what we’re going to do, together! Because human beings are endowed with a tremendous power of adaptation. If Sport is Life, then let’s live! No question of giving up your good habits or resolutions.”  
(Excerpt from the Instagram post on the FitnessSide account, 17 March 2020)

Following this announcement, and as in the case of the influencers observed, the FitnessSide Instagram account became

<sup>8</sup>As with the aforementioned influencers, in order to guarantee the anonymity of the company, “FitnessSide” is a fictitious name.



the digital theater of fitness calls to action. The next day (18 March), the company announced its new training program to be followed live on Instagram: “ConFITment<sup>9</sup> by FitnessSide.” This program was announced weekly and initially offered twice-daily online events allowing the live following of cardio training, yoga and muscle strengthening sessions (upper body, lower body or full body depending on the sessions).

“The daily grind is all in the past! We’re moving on to the next level: integrating a little workout session whenever we can, either live with our great coaches or with the most useful application of the moment: My NeoCoach. The ConFITment is a good thing!” (Excerpt from the Instagram post on the FitnessSide account, 19 March 2020)

The approach did not go unnoticed, forming part of a wider movement to which the televised evening news on *France 2* devoted a few minutes on Saturday 21 March. In a segment presenting “the French people working out during lockdown,” two FitnessSide coaches were shown giving a training session from their homes. This brief coverage also included an excerpt of an interview with a sports coach at FitnessSide, who explained how the company had “tried to build content using the means at hand” in order to allow people to work out with “things that everyone usually has around their home.”

After 5 days of this program and 6 days of lockdown, FitnessSide reported that it had measured a high level

of enthusiasm among its followers and was integrating new daily training slots. The second week of the program took the form of six sessions per day instead of two. In other words, the company increased its daily digital events by 200% to encourage fitness at home. In the same week as Prime Minister Edouard Philippe, at the instigation of the Council of State, limited the exemptions allowing physical activity to be maintained (23 March). On 10 March 2020 (6 days before the lockdown was announced), the FitnessSide Instagram account had 10,449 followers. After 5 weeks of lockdown (20 April 2020), it had 33,836 followers, an increase of 223.8% (Figure 1).

## DISCUSSION

Unlike the influencers studied above, the classes at the fitness club were given by fitness coaches who were presented as being qualified (Smith Maguire, 2001). These fitness teaching practices, which could be described as “digital coaching,” seemed, for those ensuring them, to fall within the framework of teleworking, a model of professional practice recommended by President Emmanuel Macron in his speech on 16 March.

However, the fact remains that this type of content, produced and posted by companies, such as FitnessSide for their Instagram followers (who were not limited to their clients), contributed to the construction of a digital space that multiplied incentives to work out at home. Thus, at a time

<sup>9</sup> A play on words with the French word “confinement,” meaning lockdown.

when—health authorities were encouraging rest<sup>10</sup>, and when medical and healthcare personnel were facing an unprecedented health crisis, the social network Instagram saw the creation of a new dynamic in terms of fitness recommendations on the Internet that deserves to be examined<sup>11</sup>. This study thus intends to contribute to the existing literature on social media influencers and fitness. This article has shown that in France, the closure of sports facilities led to changes in the way people practice sport and social media have played an important role in this.

This paper identifies the different approaches in how individual fitness influencers and organizations used Instagram during the pandemic and contributed to producing knowledge to feed the debates around the impacts of COVID-19 on sport and active living and contribute to social media influence knowledge. By investigating the content published by influencers during the COVID-19 outbreak, this research shows that fitness influencers were mobilized during lockdown to promote physical exercise in the home. The legitimacy on which these individuals built their discourse originated in their physical appearance, which had been previously trained and staged on Instagram. Their bodies were seen as the guarantees of the advice given, far from a complete health control of the recommended exercises. At the same time, a chain of fitness clubs was using Instagram to offer its members continuity of service. The “live” sports sessions were provided by trained professionals. During this period, online physical training was more available than ever. The diversity of the content offered

and delivered to Instagram users played an important role in providing opportunities for people to practice sport at home during lockdown.

Thus, the Instagram user is faced with digital sports content that serves the economic interests of influencers and a chain of fitness clubs. The sport “prosumer” can thus be considered to be linked with the conflation of play and labor known as “playbor” for the benefit of the digital capitalist class (Andrews and Ritzer, 2018, p. 368). In the same way to the institutional structure and operations of “prosumer sport 2.0” and eSports, influencers are characterized by abundant content production. The prosumer contributes to the creation of surplus value for the platform used. Within such conditions, the effectiveness of harnessing the prosumer’s voluminous digital output suggests that influencers contribute to blurring the boundaries between labor and consumption (Jurgenson and Ritzer, 2009). Within this world of digital sport, the study of influencers’ activities during lockdown shows contemporary sport culture can be considered both playground and factory where the digital user, the sport prosumer, is both entertained and exploited by sport prosumption (Scholz, 2013).

By reporting on strategies made visible on Instagram and most certainly initiated to limit financial losses, this paper aims to feed the debates relating to the “digitization” of fitness training during the COVID-19 lockdown and questions the consequences and the re-establishing of economic activities impacted by the governmental measures taken to deal with the 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 author/s.

## AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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# Leisure Sports Participants' Engagement in Preventive Health Behaviors and Their Experience of Constraints on Performing Leisure Activities During the COVID-19 Pandemic

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This study assessed the demographic characteristics of Koreans engaged in leisure sports activities during the COVID-19 pandemic and the differences in their preventive health behaviors and constraints on leisure activities. For this study, the demographic characteristics (gender, age, marital status, level of participation in leisure sports, years of participation, companions with whom individuals participating in these sports, type of space used for performing the sports, occupation, and average monthly income) of 544 leisure sport participants (men: 46.0%, women: 54.0%; average age: 36.8 and 33.5 years, respectively), who were recruited on a nationwide basis, were examined through an online survey. Then, comparisons between groups were performed using independent *t*-tests, one-way analysis of variance, and multivariate analysis of variance. Women who participated in both indoor and outdoor leisure sports showed higher adoption of health prevention behaviors than their male counterparts, and married individuals who participated in indoor leisure sports showed higher adoption of health prevention behaviors than unmarried participants. Moreover, individuals who participated in both indoor and outdoor leisure sports by themselves had many interpersonal constraints overall, and the group of married individuals who participated in indoor leisure sports showed structural constraints. In conclusion, leisure sports participants have adopted many health prevention behaviors during the COVID-19 pandemic, but this had led to some interpersonal constraints. These results indicate that, in the case of future pandemics, personal and institutional efforts will need to be made to promote participation in leisure sports and prevent excessive social isolation.

**Keywords:** COVID-19, leisure sports, preventive health behavior, leisure constraints, physical activity

## INTRODUCTION

The measures implemented to control the COVID-19 pandemic have resulted in people around the world becoming accustomed to new realities such as social distancing (Grenita et al., 2020). However, while social distancing measures can help to reduce COVID-19 infection rates, these measures have also been found to negatively impact physical and mental health by restricting

participation in daily activities, travel, leisure activities, physical activities, and various forms of exercise (e.g., as a result of the closure of gyms and restrictions regarding group meetings; Figueroa and Aguilera, 2020; Hossain et al., 2020).

In fact, social distancing-induced reductions in physical activity have been observed in many countries around the world (Ammar et al., 2020; Güzel et al., 2020), and studies have reported that the prolonged nature of the COVID-19 pandemic and the associated mitigation efforts could lead to secondary negative effects concerning the health and welfare of both patients as well as the general population (Gasmi et al., 2020; Lippi et al., 2020).

To reduce their risk of infection, people have adopted preventive health behaviors. Preventive health behaviors refer to activities such as refraining from visiting crowded places, maintaining high levels of personal hygiene (such as avoiding touching one's eyes, nose, and lips with unwashed hands), and remaining up-to-date on associated events by frequently watching COVID-19-related broadcast programs (Kim and Cho, 2020). Recently, some researchers have suggested that, along with everyday preventive measures, regular physical activity is also needed to prevent the disease (Chen et al., 2020b). Considering this finding, and the fact that low physical activity can increase global mortality (Kohl et al., 2012), it seems clear that public health officials should emphasize the importance of engaging in physical activity in order to maintain good health during the pandemic.

However, in Korea, the COVID-19 situation has restricted people's ability to participate in leisure sports by implementing social distancing and social isolation measures at the national level (Bond et al., 2020).

In Korea, many public spaces where people can exercise and improve their health, such as public exercise facilities, gymnasiums, and other physical activity-related institutions/facilities, are currently closed (Shin, 2020a), resulting in structural constraints on sports activities. Furthermore, a variety of interpersonal constraints have also arisen as a result of the COVID-19 prevention measures, as restrictions on public gatherings mean that people are unable to meet with friends, peers, groups, or others to participate in leisure activities (Freire, 2020).

Social constraints imposed due to the COVID-19 pandemic limit an individual's participation in leisure activities and have a huge impact on the external environment and psychological state of the individual (Crawford and Godbey, 1987). Restrictions on participation in various leisure sports can lead to emotional unease including stress, frustration, despair, and conflict. In addition, negative experiences caused by restrictions on leisure activities can lead to several problems in the long run (Rushing et al., 2019).

In light of this, people are engaging in various means of overcoming restrictions for leisure activities during the COVID-19 pandemic. Currently, indoor leisure-sports activities such as "Corona Home Training" have grown increasingly popular around the world, as these activities can be performed alone at home (Lee, 2020). In addition, there are reports of large numbers of people participating in outdoor leisure sports activities such

as hiking, which have a relatively lower risk of infection when compared to indoor exercises (Shin, 2020b).

To date, there have been several studies on COVID-19-related preventive behaviors (e.g., Chan et al., 2020), the relationship between preventive measures and regular exercise (Chen et al., 2020b), and limitations on performing recreational activities during quarantine (Güzel et al., 2020). Most of these studies have focused on quarantine environments (López-Bueno et al., 2020) and on making recommendations for improving one's health by engaging in physical activities while taking care to prevent infection (Nyenhuis et al., 2020). However, there is a lack of research regarding the preventive health behaviors adopted by participants in indoor and outdoor leisure sports activities, as well as the level of constraints these people experience with regard to performing such activities during the COVID-19 pandemic.

Therefore, the purpose of this study was to identify the types of leisure sports people are engaging in during the current pandemic situation, and to analyze, in terms of demographic characteristics, the relationship between participants' adoption of preventive health behaviors and their constraints regarding performing sports activities. This investigation helps to provide a basic understanding of leisure sports participation and related constraints, which could prove useful in the case of any future pandemics.

## MATERIALS AND METHODS

### Participants

In order to identify individuals participating in leisure sports activities during the COVID-19 pandemic, we consulted the 2019 Survey on National Leisure Activity, selecting the population comprising Koreans aged between 19 and 65 years (Ministry of Culture Sports and Tourism, 2019). The research targets included people who continuously participated in leisure activities more than once a week. The data collection was conducted online through Embrain Research Company due to limitations in conducting face-to-face surveys in the current situation. Leisure sports types were classified as defined by the Ministry of Culture, Sports, and Tourism, a Korean government agency. The concept of sports as "institutionalized competitive activity using the body" (Coakley, 1986; Lim, 1994), was employed to identify competitive sports events. Participants were asked in advance whether they participated in leisure sports activities, and the sample only included those who reported participating in such activities and who provided written informed consent for the survey. Data were collected online from July 10, 2020 to July 17, 2020; fewer than 50 confirmed COVID-19 cases were reported per day in that week. Overall, a total of 544 individuals participated in this study; their demographic characteristics are presented in **Table 1**.

### Instruments

#### Demographics

The participants provided information concerning their gender, age, marital status, occupation, average

**TABLE 1 |** Participants' characteristics, adoption of preventive behaviors, and leisure constraints.

		N	%	Adoption of COVID-19 Preventive Behaviors Mean (SD)	Leisure Constraints Mean (SD)
Gender	Male	250	46.2	3.746 (0.408)	3.396 (0.632)
	Female	291	53.8	3.882 (0.391)	3.408 (0.614)
Age (years)	19–29	199	36.8	3.780 (0.409)	3.415 (0.673)
	30–39	184	34.0	3.782 (0.410)	3.428 (0.604)
	40–49	100	18.5	3.871 (0.396)	3.328 (0.607)
	50–65	58	10.7	3.916 (0.369)	3.406 (0.517)
Marital status	Single	299	55.3	3.786 (0.413)	3.378 (0.624)
	Married	242	44.8	3.860 (0.391)	3.433 (0.620)
Type of leisure sports participated in	Outdoor sports	205	37.9	3.800 (0.399)	3.331 (0.633)
	Indoor sports	336	62.1	3.833 (0.408)	3.446 (0.612)
Experience in performing leisure sports	After the COVID-19 outbreak (After January 2020)	76	14.0	3.747 (0.403)	3.312 (0.653)
	1–2 years	175	32.3	3.821 (0.427)	3.343 (0.600)
	3–4 years	107	19.8	3.853 (0.393)	3.440 (0.582)
	More than five years	183	33.8	3.827 (0.389)	3.360 (0.648)
Companions when performing leisure sports	Alone	245	45.3	3.814 (0.418)	3.483 (0.619)
	Family	104	19.2	3.880 (0.364)	3.381 (0.610)
	Friends of the same or different gender (including colleagues)	192	35.4	3.793 (0.406)	3.312 (0.622)
Type of space used to perform leisure sports activities	Home	215	39.7	3.868 (0.389)	3.430 (0.613)
	Work	45	8.3	3.787 (0.423)	3.472 (0.507)
	Clubs	150	27.7	3.776 (0.395)	3.389 (0.629)
	Other	131	24.2	3.798 (0.429)	3.348 (0.665)
Occupation	Manager	163	30.1	3.876 (0.377)	3.456 (0.649)
	Professional	159	29.4	3.742 (0.420)	3.369 (0.558)
	Service worker	92	17.0	3.892 (0.367)	3.331 (0.630)
	Skilled worker or related person	64	11.7	3.806 (0.403)	3.473 (0.650)
	University student (graduate school student)	63	11.6	3.773 (0.455)	3.381 (0.665)
Average monthly income	= \$ 850	59	10.9	3.755 (0.456)	3.300 (0.683)
	\$ 851 – 1,700	69	12.8	3.844 (0.381)	3.394 (0.651)
	\$ 1701 – 3,420	272	50.3	3.800 (0.399)	3.412 (0.598)
	\$ 3,421 – 5,130	94	17.4	3.835 (0.399)	3.465 (0.620)
	= \$ 5,130	47	8.7	3.940 (0.399)	3.365 (0.645)
Total		541	100.0		

monthly income, type of leisure sports in which they participated, years of participation, the people with whom they participated, and their level of participation in these activities.

### COVID-19 preventive health behaviors

The COVID-19 Preventive Health Behaviors Scale, developed by Kim and Cho (2020), was used in this study. Kim and Cho (2020) created this scale by modifying a scale originally developed by

Choi et al. (2016) for use during the Middle East respiratory syndrome epidemic, which referenced the basic guidelines for preventive health behaviors published by the Korean Center for Disease Control and Prevention (Korean Centers for Disease Control and Prevention, 2020). The Preventive Health Behaviors Scale used by Kim and Cho (2020) contains 11 items, all of which are measured using a five-point Likert scale (5 = “strongly agree,” 1 = “strongly disagree”). Higher scores indicate stronger adoption of the preventive health behaviors. Examples of the items are: “I refrain from visiting crowded places,” “I wear masks when I have respiratory symptoms such as fever and cough,” and “I ventilate rooms frequently to ensure that the air indoors is clean.” In Kim and Cho (2020), the internal consistency coefficient of the scale returned a Cronbach's  $\alpha$  of 0.838. The Cronbach's  $\alpha$  for the present study was 0.793, indicating high reliability.

### Negotiation of leisure constraints

Leisure constraints comprise a variety of factors that limit participation in leisure activities. These include personal constraints related to individuals' psychological state and personality characteristics, interpersonal constraints manifested through interaction or relationships with others, and structural constraints, which refer to constraints other than personal and interpersonal constraints that may be present in participation in leisure activities. This study used the Leisure Constraints Scale developed by Crawford et al. (1991), as well as the scale used in Cho and Kim (2019). To date, leisure constraints have referred to factors that indirectly and negatively influence leisure participation, hindering individual leisure preferences and undermining the enjoyment obtained from participation in leisure activities (Kay and Jackson, 1991). As such, Cho and Kim (2019) studied factors hindering leisure participation among Korean professionals. The Leisure Constraints Scale

comprises 21 items that relate to constraints that can be found in daily life, which are divided into three sub-factors: personal, interpersonal, and structural constraints. Through a meeting with a professor of leisure studies, a doctor of sport sociology, and a doctor of leisure studies, the present authors modified the scale to better adapt it to the COVID-19 situation. For example, in terms of personal constraints, the scale statement “I will not engage in leisure activities that I feel uncomfortable with” was changed to “I feel uncomfortable participating in leisure activities during the COVID-19 pandemic,” and the interpersonal constraint-related item “I do not have friends or partners with whom I can participate in leisure activities” was changed to “I do not have friends or partners with whom I can participate in leisure activities during the COVID-19 pandemic.” The structural constraint-related item “I lack information on leisure activities” was also changed to “There is a lack of information regarding the leisure sports activities in which I can participate during the COVID-19 pandemic.” These reflect the overall changes made to the scale to befit the COVID-19 situation. The scale comprised a total of 15 items, with 5 items each for personal, interpersonal, and structural constraints.

After modification, 5 items were deleted as, according to exploratory factor analysis, their loading values were below 0.06. Consequently, the final scale comprised a total of three sub-factors: three items concerning personal constraints ( $\alpha = 0.791$ ), three items concerning interpersonal constraints ( $\alpha = 0.862$ ), and four items concerning structural constraints ( $\alpha = 0.768$ ). The overall reliability coefficient, measured using Cronbach's  $\alpha$ , was 0.841, showing high reliability. A Kaiser–Meyer–Olkin value of 0.836 was obtained, and the total variance explained was 69.52% (Table 2).

**TABLE 2 |** Results of the exploratory factor analysis of the Leisure Constraints Scale modified to reflect the COVID-19 pandemic situation.

Items	Factor 1	Factor 2	Factor 3
<b>Structural constraints</b>			
During the COVID-19 pandemic, costs to participate in leisure sports are high.	0.808	0.150	0.039
During the COVID-19 pandemic, there is insufficient time to participate in leisure sports activities.	0.771	0.100	0.166
As a result of the COVID-19 pandemic, it is difficult to obtain the necessary equipment to perform leisure sport activities.	0.750	0.025	0.296
There is a lack of information regarding the leisure sports activities in which I can participate during the COVID-19 pandemic.	0.696	0.124	0.210
<b>Personal constraints</b>			
I am uncomfortable about participating in leisure sports during the COVID-19 pandemic.	0.094	0.883	0.161
It is inconvenient to participate in leisure sports during the COVID-19 pandemic.	0.094	0.883	0.233
During the COVID-19 pandemic, I have restricted my participation in leisure activities as a result of the opinions of others.	0.154	0.841	0.107
<b>Interpersonal constraints</b>			
People in my social circle have no intention of participating in leisure sports during the COVID-19 pandemic.	0.204	0.126	0.815
I do not have friends or partners with whom I can participate in leisure activities during the COVID-19 pandemic.	0.283	0.138	0.808
My friends (or family) are reluctant to participate in leisure sports because they are worried about becoming infected with COVID-19.	0.133	0.421	0.660
Cronbach's $\alpha$	0.791	0.862	0.768
Eigenvalue	2.477	2.470	2.006
Variance (%)	24.766	24.705	20.058
Cumulative variance (%)	24.766	49.471	69.529
KMO = 0.836, $\chi^2 = 2202.701$ , $df = 45$ , $p < 0.001$			

KMO, Kaiser–Meyer–Olkin value.



## Types of Leisure Sports

The types of leisure sports activities in which the participants engaged were assessed using the “Korean Leisure Activity Survey” developed by the Ministry of Culture, Sports and Tourism (Ministry of Culture Sports and Tourism, 2019). Specifically, this survey measured the proportion of the free time that participants dedicated to performing leisure sports, the types of sports they engaged in, and the amount of time they devoted to essential physiological activities (sleeping and eating). The types of leisure sports that one can participate in during the COVID-19 situation were classified into ball games, racquet sports, winter sports, water sports, swimming, jogging, and dance-related sports; for the purpose of the present study, these sports were classified into indoor and outdoor leisure sports. Specifically, indoor leisure sports activities mainly refer to sports activities that can be performed indoors, such as physical training, badminton, table tennis, billiards, bowling, and swimming; outdoor sports activities include soccer, baseball, golf, running (jogging), cycling, and hiking.

## Data Analysis

To analyze the data, first, coding and data-cleaning were performed. All analyses in this study were conducted using SPSS version 25.0. Frequency analysis and descriptive analysis were conducted to examine demographic variables, and exploratory factor analysis was conducted using varimax rotation to resolve problems caused by multicollinearity. In addition, Cronbach's  $\alpha$  tests were performed to ensure the reliability of the measurement scales. Finally, an independent  $t$ -test and a one-way analysis of variance were used to derive the research results, and multivariate analysis of variance was conducted to simultaneously compare the means for multiple dependent variables (Finch, 2016).

## Procedure

This study was approved by the Institutional Review Board of Chung-Ang University. Data collection was conducted online due to limitations in carrying out face-to-face surveys during the current pandemic situation, which made it challenging to select target participants. Therefore, data were collected with the help of screening questions to choose only those participants who participated in leisure sports during the pandemic. The study was conducted after obtaining informed consent from the participants to complete the survey.

## RESULTS

### Participants' Characteristics

**Table 1** shows the participants' characteristics. The sample comprised 291 women (53.80%) and 250 men (46.2%), and women were found to show higher levels of adoption of preventive behaviors ( $M = 3.88$ ) and higher levels of leisure constraints ( $M = 3.40$ ). The most common age groups in the sample were 19–29 years (36.8%) and 30–39 years (34.0%), and groups with strong adoption of COVID-19 preventive behaviors were the groups aged 50–65 years ( $M = 3.91$ ) and 40–49 years ( $M = 3.87$ ). However, while the 50–65-years group ( $M = 3.40$ )

had high levels of leisure constraints, the 40–49 years group had the lowest level of leisure constraints ( $M = 3.32$ ). Overall, 299 participants were unmarried (55.3%); married participants showed greater adoption of preventive behaviors ( $M = 3.78$ ) and higher levels of leisure constraints ( $M = 3.37$ ). Overall, 336 people (62.1%) reported participating in indoor leisure sports such as home training, physical training, badminton, table tennis, and billiards during the COVID-19 pandemic, and 205 reported mainly participating in outdoor leisure-sports activities, such as hiking, fishing, soccer, and golf. Typically, those who participated in indoor sports had higher adoption of preventive behaviors ( $M = 3.80$ ) and higher levels of leisure constraints ( $M = 3.33$ ). Additionally, the group who participated in leisure-sports activities with friends and colleagues had lower adoption of preventive behaviors ( $M = 3.83$ ) and lower levels of leisure constraints ( $M = 3.44$ ). Last, service industry workers showed high adoption of preventive behaviors ( $M = 3.89$ ), but the lowest level of leisure constraints ( $M = 3.33$ ).

### Analysis of Differences Among the Participants Regarding Adoption of Preventive Health Behaviors During the COVID-19 Pandemic

**Table 3** shows the differences among the participants with regard to adoption of preventive health behaviors during the COVID-19 pandemic (**Table 3**). For both the participants in outdoor sports activities ( $M = 3.89$ ,  $SD = 0.38$ ) and the participants in indoor sports activities ( $M = 3.87$ ,  $SD = 0.39$ ), women tended to have higher adoption of preventive health behaviors than men. Furthermore, the married participants in the indoor sports activity group ( $M = 3.81$ ,  $SD = 0.38$ ) had higher adoption of preventive health behaviors when compared to the single/unmarried participants ( $M = 3.77$ ,  $SD = 0.41$ ).

### Analysis of Differences Among the Outdoor Sports Participants Regarding Leisure Constraints During the COVID-19 Pandemic

Among the outdoor leisure-sports participants, differences in the sub-factors of leisure constraints were analyzed in terms of demographic characteristics. As a result, the characteristics of the participants' companions (or lack thereof) were found to influence interpersonal constraints (Wilks'  $\lambda = 0.94$ ,  $F = 1.78$  (4.13),  $P < 0.05$ ). Specifically, the group of participants who performed sports alone ( $M = 3.47$ ,  $SD = 0.71$ ) had higher interpersonal constraints when compared to the group who performed sports with family members ( $M = 3.25$ ,  $SD = 0.76$ ) or friends of the same gender ( $M = 3.101$ ,  $SD = 0.85$ ; see **Table 4**).

### Analysis of Differences Among the Indoor Sports Participants Regarding Leisure Constraints During the COVID-19 Pandemic

Regarding indoor-leisure-sports, participants who were married ( $M = 3.10$ ,  $SD = 0.79$ ) showed higher structural constraints

**TABLE 3 |** Differences in adoption of preventive health behaviors in terms of demographic characteristics.

Variables	Outdoor sports activities (N = 205)					Indoor sports activities (N = 336)				
	N	M	SD	F	P	N	M	SD	F	P
<b>Health prevention behaviors (N = 541)</b>										
<b>Gender</b>										
Male	135	3.75	0.39	6.30	0.01	115	3.74	0.42	8.36	0.00
Female	70	3.89	0.38			221	3.87	0.39		
<b>Age (years)</b>										
19–29	55	3.81	0.42	2.37	0.071	144	3.79	0.40	1.19	0.31
30–39	72	3.71	0.38			112	3.82	0.42		
40–49	52	3.84	0.37			48	3.89	0.42		
50–65	26	3.92	0.40			32	3.90	0.34		
<b>Marital status</b>										
Single	96	3.77	0.41	0.52	0.46	203	3.79	0.41	5.24	0.02
Married	109	3.81	0.38			133	3.89	0.39		
<b>Experience of participating in leisure sports</b>										
After the COVID-19 outbreak (after January 2020)	27	3.66	0.38	1.29	0.27	49	3.79	0.41	0.41	0.74
1–2 years	54	3.83	0.44			121	3.81	0.41		
3–4 years	40	3.84	0.40			67	3.86	0.38		
More than 5 years	84	3.79	0.36			99	3.85	0.40		
<b>Companions when performing leisure sports</b>										
Alone	69	3.77	0.43	0.80	0.44	176	3.82	0.41	0.85	0.42
Family	44	3.86	0.38			60	3.88	0.34		
Colleague	92	3.78	0.37			100	3.80	0.43		

**TABLE 4 |** Differences in the leisure constraints of outdoor leisure sports participants in terms of demographic characteristics (N = 205).

Variables	Individual constraints					Interpersonal constraints				Structural constraints				Wilk's $\Lambda$	F	Sig.	$\eta^2$	Post hoc
	N	M	SD	F	P	M	SD	F	P	M	SD	F	P					
Gender														0.98	1.09	0.35	0.01	
Male	135	3.79	0.76	0.76	0.38	3.30	0.82	0.99	0.31	2.93	0.88	0.52	0.47					
Female	70	3.89	0.73			3.19	0.75			2.83	0.81							
Age (years)														0.97	0.57	0.81	0.00	
19–29	55	3.75	0.90	1.04	0.37	3.32	0.95	0.40	0.74	2.91	0.99	0.30	0.82					
30–40	72	3.94	0.72			3.30	0.77			2.95	0.86							
40–50	52	3.73	0.62			3.17	0.75			2.87	0.80							
50–65	26	3.82	0.77			3.23	0.63			2.76	0.68							
Marital status														0.99	0.45	0.71	0.00	
Single	96	3.82	0.80	0.00	0.95	3.32	0.86	0.94	0.33	2.95	0.87	0.61	43					
Married	109	3.82	0.71			3.21	0.74			2.85	0.85							
Experience of participating in leisure sports														0.95	0.92	0.49	0.01	
After the COVID-19 outbreak (after January 2020)	27	3.74	0.88	0.99	0.39	3.28	0.63	1.51	0.21	3.00	0.82	0.24	0.86					
1–2 years	54	3.97	0.78			3.41	0.80			2.93	0.92							
3–4 years	40	3.80	0.58			3.05	0.87			2.86	0.88							
More than 5 years	84	3.76	0.76			3.26	0.81			2.86	0.83							
Companions when performing leisure sports														0.94	1.78	0.10	0.02	
Alone	69	3.83	0.77	0.52	0.59	3.47	0.71	4.13	0.01	2.97	0.87	0.42	0.65			a > c		
Family	44	3.91	0.76			3.25	0.76			2.85	0.93							
Colleague	92	3.77	0.74			3.11	0.85			2.86	0.82							

when compared to those who were single ( $M = 2.86$ ,  $SD = 0.78$ ; Wilks' lambda = 0.97,  $F = 3.12$  (7.38),  $P < 0.05$ ). Specifically, similar to the participants in outdoor leisure sports, the group of

participants who performed sports alone ( $M = 3.57$ ,  $SD = 0.80$ ) had higher interpersonal constraints when compared to the group who performed sports with family members ( $M = 3.27$ ,

**TABLE 5 |** Differences in the leisure constraints of indoor leisure sports participants in terms of demographic characteristics ( $N = 336$ ).

Variables	Individual constraints					Interpersonal constraints				Structural constraints				Wilk's $\Lambda$	$F$	Sig.	$\eta^2$	Post hoc
	$N$	$M$	$SD$	$F$	$P$	$M$	$SD$	$F$	$P$	$M$	$SD$	$F$	$P$					
<b>Gender</b>														0.97	2.34	0.07	0.02	
Male	115	3.87	0.77	2.44	0.11	3.46	0.72	0.79	0.38	3.02	0.69	1.39	0.23					
Female	221	4.01	0.75			3.38	0.84			2.92	0.83							
<b>Age (years)</b>														0.98	0.55	0.83	0.00	
19–29	144	3.97	0.80	0.39	0.75	3.40	0.85	0.74	0.52	2.96	0.84	0.03	0.99					
30–40	112	3.92	0.76			3.46	0.77			2.93	0.76							
40–50	48	3.95	0.69			3.27	0.74			2.97	0.79							
50–65	32	4.09	0.66			3.47	0.78			2.96	0.65							
<b>Marital status</b>														0.97	3.12	0.02	0.02	
Single	203	3.90	0.81	3.39	0.06	3.38	0.81	0.76	0.38	2.86	0.78	7.38	0.00					
Married	133	4.06	0.67			3.46	0.78			3.10	0.78							
<b>Experience of participating in leisure sports</b>														0.97	0.93	0.49	0.00	1 < 3
After the COVID-19 outbreak (after January 2020)	49	3.74	0.93	2.52	0.05	3.27	0.93	0.95	0.41	2.87	0.79	0.58	0.62					
1–2 years	121	4.00	0.72			3.41	0.78			2.99	0.81							
3–4 years	67	4.11	0.59			3.52	0.72			3.02	0.80							
More than 5 years	199	3.93	0.79			3.40	0.80			2.90	0.75							
<b>Companions when performing leisure sports</b>														0.942	3.33	0.00	0.03	a>b,c
Alone	176	3.97	0.82	0.04	0.95	3.57	0.80	7.21	0.00	2.96	0.84	0.07	0.93					
Family	60	3.98	0.75			3.27	0.76			2.97	0.76							
Colleague	101	3.95	0.66			3.22	0.71			2.93	0.71							

$SD = 0.76$ ) or friends of the same or opposite gender ( $M = 3.22$ ,  $SD = 0.71$ ; see **Table 5**).

## DISCUSSION

This study analyzed, in terms of demographic characteristics, the relationship between preventive health behaviors and leisure constraints among leisure sports participants during the COVID-19 pandemic.

We found that women who participated in both indoor and outdoor leisure sports showed a higher level of adoption of preventive health behaviors as compared to men. This accords with the findings of Kim and Cho (2020), who reported that women had higher adoption of COVID-19-preventive behaviors and better psychosocial health when compared to men. While the present study did not consider the influence of gender on COVID-19 preventive behaviors (Smith, 2019), one reason why women show higher adoption of preventive health behaviors may be that they commonly play the roles of caregivers and front-line health care staff for their families (Wenham et al., 2020). Preventive health behaviors were highly prevalent in the groups aged 50–62 years. A possible reason for this may be that COVID-19 has the highest mortality rate among older people. Thus, they may feel a responsibility to be more mindful of their actions.

Furthermore, COVID-19 is an infectious disease that can be transmitted through contact with other people. All of the participants in outdoor sports activities who avoided enclosed spaces for health-related reasons, and participants of indoor

sports such as badminton or swimming, in which there is a risk of infection through contact with the bodily fluids of others, were aware of the risk of infection, and engaged in preventive behaviors. In other words, the fact that there were no differences in terms of gender, age, participation experience, or participants' companions in relation to the preventive health behaviors for both indoor and outdoor leisure sports participants indicates a generally high level of adoption of preventive health behaviors in the society during the current pandemic. In Kim and Cho (2020), adoption of COVID-19 preventive behaviors was found to be high among the adolescents and adults in their 60s; however, this study did not research the adolescent age group, indicating a gap that should be addressed in future studies. Nevertheless, we can conclude that, in situations of epidemics or infectious diseases, guidelines are required to help people exercise preventive health behaviors while engaging in healthy leisure sports.

During the COVID-19 pandemic, sports participation in Korea can be divided into indoor sports, such as life sports involving virtual reality (Kim, 2020) and home training that is easily done at home (Lee, 2020), and outdoor sports, such as hiking alone or with a single companion (to facilitate social distancing; Kang and Ban, 2020).

Intrinsic factors have been found to be more important than other factors for determining leisure participation (Ajzen and Driver, 1991). However, in the COVID-19 situation, demographic characteristics create differences in the leisure constraints of the participants in indoor and outdoor sports. Our findings indicated that the group of participants who performed sports alone experienced higher interpersonal constraints when

compared to those who participated with friends of the same or opposite gender. This may be because COVID-19-related mitigation measures such as social distancing are widespread, causing people to exercise additional caution regarding interpersonal relationships (Kim and Cho, 2020). In other words, constraints on indoor and outdoor physical activities and limitations regarding access to public spaces may have exacerbated the sense of isolation for those who were isolating as a result of the COVID-19 pandemic (Güzel et al., 2020).

Married participants who performed indoor leisure sports generally showed higher levels of structural constraints. This may be because parents with school-going children typically spend a lot of time at home (Jung, 2020), or face limitations performing leisure activities as a result of responsibilities relating to work, housekeeping, etc. In addition, married individuals often engage in family leisure activities. They were reluctant to engage in indoor activities as poor ventilation indoors may lead to higher chances of being infected by COVID-19, which would increase the health risk for their families. Many studies have reported that, while people want to participate in leisure activities, time constraints are a primary preventive reason (Kim et al., 2015). Notably, availability of time has a strong influence on the presence of structural constraints (Iso-Ahola, 1980). Additionally, most leisure activity participation incurs additional costs. Along with time-related factors, economic constraints may be particularly relevant during the COVID-19 pandemic. This is because COVID-19 has created a crisis for the global economy; the International Monetary Fund has reported that the COVID-19 pandemic may result in a deterioration in the economic activity of women worldwide, creating issues concerning income inequality and work-family balance (Korean Herald, 2020). This phenomenon suggests that, in addition to income inequality, there is the potential that structural issues such as “work-leisure conflicts” and “disease-leisure conflicts” will arise in pandemic situations. Therefore, it is necessary to take such changes in lifestyle into account when promoting participation in leisure sports.

There are some limitations to this study. While the study population was selected from across Korea and comprised actual participants in leisure sports during the COVID-19 pandemic, the sample comprised just 541 subjects; nevertheless, this study may be valuable as preliminary research. Second, the results of this study may differ when compared to situations before and after COVID-19, as this study was conducted while the pandemic was still in progress. Third, because the study was limited to Korea, results may differ depending on the restrictions and containment of COVID-19 in other countries. Fourth, this study did not include those who discontinued sports during the pandemic. A follow-up study is necessary to analyze the influence of psychological factors by comparing those who stopped and

those who continued to participate in sports activities during the pandemic period.

## CONCLUSION

In conclusion, leisure-sports participants were found to show high adoption of preventive health behaviors during the COVID-19 situation, and to experience interpersonal constraints when participating in indoor or outdoor leisure sports alone (i.e., the social isolation measures adopted during the COVID-19 pandemic have restricted opportunities for group participation in leisure sports). These results suggest how people participating in leisure sports should adapt to the situation of the COVID-19 pandemic. Furthermore, personal and institutional efforts should be made to promote participation in leisure sports and better social interaction in any similar epidemic in the future.

## 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 participants were reviewed and approved by Ethics Committee of Research University of Chung-Ang (1041078-202007-HRSB-170-01). The participants provided their on-line written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

Y-JK designed the study, while Y-JP conducted the study and analyzed the data. Y-JP interpreted the data, and wrote and revised the manuscript. Y-JK and J-HC revised and improved the quality of the analyses performed, critically revised the draft, and made important contributions. All of the authors read and approved the final version of the manuscript.

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# The Impact of Covid-19 Pandemic Lockdown During Spring 2020 on Personal Trainers' Working and Living Conditions

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**Purpose:** The aim of this study was to map changes in working and living conditions of Norwegian personal trainers (PTs) during the Covid-19 lockdown spring 2020.

**Methods:** A total of 150 PTs (mean (SD) age 35.5 (8.4) years, with 6.5 (5.3) years of experience as PT, and 61% female) in Norway responded to an online survey.

**Results:** Number of PT sessions per week was reduced during the lockdown and the majority of the respondents reported loss of clients and negative impact on their working conditions. The official restrictions and guidelines were considered difficult to interpret and somewhat discriminatory compared to restrictions and guidelines for other comparable exercise occupational groups. The lockdown period provided more PTs to offer online and outdoor training. Living conditions were also affected with reported impairments in private economy and reduced vitality ( $p < 0.05$ ), and with vitality being lower in female compared to male respondents during, but not before, the lockdown period.

**Discussion:** The reported negative impact of the Covid-19 lockdown period on PTs' working and living conditions are discussed with focus on the reported gender differences and considering the previously reported poor reputation of the fitness industry.

**Keywords:** mental health, wellbeing, occupational health, physical activity, public health, exercise, fitness

## INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes an infectious disease (Covid-19) and has per July 2020 spread to more than 200 countries and infected more than 15 million people (WHO, 2020). SARS-CoV-2 is a highly transmissible virus that is primarily spread through airborne droplets when infected individuals congregate with others in enclosed spaces (Morawska and Milton, 2020). The outbreak of the Covid-19 pandemic in Norway led to a national lockdown starting on March 12th, 2020. The lockdown included among others closing of all fitness centers, organized sports and sports events, and the whole community was advised to keep a social distance of two meters (The Norwegian Directorate of Health, 2020). Such intervening specifically affected those employed within the private and/or civil sector (e.g., freelancers, self-employed persons, part-time staff within culture, sport and fitness), and many suddenly found themselves without jobs

and reduced income. The first 2 weeks of lockdown were followed by a gradual re-opening of the community in prioritized order. Operators within the health sector were specifically prioritized, and authorized health personnel such as physiotherapists and wellness actors such as massage therapists could reopen their practices from April 27th 2020. Schools reopened on May 11th 2020, organized youth-sports carefully returned toward normal operation from June 1st 2020; while fitness facilities were held on wait until June 15<sup>th</sup> 2020. For the occupational group of personal trainers (PT), no specific recommendations concerning return to work and reopening of practice were made besides the opening of fitness facilities.

The occupational group of personal trainers (PTs) in Norway is an increasing group, estimated to ~3,000 in number, and with official reports of an exponential growth in service sales (Virke Trening, 2019). Yet, there is limited knowledge about this profession and their working conditions. There is no requirement of formal accreditation to work as a PT, and a report from 2016 showed that 84% of the Norwegian PTs lack a formal university degree in exercise science (Virke Trening, 2016). Malek et al. (2002) showed that formal education in exercise science, and not years of work experience, predicted the PTs' knowledge about nutrition, health screening, testing, exercise prescription, and clinical exercise physiology. Norway also lacks a formal accreditation of clinical exercise physiologists such as seen in e.g., Australia (Cheema et al., 2014; Soan et al., 2014; Lederman et al., 2016), and PTs with and without such exercise-specific higher education are thus given the same rights, privileges and responsibilities when performing their profession. Although the fitness industry has been mentioned as an important partner for physical activity, and hence public health, in white papers and global actions for physical activity by the World Health Organization (WHO, 2018) and by the Norwegian government (Departementene, 2020), little has been done to formally develop this partnership by the authorities. This lack of formal partnership might be viewed in light of poor reputation of the fitness center industry in Norway, mainly due to the impression of the industry's focus on cosmetics/aesthetics, body and appearance (Klepaker and Norøy, 2019). The prolonged lockdown of the industry was also maintained despite attempts from the fitness industry trade organization *Virke trening* to develop standards and guidelines for infection control within fitness centers (Kristiansen, 2020a). The industry thus questioned the late opening of the fitness centers, in addition to the lack of any concrete guidelines addressing PTs during the lock-down reopening phase, yet no empirical data exists on how the PTs experienced this lack of concrete guidelines.

Across several occupational groups and sectors, there has been shown important gender differences in e.g., sick leave, occupational health and family obligations. Women show higher sick leave rates compared to men (Barmby et al., 2002), and numbers from Swedish statistics (Angelov et al., 2013) showed that sickness absence in women were between 0.5 and 0.85 days per month higher than in men when entering parenthood. The most plausible explanation for this difference is the inequality in family responsibilities between men and women (Angelov et al., 2013). Studies on other occupations, such as teachers, also report poorer health and well-being, higher job stress and

lower job satisfaction among females compared to males (Klassen and Chiu, 2010). Due to the aforementioned scarce knowledge about PTs' working status and pattern, potential gender issues and perspectives are important to examine.

The Covid-19 pandemic and actions to reduce infection spreading, such as lockdown, quarantine and isolations, have a huge impact on several levels (Raymond et al., 2020; Shammie et al., 2020; Wang et al., 2020). It affects societies, economies, spread fear, and hence potentially impairs lifestyle behavior and increase mental health challenges (Carbone, 2020). Impacts such as loss of income, the experience of not being evaluated as adequately important to reopen business, and the isolation from social interaction may have profound effects on health (Holmes et al., 2020). Besides grief, stress, anxiety and depression; changes in lifestyle behavior such as sleep, eating and physical activity may also cause somatic health impairment (Woods et al., 2020). Also, it is reasonable to believe that the increase in mental health challenges also can contribute to a rise in suicide rates (Kawohl and Nordt, 2020). It is thus possible that these detrimental consequences of the lockdown also influence the PTs' own health and lifestyle.

The Norwegian government acknowledged the huge impact and potential financial crisis on companies and businesses of the forced lockdown, and thus developed an *ad hoc* financial compensatory arrangement for companies and self-employed who experienced losses of minimum 20% of their income in March 2020 and 30% loss of income in April 2020 (Norwegian Government, 2020). Nevertheless, the arrangement, administered by the Norwegian Labor and Welfare Organization (NAV), has been debated in the media for not being sufficient (Arnesen and Jordal, 2020). The lock-down of fitness centers has led to a documented loss of members terminating their memberships (Revfem, 2020), which may have profound impact on the PTs' personal economy and future income and personal economy.

This descriptive study therefore aims to expose the impact of Covid-19 and the enforced lockdown on the work and living conditions of the PTs, and to explore whether there were gender differences in these conditions. We wanted to detect how many PTs were on lay off temporarily, which changes in working hours and sessions they experienced, and whether they managed to reorganize and offer new products using digital platforms and outdoor facilities. Furthermore, the PTs perspectives on the general restrictions and guidelines for the lockdown and the infection control were of interest. We also wanted to describe if and how the pandemic, as well as the lockdown itself, had an impact on the PTs' routines of exercise, their health, and their view on their future as PT. Finally, we examined the PTs' educational background, their working conditions, and whether they had other/additional occupations in addition to their PT occupation or received economic support from the NAV.

## MATERIALS AND METHODS

### Design

This is a cross-sectional, national cohort study inviting PTs to respond to a digital, anonymous survey on experiences related to personal health and -economics, and to the

communication of- and interpretation of regulations during the Covid-19 lockdown. Written information about the study and its purposes was made available together with a link to the survey in all recruitment areas. The PTs were recruited through announcement in social media (through researchers' personal posting and sharing on Facebook and Instagram, and through posts in industry network pages on Facebook) and through leaders of the PT educations and leaders of the national fitness center chains in Norway. The survey was completely anonymous, and hence no personal identification such as work site, IP-address or contact information were collected. Inclusion criteria were Norwegian language skills at the B2 level, and operative in the PT profession at least during the four last weeks leading up to the Covid-19 pandemic lockdown. In total 172 PTs responded to recruitment, of which 150 fulfilled the inclusion criteria and completed the survey.

## Survey

The digital survey included demographic data, specially designed questions relating to the objectives in this survey (i.e., personal economic consequences of lockdown, and interpretation of regulations pertaining the Covid-19 lockdown, including initiation of new services), open-ended questions related to the closed questions, and the standardized instrument Subjective Vitality Scale (SVS).

## Demographic Data

The demographic data included gender, age, highest general- and exercise specific education, years of experience as PT, other work commitment, and work situation during Covid-19.

## Developed and Designed Survey Questions

The survey consisted of items and questions related to the lockdown and experienced changes in working and living conditions. The project group strategically selected three PTs with differences in gender, education and employment status to give input on items and topics that were considered necessary to include in the survey. Written feedback from these PTs were then used for development of the questions described in Personal opinions and interpretations of regulation for exercise-services during Covid-19, Economic situation/consequences from Covid-19, Open-ended survey responses. The draft of the questions were sent to the PTs, and the final questions were revised following their comments and feedback.

### Personal Opinions and Interpretations of Regulation for Exercise-Services During Covid-19

Eleven items were developed by the project group on (1) opinions to the lockdown of the fitness industry, (2) personal interpretation of the regulations, and (3) observed practice by colleagues, during Covid-19 lockdown. Responses were given on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree" and a final option of "I don't know." Examples of questions were: "PTs have interpreted the regulations differently" and "It feels like an unfair treatment of PTs and other operators within exercise-services with regards to the restrictions."

## Economic Situation/Consequences From Covid-19

We developed questions about other occupational work, whether the respondents were temporarily laid off from their PT occupation and/or other occupations, whether the lockdown affected their personal economy, whether they lost clients during the lockdown, if they believed the clients would return after the lockdown, and finally; whether they qualified for- and received financial support by the government. We also asked about any attempts to study for increased professional competence during the lockdown, and about their initiative to develop new PT services/new ways of delivering PT services (e.g., online training).

## Open-Ended Survey Responses

The respondents were given the opportunity to formulate and express their opinion about eight areas related to the impact of Covid-19. These were about (i) economic compensation arrangement from The Norwegian Labor and Welfare Administration (NAV), (ii) the governmental guidelines and restrictions to control the transmission of the disease, (iii) new and innovative forms of exercise that PTs offered their clients, (iv) feedback from the clients about their exercise habits before and after the outbreak of Covid-19 and the national lockdown, (v) the relations between the PTs and their clients, (vi) changes in these relationships due to lockdown, (vii) the PTs viewpoints regarding their health, exercise behavior and quality of life during the lockdown, and (viii) other comments about the future as a PT. These open-ended questions gave the respondents the possibility to freely express their experiences, feelings and emotions related to the effects of the pandemic, without limiting or influencing them with predefined answers. Asking open-ended questions may elicit surprising answers, new ideas, and unexpected experiences. Often such freely formulated answers are raw, unfiltered, and emotional. Many of them give colors to their experiences, as well as providing a deeper insight to the predefined questions they have just answered. These qualities were likely to be lost if we coded the answers according to our interpretations. In other words, we gave the respondents a voice beyond the statistics. In the following, the data from the open-ended questions are presented as an elaboration of the responses to the close-ended questions. However, not every respondent filled out the space in the open-ended questions. We therefore indicate how many respondents who used this option when presenting the open answers. These answers were not always very interesting, usable, or clear. Nevertheless, they are authentic and genuine answers in a frustrating, even frightening situation, and should be taken seriously in a project like this.

## Subjective Vitality Scale (SVS)

The SVS measures subjective vitality, i.e., the state of feeling alive and alert (Ryan and Frederick, 1997). It consists of seven items scored on a 7-point Likert scale (1, strongly disagree; 7, strongly agree), with optimal validity (Ryan and Frederick, 1997). One of the seven items is negatively worded, hence reversed scored for the analysis. The mean score was calculated with higher scoring indicating higher vitality. The respondents completed two versions of the SVS, one where they were asked to rate how they were normally feeling (i.e., before the Covid-19 lockdown)



and one version where they were asked to rate how they felt the past 2 weeks before completing the survey (i.e., during the Covid-19 lockdown). Cronbach's alpha was 0.73 for the "before Covid-19 lockdown" -version and 0.76 for the "past 2 weeks" -version.

## Data Management

The data were obtained through the online survey tool Nettskjema ([www.uio.no/nettskjema](http://www.uio.no/nettskjema)). The responses are anonymous, which means that information such as IP addresses were not collected/registered. According to the Norwegian Data Protection Services, we did not collect information that were potentially identifying, or sensitive data about the respondents, hence no approval for the study was needed. All data are held within the scientific group. Data sharing may be possible on request.

## Statistics

Data were analyzed by IBM SPSS Statistics version 26. All data were visually inspected for normality, and continuous data are presented as mean (SD) or median (range) as appropriate, while categorical data are presented as percentage. Differences between gender were analyzed by students' *t*-test or Mann Whitney *U*-test as appropriate for continuous data, and with Pearson's chi-square test for categorical data. A significance level of 0.05 was considered sufficient to discover any differences.

## RESULTS

### Demographics

Half of the respondents reported general education from university/college on graduate or post-graduate level (**Table 1**), and 13% of the respondents had higher education with authorization as health personnel. A higher proportion of male vs. female respondents had a university degree in exercise science (**Table 1**). Nearly half of the respondents reported other paid work besides the work as a PT, with 14% working in health services and 10% in the teaching/educational sector. Of the 79 respondents with employment contracts as PT, 89% reported layoffs during the Covid-19 lockdown period. Of these, 49% reported resuming of the work as PT before reopening of the fitness centers at June 15th 2020.

### Operational Activity

Mean (SD) number of sessions per week before Covid-19 lockdown was 18.8 (14.1), with range from 2 to 100 sessions per week. Males had higher mean number of sessions per week prior to Covid-19 lockdown compared to females (**Figure 1**). During Covid-19 lockdown, number of sessions per week was reduced to 2.9 (5.3) with range from 0 to 40.

Several of the respondents reported initiation of online and/or outdoor sessions for their clients during the Covid-19 lockdown, and online training was offered by three times as many PTs during Covid-19 lockdown compared to before the Covid-19 lockdown (**Figure 2**). A higher number of male respondents (58%) compared to female respondents (41%,  $t = 3.68$ ,  $p = 0.03$ ) reported use of online coaching during Covid-19. From the 31 commentaries about the new products, we learned that some moved the exercise outdoors keeping social distance. Others did

online live-streams or established a Facebook group. However, most commentaries showed that these activities generated little income or led to expenses, as they often were free to clients and some of the online services such as *MyPTHub* meant extra costs to the PTs. The commentaries also showed that few clients wanted this service.

### Economic Situation and Governmental Compensation Offer

A total of 87% reported that the Covid-19 lockdown had affected their private economy, and 59% reported that they received financial support from the NAV. We asked the respondents to describe their own experiences with the *ad hoc* official compensation arrangement by NAV. Of the 150 participants in this study, 66 commented. The responses indicated great variations with NAV to perform homogeneous casework. Some expressed satisfaction with the arrangement. One respondent reported: *"This arrangement worked very well. Fast casework, smooth application procedure, and great services."* Others complained about the arrangement and the processing time: *"[The arrangement works] ... rather bad for me. Long processing time, no one at NAV can answer my questions, many contradictory answers."* However, quite a few found the arrangement ok when it finally was up and running: *"It has worked well when finally activated. The solution was simple, and the money arrived fast."* Importantly, economic compensation from NAV did not cover fully the ordinary income of the respondents. Many suffered from economic difficulties, which frustrated some of the respondents: *"We only received a symbolic amount of money to cover our overheads."*

### Customer Base and Relations With Clients

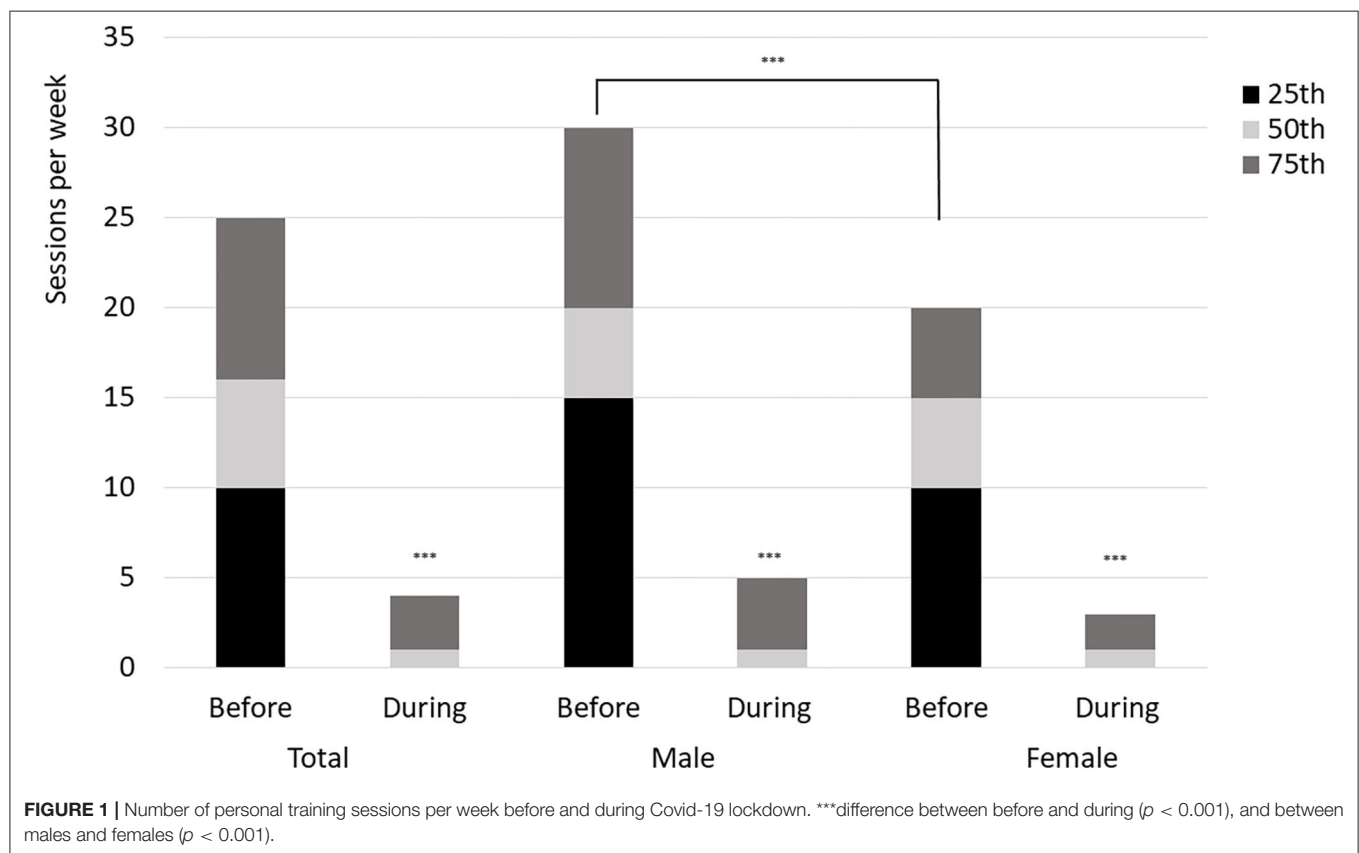
Sixty-six percent of the respondents reported loss of clients due to the Covid-19 lockdown. Of these, 50% reported insecurity about, and 30% reported that they felt secure about, that the lost clients would return after the lockdown. Most of the 98 comments regarding clients' responses during the lockdown concerned a feeling of "privation" and "loss." *"Miss gym - Miss me"* is a general comment in the open-ended question responses from the PTs. However, some of the PTs explicitly wrote that the clients approved the lockdown: *"Most of the clients recognized the situation but missed the opportunity to exercise at the center."* The comments from several of the PTs also express a concern for the clients' reduced opportunity to exercise, their reduced motivation to exercise during the lockdown, yet their eagerness to start training again: *"Almost everyone have lost their motivation and have put their exercise on hold. Most of my clients express sadness about the closure of the center, but are looking very much forward to its reopening."* Some PTs are also concerned about whether the clients will come back after the lockdown. They have registered that some clients are afraid of being infected: *"Based on an assumed insecure future, some of my clients do not want to spend money on PT. Many are afraid of a GREAT risk for infection."*

A total of 88 respondents commented on impact of the lockdown on the relations to the clients, revealing a diversity of effects. Many indicated that the contact with the clients had suffered, with comments like *"less contact," "I haven't seen them*

**TABLE 1** | Descriptive data presented for male, female and total respondents.

	Male ( <i>n</i> = 57)	Female ( <i>n</i> = 92)	Diff	Total ( <i>n</i> = 150) <sup>a</sup>
	Mean (SD)	Mean (SD)		Mean (SD)
Age, yrs	35.3 (8.4)	35.4 (8.2)	<i>t</i> = 0.09	35.5 (8.4)
Experience as PT, yrs	8.4 (6.0)	5.3 (4.5)	<i>t</i> = 3.57***	6.5 (5.3)
	<i>n</i> (%)	<i>n</i> (%)		<i>n</i> (%)
General education level, BA or MA	26 (46)	48 (52)	$\chi^2(1) = 0.61$	75 (50)
Exercise-specific higher education, BA or MA	22 (39)	19 (21)	$\chi^2(1) = 5.68^*$	42 (28)
<b>Work as PT</b>				
Self-employed	36 (63)	48 (52)	$\chi^2(1) = 1.73$	84 (49)
Contract with fitness center	23 (64)	29 (60)	$\chi^2(1) = 0.11$	52 (62)
Employed full time	18 (32)	39 (42)	$\chi^2(1) = 1.74$	57 (33)
Employed part time	6 (11)	15 (16)	$\chi^2(1) = 0.97$	22 (13)
Other work besides PT	29 (51)	42 (46)	$\chi^2(1) = 0.39$	72 (48)

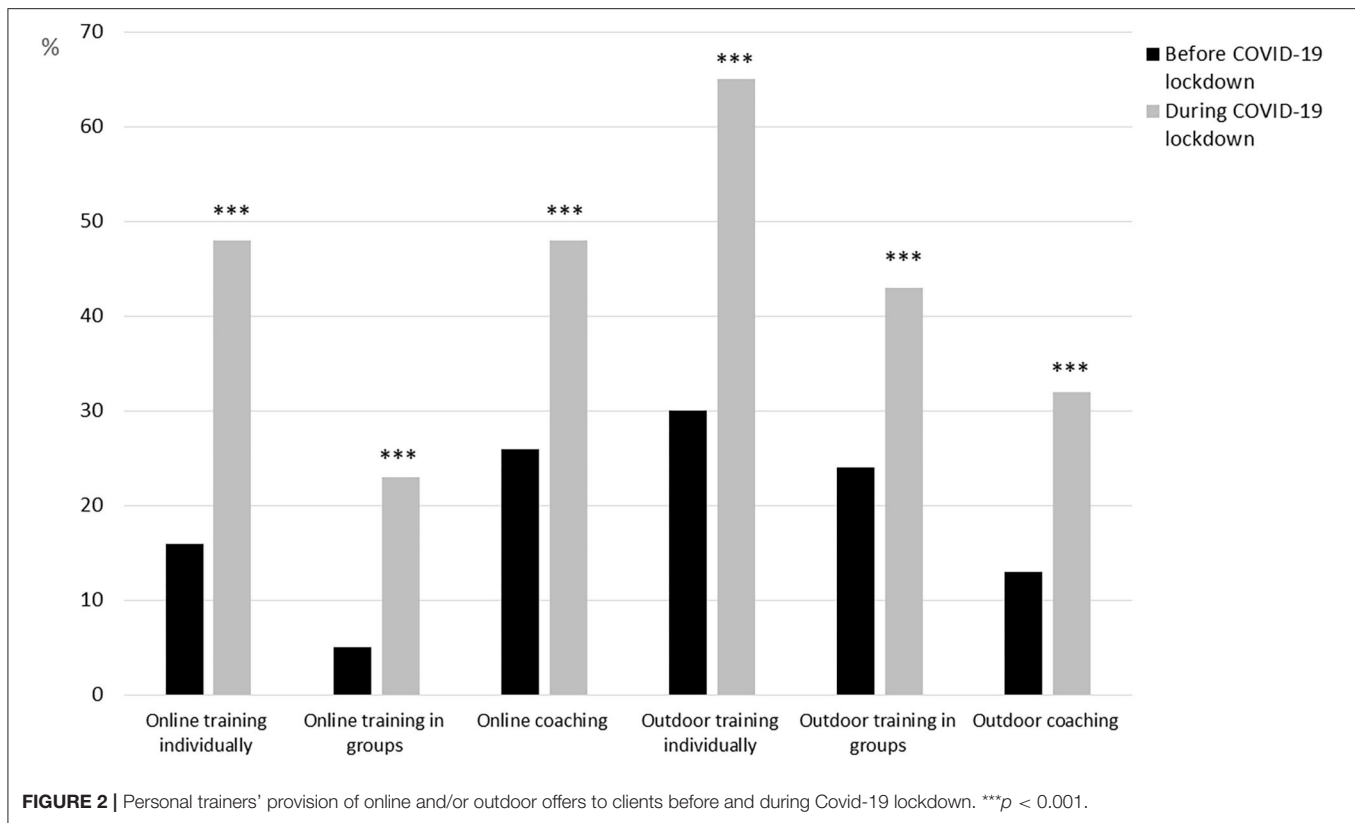
<sup>a</sup>One respondent refused to report the biological sex and is therefore excluded from the comparative analyses between males and females. The respondent is included in the total population. PT: personal trainer. BA: bachelors degree. MA, masters degree;  $\chi^2(1)$ , chi-square (df); *t*, *t*-value. \**p* < 0.05. \*\*\**p* < 0.001.



in months,” “I have to a certain degree lost the good relations we had built before the lockdown,” “Some have not answered my texts and emails,” “More distance between us” and so forth. In addition, while one said: “Some are easy to communicate with. Others are more difficult.” other respondents stated: “I have come closer to some of my clients. In a way, we have developed a new product together,” “I feel a more intimate and confident relation to some

of my clients,” “The relation to old clients have grown stronger. The relation to new clients, are falling apart or has become non-existent.” To some PTs, this bettering of relationships is attributed to being outdoor where the risk of being infected was reduced.

However, several of the PTs expressed concerns about their clients’ motivation and drop out under the lockdown, but also after. “Due to the insecure future, not everyone [of the clients] is



willing to spend money on a PT. Many fears that exercise imply HIGH RISK for exposure to infection. Therefore, many have been very inactive." "[Some of my clients] ... are reluctant to start exercising again due to the Covid-19." Reading the commentaries, one gets the impression that the PTs are anxious about the industry's future. They express concerns about whether they will work as a PT in the future, and whether people will come back to the fitness centers. It seems that their concerns are rooted to their conviction that the PTs and the industry represent an important contribution to public health.

Both the quantitative data and the responses to the open-ended questions indicated that the PTs perceive the base of clients to be rather fragile and unpredictable with regards to future income. The intersection between privation, motivation, fear of Covid-19 upon return to exercise, communication and interaction with the clients, all tell a story about insecurity, uncertainty and concerns about the future. For the industry, this ought to raise some concerns about the ways commercial exercise are organized as well as the type of employment the PTs have in the organization.

## Perspectives on Rules and Regulations During the Covid-19 Lockdown

The majority agreed on the necessity of lockdown for the fitness center facilities from March 12th 2020, but due to the lack of specific guidelines for PTs, they reported difficulties in interpretation of operational opportunities (Table 2). They found the restrictions/guidelines unclear and difficult to

understand and interpret compared to restrictions/guidelines for other exercise occupational groups (e.g., physiotherapists). There was a general perspective among the respondents about the restrictions/guidelines being discriminative between various professions and occupational groups (Table 2). A total of 40 respondents (27%) reported that they had completed a course in communicable disease and infection control, and 14 (8%) had completed such a course in their work as PT.

In the 29 commentaries to the open-ended questions about the restriction and guidelines, there was frustration about too absolute and oversimplified guidelines. Some respondents argued that there are important differences between large and smaller fitness centers with regards to exposure to infection. Others accused the guidelines to be unclear and that this had unintended consequences: "Vague governmental communication early during the lockdown created great insecurity and disagreements in the industry." Some found it difficult to understand that a one-to-one session with a PT was hazardous considering the request for social distancing. In general, the respondents expressed an understanding for the lockdown during the 1st weeks, but this understanding vanished when other sectors and occupations, such as bars, restaurants and tattoo studios, were allowed to reopen when fitness centers were in lockdown until June 15th 2020: "I support the lockdown until the 28<sup>th</sup> of April and agree with the decision. However, I cannot comprehend that piercing and tattooing were allowed the 28<sup>th</sup>, but not to have indoor instructions from PTs."

**TABLE 2 |** The personal trainers' perspectives on the restrictions and guidelines during Covid-19 lockdown.

	Disagree	Either/or	Agree	Don't know
	n(%)	n(%)	n(%)	n(%)
The lockdown of fitness/training facilities was necessary	57 (38)	9 (6)	82 (55)	2 (1)
<b>The restrictions/guidelines applied to PTs during Covid-19 were...</b>				
...clear	83 (55)	15 (10)	51 (34)	1 (1)
...too strict	33 (22)	19 (13)	96 (64)	2 (1)
...easily understandable compared to restrictions/guidelines for other exercise occupational groups	95 (63)	20 (13)	31 (20)	4 (3)
I adhered to the guidelines provided for organized sports	25 (17)	26 (17)	91 (61)	8 (5)
I adhered to the guidelines provided for outdoor physical activity	5 (3)	12 (8)	128 (85)	5 (3)
<b>PTs have been...</b>				
...generally loyal to the restrictions/guidelines	21 (14)	12 (8)	96 (64)	21 (14)
...interpreting the guidelines differently/individually	14 (9)	17 (11)	104 (69)	15 (10)
...discriminated with regards to restrictions/guidelines that have been applied to other exercise occupational groups	12 (8)	13 (9)	123 (82)	2 (1)
Many PTs have not been loyal to the restrictions/guidelines	33 (22)	26 (17)	59 (40)	32 (21)

## Self-Reported Health and Wellbeing

The respondents reported reduction in vitality ( $p < 0.001$ ) from how they normally feel to how they felt during the Covid-19 lockdown. During the lockdown, females reported lower levels of vitality compared to males (3.55 vs. 4.44, **Figure 3**), while no gender differences existed for their usual SVS score. Sixty-two percent of the respondents reported that they managed to continue with their own physical activity and exercise behavior during the lockdown period. A higher percentage of the male compared to female respondents reported use of the Covid-19 lockdown period for update through own studying ( $p < 0.05$ , **Figure 4**).

Answers to the open-ended questions on the issues of own health, wellbeing and exercise were given by 48 PTs. The main impression is that Covid-19 had a detrimental impact on their health, quality of life, and exercise routines. Words used to describe the situation were often "lowered energy-level," "wear on the psyche," "depressed," "stressed," "darkness," "demanding," "reduced motivation," "lowered self-esteem," and so forth. For example: "Both spirit, health and job satisfaction were low in this period." "It wears down my psyche to be at home without a job. Not having something to do regularly, in addition to the uncertainty about income and how the employer takes care of us, is tiresome." "... working 12–14 h a day to get a decent salary, [and now almost nothing] creates a great vacuum." Some missed their clients as well as their colleagues.

However, some reported positive changes during the lockdown. They had started to appreciate the job as an important social arena while others considered to study more or were actually studying during the lockdown period (see **Figure 4**). One respondent called for "Leading by doing. It's of no use preaching about good health and quality of life through exercise and not follow up yourself. I'm taking my recommended medicine myself now." Quite a few experienced "ups and downs," having spare time, time to think through the current situation, and the future. One comment sums up rather precisely most of the experiences revealed in the commentaries:

*"In the beginning, I was very depressed. I don't cope with being at home. I have lately started to appreciate more leisure time and*

*time to rest. However, I have trouble maintaining sound routines for sleeping and eating. In sum, I am less active; eat more and less healthy... I am looking forward to coming back to daily routines, but wonder if ordinary days should be different from what they have been the last years. Despite challenges in this period, the circumstances have forced me to reconsider and rethink... [giving me]... time to deal with anxiety for having nothing to do."*

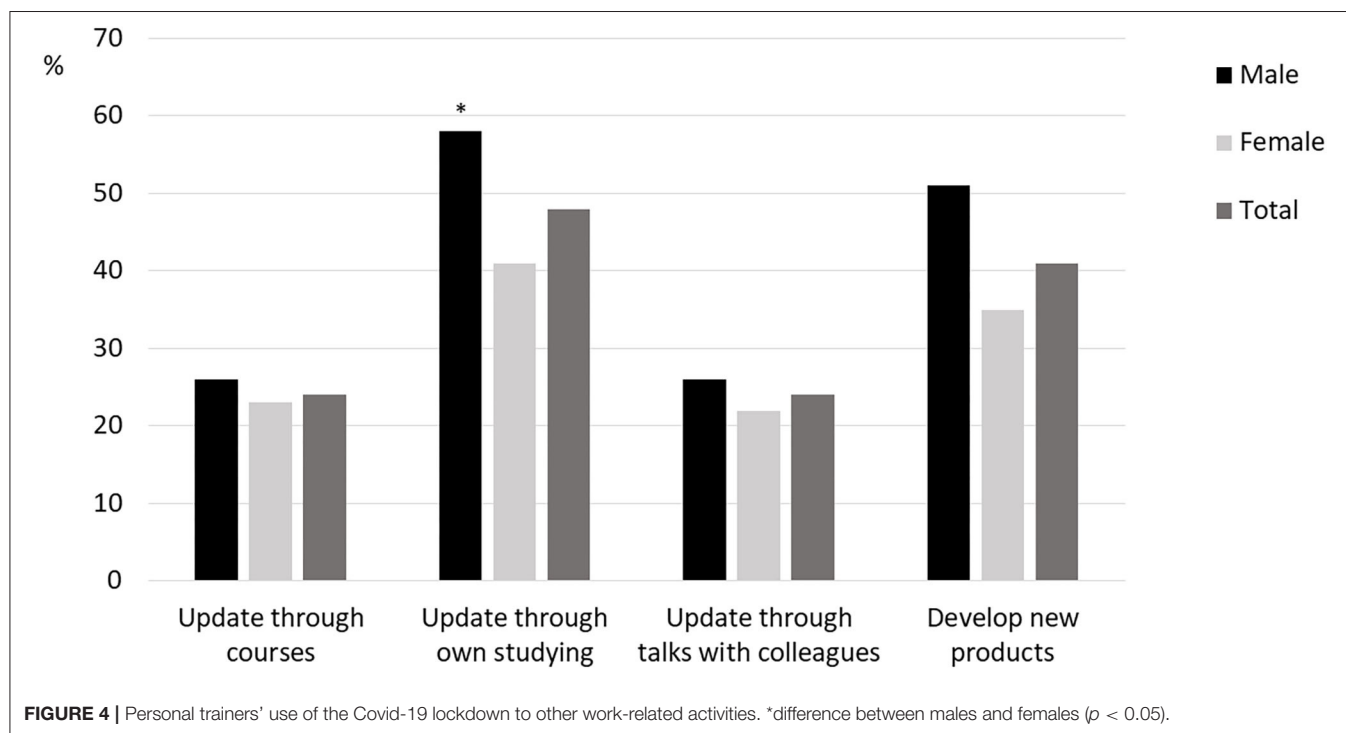
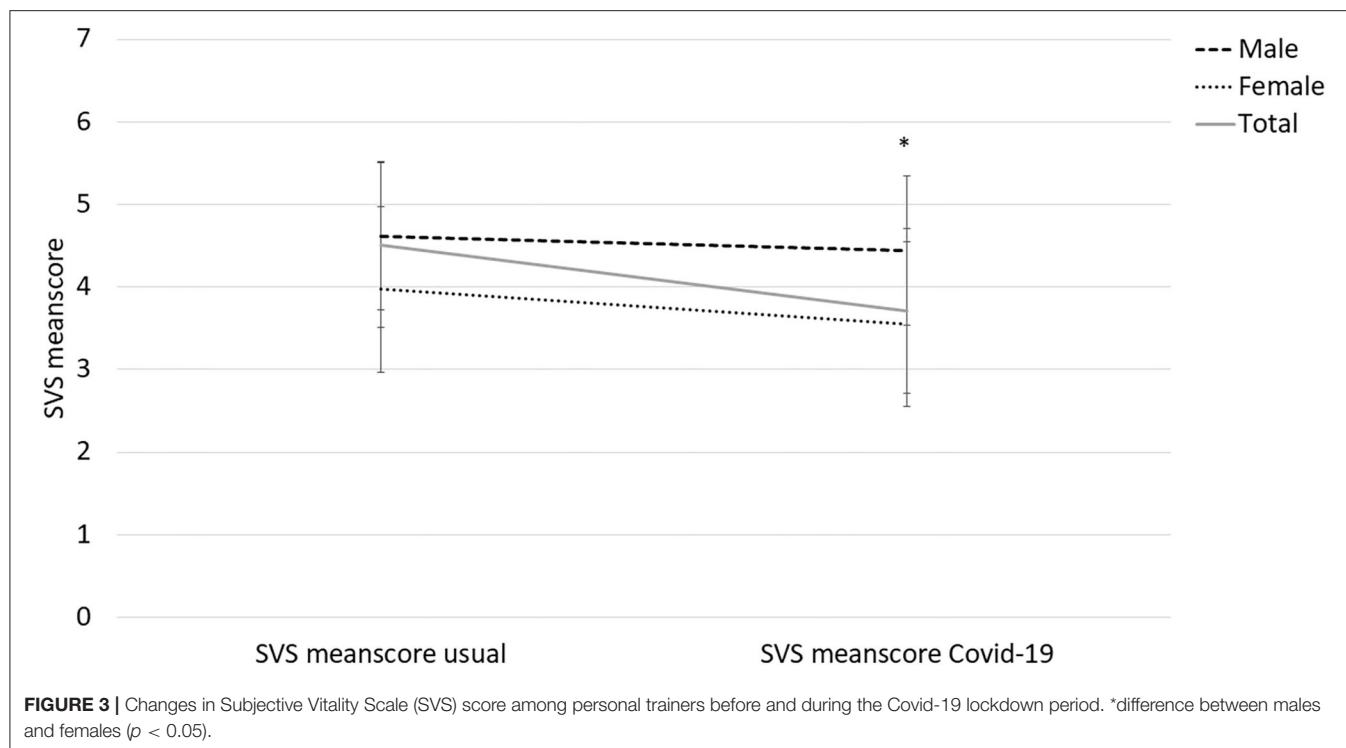
## Thoughts About the Future as a Personal Trainer

Eighty-seven percent of the respondents considered it likely that they were still working as PTs in 6 months, and 21% were pessimistic about the future as PT. When asked about the PT occupation's role in public health work, 98% of the respondents reported that they considered their job as important for the public health. They considered this task as particularly important for the future work as PT. This is both strengthened and nuanced in the comments. Many believe that their contribution to public health has become clearer through the lockdown. One respondent said: "I look forward to the day when I get acknowledged as a health worker." However, quite a few uttered concerns about factors that had to be clarified if this should become a reality. Eighty-two percent of the respondents reported the strong need for a union/organization for exercise professionals to secure a stable income – preferably a regular paycheck. Some also argue that online coaching and exercising outdoors likely will be more common in the future.

## DISCUSSION

The aim of this study was to examine the impact of Covid-19 and the enforced lockdown on the work and living conditions of the PTs. Our main findings were that the lockdown had significantly negative, yet potentially unnecessary impact, on the working and living conditions for the PTs. We will in the discussion argue that the negative impact could have been avoided by more concise and specific regulations for the PTs from the start of the lockdown, and we will interpret this considering the known poor reputation of the fitness industry (Klepaker and Norøy, 2019).





## Gender Differences in the Reported Changes to Working and Living Conditions

With the lockdown, number of PT sessions per week was significantly reduced and many were either temporarily laid off by their employers or experienced sufficient loss in income

to qualify for the *ad hoc* financial compensation from the Norwegian authorities/government. The lockdown period led to a reduction in self-reported vitality, especially among the female respondents. Simultaneously, there was an increase in use of online and/or outdoor training during the lockdown especially

among the male respondents. Also, more males than females reported use of the lockdown period to study and/or follow courses. These gender differences can be compared to what have been reported in academia during the lockdown; finding fewer paper submissions and projects initiations among females compared to male researchers (Viglione, 2020).

Regarding the latter, one important reason for this gender difference was that female researchers to a greater extent than males had family obligations with home kindergarten and home school during the lockdown period. Family obligations have also been identified as the most plausible explanation for gender differences in sick absence from work in Swedish employees. We did not collect data on the respondents' family situation, and can therefore only speculate that inequality in family obligations might explain the detected gender differences. Future studies should test this hypothesis thoroughly. A second hypothesis for the observed gender differences has to do with masculinity and health information behavior (Courtenay, 2000; Ek, 2015). Previous studies show that men take less precaution and they care less about health information and behavior, and perhaps this form of masculinity became prominent with the pandemic and the lockdown. This can thus explain why the males kept the PT business going to a greater extent than the females.

Assuming PTs are vital and in good health, we were surprised to find lower SVS scores in our sample before the lockdown compared to what have been reported previously in university students, youth sport athletes and vocational dancers (Castillo et al., 2017). The female respondents in our study also showed lower scores on SVS compared to Norwegian early adolescents (Schmidt et al., 2020). One potential explanation might be that vitality is a unidimensional, dynamic construct of well-being sensitive to changes in e.g., life events (Ryan and Frederick, 1997), hence we cannot exclude the possibility that the retrospective "before Covid-19 lockdown period" has a limited validity in this sample due to completion of the instrument during the difficult times of the lockdown. The open-ended answers about health and wellbeing further indicated that the lockdown had detrimental effects on the PTs living conditions with reports of mental health challenges.

## Perspectives of the PTs Considering the Fitness Industry's Reputation

Our findings point to an initial approval and respect of the lockdown among the PTs, yet several questioned the necessity of keeping the fitness centers closed for 13.5 weeks as other health and wellness businesses such as tattoo studios, hair salons, spa and massage therapy and physiotherapy/chiropractic were allowed to re-open after ~6–8 weeks. The lack of union organization and lack of formal licensing with protection of the title "PT" have emerged specifically disadvantageous in a situation like the Covid-19. Our findings points toward frustration and a feeling of conflict as they identified themselves as public health providers, but were imposed restrictions and rules, which were difficult to interpret. Not being directly addressed in the official regulations during Covid-19, resulted in different interpretations of work opportunities among the

PTs. The commentaries given in the open-ended questions in this survey, revealed a diversity in temporarily solutions among PTs. Many waited for the fitness facility to reopen, still others identified their service either in line with other health professionals or with organized sports and started private services when these were allowed to reopen their practices. Some PTs even found their operative activity reasonable as long as they adhered to the public regulations (i.e., operating in small groups, keeping a social distancing of 2 meters) (Bugge, 2020). This diversity in interpretation resulted in an impression that some PTs were not being loyal to the guidelines, which can be a source for conflict. What seems to be the core of the difference in interpretation of the guidelines is the outdoor training. This potential discord and conflict among the PTs could have been solved by more explicit guidelines for organized outdoor training from the government. As mentioned in the Introduction, *Virke trening* provided several attempts to develop such guidelines and have these reviewed and approved by the government (Kristiansen, 2020a), yet the Norwegian health authorities were reluctant to do so. One reason for why the authorities overlooked the PTs in their specific guidelines and priorities when reopening the community, may be a reputational history of the fitness industry as a body appearance focused arena, with less health related motivation (Klepaker and Norøy, 2019; Kristiansen, 2020b). Hence, when health authorities prioritized the first services to reopen, the PTs and fitness industry was not considered sufficiently important prior to other health and wellness services. Other than being overlooked as a health promoting service, the activities typically associated with the fitness industry could also cause concerns about infection control. One suggested explanation for the reluctance to reopen the fitness center facilities by the government was that the typical fitness center activities takes place inside crowded facilities using shared equipment, and that services by PTs are associated to these arenas (Kristiansen, 2020b). Previous studies have also shown poor sanitation of surfaces in fitness centers (Mukherjee et al., 2014; Maurice Bilung et al., 2018), and it is plausible to believe that the decision-makers therefore were unsure about the industry's ability to adhere to strict guidelines and regimes for sanitation during a pandemic.

Additionally, with the encouragement of authorities and the allowance of using outdoor, recreational physical activities during the lockdown (Seljeseth, 2020; The Norwegian Directorate of Health, 2020), the decision-makers might have had an impression that the general public did not need the fitness center facilities in order to stay physically active during the pandemic. Given the popularity of outdoor physical activities in Norway, and the image of Norwegians as an "outdoor and hiking people" (Gurholt and Broch, 2019), this was a reasonable assumption. However, the decision-makers seem to have neglected the empirical knowledge that more than 30% of the Norwegian population exercise regularly in fitness centers (Breivik, 2013; Virke Trening, 2019). Despite well-known social inequalities in health and physical activity level, outdoor life is the only arena for physical activity where the effect of social class seem to be negligible (Breivik, 2013), and hence it can be argued that the highest social classes were most affected by the lockdown of the fitness centers. The picture is however more complex, as those in high social class are

often more motivated to exercise by themselves and for health related reasons compared to the lower social classes (Breivik and Rafoss, 2017). Some of the open-ended comments by the respondents also points to the social connection enabled by PTs in both individual and group exercise. The fitness centers' role in social life and how their lockdown for 13.5 weeks affected the clients' social network and isolation should therefore be examined thoroughly in future studies. Also, more knowledge is therefore needed on how social inequality in health and physical activity might have been impacted by the lockdown of fitness centers.

The PTs reveal an apparently genuine concern about the health and wellbeing of their clients during the lockdown period, and an understanding and insight into the complexity of exercise behavior. This finding must be viewed in light of the relatively high educational level among the PTs who responded to our survey, but nevertheless this insight is in our opinion an argument for the PTs general level of competence and thus that they are under-evaluated as public health ambassadors. We also find that the concerns about the loss of clients not necessarily was related to their own loss of income but also an expression of idealism, which is in line with a previous finding (Rahman and Wills, 2013). The use of more or less free online and/or outdoor offers for the clients also add up to this interpretation. The restrictions for fitness centers were perceived as oversimplified and can add up to the impression that the government is not sufficiently familiar with the diversity of fitness centers and the work of PTs.

## Covid-19 Lockdown as a Window of Opportunity?

Based on the findings of our study, there is reason to say that the Covid-19 lockdown has illuminated several issues for the PTs as a profession and for the fitness industry as discussed in Perspectives of the PTs considering the fitness industry's reputation. This can also be viewed as a window of opportunity for discussion and change both internally in the industry, but also toward stakeholders and decision makers within public health. On organizational level, we argue that this lockdown period, the experiences and how it was handled, can serve as an opportunity for the fitness industry and the profession of PTs to unite and demand changes. For instance, development and implementation of an accreditation system will likely improve the reputation and how the PTs' competence is viewed and acknowledged, and further improve professionalism of the industry.

Despite the identified negative impacts of the Covid-19 lockdown period, the majority of the respondents were positive about the future as a PT. They rate their own services as important public health work, and they find their profession needed also in the years to come. Perhaps the Covid-19 will affect the public health negatively both on short and long term, and such an effect will require much effort and collaboration between sectors and professions. Moving services into online platforms, outdoors, and development of new products provides other possibilities and potentially new groups of clients for the PTs. Although it was reported that moving services online during

the lockdown generated little income, and actually provided economic loss for some PTs, this must be seen in relation to the rapid change of political responses to the pandemic and that the lockdown happened over night. Such digital services might have a potential for generating income when this can be planned and developed properly by the PTs. Nevertheless, the importance of social connection and meeting clients and colleagues face to face should also be addressed in future studies concerning PTs working conditions and occupational health. Our data show the genuine care and concern PTs show for their clients, and how this client/PT relationship can be kept and further developed is an area for future research.

## Implications of the Findings

Practically, the findings call for more concrete and specific guidelines for how the work of PTs can be performed during pandemic situations. Such guidelines can be in accordance with the guidelines for other health and exercise professions. Also, the findings implicate the need for establishing a union organization for PTs, an organization that can take care of the needs of the PTs both toward their employers (i.e., large fitness center companies) and toward the government and health authorities. The findings, also documented in other studies, suggest a discussion of the PTs' educational level. Increased scientific knowledge, acquired through university degrees, may help the PTs to be more qualified and more accepted as health providers in the society. This will benefit the PTs, the industry and the society in general. In the aftermath of the pandemic, this should be a lesson learned, in this industry as well as in other industries within the field of culture.

## Suggestions for Future Research

The scientific implications of our findings are the need for follow-up on the working and living conditions of PTs on a more long-term basis. The descriptive nature of this study is suited to create hypotheses based on the findings. Based on the results from this study, we argue that the documented gender differences and the low scores on vitality calls for future research.

First, two factors that has been found important in explaining gender differences in work life and health are differences in family obligation (Angelov et al., 2013) and masculinity in health behavior (Courtenay, 2000; Ek, 2015). One important reason for the observed gender difference in Viglione (2020) was that female researchers to a greater extent than males had family obligations with home kindergarten and home school during the lockdown period. Family obligations have also been identified as the most plausible explanation for gender differences in sick absence from work in Swedish employees (Angelov et al., 2013). We did not collect data on the respondents' family situation, and future studies therefore need to collect this information to explore potential family obligation inequality among PTs. The importance of masculinity in health behavior manifests with men taking less precaution and care less about health information and behavior (Courtenay, 2000; Ek, 2015). Future studies should examine if this form of masculinity became more prominent with the pandemic and the lockdown, and if this can explain why males kept the PT business going to a greater extent than the females.

Second, the low scores on vitality combined with the reported negative impact of the lockdown on the working conditions calls for more research on the PTs general health, including somatic, mental, social and occupational health. Their motivation for becoming PTs and how this motivation affects their job motivation and job satisfaction should also be addressed in future studies. This motivation is important to understand because it might relate to their health. For instance, previously published anecdotes describe PTs who chose this profession due to themselves being helped to e.g., recover from illness and/or injury, improve performance, or that they somehow discovered the greatness of physical activity and exercise and then want others to have the same positive experiences (Howliston, 2016; Green, 2018). A study on health trainers' professional journey in UK (Rahman and Wills, 2013) showed that the health trainers were highly motivated by the value of "giving back" to their community, and this might also be an important motivation for PTs.

## Strengths and Limitations

This is to our knowledge the first study examining the working and living conditions of PTs as a profession. The study is limited by the self-report, the cross-sectional and retrospective design, and the recruitment through social media. The SVS was completed twice in the survey, one with focus on vitality prior to the lockdown and one version with focus on vitality during the lockdown. As they were completed during the same session, but with one version retrospectively, we must take into account that they might have over-evaluated how their vitality level was prior to the lockdown. Further, almost 30% of the respondents reported exercise-specific education from university/college on graduate or post-graduate level, this was higher than expected when comparing to a survey about the formal exercise-specific competence of PTs from 2016 (Virke Trening, 2016). Hence, the results may not be generalizable for the entire population of PTs. Although this survey has a quantitative approach, we allowed the respondents to comment to open-ended questions. These comments and answers were used as a supplement to elaborate on the quantitative findings, and they were voluntary to complete. Hence, not all responded to these open-ended questions and

the content of the comments varied from one-word phrases to longer narratives. We acknowledge that this limits the possibility for a deeper and more qualitative understanding of the PTs experiences and perspectives.

## CONCLUSION

This study showed that the working and living conditions of Norwegian PTs were detrimentally affected by the Covid-19 lockdown period. Some gender differences were detected, with females reporting larger reduction in working hours and in subjective vitality than males. The PTs acknowledged the need for lockdown and restrictions; however, they called for concrete and specific guidelines for their profession. Although the majority of the respondents reported continuance of own physical activity and exercise during the lockdown, almost 40% were not able to do so. The majority was also optimistic about the future of their occupation, yet we recommend that future studies follow-up on these topics among the PTs.

## 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

SB-S had the idea to the project and did the statistical analysis. SB-S, TM, CS-B, JS-B, and JT developed the survey, performed the data collection, and wrote the manuscript. JT had responsibility for the commentaries on the open-ended questions. All have read and approved the final version of the 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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# The Effects of Displacing Sedentary Behavior With Two Distinct Patterns of Light Activity on Health Outcomes in Older Adults (Implications for COVID-19 Quarantine)

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**Rationale:** The COVID-19 pandemic is limiting outdoor and community-based activities, especially for older adults owing to the requirement for self-isolation, potentially increasing prolonged sedentary behavior (SB). Given a poor tolerance for intense exercise, SB displacement with light intensity physical activity (LIPA) is a promising health enhancing alternative. Therefore, the aims of this study were to investigate the effects of two different types of SB displacement on health outcomes in older adults and any differential impact of associated LIPA pattern.

**Method:** 28 older women (age:  $73 \pm 5$  years, height:  $1.60 \pm 0.07$  m, weight:  $67 \pm 10$  kg, and BMI:  $26.1 \pm 3.6$  kg/m<sup>2</sup>) underwent overnight fasted dual energy x-ray absorptiometry (DEXA) imaging, blood sampling, and functional assessments before being randomly allocated to one of two groups: (1) single continuous bout of 45–50 min LIPA daily ( $n = 14$ ); or (2) SB fragmentation (SBF; ~48 min LIPA daily, 2 min LIPA for every 30 min of SB;  $n = 14$ ). Compliance was systematically monitored using tri-axial accelerometry. All measures were taken at weeks 0 and 8.

**Results:** Physical behavior significantly altered (decreased SB/increased LIPA;  $p < 0.05$ ) and to a similar extent in both groups. We observed a significant reduction in serum triglycerides [ $p = 0.045$ , effect size ( $\eta^2$ ) = 0.15; SBF:  $-0.26 \pm 0.77$  mmol/L, LIPA:  $-0.26 \pm 0.51$  mmol/L], improved 30 s sit-to-stand (STS) count ( $p = 0.002$ ,  $\eta^2 = 0.32$ ,  $2 \pm 3$  STS) and speed ( $p = 0.009$ ,  $\eta^2 = 0.35$ ,  $-10 \pm 33\%$ ), as well as increased average handgrip strength ( $p = 0.001$ ,  $\eta^2 = 0.45$ ,  $6 \pm 12\%$ ), and gait speed ( $p = 0.005$ ,  $\eta^2 = 0.27$ ,  $0.09 \pm 0.16$  m/s) in both groups. Interestingly, SBF caused a greater increase in peak handgrip strength ( $8 \pm 14\%$ ), compared to LIPA ( $2 \pm 10\%$ ;  $p = 0.04$ ,  $\eta^2 = 0.38$ ).

**Conclusion:** SB displacement induced significant improvements in fasting triglycerides, gait speed, as-well as STS endurance/speed in older women. Frequent vs. continuous SB displacement also caused greater increases in handgrip strength. While both SB displacement protocols display promise as efficacious home-based

interventions for self-isolating older adults, our results would suggest a physical functioning advantage of the SBF protocol for certain outcomes.

**Keywords:** COVID-19, physical functioning, sedentary behaviour, sit-to-stand, triglyceride, light intensity physical activity

## INTRODUCTION

The rapid spread of Coronavirus disease 2019 (COVID-19) has prompted many nationwide lockdowns (Lu et al., 2020; Sohrabi et al., 2020). In most cases, it is understood that patients requiring intensive care, are more likely to be older (Wang et al., 2020), prompting the call for all older adults (herein defined as  $\geq 65$ y), to shield themselves, by proceeding to immediately begin prolonged and strict self-isolation (Armitage and Nellums, 2020). Habitually, older adults spend ~65–80% of their waking hours performing sedentary behavior (SB; Wullems et al., 2016; Loyen et al., 2017). SB is associated with sarcopenic obesity (Henson et al., 2018; Reid et al., 2018), reduced bone mineral density (BMD; Onambélé-Pearson et al., 2019), heightened cardio-metabolic risk profile (Biswas et al., 2015; Hadgraft et al., 2020), frailty (da Silva et al., 2019), and premature mortality (Ekelund et al., 2019), in older adults. Furthermore, women tend to exhibit greater anabolic resistance and larger reductions in strength following disuse compared to men (Smith et al., 2008, 2012). Self-isolation is likely to exacerbate SB, given that habitual SB is primarily accumulated at home, during social isolation (Leask et al., 2015; Dontje et al., 2018). Despite acknowledgement of their limited efficacy/palatability (Chen et al., 2020; Jiménez-Pavón et al., 2020; Lippi et al., 2020), the default solution is simply recommending that older adults engage in moderate to vigorous physical activity [structured exercise (moderate to vigorous physical activity, MVPA)] with no clear directives *vis-a-vis* breaking up sitting time. However, many barriers inhibit long-term adherence to conventional MVPA recommendations ( $\geq 150$  min/week, ~21 min/day; World Health Organization, 2010) in older adults (Hansen et al., 2019), including a lack confidence (Forkan et al., 2006) and appropriate equipment (Rhodes et al., 1999; Forkan et al., 2006; Bell et al., 2007). Given such barriers, older adults report a poor tolerance for intense physical activity, including greater perceived difficulty, and greater dropout rate (Onambélé-Pearson et al., 2010; Brawner et al., 2016). This can be problematic in the long term as only supramaximal MVPA engagement ( $\geq 420$  min/week, ~60 min/day), appears to offset the negative health effects of concurrent high SB time (Ekelund et al., 2016; Manas et al., 2019). Furthermore, given that sudden surges in exercise can compromise immune response (Siedlik et al., 2016; Nieman and Wentz, 2019), reduced protection from infections like COVID-19, is a further concern. Such limitations create scope for safer alternative home-based interventions to mitigate the potential for further compromised health during self-isolation.

Displacing or breaking up SB time is one such viable option. Promisingly, older adults perceive SB displacement as acceptable and easy to incorporate in their daily routine (Matson et al., 2018).

Light intensity physical activity (LIPA) during SB displacement, is a pre-requisite for long-term health benefits (Dohrn et al., 2018; Chastin et al., 2019; Stamatakis et al., 2019), due to LIPA generating superior responses in both muscle activity (MA; Tikkanen et al., 2013; Lerma et al., 2016), and energy expenditure (Carter et al., 2015; Lerma et al., 2016; Saeidifard et al., 2018), compared to stationary standing. Acute reductions in both postprandial glucose (Bailey and Locke, 2015; Welch et al., 2019) and triglycerides (TGs; Miyashita et al., 2016; Kashiwabara et al., 2017), as-well as chronic functional improvement (Barone Gibbs et al., 2017; Harvey et al., 2018), following SB displacement further highlights its potential to enhance cardio-metabolic health and physical function in older adults. However, despite a clearly established link with SB (Hamer and Stamatakis, 2013; Aggio et al., 2016), many functional markers like handgrip strength (HGS), have yet to be investigated. Furthermore, previous studies have merely displaced SB in arbitrary fashion without controlling for the prescribed pattern of LIPA. SB tends to be accumulated in prolonged uninterrupted bouts (Schlaff et al., 2017), which are associated with worse health outcomes (Gennuso et al., 2013, 2016; Diaz et al., 2017), compared with a more fragmented pattern. Therefore, a longitudinal intervention trial is warranted to investigate the chronic effects of SB displacement on health in older adults, while elucidating what role the pattern (fragmentation vs. a single bout) of prescribed LIPA plays in benefiting anyone but especially self-isolated frail older adults such as during the COVID-19 pandemic.

Therefore, the aims of this study were to (1) compare the chronic effects of two distinct SB displacement interventions on commonly assessed markers of health in older adults and (2) examine the impact prescribed patterns of activity have on the aforementioned outcomes. Given the clearly established link between SB and poor health outcomes in older adults (da Silva et al., 2019; Ekelund et al., 2019; Hadgraft et al., 2020), especially when SB is accumulated in a prolonged pattern (Gennuso et al., 2013, 2016; Diaz et al., 2017), it was hypothesized that (1) SB displacement would have small yet positive effects on markers of health and physical functioning in older adults and (2) SB fragmentation (SBF) throughout the day would induce greater health benefits compared to a single continuous bout of LIPA.

## MATERIALS AND METHODS

### Participants and Experimental Design

Twenty-eight elderly women voluntarily participated in the study. Ethical approval was obtained [230118-ESS-DG-(2)], and written informed consent obtained prior to any procedures being performed, in line with the Declaration of Helsinki.

Participants were recruited from the local community (Cheshire East) through advertising (posters, speaking engagements, etc.) and from a research volunteer database (local participants). Prior to the general data protection regulation deadline on May 25, 2018, recruitment packages (which included “General Data Protection Regulation” opt in/out permission slips, health questionnaires, participant information sheets, informed consent forms, and a pre-paid return envelope), were sent to all contacts aged 65–85 years. Returned questionnaires were screened for potential eligibility. Exclusion criteria included recent history of lower limb disorders, or current chronic health conditions [e.g., cardiovascular disease (CVD), uncontrolled diabetes, active cancer, etc.], likely to affect their ability to safely and independently undertake a program of decreased SB. Estimation of required sample size to detect significant changes in the desired outcomes was based upon the fact that previous SB interventions in older adults that have observed improvements to physical function, utilized total sample sizes of ~25–38 (Rosenberg et al., 2015; Barone Gibbs et al., 2017; Harvey et al., 2018). The current achieved sample size of 28 older women, falls within this range. Participants underwent familiarization and, after 7 days, returned to the laboratories to undergo body composition analysis, blood sampling, and functional assessments. Participants were then randomly allocated in a 1:1 fashion to one of two groups: (1) SBF ( $n = 14$ ) or (2) single bout LIPA ( $n = 14$ ). All measures were taken at weeks 0 (baseline) and 8 (post intervention).

## Body Composition

A dual energy x-ray absorptiometry (DEXA) scanner (Hologic Discovery: Vertec Scientific Ltd., United Kingdom) was used (whole body procedure, EF 8.4 lSv; Tomlinson et al., 2014), to ascertain BMD, lean body mass (LBM), and body fat percentage (BFP%) metrics.

## Blood Sampling

A 20 ml blood sample was drawn using a 0.5 Inch 23 g BD Needle (Mistry Medical Supplies, England). Whole blood analyses of fasting plasma glucose, total cholesterol, and TGs were performed using an Accutrend Plus (Roche Diagnostics Limited, United Kingdom), while glycated hemoglobin (HbA1C%) was analyzed using a 501 device (HemoCue, Sweden). Accordingly, both Accutrend and Hemocue have shown good reliability (Luley et al., 2000; Newman and Turner, 2005; Phillips et al., 2014) and validity (Luley et al., 2000; Coqueiro et al., 2014; Hirst et al., 2017), when compared to laboratory testing.

## Physical Function Assessment: Gait Speed, Sit-to-Stand Ability, and Handgrip Strength

A modified pressure sensor (Tekscan, United States) and height adjustable stool were used to reduce testing variability (Demura and Yamada, 2007). Gait speed was assessed through the timed up and go test (TUG; Podsiadlo and Richardson, 1991). Participants rose from the chair and walked at maximum speed to a marker 6 m away before returning to the seated position.

Gait speed was defined as the quickest speed recorded over three trials [meters per second (m/s)]. Participants were then instructed to rise from the chair until the knee was fully extended and then return to a seated position. This was performed once as quickly as possible in the case of the one sit-to-stand (1STS, functional speed), and as many times as the participant could perform in an exact 30 s time frame for the 30STS (30 s STSs, functional endurance). A handgrip dynamometer (Takei, Japan), was used to assess HGS. Dynamometry is both a reliable and valid measure of strength in the elderly (Bohannon and Schaubert, 2005; Abizanda et al., 2012). Briefly, participants were instructed to maximally squeeze the handle and discontinue grasping at self-perceived maximum voluntary effort. Three trials were performed on each hand, with peak HGS defined as the maximum value achieved across both hands, and the average of three trials used to provide an average of both arms. Importantly, gait speed (Studenski et al., 2011), STS ability (Cooper et al., 2010), and grip strength (Sasaki et al., 2007) are all significant predictors of mortality in older adults.

## Physical Behavior Interventions

The purpose of the two intervention groups was to manipulate the protocol for displacing SB time with added daily LIPA (45–50 min in total). The interventions were confined to a 12-h period between 09:00 and 21:00. The prescribed amount of LIPA (45–50 min) was based upon two key points. First, the WHO’s MVPA recommendation (World Health Organization, 2010) gives a theoretical starting point for what activity amount may be beneficial. Utilizing metabolic equivalent of task (MET) thresholds (SB: <1.5 METs, LIPA: 1.5–3.0 METs, MVPA: >3.0 METs), 150 min/week translates into ~21 min/day moderate activity (~64 MET·min/day), meaning the same amount of MET·min/day, performed in LIPA (with a minimum intensity of 1.6 METs), would theoretically total ~40 min/day. Furthermore, the SBF group was instructed to fragment sitting time every 30 min over a 12-h period (09:00–21:00), based on recent epidemiological evidence linking a more prolonged sedentary accumulation pattern ( $\geq 30$  min bouts) with greater all-cause mortality (Diaz et al., 2017). Consequently, this totaled a maximum of 24 2-min LIPA bouts throughout the day (48 min). Envisaging a varied compliance response, the LIPA group was prescribed a range for their single continuous bout. Accordingly, the prescribed amount of LIPA (an additional 45–50 min per day), was equally matched between the two groups, whereas the prescribed pattern (intermittent micro-bouts vs. single continuous bout) was different. Both intervention groups were provided with an illustrated booklet, which contained LIPA suggestions compiled from the compendium of physical activities (Ainsworth et al., 2011). Importantly such activities were intentionally selected due to their simplicity, safety, and ease of implementation within the home environment.

Individual participant compliance was objectively monitored at weeks 0 and 8, using a thigh mounted GENEActiv original triaxial accelerometer (Activinsights Ltd., United Kingdom). Data were subsequently extracted using GENE software, and a previously validated algorithm (Wullems et al., 2017) used



for baseline and post-intervention data analysis. Briefly, the aforementioned validation study calculated the incremental metabolic cost of 10 everyday tasks in 40 healthy older adults (~74 years; e.g., lying down, brisk treadmill walking, etc.), and used regression analysis to identify specific physical activity intensity ranges [utilizing MET thresholds (SB: <1.5 METs, LIPA: 1.5–3.0 METs, MVPA: >3.0 METs)] mapped against the concurrently recorded GENEActiv gravitational pull and acceleration data. The robustly derived data on SB, standing, LIPA, and MVPA in older adults were used for further analyses. Participants were also further classified as physically active ( $\geq 150$  min/week MVPA $_{\geq 10}$  min bouts), or non-physically active (<150 min/week MVPA $_{\geq 10}$  min bouts), given that the World Health Organization (WHO) recommends a weekly MVPA engagement time of 150 min/week (World Health Organization, 2010).

### SBF Group

Participants were told that the purpose of their intervention was to reduce the amount of time spent performing SB (sitting, lying, or reclining) especially in prolonged uninterrupted bouts. Participants were instructed not to perform SB for more than 30 min at a time, and that for every 30 min of SB performed the participant should stand up and perform 2 min of upright LIPA (general ambulatory walking, side to side shuffling, washing dishes, etc.).

### LIPA Group

Participants were informed that the purpose of their intervention was to increase the amount of time spent performing LIPA while maintaining habitual routines. Participants were instructed to perform a continuous single bout of 45–50 min LIPA (general ambulatory walking, side to side shuffling, washing dishes, etc.), every day for the duration of the 8-week intervention.

### Palatability Assessment

During the post-test visit, participants were asked to complete a palatability questionnaire. Each question was designed to rate an aspect of the participants experience and gain insight on perceived quality of life (QoL).

### Statistical Analyses

Statistical analyses were carried out using SPSS (Version 26, SPSS Inc., Chicago, IL, United States). Normal distribution and equality of variances between groups were checked using the Shapiro-Wilk and Levene's tests, respectively. Baseline group differences were subsequently examined with an independent sample's T-test or Mann-Whitney U test (SBF vs. LIPA) as appropriate. The effects of the interventions were determined using  $2 \times 2$  split plot ANOVA [two time phases (pre and post intervention) and two intervention groups]. In cases of non-normally distributed data, within group comparisons were made using the Wilcoxon-Sign Rank test, while, between group differences were analyzed through a Mann-Whitney U test on the relative changes from baseline. A Chi squared test was used to compare between group differences for ordinal/nominal data from the palatability questionnaire. Furthermore, Spearman

bivariate correlations were utilized to investigate associations between the relative changes in LBM metrics and the relative changes in functional assessments. Data are reported as mean  $\pm$  SD [or median  $\pm$  interquartile range (IQR) for non-parametric data]. Statistical significance was accepted when  $p \leq 0.05$ . Furthermore, a statistical trend was deemed to be present when  $p$  was in the range of between 0.05 and 0.10. Effect size ( $\eta_p^2$ ) was also reported, where  $p$  is significant.

## RESULTS

### Descriptive Characteristics of Participants at Baseline

The 28 older women (age:  $73 \pm 5$  years, height:  $1.60 \pm 0.07$  m, weight:  $67 \pm 10$  kg, and BMI:  $26.1 \pm 3.6$  kg.m<sup>2</sup>) were matched at baseline for all outcomes of interest ( $p > 0.05$ ), denoting a well-matched study sample (see Table 1).

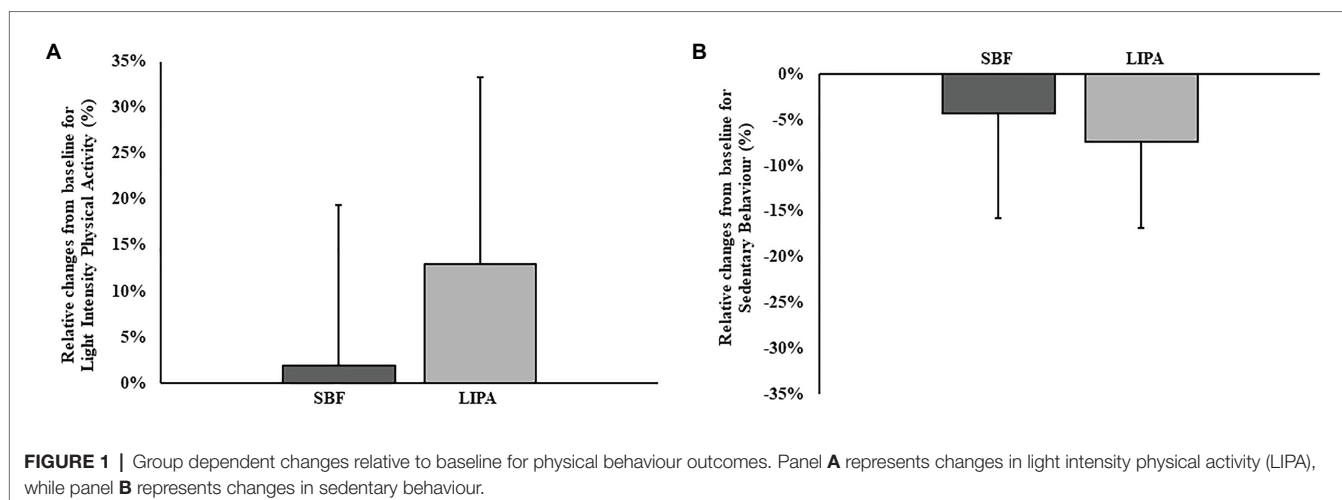
### Intervention, Compliance, and Palatability

No differences existed between groups regarding the number of intervention days (days from pre-lab visit to post) that the participants undertook (SBF:  $56 \pm 2$  days, LIPA:  $56 \pm 1$  days;  $p = 0.37$ ). Regarding 3D-accelerometer-based compliance data, both groups were matched for all variables at baseline. SB significantly decreased over time in both groups ( $p = 0.006$ ,  $\eta_p^2 = 0.26$ ), but did not exhibit a group  $\times$  time interaction ( $p = 0.41$ ; Figure 1). Similarly, mean SB bout time significantly decreased over time in both groups ( $p = 0.045$ ,  $\eta_p^2 = 0.27$ ), but did not exhibit a group  $\times$  time interaction ( $p = 0.96$ ; Table 2). LIPA significantly increased over time in both groups ( $p = 0.04$ ,  $\eta_p^2 = 0.15$ ), but did not exhibit a group  $\times$  time interaction ( $p = 0.11$ ; Figure 1). Standing and MVPA time, however, did not significantly change (Table 2). Concerning intervention palatability, promisingly, all participants agreed the instructions were easy to follow at home, with 89% reporting

TABLE 1 | Participant characteristics at baseline.

Participants characteristics	SBF (n = 14)	LIPA (n = 14)
Age (y)	74 $\pm$ 5	73 $\pm$ 6
Weight (kg)	68.6 $\pm$ 11.3	65.5 $\pm$ 8.6
BMI (kg.m <sup>2</sup> )	26.9 $\pm$ 3.6	25.3 $\pm$ 3.6
Total lean body mass (LBM; kg)	39.3 $\pm$ 5.7	37.2 $\pm$ 3.9
Proportional T-score classification as osteoporotic/osteopenic (normal)	29% (71%)	43% (57%)
Proportion who live alone/ (cohabitate)	36% (64%)	43% (57%)
Polypharmacy (n)	2 $\pm$ 2	1 $\pm$ 1
FRAT (number of positive responses)	1 $\pm$ 1	1 $\pm$ 1

FRAT, falls risk assessment tool; LIPA, light intensity physical activity; and SBF, sedentary behavior fragmentation.



increased awareness of their daily sedentarism. Accordingly, 82% of participants reported feeling more positive about their health, and most importantly, 61% of participants stated they could definitely continue following this intervention long term. Furthermore, 54% of participants stated their intervention had motivated them to become more active. However, only 25% of participants stated they definitely felt more confident about performing household tasks following their respective interventions. There was no difference in self-reported satisfaction or continued adherence between groups ( $p \geq 0.05$ ).

## Bone Mineral Density

After accounting for previously identified co-variables [total body fat (TFAT), Android:Gynoid fat ratio (AGR), and BMI; Onambele-Pearson et al., 2019], thoracic ( $p = 0.09$ ,  $\eta_p^2 = 0.12$ ), but not lumbar spine mineral density ( $p = 0.70$ ), exhibited a trend to change over time. Importantly, thoracic spine did not exhibit a significant group  $\times$  time interaction effect ( $p = 0.71$ ) with changes similar in both groups (SBF:  $5 \pm 14\%$ , LIPA:  $4 \pm 9\%$ ).

## Body Composition

Neither arm ( $p = 0.73$ ), leg ( $p = 0.17$ ), nor total ( $p = 0.20$ ) LBM, significantly changed over time. Despite no change in BFP% ( $p = 0.12$ ), we did observe trends for AGR ( $p = 0.08$ ,  $\eta_p^2 = 0.11$ ), and TFAT ( $p = 0.10$ ,  $\eta_p^2 = 0.004$ ), to change over time (Table 2). We also observed a significant reduction in hip circumference over time ( $p = 0.02$ ,  $\eta_p^2 = 0.19$ ), as-well as a trend ( $p = 0.07$ ,  $\eta_p^2 = 0.12$ ), toward a group  $\times$  time interaction effect (Table 2) primarily driven through apparent greater reductions in SBF ( $-1.79 \pm 2.34$  cm), compared to LIPA ( $-0.25 \pm 1.94$  cm; Figure 2).

## Cardio-Metabolic Biomarkers

We observed a significant main effect of time for fasting blood TG ( $p = 0.045$ ,  $\eta_p^2 = 0.15$ ), which was similar in the two groups, given no significant group  $\times$  time interaction ( $p = 0.98$ ; SBF:  $-0.26 \pm 0.77$  mmol/L, LIPA:  $-0.26 \pm 0.51$  mmol/L; Figure 3). No other cardio-metabolic

serum biomarkers exhibited main effects for group, time, or group  $\times$  time interactions.

## Physical Function

A significant main effect for time was exhibited for gait speed ( $p = 0.005$ ,  $\eta_p^2 = 0.27$ ,  $0.09 \pm 0.16$  m/s), but not a group  $\times$  time interaction effect ( $p = 0.44$ ). There was also a significant main effect of time for 30STS ( $p = 0.002$ ,  $\eta_p^2 = 0.32$ ,  $2 \pm 3$  STS), 1STS ( $p = 0.009$ ,  $\eta_p^2 = 0.35$ ,  $-10 \pm 33\%$ ; see Figure 4), and average HGS ( $p = 0.001$ ,  $\eta_p^2 = 0.45$ ,  $6 \pm 12\%$ ). Furthermore, peak HGS was the only functional outcome to exhibit both a significant main effect of time ( $p = 0.044$ ,  $\eta_p^2 = 0.27$ ), and a group  $\times$  time interaction ( $p = 0.04$ ,  $\eta_p^2 = 0.38$ ), with a greater increase in SBF than LIPA (SBF:  $8 \pm 14\%$  and LIPA:  $2 \pm 10\%$ ; Figure 4). Interestingly, the relative change from baseline in arm LBM, was significantly associated with the relative change from baseline in peak HGS ( $R^2 = 0.17$   $p = 0.03$ ), accounting for ~17% of the explained variance when both groups were pooled. Furthermore, when sub-analyzed by group, such an association persisted in LIPA ( $R^2 = 0.53$ ,  $p = 0.004$ ) but not SBF, accounting for 53% of the explained variance.

## DISCUSSION

This is the first study to investigate the chronic effects of SB displacement on health outcomes in older women and provide recommendations to mitigate any negative health consequences. We hypothesized that SB displacement would have measurable and positive effects on markers of health and physical functioning in older adults. We observed significant improvements over time for circulating TG, hip circumference, gait speed, 30STS, 1STS time, average HGS, and peak HGS, thereby upholding our first hypothesis. We further hypothesized that SBF would induce greater benefits compared to continuous LIPA. Here, we observed a trend for hip circumference ( $p = 0.07$ ) and a significant effect for peak HGS ( $p = 0.04$ ) to exhibit the predicted SBF advantage. Consequently, the second hypothesis was partially upheld.

**TABLE 2 |** Pre and post values for health outcomes.

		SBF (n = 14)		LIPA (n = 14)	
		Pre	Post	Pre	Post
LBM (dual energy x-ray absorptiometry, DEXA)	Arms (kg)	1.86 ± 0.32	1.85 ± 0.28	1.78 ± 0.21	1.76 ± 0.23
	Legs (kg)	6.18 ± 1.19	6.04 ± 0.95	5.89 ± 0.75	5.84 ± 0.68
Bone mineral density	Thoracic spine (g/cm <sup>3</sup> )	0.90 ± 0.09	0.94 ± 0.13	0.90 ± 0.14	0.94 ± 0.15
	Lumbar spine (g/cm <sup>3</sup> )	0.98 ± 0.16	0.96 ± 0.15	0.97 ± 0.16	0.98 ± 0.16
	Total (g/cm <sup>3</sup> )	1.10 ± 0.11	1.09 ± 0.11	1.11 ± 0.15	1.11 ± 0.14
Adiposity indices	Total (kg)	26.1 ± 6.6	26.5 ± 6.3	25.1 ± 5.5	25.3 ± 5.8
	Android: Gynoid ratio	0.94 ± 0.15	0.93 ± 0.14	0.93 ± 0.18	0.90 ± 0.17
	Waist (cm)	92 ± 18	92 ± 24	91 ± 5	92 ± 8
	Hip (cm)	100 ± 7	99 ± 6*	100 ± 8	99 ± 8*
	WHR	0.95 ± 0.11	0.95 ± 0.18	0.91 ± 0.10	0.92 ± 0.10
	Body fat percentage (BFP, %)	39 ± 7	38 ± 5	38 ± 7	38 ± 7
Cardio-metabolic biomarkers	HbA1C (%)	5 ± 1	6 ± 0	6 ± 1	6 ± 1
	Glucose (mmol/L)	5.34 ± 0.98	5.01 ± 1.73	4.94 ± 0.86	4.73 ± 0.88
	Triglycerides (mmol/L)	2.19 ± 0.82	1.94 ± 0.50*	1.94 ± 0.52	1.68 ± 0.40*
	Total cholesterol (mmol/L)	5.53 ± 1.47	5.80 ± 1.86	5.33 ± 1.58	5.97 ± 1.25
Physical function	Peak HGS (kg)	26.3 ± 8.5	26.8 ± 6.1**	26.5 ± 4.4	26.5 ± 7.3**
	Average HGS (kg)	22.8 ± 6.6	23.9 ± 5.4*	22.9 ± 5.7	23.8 ± 7.2*
	30STS	14 ± 3	17 ± 3*	17 ± 3	18 ± 4*
	1STS (s)	2.49 ± 1.02	2.15 ± 0.70*	1.98 ± 0.52	1.86 ± 0.52*
Daily physical behavior	Max gait speed (m/s)	1.17 ± 0.22	1.26 ± 0.19*	1.22 ± 0.13	1.28 ± 0.11*
	SB time (hr/24 h)	9.6 ± 1.2	9.2 ± 1.6*	9.6 ± 1.1	8.9 ± 1.2*
	Standing time (hrs/24 h)	1.0 ± 0.6	1.0 ± 0.6	1.4 ± 1.1	1.5 ± 0.7
	LIPA time (hrs/24 h)	2.2 ± 0.5	2.2 ± 0.6*	2.1 ± 0.4	2.3 ± 0.5*
	MVPA time (hrs/24 h)	3.0 ± 1.0	2.8 ± 1.0	2.5 ± 0.8	2.8 ± 0.7
	Mean SB bout time (min)	31 ± 8	27 ± 9*	32 ± 14	29 ± 11*
	Proportion meeting recommended MVPA time	29%/71%	7%/93%	0%/100%	7%/93%
	≥150 min/week MVPA				
	(≥10 min bouts; World Health Organization, 2010)/ below recommended MVPA				

\*Significant change from baseline.

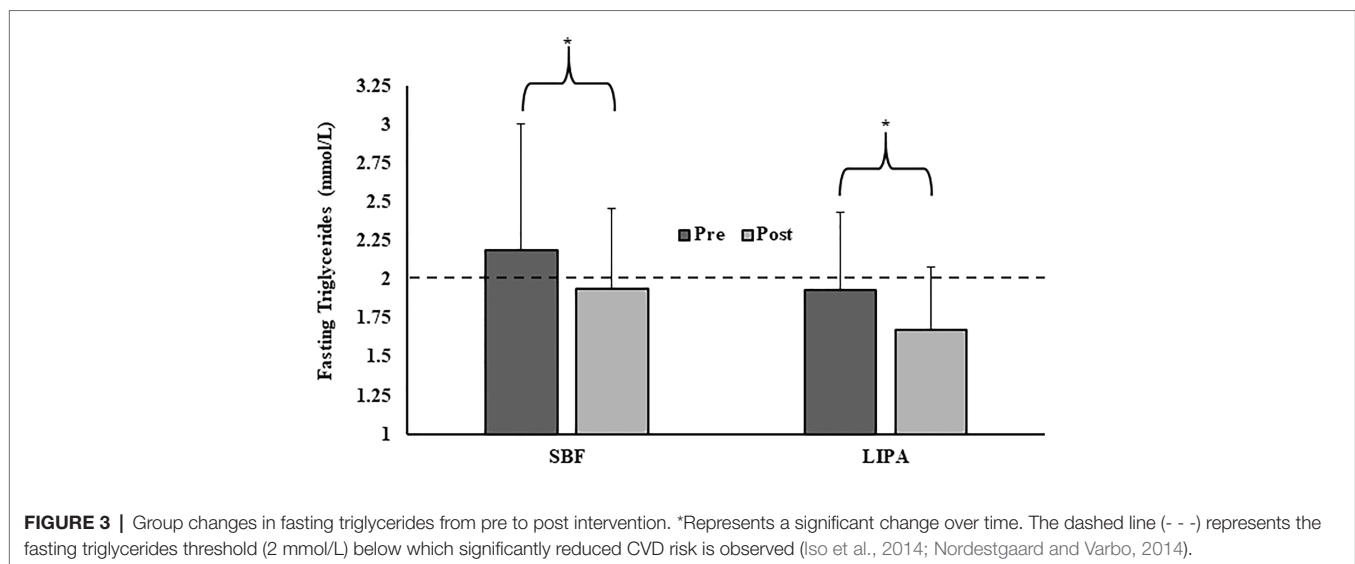
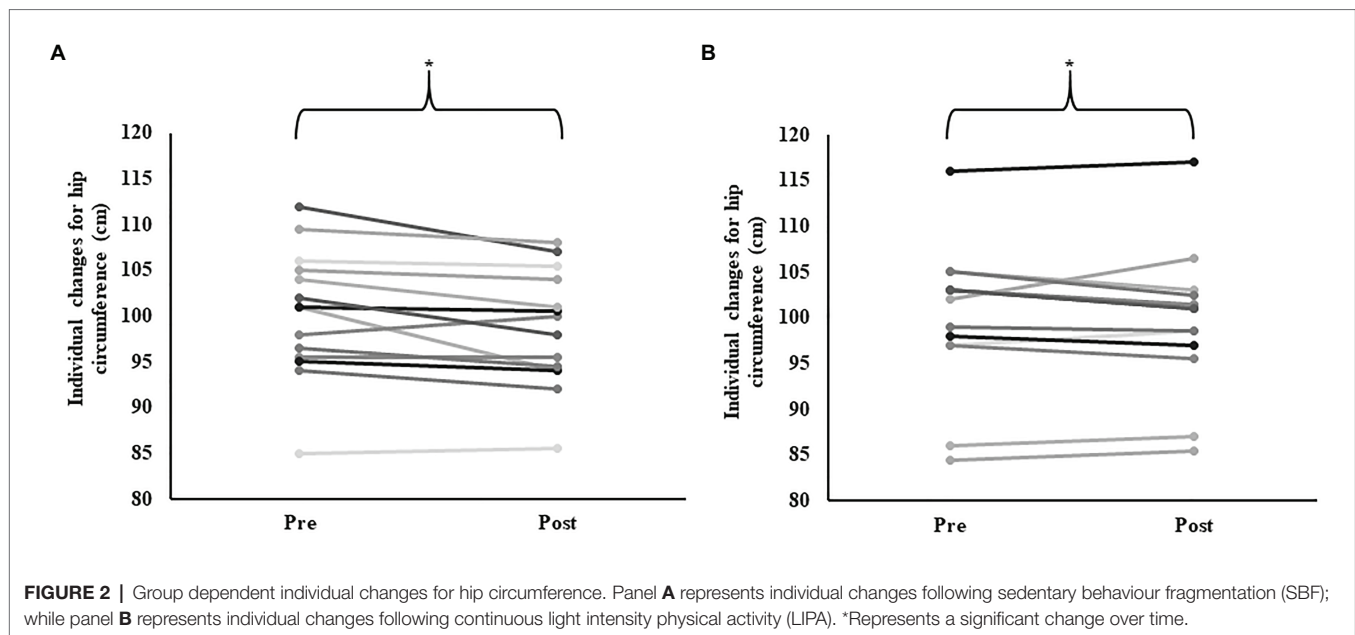
\*\*Significant group dependent effect.

HGS, handgrip strength; LIPA, light intensity physical activity; MVPA, moderate to vigorous physical activity; SB, sedentary behavior; SBF, sedentary behavior fragmentation; STS, sit-to-stands; and WHR, waist to hip ratio.

We observed significant functional improvements post-intervention. Firstly, increased muscular endurance (30STS) and enhanced gait speed are consistent findings across previous SB studies (Barone Gibbs et al., 2017; Harvey et al., 2018), potentially highlighting a specificity of training effect, improving one's ability to mobilize from a seated position. We also observed for the first time a decrease in the time taken to complete 1STS (an index of functional speed), further suggesting improved movement execution and enhanced muscular power. This positive effect is of notable impact given that inappropriate STS transitions are responsible for up to 41% of falls in care home residents (Rapp et al., 2012). Importantly, peak HGS improved to a greater extent in SBF compared to LIPA. Holding onto the arm of a chair and pushing through one's arms are common cues given to older adults when performing STS (Kindblom-Rising et al., 2010). Therefore, we propose that the increased STS frequency may have also increased the frequency with which the SBF participants utilized the arm stabilization tactic, subsequently, causing gradual functional adaptation in the upper body (including arm) musculature. Nevertheless, we advised all participants to implement many upright upper body tasks

(sweeping up, etc.), and improvements in HGS have been reported following implementation of light upper body based movements (Nicholson et al., 1997; Anthony et al., 2013; Sexton and Taylor, 2019). Interestingly, arm LBM did not significantly change from pre to post, yet the relative change in arm LBM significantly accounted for 17–53% of the explained variance for the change in peak HGS. The greater association between muscle tissue content and peak HGS in the LIPA group may be linked to the fact that these participants were requested to perform various operational tasks in a continuous fashion, which appears to have caused a statistically insignificant yet clinically meaningful hypertrophic response leading to enhanced peak HGS. The observed improvements in lower body muscular endurance/power, in both intervention groups, as-well as HGS are compelling positive changes associated with an exercise intensity not customarily regarded as optimal.

We observed significant reductions in fasting circulating TG. Acutely interrupting sitting time with brief bouts of LIPA attenuates postprandial TG concentrations (Miyashita et al., 2016; Kashiwabara et al., 2017), and habitual LIPA is associated with reduced TG in older adults (Ryan et al., 2015), which

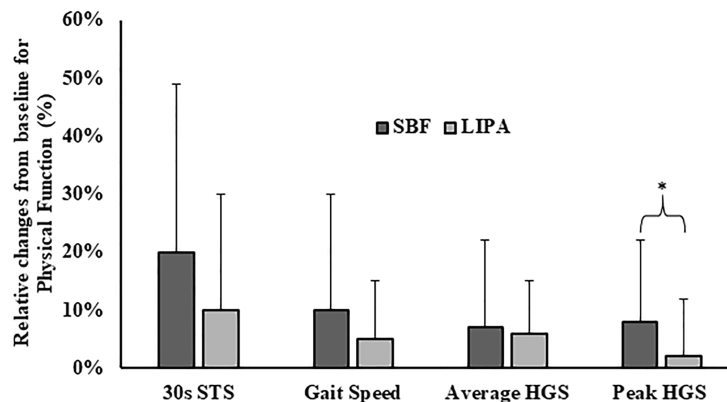


in turn is linked to reduced CVD risk (Baigent et al., 2010). Our data demonstrate such acute effects, persist into accumulated long-term benefits. Importantly, fasting TG levels below 2 mmol/L, confer significantly reduced risk of CVD (Iso et al., 2014; Nordestgaard and Varbo, 2014), a level that was beneficially achieved by both groups, post intervention (SBF:  $1.94 \pm 0.50$  mmol/L and LIPA:  $1.68 \pm 0.40$  mmol/L). Increased lipoprotein lipase (LPL) is a probable underlying mechanism, given the significant role it plays in reduced CVD risk (Hamilton et al., 2007). We thus propose persistent increases in the energy demand of contracting muscle facilitated enhanced substrate uptake. In contrast to previous evidence showing a more fragmented SB pattern is associated with decreased TG (Carson et al., 2014; Brocklebank et al., 2015), our data suggest the prescribed LIPA pattern is not of such relative importance,

given that both groups decreased TG to a similar extent over time. Elucidating alterations in peripheral insulin sensitivity, requires a glucose tolerance test (Davies et al., 2000; Petersen and McGuire, 2005; Tabák et al., 2012), which we recommend future studies investigate. As they currently stand, our data simply suggest that chronic SB displacement in older women causes beneficial reductions in fasting circulating TG, irrespective of prescribed pattern.

Our data show reduced hip circumference following both interventions. Given that LIPA raises energy expenditure (Carter et al., 2015; Lerma et al., 2016), a chronically sustained LIPA increase likely created a negative energy balance (Levine et al., 2005), beneficially reducing what we will assume were fat deposits around the hips. Furthermore, AGR also exhibited a trend to decrease over time. Together, these changes can





**FIGURE 4 |** Group dependent changes relative to baseline for physical function parameters. \*Represents a significant group  $\times$  time interaction effect. HGS, handgrip strength and STS, sit-to-stands.

be viewed as positive given that abdominal adiposity (Android) is more detrimental to health compared to lower body accumulation (Bastien et al., 2014; Chrysant and Chrysant, 2019). In support of our findings, a previous exercise intervention has noted a reduction in waist to hip ratio (de Mendonça et al., 2014). We also observed trends toward improved thoracic spine BMD. Accordingly, LIPA is associated with increased thoracic spine BMD in older adults (Onambele-Pearson et al., 2019), where the authors speculated excessive kyphotic curvature likely increases (forward) shear forces between thoracic vertebrae while walking (Kohrt et al., 1997), and thus places stress/strain on the bone structures, sufficient to cause adaptation. Our findings therefore support the notion of beneficial body composition changes (statistically significant and trends) following SB displacement in older women.

Together with the successful implementation of a randomized chronic SB intervention study in older adults, the novel manipulation of the prescribed LIPA pattern, makes the current study's design one of its primary strengths. Despite the lack of a control group limiting our design, the different patterns of LIPA prescription took priority. Furthermore, while the exclusive inclusion of older women somewhat limits the generalizability of our findings, we ultimately see this as a strength, given that muscle-tendon adaptation to resistance training appears to be gender dependent (McMahon et al., 2018). Moreover, we collected data on a range of health and physical functioning markers, 3D-accelerometer-based compliance, and self-reported adherence following SB displacement. Given that we successfully altered objectively measured SB, LIPA, and SB bout length in our participants, this reinforces our conclusion, that SB displacement specifically with LIPA mediated the health improvements observed. Furthermore, both interventions, were similarly rated as easy to implement at home, increased awareness of habitual SB, self-perceived health, and marked likelihood to integrate into lifestyle in the long term. Our findings add to the knowledge-base in the topic of SB effects (Wu et al., 2013; Matson et al., 2018, 2019; Wilson et al., 2019). Perhaps future studies could

implement a similar intervention strategy, while elucidating the physiological mechanisms that underpin such positive changes, including muscle-tendon complex adaptation (e.g., neuromuscular adaptation), serum lipid transporters (e.g., LPL), and biological markers of inflammation (interleukin 6, tumor necrosis factor alpha, and C-reactive protein). Future studies should also investigate the effects of SB displacement on validated QoL assessments in older adults (e.g., SF-36 and EQ-5D; Bohannon and DePasquale, 2010), as-well as comprehensive physical capacity assessments [e.g., 6 min walk test (6MWT; Agarwala and Salzman, 2020)].

Given that older adults are being requested to “shield” and engage in prolonged and strict self-isolation (Armitage and Nellums, 2020), this makes the results of the current study very applicable. Accordingly, we recruited community dwelling older women from the local community, the population in need of targeted activity interventions during COVID-19 related quarantine. Our results suggest displacing SB with LIPA enhances various markers of health status. Such an intervention can be carried out from the home environment, with minimal effort/support, and displays good likelihood of long-term compliance. However, it must be noted, participants received a fortnightly home visit from the principal investigator to facilitate compliance and troubleshoot issues, which under quarantine conditions is simply not permitted. Such a limitation could be somewhat mitigated through indirect means of contact (telephone calls, emails, video conferencing software, etc.). Nevertheless, our results suggest SB displacement with LIPA is an efficacious home-based intervention for self-isolating community dwelling older adults to mitigate the detrimental health consequences of prolonged sedentarism during quarantine.

## CONCLUSION

Due to the unrelenting global spread of pandemics such as COVID-19, further quarantine periods are looking increasingly

likely for the general population but especially for frail older adults (Lu et al., 2020; Sohrabi et al., 2020). Following 8 weeks of SB displacement with LIPA, we observed significant improvements in blood biomarkers (fasting TGs), and markers of physical function (gait speed, STS endurance/speed, and hand grip strength) in older women. Frequent vs. continuous SB displacement also caused greater increases in peak HGS. Therefore, based on our results, we propose SB displacement is an efficacious home-based intervention for self-isolating older adults, where MVPA is especially challenging. Our data suggest that MVPA engagement is not always necessary for mitigating the detrimental health consequences of prolonged SB. We propose that the positive palatability and high adherence results from our LIPA interventions are testament to the potential for long-term and wide adoption of this type of exercise interventions by key end-users. Furthermore, certain outcomes may be enhanced favorably with fragmented physical activity throughout the day rather than a single bout of exercise, even though both do enhance markers of health and physical functioning.

## 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

The studies involving human participants were reviewed and approved by Ethical committee of the Manchester Metropolitan University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

GO-P, DT, and KT designed the research. DG conducted the research. DG and GO-P analyzed data, wrote the paper, and had primary responsibility for final content. All authors contributed to the article and approved the submitted version.

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# Sport for Development and COVID-19: Responding to Change and Participant Needs

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As COVID-19 hit in the Spring of 2020, substantial challenges began to emerge for individuals around the world. In this empirical piece we examine the impacts of COVID-19 in the sport for development (SFD) context, as it relates to the individual participant, as well as how those individual needs impact the organization itself. This case study, explores a hybrid SFD organization, Highway of Hope (HOH) in Kenya, and the actions of local leadership in response to emergent participant needs during the onset of the pandemic. Using a case study approach, involving journal responses from program youth participants and local program leadership, along with other field and meeting notes, themes were generated to highlight the most salient challenges and experiences faced by individual participants, as well as the means of addressing those challenges by HOH. Participant journals consisted of both positive and negative thematic findings. Positive experiences included Family Time, Rest, and Practicing Better Hygiene, while negative experiences revolved around Restriction of Activity, and Difficulty at Home. The overall impact on participant lives were expressed in themes such as Socio-emotional, Physical, and Sport-Specific. Further, practical implications for grassroots and hybrid SFD programs during times of unprecedented challenge and notable turning points are highlighted.

**Keywords:** sport for development, hybrid organizations, case study, girls sport, lifecourse theory

## INTRODUCTION

*When the first COVID-19 case was confirmed and announced, there was evident panic and fear that engulfed the whole crowd at Upperhill school where the games were being hosted. That one announcement changed a lot of things, within a few minutes people started to treat each other as strangers, there were quick and regular visits to the open public water points (taps) to hand-wash, and people began self-distancing. On the same day as Highway of Hope (HOH) girls were playing their final game, the government, through the ministry of education and ministry of sports issued a directive to close all public events and sports around Nairobi. That was the beginning of a new normal in my life. (HOH Kenyan Program Director).*

During the Spring of 2020, the COVID-19 pandemic wreaked havoc on everyday life for over 7.5 Billion people around the globe. While the initial declaration of the outbreak was announced in January, it was not until March that regulations on social distancing, group gatherings, business operations, and various facility closures (including sport training facilities) were put into

place (Zinner et al., 2020). Within the sport sector, the closing of facilities, events, businesses, tournaments, and previously normal operations lead to a freeze on a multibillion-dollar global industry (Robert Pearl, 2020). While this freeze was a global adjustment for the sport community, contextual factors such as degrees of lockdown, community support of safety measures, and specific restrictions placed on sport were major determinants of differences in sport participant experiences (Kelly et al., 2020). More specifically with regard to youth sport, public health professionals have seen increased childhood obesity in the months following the virus outbreak, and they predict will continue throughout the duration of limited sport and play model (Robert Pearl, 2020). Health experts have also found that these physical health issues in combination with social isolation have already, and will continue to be a serious issue of adolescent mental health for the foreseeable future (Robert Pearl, 2020).

Acknowledging these challenges, Warner and Martin (2020) also wrote about the impact the COVID-19 pandemic has had on sports worldwide. However, they argued that while the pandemic has presented enormous challenges, it has also created opportunities for growth and change within sport organizations. Warner and Martin (2020) stated:

How our sport systems react will be key to demonstrating, justifying, and legitimizing just how fundamental and important sport is to individuals' overall well-being, health, and everyday life. Thus, the COVID-19 crisis can and should be viewed as an opportunity for sport fans, athletes, and sport managers to validate the role and power of sport to positively impact society.

Although their whitepaper highlighted various sport systems and organizations (e.g., U.S. youth sport, NBA, MLB, etc.), it failed to consider Sport for Development (SFD) programs or organizations. SFD organizations provide sport in various forms to millions of young people around the world, and sport is often only one component of more broadly designed programs that impact both individuals and communities (Schulenkorf et al., 2016).

The SFD domain is ever changing to become more intentional in mobilizing grassroots projects and empowering local leadership. However, many of these organizations represent the interests of a variety of stakeholders that inform, assist, and sometimes hinder integrity of grassroots providers' vision and implementation of SFD programming (e.g., Giulianotti et al., 2016; Svensson, 2017; Dixon and Svensson, 2019). The ability of organizations to adapt to changing environmental conditions and stakeholder input remains a concern for the long-term development and sustainability of SFD organizations (Dixon and Svensson, 2019). We argue that this global pandemic, while challenging, may provide multiple opportunities for SFD programs. Specifically, it could demonstrate the role SFD can play in addressing the most salient participant needs, and how SFD organizations adapt in operations and direction to meet emerging participant needs.

Using a life course perspective, COVID-19 could be viewed as what Giele and Elder (1998) call a "turning point." From

an individual perspective, a turning point is a moment when a decision must be made between two life choices—for example, a choice based on a job offer, a geographic location, or the choice to marry/not, or to have children/not. Dixon and Svensson (2019) demonstrated that SFD organizations encounter turning points in their life course where disruptions (e.g., the introduction of stakeholders, economic needs, and/or changes in organizational leadership) create opportunities for organizations to adapt and adjust to remain both viable and true to the organizational mission. Changes can include adaptations to structure, content, programming, relationships, financial partnerships, and stakeholders (Dixon and Svensson, 2019). Leveraging this concept of turning points and the opportunities they can create, the purpose of this study is to better understand the voices and perspective of grassroots SFD participants during the COVID-19 crisis. The ultimate goal is to learn how one hybrid SFD organization responded to the changing needs of its participants, and draw from that learning toward other SFD organizations.

## Adaptability Within SFD Organizations

New SFD initiatives are difficult not only to build, but also to sustain because they often involve scarce resources, as well as multiple stakeholders, agendas, and organizational forms (Giulianotti et al., 2016; Svensson, 2017; Svensson and Seifried, 2017; Dixon and Svensson, 2019). Several scholars have noted the complexities of developing and operating SFD programs as well as the multiplicity of stakeholders that can be involved, including non-profits, corporations, inter-governmental agencies, governments, and high-performance sport organizations (Svensson, 2017; Svensson and Seifried, 2017; Dixon and Svensson, 2019). One way that organizations can manage multiple stakeholders and interests is to adopt a hybridized form, embracing structures and processes that combine multiple organizational logics and embrace the input and values of multiple stakeholders (Battilana et al., 2014). Organizational logics are socially constructed frames of reference from which individuals derive meaning and function within their organizations (Thornton and Ocasio, 1999; Battilana et al., 2014).

The process of hybridization and functioning within hybrid forms is not always smooth, often bringing about organizational tensions (Smith and Lewis, 2011). In some ways, hybrids also can be slow to adapt because of the need to address multiple stakeholders and interests, and the need to resolve tensions before moving forward. However, others have suggested that hybrid organizations have superior flexibility in the face of environmental challenges because of their multiple sources of resources, their flexible structure, and their malleable functions (Svensson and Seifried, 2017; Dixon and Svensson, 2019).

Hybrid organizations, therefore, are an excellent context to study organizational adaptations (Svensson and Seifried, 2017; Dixon and Svensson, 2019). For example, Dixon and Svensson (2019) described the evolution of a hybrid organization from conception through the first 4 years of operations, highlighting both the tensions and the opportunities created from the combination of organizational partners and multiple stakeholders. In their study, like in the case of many SFD

organizations, the impact of multiple stakeholders (especially with heavy influence from Global North partners) can limit the flexibility of grassroots sport organizations to respond to emergent need in their own contexts and constrain choices for such response (Schulenkorf, 2012). As Svensson (2017) pointed out, grassroots entities can face considerable pressures regarding the funding, management, program design, areas of focus, and program outcomes by external stakeholders. For one example, program curriculum that is developed from Global North partners may not be sensitive to or capable of fulfilling cultural needs within a context, especially if those needs are in flux (Schulenkorf, 2010). Yet, grassroots partners may adopt the curriculum anyway. In this and other ways, they may be unwilling to set strong organizational boundaries, especially if they threaten valuable resources the organization needs for survival (Svensson, 2017).

Although hybrid SFD organizations face challenges, within a culture of trust, cultural sensitivity, and openness to new ideas, organizational leaders, particularly in hybrid organizations, have been able to create new ways of responding to organizational problems (Smith et al., 2012; Doherty et al., 2014; Dixon and Svensson, 2019). This process of negotiating tensions and thinking beyond current operational or structural constraints can build capacity of the individual organizational members, as well as the organization as a whole (Doherty et al., 2014; Dixon and Svensson, 2019).

With the onset of COVID-19, organizations were forced to re-evaluate participant needs, and plans for meeting those needs (*cf.* Warner and Martin, 2020). Through viewing COVID-19 as a turning point with opportunities and constraints for grassroots hybrid SFD organizations, we can further our understanding of the lived experiences of SFD participants. Ultimately, the insights gained can help shape the future for SFD organizations (Battilana et al., 2014; Smith and Besharov, 2017). Thus, the current study addresses the following research questions:

1. What were the salient changes in participants' lives created by the onset of COVID-19 and how did those changes impact participant lives?
2. What were the emergent participant needs, and in what ways did the SFD organization adapt to meet the emerging participant needs?
3. How might those changes affect the future of the organization?

## METHOD

### Case Setting

Given the goal to represent the lived experiences of SFD grassroots participants, a qualitative descriptive case study approach, with its focus on naturalistic inquiry, proved the best methodological fit (Eisenhardt, 1989; Sandelowski, 2000; Creswell, 2013). A number of SFD scholars have argued that research should be constructed not only to highlight local voices, but also to engage local collaborators in the study design, questions, and methodology that inform and undergird the inquiry (e.g., Giulianotti et al., 2016; Schulenkorf et al.,

2016; Darnell et al., 2018). Therefore, the study design takes a collaborative approach, whereby every step of the study was co-created, analyzed, and authored by the U.S. and Kenyan partners.

### SFD Grassroot Hybrid Organization

Highway of Hope (HOH) operates in Nairobi, Kenya in the informal settlement of Kibera. It exists as a partnership between local community members and several U.S. partners who help design, implement, and refine the program. Prior to COVID-19, the program had grown from one team of 12 adolescent girls from one school in Kibera, to 5 teams across 3 schools, with 59 young women taking part in the sport and mentoring activities. Pre-COVID-19, the programming consisted of basketball training 5 days/week for each team, and weekly mentoring sessions. The teams participated in their school-based basketball leagues, typically playing several games per week, until these were abruptly suspended in early March.

The program (co-created and supported by Kenyan and U.S. partners) was delivered by local coaches and mentors. These coaches and mentors had relationships with the participants that spanned several months to 3 years. The U.S. partners have been involved with the project for since its inception, spending extensive time on-site with the participants, coaches, mentors, and program leaders. No site visits were conducted during the time of this study (March 2020–August 2020).

From April 2020 to date, the program decreased from 59 girls in 3 schools to 16 young women from one school, based on physical space capacity of the organization. As of mid-May, these young women participated in academic tutoring and mentoring three times a week in a safe environment that allowed for social distancing. Initially, all sport training was discontinued, but as time passed, some restrictions were lifted, and the team could practice 1–2 times per week in small groups. They could eventually participate in some 1-h scrimmages, but the courts were limited to only 15 players at a time. The participants also took part in individual physical training, but did not have access to any basketballs, goals, or sport equipment for basketball skill development.

### Data Collection

Case studies rely on a variety of data collection methods in order to understand the case in as much depth as possible. These collection methods can include archives, observations, field notes, journals, and interviews (Eisenhardt, 1989). The data from this study are part of a larger ongoing project involving several of the research team members (for more context and information about the organization see Dixon and Svensson, 2019). However, for this study, a specific emphasis was placed on a journaling activity related to COVID-19. This study received all necessary human subjects' approvals.

### Observations/Field Notes

Observations and field notes of the organization for this study included regular online meetings of project sub-groups, bi-monthly conference calls involving the entire project team, weekly informal interactions with project team members, participants, and program leaders via zoom, WhatsApp, and

email. During these interactions, extensive field notes were kept (Kieren and Munro, 1985). Meetings and conversation focused largely on the changing landscape of the COVID-19 situation, the changes in program delivery, and the need for reducing the scale of operations. These informal conversations were documented in the same manner as field notes, with some notations taken as jottings or key words, and others as verbatim quotes (Emerson et al., 1995).

These conversations and observations were organic to the operations of the organization and were not specifically derived around life course or organizational hybridity theories. They were the practical, emergent conversations within the organization as they navigated the COVID-19 pandemic. Thus, while specific questions relative to life course theory and/or hybridity tensions/opportunities were not explicitly utilized in the conversation, the conversations themselves naturally lent themselves to both of these perspectives.

## Participant Journals

In addition to the ongoing conversations with the program leaders, coaches, and mentors, the program participants engaged in a targeted journaling exercise specifically designed to understand their COVID-19 experiences from a life course perspective (Giele and Elder, 1998). Specifically, one element of life course theory is the identification of turning points and the specific contexts and outcomes surrounding those turning points (e.g., what happened, who was involved, what was the outcome?). Based in this concept, and previous sport management literature using life course theory (see Bruening and Dixon, 2008; Dixon et al., 2008), the journaling activity consisted of nine questions, derived from the entire project team (the U.S. researchers and Kenyan program implementers and with input from several of the participants), regarding the changes they experienced as a result of COVID-19. This collaborative approach helped ensure that the journaling prompts were simultaneously consistent with life course theory and relevant to the context. Example questions included: How has COVID-19 impacted your life? What are the biggest changes to you? How has COVID-19 impacted your ability to practice and play basketball? The 16 participants (See **Table 1**) were instructed to give some general insights about these experiences and to provide specific examples. Mentors debriefed the journaling activities with the small group of participants to help them process any issues that were troubling or needed further action. These documents—observational field notes, journal entries, interviews/conversations, and journals—formed the in-depth “story” of the organization, which is the basis of analysis (Eisenhardt, 1989; Giele and Elder, 1998).

## Data Analysis

Using qualitative content analysis, we analyzed the data according to the research questions, with the purpose of creating a “comprehensive summary of the events in the everyday terms of those events” (Sandelowski, 2000, p. 336). That is, using the field notes, meeting transcripts, and the journal entries, the entire research team (both U.S. and Kenyan project partners) compiled the story of the organization as it relates to the specific purpose of this study. For Research Question 1 the data were drawn almost

**TABLE 1 |** Participant pseudonyms and demographics.

Pseudonym	Age	Year in School/Program role
Jennifer	16	**Form 2
Sophia	14	Form 2
Sarah	16	Form 3
Serenity	16	Form 2
Vanessa	17	Form 3
Melissa	15	Form 2
Theresa	17	Form 3
Priscilla	14	Form 2
Grace	15	Form 2
Samara	15	Form 2
Diana	18	Form 4
Savannah	16	Form 2
Victoria	17	Form 3
Maya	18	Form 3
Mila	16	Form 2
Miriam	17	Form 3
Marlene	N/A	U.S. Program Director
Irene	N/A	Kenyan Program Director
Dennis	N/A	Head Basketball Coach
Emmaculata	N/A	Head Mentor

*\*\*In the Kenyan school system, children typically attend 8 years of lower school, namely grades 1–8. Then, upper or high school consists of 4 years, Forms 1–4.*

exclusively from the participant journals. For Research Questions 2 and 3 data were derived and interpreted from participant journals, team meetings, and informal conversations/field notes.

We employed an inductive process for developing codes and themes. This required a multi-step process and attention to what each participant had to say, rather than trying to force data into pre-existing codes (Miles et al., 2013). In the first step, Kenyan team leaders read through the documents and journals and provided feedback to the research team as to what elements of the story they considered salient and how they interpreted that information. This process helped accomplish a goal of hearing from the grassroots providers themselves, as well as having the analysis rooted in local understanding and interpretations of participant voices, rather than relying solely on foreign, researcher interpretations (see Giulianotti et al., 2016; Schulenkorf et al., 2016).

Next, the entire research team read through the data, and made notes of overall comments related to the main research questions and with specific mindfulness to turning points in individual lives and the organization itself (participant experiences and responses, organizational responses, and future directions). In the second step, we developed pattern coding, which pulled the overall first-level comments into groups or preliminary themes. Essentially, the goal in this step was to identify patterns and key excerpts from the data (representative themes) that described the overall essence of what the participants collectively communicated through their journals, interviews, or field notes (Miles et al., 2013).



Then, the research team generated themes using the patterned codes as well as the initial interpretive feedback from the Kenyan project leaders. Thus, the theme generating process went beyond simply finding commonalities between meaning units and grouping them together. In generating themes, we collectively discussed and made evaluative decisions about what information was most relevant to each research question, and we interpreted salient portions of the journals, field notes, and interviews at a low-inference level (Sandelowski, 2000, 2010). Finally, we located representative quotes from the data to support these interpretations, being careful to stay true to participant description of their own lived experiences (Sandelowski, 2000, 2010). **Figure 1** visually illustrates the emergent themes as presented in the results below.

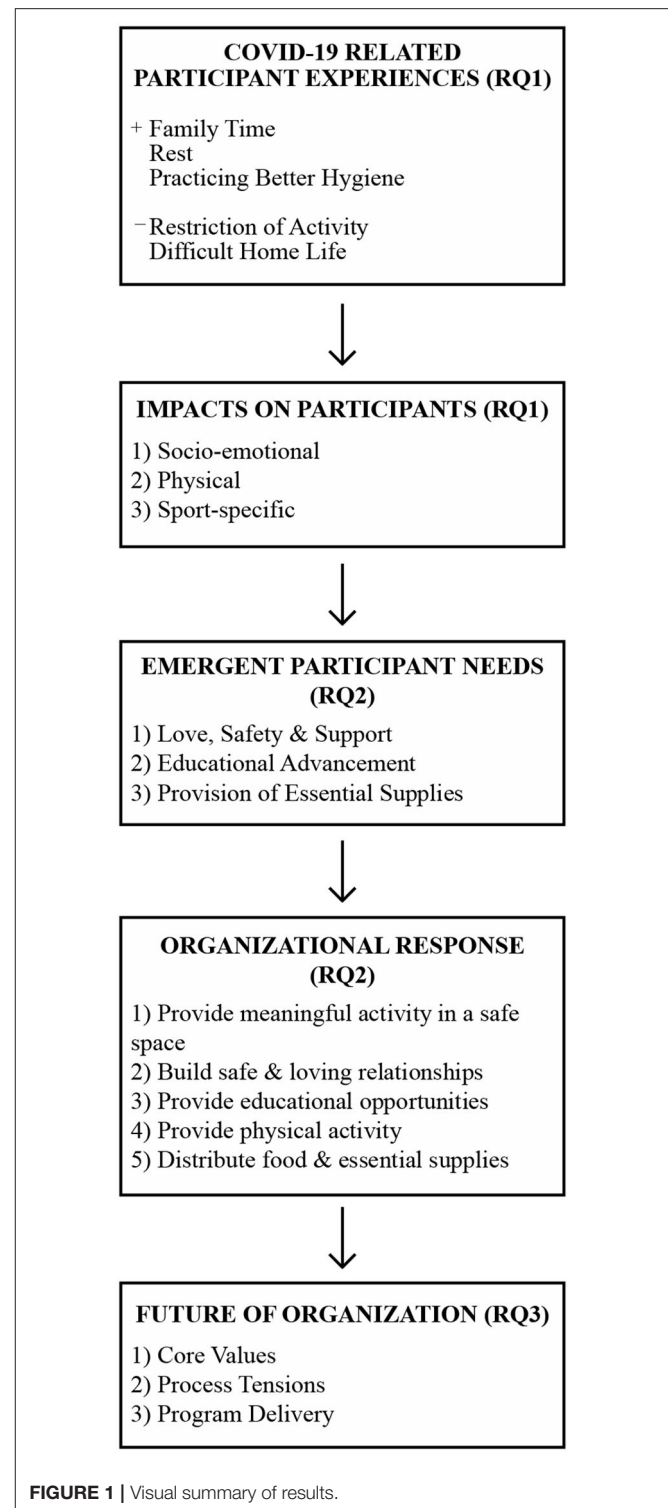
## RESULTS

The results are presented by research question and while not all the participants' views can be represented the most salient ones are provided. The results of RQ1, "What were the salient changes in participants' lives created by the onset of COVID-19 and how did those changes impact participant lives?" revealed the COVID-19 impact on the lives of the young participants in the SDP program. While COVID-19 has presented a number of challenges for individuals around the globe, there have been emergent opportunities for positive takeaways, as well. The positive changes (*Family Time, Rest, and Increased Attention to Sanitation and Hygiene*) will be first be presented followed by the challenges (*Restriction of Activity and Difficult Home Life*). After this, the impact on participant lives (*Socio-emotional, Physical, and Sport-specific*) will be presented.

### Positive Experiences

Some of the positives that have come out of the pandemic for the participants are *Family Time, Rest, and Practicing Better Hygiene*. First, the participants expressed that they were able to spend more time with their families while sporting activities are not taking place. Serenity explained, "I have never had time to spend with my family before, but right now I am indoors with them and we share bright moments." The pandemic highlighted that the time spent on sport is often at the expense of time with one's family. As Sarah explained, "I used to spend most of my time in school and basketball but now I have the whole day with my family." Melissa added, "Now I also finally have time to spend with my family. Unlike before, when I was tangled up in sports." Thus, increased *Family Time*, was a theme that emerged from the data and seemed to be a positive for the SDP participants.

*Rest* was the second theme to emerge. Several players who needed personal time or players that have been battling an injury mentioned *Rest* as a positive aspect of COVID-19. For example, Priscilla said, "Positively it has given me a lot of time to rest." While Theresa wrote, "My mental health is not at all that disturbed because I have injuries that actually have more than enough time to recover." The time away from basketball has given some players the opportunity to try out other activities apart from sport and discover new interest. As Savannah explained, "COVID-19 has given me a break to recover from



injuries and discover new hobbies." Unexpectedly, the pandemic provided a time for a break, which allowed the participants to rest, recover, and discover new interests.

Finally, the participants and program leaders noted that the community in general had adopted a higher standard of hygiene.

This theme entitled, *Practicing Better Hygiene*, was noted as being especially important in areas like the slums where sanitation is already a prominent issue. As Melissa said, “On the positive side, it has helped many of us to maintain cleanness.” From this perspective, the program leaders suggested this may increase the health and well-being of the community overall. However, the participants also expressed the weariness and annoyance of constantly managing this aspect of life. As Sarah expressed, “Now we have to sanitize everywhere every time, which is a bit tiresome.” Sanitation and precautionary practices like wearing a mask, hand washing, and social distancing were all also new concepts for the adolescents to adjust to and take responsibility for.

## Challenges

While it is encouraging to learn of the positive takeaways the participants have drawn from this experience, the challenges that COVID-19 has presented remain. Overall, the negative experience of COVID-19 stems around *Restriction of Activity* exacerbated by a *Difficult Home Life*. Our findings showed frustration with the restrictions placed on the community due to government lockdowns and curfews, as well as the closing of schools and other public places. Because most of the participants do not have access to online classes, participants felt that the pandemic has especially negatively impacted them.

## Restriction of Activity

The *Restriction of Activity* theme was comprised of the participants’ discussions surrounding the closing of schools, canceling of sport, and curfews. The detachment from their teachers and support group from school was noted by the majority of the students. The schools also offer resources like books and sports equipment and thus the detachment from both social and physical resources was especially noteworthy and a negative. Mila stated, “From the time that school was closed I really missed out on so many things, about school, family, sports, and even friends. I miss my teachers and classmates.” It was clear the social support found through school was missing, as well as the resources. Grace added, “It makes one feel uncomfortable, especially students, they are supposed to learn through the internet and television of which not all students can afford those materials.”

This closing of the schools consequently impacted sport opportunities for the participants. As Vanessa explained:

COVID-19 caused all the schools to be closed. Since the schools were closed, there are no open courts because the courts are all in the school. So now we no longer train because we are not allowed to enter the school premises and there are no public courts.

Victoria added, “Having no school has really impacted my access in sports since I have no access in basketball courts. I also cannot be with my coaches, and teammates.”

The cancellation of sport programming was devastating to many as basketball was not simply an after-school activity, but also part of a larger social community. As Sarah explained:

Before the pandemic began we used to go to tournaments, train until late hours, and workout happily with teammates but right now all the courts have been closed, we are not supposed to hang out and hug our teammates as we did before.

Grace’s comments also reflect those of many others. She said, “COVID-19 impacted the closing of schools, which led to no accessibility of basketball courts, training facilities, and coaches. This has led to the slow decline of my basketball skills and abilities as a player.” Victoria added, “COVID-19 has affected me mentally and it is because I miss training with my teammates and going to school.”

## Difficult Home Life

In addition to these external restrictions the home lives of the participants were difficult because of parent unemployment, which increased the stress on the participants. Savannah said, “COVID-19 has led to the closure of schools and loss of jobs too. This pandemic has brought about budget cuts in the household and also idleness of children at home.” Sarah added, “COVID-19 has brought about many needs in our lives that we need. Everyone has been forced to stay home, and unemployment increased. There is a need for food and shelter which are the main things. The food prices have also raised.”

Life at home was also unpleasant because of few resources in the community, leading to boredom. The theme of *Difficult Home Life* is also reflected in numerous quotes from the participants about how bored, lonely, and tiresome their lives are, especially as they consist of home chores and tutoring. Consider the following quotes from the participants:

I feel so bad and embarrassed by this disease because all my time I am at home doing nothing after my house chores. (Samara)  
Due to the pandemic, everybody in our family is now at home starting from my parents to my brothers and sisters. In my family, since COVID-19 started we have been just staying at the home with my family with nothing to do at all. The only thing we have been doing is just to eat and read with each other. (Victoria)  
COVID-19 has impacted my relationship with my family members by avoiding talking to them. Before we used to meet and socialize together, I have missed them and would like to see them and talk to them. (Priscilla).

The participants experience of COVID-19 revolved around severe *Restriction of Activity* in addition to their *Difficult Home Lives*. COVID-19 was clearly an unwelcome change in their lives.

## Impact on Participant Lives

After describing their experiences, the participants went further to discuss the impact that the disruptions related to COVID-19 had on their lives. These impacts, both in and out of sport were profound. The participants expressed impacts on multiple life areas including *Socio-emotional*, *Physical*, and *Sport-specific*.

## Socio-Emotional

Socio-emotional impacts include the feelings of sadness, loneliness, and disappointment that the girls are experiencing as a result of not being able to play, and interact with their

friends, teammates, and supporting network program coaches and mentors, but also not being able to hug, share physical contact with those same individuals. The following three quotes illustrate this theme:

COVID-19 has affected my mental health, especially quarantine. It has affected my usual activities. My level of loneliness, and feeling alienated has also gone up. This has saddened me a lot, but things will get better soon. (Melissa)

So many problems have been disturbing my mind, like peer pressure. COVID-19 has affected me mentally and it is because I miss training with my teammates and going to school. (Jennifer) For my mental health, it has made me to be emotionally unstable, since I can no longer be with my fellow teammates, coaches, and beloved ones. I feel depressed on what is going on and I do wish that things would go back to how they were. (Mila).

Interestingly, many of the participants expressed their feelings about the impact of COVID-19 in terms of regrets or things they took for granted prior to the regulations. As Savannah stated, “This makes me feel regretful of the time I wasted when the changes I left to go by. I really miss getting out of the house for tournaments.” Sarah added, “Life before COVID-19 pandemic was such a blessing, that we all took for granted.” In particular, the participants missed basketball and their teammates. As one example, Veronica said, “What I took for granted was that I did not think that my teammates will 1 day be separated from me.” And Melissa said, “I miss my coaches, my teammates, and even my opponents since we can no longer meet and have fun together and we cannot plan and train together.”

## Physical

COVID-19 also impacted physical aspects of the participants lives. In fact, every participant commented on the impact of COVID-19 on their fitness levels and physical well-being. These are illustrated in the following quotes:

I used to have fun with my mates but right now we cannot meet and I really miss them. I feel so bad. I feel as if I'm growing fat on the inside. I just miss the court, the balls, our coaches, and my mates. (Theresa).

COVID has impacted my physical health by making my body weak, and impacted my mental health by being idle, hence making my thinking capacity to be low. Training exercise also improved my mental health and kept me busy. (Priscilla).

I used to have a flat belly, but now that I have to stay at home my belly is enlarging and becoming a pot. (Savannah).

## Sport-Specific

Related, the lack of basketball activity impacted participants' development of basketball skills; these are expressed in the theme *Sport-specific*. As Grace explained, “COVID-19 impacted the closing of schools, which led to no accessibility of basketball courts, training facilities, and coaches. This has led to the slow decline of my basketball skills and abilities as a player.” Vanessa added, “Personally, my skills now have deteriorated and I can't handle the ball like I used to before. I miss my shooting, like three-point shooting, and defense.” Similarly, Savannah said,

“My skills in basketball are stagnant and have started to wear-out for I have no access to improve my skills.” The athletes expressed frustration at having worked very hard to gain a skill, then watching it deteriorate over time. As Priscilla said, “When this is over, I hope I don't have to start from square one.”

Overall, the participants' articulated both positive experiences (i.e., *Family, Rest, and Practicing Better Hygiene*) and struggles (i.e., *Restriction of Activity, Difficult Home Life*) as well as the various ways that COVID-19 impacted their lives in and out of sport. The emerging participant experiences highlighted core participant needs as well as opportunities for HOH local leadership to take on new ways of helping their participants, and the organizational adjustments it would take to do so.

## Organizational Response to Participant Needs

Research Question 2 asked, “What were the emergent participant needs, and in what ways did the SFD organization adapt to meet the emerging participant needs? The review of the participant data and daily interactions with the participants led the local program leaders to suggest that the three main needs of the participants were the following: (1) *Love, Safety, and Support*, (2) *Educational Advancement*, and (3) *Provision of Essential Supplies*. In the words of the Head Basketball Coach:

The pandemic has exposed most of the students, especially girls, to a lot of situations which has left them vulnerable to fall into wrong hands and make bad choices. The lack of safer space in the slums and support has caused a lot of pressure for the students.

Multiple youth participants expressed gratitude toward the organization in their journal entries, saying that “the organization helped [give them] mentorship classes, which helped my life because outside there are young teenagers engaged in bad company,” and “since we are on a long holiday [they] are more likely to be engaged in bad things like prostitution, getting pregnant, and stealing.”

## Love, Safety, and Support

To address the first need—*Love, Safety, and Support*—the organization arranged a safe space and began to offer small-group and individual mentorship. This has assisted the students in having time in a safe space away from slum pressure as well as positive engagement with their teammates, coaches, and mentors. As stated by the Kenyan Program Director:

The other challenge that was presented to us was to have girls' teenagers, those who did not travel to the countryside, sit idle and move around their neighborhood without any serious engagement. We have had a nationwide outcry of teenage pregnancies that is worrying during this COVID-19 period, which was documented and aired in our national televisions. This called upon the HOH team to think of a rapid response toward engaging the girls in a meaningful tutorials, training and mentorship out of the normal school program. We've not been able to meet to all the girls in the program but we are grateful for the opportunity to reach out to the small number, which has been made possible due to the long working relationship we've had with the girls and

their parents. This has presented me as a leader in the program to rethink of the design as we implement this program and other similar programs in the future: Parental/guardian involvement is very key and important at the onset of every sport program targeting youths/children below 18 years in our context.

The mentoring and tutoring structure, delivery and actual content is a departure from the original HOH program design, which follows a weekly group mentoring model and pre-developed curriculum. However, based on notes from the bi-monthly team meetings, the entire program team felt the adaptation was true to the organizational mission, and presented a valuable opportunity to build deeper relationships with a smaller number of young women. The team members agreed that the socio-emotional, physical, and mental health of the girls was of primary importance. As explained by the Head Basketball Coach, “The coaches and mentors have also maintained love and support to the kids by being the go-to person whenever they have issues they would want to share.” Participant journals were full with statements like, “I would like to thank HOH for how they mentored us, because they make our future safer than those young youth idling outside and having nowhere to be helped,” “they have given me support and love, and shared everything with us,” and “they have supported me and mentored me in such a way that not to give up on life.”

As an additional measure to address a desire to have some physical activity and interactions with coaches, HOH has also been able to secure a training ground and the students get to play thrice a week which is helping them to stay active, fit, and out of any possible trouble. It is clear that providing Love, Safety, and Support are fundamental to HOH, and this was a participant need that the organization had to adapt to providing.

## Educational Advancement

Second, it became obvious that educational needs were not being met for many of the participants. As explained by the Head Mentor:

The government closed schools and most of the children could not access online classes due to lack of gadgets and Wi-Fi. This meant that most of the students were heavily disadvantaged. The coaches and mentors have now been forced to step up and be the teachers to the kids to ensure their education continues. The program has gone a long way to use the coaches and mentors to personally tutor the kids and provide them with practical job skills training that will help them in the future.

Specifically, HOH helped by setting up a study group for the students where they can come and learn together. The program implementers, of their own initiative and through their local community networks, secured a sufficiently large space for the study group. The teaching is done by the coaches and a few invited individuals who have come out to support the study group. The students also have access to a library through the partnership of several local organizations. Grace expressed her concern about home schooling by saying:

Before we learned by going to school, hence now we have to learn through the internet and television. This story makes me feel uncomfortable about learning through the internet and television because not all students can afford those materials... and the teacher may explain something that we cannot understand without asking questions.

The young women's appreciation for the HOH response to these needs was overwhelmingly positive. Journal entries included statements like those from Vanessa,

My biggest needs during this time is to really study hard so that when I go back to school I can catch up with the teachers lessons and my mind won't be shut down. HOH has really helped me because by now I would be at home and studying alone, which is boring, and they helped me by creating a study group.

From a program development perspective, the HOH program implementers took the initiative not only to secure the space, but also to design the tutoring program as well as the practical skills/leadership training component. Interestingly, the development of this practical skills/leadership component was something that was a strategic goal of the organization for 2020 and had not received much attention or traction due to the rapid growth of the program and the emphasis on basketball during the inter-school season which takes place from February to April. The reduction of the program size and scope actually allowed for more focus on this aspect of the program. As the US Program Director said:

One good thing, from my perspective was that we were able to develop the senior leadership curriculum, and to really dig-in on the relationships of the senior girls who had been involved for three years now. To watch what the Kenyan team built and delivered, and thinking how we might utilize that in the future, was a huge step forward for our organization.

It was clear from the data that *Educational Advancement* was also something HOH needed to adapt in their delivery to ensure participant needs were being met during the pandemic.

## Provision of Essential Supplies

Finally, the need for the *Provision of Essential Supplies* became immediately apparent as the pandemic led to most of the participants' parents losing their casual labor jobs. This meant that most parents were home without money. Most of the parents do not have savings and had little way to provide for their children. As Diana shared,

Due to the pandemic, everyone has been forced to stay home and when this happened many people lost their jobs and unemployment increased. There is a need for food and shelter, which are the main things. The food prices have also raised. However, there is still hope because HOH came at the right time to help people. They assist people by giving them food and other necessities. I am really grateful for their help.

Mila added, “What I have been needing is food, studies, and sanitary towels. I want to thank HOH because they have provided what I needed.”



The HOH program responded by organizing food/supply distributions within 2 weeks of the government shut-down. Since then, the HOH program staff has continued shopping for food stuffs and other essentials like sanitary pads at least twice a month to relieve the pressure from the parents and the families. In the words of the Kenyan Program Director:

Working with the coaches and mentors and with consultation and financial support from our U.S. partners, we have been able to redirect some funds that were budgeted for appreciating mentors. This money has been used to buy food supplies for the girls in the program whose families have been hardly hit by this pandemic. The food supplies have helped to cushion the girls and their families, from hunger, hustles of child labor and sexual exploitation in search of daily bread. This has greatly aided to keep our girls safe from sexual transmitted diseases, teenage pregnancies, child labor and sexual assaults and abuse.

The program implementors were ambitious and creative in developing plans for food distribution and in raising the funding for much of the initiative. In addition, the program leaders suggest that this distribution helped develop closer relationships with the participants' families, which will continue to build trust not only in these families, but also across the community.

In summation, *Love, Safety, and Support, Educational Advancement, and Provision of Essential Supplies* were the most salient participants needs. To meet those needs, HOH, at the direction of grassroots providers adapted both content and delivery of their SFD programming to provide for these needs during the COVID-19 pandemic.

## Impact on the Future of the Organization

Research Question 3 addressed how the program changes might affect the future of the organization. There were three main themes related to the future of the organization: (1) *Core Values*, (2) *Process Tensions*, (3) *Delivery*. Each of these is discussed below.

### Core Values

First, the HOH program response to changing participant needs highlighted the *Core Values* of the organization that will continue to inform its future. That is, the core value of loving and supporting young people was strongly reified through the experiences with COVID-19. As the Head Program Mentor and Head Basketball Coach discussed, "The main program interest when dealing with kids is the love, care, and support. When this is achieved any other challenges can be tackled." This sentiment was affirmed in the bi-monthly conference calls where the entire program staff discussed that the actual content and specific delivery mechanisms of the HOH program were all flexible as long as they were directed toward loving and serving local young people.

### Process Tensions

Second, the organization's response to the participant needs highlighted a few *Process Tensions* within the organization. These were mainly related to discussions about which organizational members were responsible for what program aspects (e.g., design,

implementation), and how funding and other resources would be distributed to the various stakeholders. As documented in the internal program documents, bi-monthly conference calls, prior to COVID-19, the program staff agreed to a set of organizational goals with a timeline and designated personnel. The drastic shift in participant needs coupled with government restrictions essentially negated the entire program plan that had been agreed upon.

This created some tension within the organization based on internal agreements about what activities each stakeholder would be responsible for conducting and contributing to the organizational goals. As reflected in an informal interview with the Head Mentor:

It's difficult because we want to do the best thing for the girls, but we are not able to receive the support from the organization as a whole because they cannot come here where we are. We cannot leave the girls with nothing, but we are not sure what to do. So that is troublesome.

The field notes from the U.S. Program Director echo this tension,

I am in uncharted waters. I feel that we should just release all obligations from the time COVID started, but I am not sure if that is the right way to go. It seems unreasonable to hold people accountable for activities they have NO WAY of carrying through. I think the best way forward is to start fresh with expectations from everyone.

According to the field notes, the organization essentially did that, collectively revamping the roles and responsibilities of the US Program Director, Kenyan Program Director, Head Basketball Coach, and Head Mentor according to the newly defined participant needs, and the activities that seemed reasonable and feasible to conduct at least for the remainder of 2020. The organization quickly moved forward at the direction of the program implementers.

### Program Delivery

Finally, the adaptations necessary to work through COVID-19 provided an opportunity to revisit and reconsider the future of HOH *Program Delivery*. For example, the Kenyan Program Director mentioned that prior to COVID-19 the program focus "has been solely school based and child/teen centered/oriented. So, COVID-19 has challenged our working/implementation model." This presented a challenge, in terms of delivery because schools were closed. This also created an opportunity to reconsider delivery. In her words,

In future this calls for a more holistic approach, and includes parents and caregivers/guardians at the onset of the program implementation, especially at recruitment level. This makes follow-ups easier, and trust is built and enhanced during earlier stages of the program.

Because the program has been operating almost entirely through communication with the schools, the closing of schools

created a massive communication gap between HOH and their participants, which can be addressed through those recommended changes.

Another challenge that the Kenyan Program Director expressed during the COVID-19 season was technology. While they had put together “plans and projections to conduct e-mentoring sessions with mentees,” they experienced “major setbacks due to the lack of necessary quotient and technology know-how of some mentors and mentees.” For future delivery of the HOH program she recommended increased investment “on building the capacities of the volunteers, and both mentors and coaches on matters of IT and social media.” Further she notes that it would be helpful to also empower the program participants on “responsible, disciplined, use and access to social media platforms.”

## DISCUSSION

The COVID-19 pandemic represented a turning point both for individuals and organizations around the world (Giele and Elder, 1998). SFD programs also strongly felt this impact. While it may be to varying degrees, facility closures and sport and play activity cancellations around the globe changed the routines, social interactions, and overall daily norms of sport programs and sport participants on a global scale (Kelly et al., 2020). The results from this study highlight the impact this turning point had on the individual lives of grassroots SFD participants (RQ1). The participants not only identified positive takeaways and challenges from the fallout of COVID-19, particularly as schools were shut down and their activities restricted, but importantly provided insight on emergent participant needs (RQ2) and future directions for SFD programs (RQ3). They clearly articulated responses to that turning point, including short and long-term feelings and strategies for coping with the change. The impact of COVID-19 illuminated the core participant needs for *Love, Safety, and Security, Education, and Provision of Essential Supplies*. The focal case organization, Highway of Hope, responded in multiple ways, demonstrating flexibility in content, place, and delivery model. Consistent with Warner and Martin (2020) COVID-19 indeed created an opportunity for this sport organization to further justify their role in a society. It was clear that HOH has and can continue to impact lives, but must adjust, learn, and view the COVID-19 pandemic as an opportunity.

The framing of COVID-19 as both an individual and organizational turning point supports the use of life course theory for understanding individual's sport experiences. Clearly, these sport experiences are shaped and constrained by historical and social forces beyond their control, and exploring both the impact and the response can provide a richer understanding of the lived experiences of SFD participants around the globe.

Further, this study extends Warner and Martin (2020) by adding empirical data regarding the lived experiences of participants in a grassroots SFD organization in Kenya. To echo their charge, the results from this demonstrate “just how fundamental sport is to individuals' overall well-being, health, and everyday life.” The removal of sport from the participants in

this organization had drastic impacts on their relationships with others, their daily activity routines, their *Socio-emotional* and *Physical Health*, and their *Sport-specific* skills. Prior to COVID-19, sport was clearly making a positive impact on their lives and the removal of sport was felt well-beyond the act of playing the game.

At an organizational level the results demonstrated the ability of grassroots SFD organization to rapidly identify and respond to emerging participant needs. This organizational response highlights both the tensions and the adaptability of a hybrid grassroots organizations (see Dixon and Svensson, 2019), and provides several points for discussion and learning in other contexts. First, it appears that the flexible nature of the organization allowed for meaningful and relatively rapid shifts in organizational programming and delivery. SFD scholars have suggested that top-down policies and restrictions from external stakeholders can limit the ability of grassroots organizations to respond to contextual needs (e.g., Schlenker, 2012; Svensson, 2017). In spite of minor organizational tensions that needed to be resolved, the organization did not appear to be restricted in its adaptations by such top-down pressures from external stakeholders. In fact, local leaders appeared to be empowered and confident in their ability to address the challenges in response to emergent participant needs. Thus, the actions of the program seem more in line with arguments suggesting that hybrid organizations, given the right conditions, can create new ways of responding to problems (e.g., Doherty et al., 2014; Dixon and Svensson, 2019). This organization seemed to pivot around the actions and advice of the program implementors who initiated changes in program design and delivery.

It appears that the organizational structure and values were flexible enough to adapt to the organizational changes, but it is not entirely clear what other factors led to the ability of the organization to adapt quickly. Previous scholars have suggested that trust, cultural sensitivity, and openminded organizational leadership are essential for maximizing the strengths of hybrid organizations (Smith et al., 2012; Doherty et al., 2014; Dixon and Svensson, 2019). The enduring involvement of both the Kenyan and U.S. partners over time worked to build such an organizational culture may have played a role. While this study supports the assertion that hybrid organizations can be highly adaptable, clearly there is room for additional empirical and theoretical advancement concerning the wider contextual contingencies that impact hybrid organizations' response to organizational turning points such as COVID-19.

The study was limited to the examination of one SFD organization, and the participant experiences of young women in a high school setting. Because the study was focused on life course theory and on understanding organizational responses to turning points, it was not focused specifically on women's experiences. However, it is possible that the life course experiences of these young women are gendered in nature (see Bruening and Dixon, 2008; Dixon et al., 2008) and may not apply to programs that serve boys and girls, or ones that serve primarily boys. Future research should examine the differences in experiences, interpretations, and impacts both of SFD, and of COVID-19 based on gender.

## Implications for SFD Organizations

The results from this study suggest that SFD organizations need to continue to focus on identifying the core needs of their constituents in program design, and also ensure that the programming meets those needs first, rather than the demands imposed by external stakeholders who may not understand or value the core needs of those participating in the programs (Giulianotti et al., 2016). External stakeholders also need to hear and value the voices of those delivering the program, such that they do not unnecessarily constrain the ability of grassroots providers to respond to needs, especially as those needs pivot in the face of turning points like COVID-19.

Second, this study points to the need for ongoing capacity building of grassroots providers for several reasons. First grassroots providers need to be able to respond to participant needs without “strong” dependency on external organizations. For example, in this organization, the primary program providers were able to initiate food distributions and secure a location for tutoring based on their own internal community networks. Then, the organization as a whole was able to support those needs and help broaden and sustain them. But the capability of the primary providers allowed for the most flexibility and rapid response from the organization. This could be a sign of the organizations’ path toward sustainability, as the very definition of organizational sustainability according to Lindsey (2008, p. 283) is “the maintenance or expansion of sports development programs by the organization responsible for their delivery.” This is an example of how local leadership can and should be able to tackle challenges as they arise in their communities, not having to wait or rely on external involvement.

Building capacity of grassroots providers also enhances their capability to respond to a broader array of participant needs. For example, within this organization, basketball coaches were able to at least provide rudimentary tutoring and educational programming. If they had broader skills and/or training, they might have been able to provide even better educational components or more mental health support than a “listening ear.”

Third, the study points to the need for continuing to build SFD programming that enables and bolsters capacity and independence of the participants themselves. That is, some SFD organizations by the design of their programming, actually develop a dependency on the organization (Schulenkorf, 2010). The young women in this organization struggled with moving toward a place where they were coping and feeling a sense of hope and survival with or without the HOH programming. HOH and other SFD organizations need to consider ways encourage and equip participants to learn their own training skills and develop their own practical educational skills such that they could survive and thrive even in the absence of the organization.

## Theoretical Implications

Along with the practical implications, this work also offers some important theoretical insights related to life course theory and turning points (Giele and Elder, 1998; Bruening and Dixon, 2008). Specifically, turning points within a life course perspective are traditionally used to understand an individual’s intentional

decisions at specific points in time or instigated by a significant social event. This study highlights how a life course perspective can and should be used to better understand organizations and organizational responses to significant events. By utilizing a life course approach, the results demonstrate how HOH, an SFD hybrid organization, was able to adapt and respond to COVID-19, a significant social event, in a manner that could not have been predicted or designed. This expands life course theory in its usefulness for understanding not only intentional decision points, but also responses to events outside the organization’s control.

The results also extend theory in the area of organizational hybridity, whereby the events created opportunities for the organizational partners to continually renegotiate partner roles, expectations, and organizational logics. The study illuminated the need for organizational hybridity to be viewed not as a static state to which organizations arrive, but as a continuously responsive and dynamic process (see also Battilana et al., 2014; Dixon and Svensson, 2019). Future work in the area of hybridity should continue to combine the concepts of life course theory and turning points to help inform when, where, and how hybrid organizations develop and morph into various organizational forms over time and in response to their environment.

## Conclusion

The clear story of this study is the central role that sport plays in the lives of participants in a grassroots setting. The role of sport in this context extends well-beyond the playing of a game, but instead anchors the participants’ individual and social lives. The participants’ lived experience of COVID-19 is that it took away sport from them, which impacted not only their sport skills, but also their physical and socio-emotional well-being. Therefore, it is imperative that grassroots organizations are prepared, adaptable, creative, and participant-centric such that they can seamlessly continue to carry out their operations in the face of challenges, turning them instead into opportunities for new ways of advancing sport as a positive impact in individuals and communities around the world.

## DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because these are confidential data per IRB requirements, particularly because the organization is named in the study. Requests to access the datasets should be directed to Marlene A. Dixon, [madixon@tamu.edu](mailto:madixon@tamu.edu).

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Texas A&M University IRB. Written informed consent from the participants’ legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

## AUTHOR CONTRIBUTIONS

MD conceptualized the study, helped with the design of data collection, analyzed, interpreted, and wrote much of the manuscript and was the lead author. AH helped with conceptualization and framing, data analysis, and also contributed to technical aspects of the manuscript. SW helped with conceptualization, framing, and writing the results. EO and DO helped with conceptualization, design of the case study,

research questions/journal prompts, and also collected and analyzed the data. 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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# Access to Physical Activity and Sport and the Effects of Isolation and Cordon Sanitaire During COVID-19 for People With Disabilities in Scotland and Canada

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People with a disability are more at risk of experiencing inequalities in relation to sporting and physical activity opportunities, Covid-19 and the resulting restrictions stand to exacerbate these inequalities. This research directly contributes toward the World Health Organization, global research roadmap priority to explore “the impact of restrictive public health measures (e.g., quarantine, isolation, cordon sanitaire).” Social loneliness and social isolation have a significant impact on the health and wellbeing of individuals, therefore, it is imperative to gain an understanding of the effects of self-isolation and shielding during Covid-19 for people with disabilities to help those in policy and agency positions address these issues. This research utilized a qualitative approach, to speak with people with a disability, athletes and non-athletes and those in a position of management and policy making. Six online focus groups, with people participating in sport and physical activity, using live captioning, chat functions, and an online written discussion forum; through Project Echo website as part of a wider study on sport and accessibility were utilized. The study also drew on interviews and one of the focus groups was with senior policy makers and regional managers responsible for disability sport in Scotland.

**Keywords:** disability, sport, physical activity, Covid-19, isolation, inequalities

## INTRODUCTION

The aim of this research is to understand how People with a Disability (PwD)<sup>1</sup> have been impacted by Covid-19, specifically in relation to their ability to participate in sport or physical activity. It is known that a decrease in physical activity is a risk factor for secondary non-communicable diseases (van Schijndel-Speet et al., 2014). It is therefore pertinent that groups at a higher risk of acquiring secondary chronic conditions are provided with adequate opportunities to participate in physical activity. Social loneliness and social isolation have a significant impact on the health and well-being of individuals (Macdonald et al., 2018) therefore it is imperative to gain an understanding of the effects of self-isolation and shielding during Covid-19 for PwD. Vice versa, it is also important to explore if reduced access to physical activity could exacerbate the challenges of social isolation

<sup>1</sup> We recognize the political nature and contested language for disabled persons/people with disabilities. We use the United Nations accepted terminology of Persons with Disabilities (2006).

and loneliness for groups such as PwD, during lockdown. This impetus for this research stems from the need to investigate the impact of reductionist measures on PwD, a population that already faced recognized socio-economic challenges before Covid-19. Researching the impact of these measures on existing pressures, combined with new ways of exercising and engaging in sport and physical activity is brought about as a result of slowly emerging from lockdown represents a unique and valuable opportunity to understand the needs of PwD and to build connectedness and resilience for those who find themselves, excluded further from society due to Covid-19, and resultant government responses.

## RATIONALE

There are concerns that governments will exacerbate the marginalization of PwDs, by neglecting to ensure that Covid-19 responses are inclusive and accessible for all. A news release by (UN News, 2020) raised awareness to the following key considerations for avoiding increased disparity in treatment of PwD included: safeguarding access to healthcare as a priority, disseminating Covid-19 related information through accessible mediums, training of essential workers on non-discriminatory treatment of PwD, and providing support to ensure that the economic statuses of PwD do not deteriorate any further.

The Canadian government's last announcement on PwD and the Covid-19 response, addressed the concerns of the UN. The government published recommendations and considerations for organizations and people working with PwD. These considerations reiterated the UN's concerns but also included: anticipated difficulties with the use of face masks and visors, provisions for caregivers, and the need for gender sensitive response measures (Canada.Ca, 2020). The government, however, did not offer any formal policy for the implementation of these considerations. Instead in response to the pandemic and its economic impact on PwD, the federal and Ontario government in Canada offered PwD up to \$600 CAD in financial support. They provided up to \$15 million CAD in funding to support the employment of PwD and \$1.8 million CAD to fund the technology upgrades and projects designed to make work from home systems more accessible (Prime Minister of Canada, 2020).

Within the UK the COVID-19—Framework for Decision Making (2020) was introduced into legislation to provide emergency powers to respond to the Coronavirus pandemic including the provision of support for PwD. Specifically, within the devolved Scottish government, work continues with key stakeholders such as Disability Equality Scotland, Inclusion Scotland and Glasgow Disability Alliance to support the provision of essential services and to maintain communication from its members on key issues facing PwD including the wearing of face masks. Additionally, £350 million community funding was provided to support the access of food to those shielding including PwD with the Covid-19 Transition Fund also assisting organizations as they manage the evolving situation and the changing needs of their members in a way that will ensure sustainability.

Monetary relief packages and investments that bolster work at home accessibility features, are paramount in the support for PwD. However, we believe that access to physical activity can contribute significantly to providing holistic support during the pandemic, amidst lockdown restrictions.

## Aims and Objectives

This research aimed to gain an understanding of the experience and perceptions of people with disabilities, with regards to the Covid-19 lockdown in Canada and Scotland. We aimed to understand how the associated closures of parks and open spaces have impacted their ability to be physically active. In addition, we aimed to understand the perceptions of those in management or policy positions who are trying to aid accessibility and participation in disability sport. The research examines both the reduction in access to facilities, venues, and services, such as personal care and looks at how engagement from sport disability groups, charities, and family members have acted as a lifeline for social contact, physical engagement and for those who are athletes' online access to peers. To do so, we draw upon the theoretical understandings of the biopsychosocial model of disability focusing on how structural and economic barriers have led to further isolation for PwD who were already marginalized from society. Thus, we address this by examining how PwD have been affected by the social, cultural, and economic conditions to access physical activity brought about by Covid-19 and the policy responses aimed at safeguarding the population.

## Literature Review

The literature draws on contemporary debates emerging from academic and gray literature centering around the biopsychosocial model of disability and the United Nations (UN) Convention of Human Rights that every individual has a right to access leisure and recreation (UN, 2006). Furthermore, we draw from literature on loneliness, social exclusion and mental health. Previous work has highlighted that often an individuals' disability is only one form of oppression that they are experiencing, and they are only prevented from doing so because of other social, cultural or political constraints (Misener et al., 2019).

## Social Model of Disability

The framework of this paper is based on the social model of disability (SMD). The model borrows claims from the Union of the Physically Impaired Against Segregation (UPIAS) in 1975, that disability is not merely a medicalized condition but rather an imposition of what limitations society perceives a PwD would face due to their impairment (Shakespeare, 2006). In the fight for equality, it has been argued that this misinterpretation of disability has resulted in the exclusion of PwD from economic and recreation participation in society. Rather than insisting that PwD adapt to society, the social model of disability, scrutinizes social structures, and instead addresses how society itself can adapt to people with an impairment (Hughes, 2000).

The SDM however, is not free from criticism. In many ways, it fails to take into account the heterogeneity of impairment and how this varies according to the lived experiences of PwD. For a more tempered approach, this study included the Biopsychosocial Model of disability (BMD). This model

is predicated on the SDM, with the additional feature of accounting for the subjective experiences of PwD. The BMD is based on psychological variables as well as biological variables (Waddell et al., 2002). According to George and Engel (1980) this interaction between psychological and medical must be explored within the myriad of social systems, this thus provides a premise for this study. In addition to the social variables, this model allows us to incorporate the psychological and emotional variables that contribute to or precipitate from an inability to participate in physical activity.

### Loneliness and People With Disabilities

According to cognitive theory, loneliness is experienced by people who perceive a deficit in their desired amount of meaningful social interaction (Perlman and Peplau, 1982). It is important to highlight that the cognitive characteristics of loneliness are dependent on how an individual perceives their social relationships as inadequate or of low quality. Loneliness, which is synonymous with social isolation, is subjectively measured against the quality of relationships an individual has had in the past or against the quality of relationships the individual perceives others to have (de Jong Gierveld, 1998; Hawkey and Cacioppo, 2010). In 2017, 1.3 million PwD over the age of 15 (21%), reported living alone, thus justifying a concern for the onset of loneliness experienced by this population during lockdown (Statistics Canada, 2020).

There is a corpus of longitudinal research that identifies both chronic and acute loneliness as a risk factor to increased morbidity and mortality (Hawkey and Cacioppo, 2010; Holt-Lunstad et al., 2015; Leigh-Hunt et al., 2017). Loneliness is shown to diminish individuals' abilities to self-regulate thoughts, feelings, and behavior. This often results in a negative effect which could reduce motivation for physical activity (Hawkey and Cacioppo, 2010; Holt-Lunstad et al., 2015; Leigh-Hunt et al., 2017). Acute or "Situational" loneliness is described by Shiovitz-Ezra and Ayalon (2010, p. 456), as a short period of increased stress caused by a loss or reduction in quality social relationships. Acute loneliness experienced by PwD during the Covid-19 pandemic and subsequent lockdowns, could have catalytic effects on the deterioration of their physiological conditions, particularly for people with progressive conditions. Hawkey and Cacioppo (2010), propose that loneliness is affiliated with perpetual pessimism, feeling unsafe, anxiety, and low self-esteem. This results in an exhibition of paranoid and overly cautious behavior toward the environment and people outside of the PwDs' intimate circles. This perceived threat is often projected onto others and elicits a negative reaction from people in society, thus perpetuating the deviant identity of PwD. Research has shown that, in many cases, PwD relate loneliness to their bodily and social differences (Tarvainen, 2020). Research has in fact indicated that physical activity can play an important role in reducing social isolation, particularly for groups more at risk of experiencing isolation and loneliness (Schrempft et al., 2019).

### Negative Social Perceptions on Disability

The "deviant" identity is a socially imposed perspective that often contributes to the exclusion of PwD from society (Low, 1996,

p. 236). We turn to ableism literature to provide us with the vocabulary to dissect social norms that inherently create barriers to inclusion and participation. Ableism is also predicated on the Social Model of Disability, however, attributing discrimination in favor of people without disability. Ableism in essence addresses society's tendency to conveniently accommodate the non-disabled population. Campbell (2009) introduced the term internalized ableism to describe the self-inflicted oppression imposed by PwD who prefer to shy away from their impairment, either as a result of self-loathing or a need to blend in with the able bodied. Campell draws from critical race studies to describe the concept of "passing" (p. 26), in which a person with a disability works to mask their impairment or avoid questions about their disability. In this they hope to create a space where they are "not disturbing the peace, by containing the matter that is potentially out of place" (p. 26).

Brittain et al. (2020), propose a model that identifies ableism as a regulating mechanism to self-determination and consequently participation in physical activity. Self-determination speaks to one's ability to self-motivate. Brittain et al. (2020) argue that the self-motivation to participate in physical activity is curtailed by ableism and its effects on autonomy, competence, and relatedness. Under the lens of ableism, there is a misconception that PwD have little autonomy, worse yet, they are increasingly robbed of their autonomy by the various barriers to participation that exist as a result of this misconception. The authors (Brittain et al., 2020) believe that PwD's perceived lack of competence with physical activity is explicated by internal ableism, which further impedes self-motivation. Lastly, the ability to relate to, and through, physical activity is a much-celebrated (in normative culture) tenet of sport and physical activity, however, external ableism impacts on PwD's "relatedness" to physical activity (Brittain et al., 2020, p. 220). The ability to relate facilitates the building of social networks and thus social capital. An inability to relate therefore limits one's sense of belonging and creates constraints to participation. It is therefore apparent that in order to dismantle barriers informed by ableism, disability identity needs to be recognized as different rather than being ignored, made invisible, or homogenized (Loja et al., 2013). This reaffirms the need to go beyond the Social Model of Disability, toward a tempered perspective that involves a Biopsychosocial Model of Disability. The biopsychosocial model also allows us to incorporate the heterogenic responses and experience with the Covid-19 lockdown measure, attributed to various disabilities and levels of disability represented in our research.

Exclusion from sport and physical activity for PwD, is best evaluated in terms of experiences with constraints to participation (Darcy et al., 2017). The most common constraints experienced are associated with a lack of financial resources, transportation, sports coaches/instructors, and accessibility features (Darcy et al., 2017). In many developing countries, negative social perceptions of PwD presented the greatest constraint on participation. With regards to participation in outdoor recreation PwD face the added constraint of not having a person or group to accompany them (Burns and Graefe, 2007).

Studies however show that constraints do not necessarily equate to a decrease in participation (Darcy et al., 2017). So, in

addition to understanding the perceptions toward participating in physical activity, this paper looks at some mechanisms employed to help overcome the constraints to participation in physical activity during lockdown periods.

### Physical Activity and Mental Health

Research exploring the relationship between physical activity and mental health, allude to a feedback mechanism that connects self-determination theory to the positive effects of participating in physical activity, namely the social connectedness or “relatedness.” To further explain the loop, self-determination provides the motivation to participate and experience meaningful social connections, social connections augment control over positive cognitive behavior which in turn promotes self-determination, and the loop continues (Burke et al., 2006; Graham et al., 2008). The literature on the psychological effects of barriers to physical activity is seen in the study conducted by Putnam et al. (2003). Participants in the study linked their well-being (i.e., mental health, depression, and stress) directly to the inaccessibility of their build environment and its role as a barrier to physical activity. It is agreed upon that PwD are prone to secondary conditions including debilitating pain, depression, anxiety, stress and loneliness (Kinne et al., 2004; Olsen, 2018). The preventative interventions can, therefore, include not just participation in physical activities but also actively removing barriers to participation.

## METHODS

This study aimed to generate evidence on the impact of Covid-19 restrictions on people with disabilities particularly pertaining to physical activity and associated issues. Inclusion criteria were any person with a disability in the Greater Glasgow and Ontario regions of Scotland and Canada, respectively. The study used process consent which assumes that consent is a process meaning participants can withdraw consent for their information to be used at any stage (Dewing, 2007).

The research formed part of a wider Canadian funded Social Science Humanities Research Council, study on parasport and disability sport and physical activity participation, as a legacy of mega-parasport events in Scotland and Canada. Participants already registered on the Project Echo online web research forum were invited to take part in an online focus group via Zoom. Additionally, members of partner organizations including Scottish Disability Sport (SDS) were invited to attend other focus groups. The study was wholly qualitative as we were interested in the meaning and impact that Covid-19 had, had on people's lives. Interviews and focus groups allowed for more discussion and sharing of experiences between participants. Which in turn helped the individuals participating, given some of the key areas centered on loneliness, isolation and mental and physical health and accessibility. It also created new networks for some of the participants, both in their home countries and internationally.

### Data Collection

Six focus groups were held using Zoom with participants signing up via an event created on the Project Echo forum website. These

**TABLE 1 |** Participant names and physical activity levels.

Participant number	Pseudonym	Participant type
P1	Jamie	Recreational
P2	Gareth	Recreational
P3	Angela	Recreational
P4	Anna	Recreational
P5	Sean	Casual
P6	Kai	Casual
P7	Mark	Competitive
P8	Ryan	Competitive
P9	Grace	Performance
P10	Chloe	Competitive
P11	Catherine	Competitive
P12	Alison	Competitive
P13	Hazel	Organizational
P14	Laura	Organizational
P15	Nick	Organizational
P16	Gerard	Organizational
P17	Amy	Organizational
P18	Karen	Organizational
P19	Leanne	Organizational
P20	Helen	Performance
P21	Grace	Performance
P22	Roy	Performance
P23	Richard	Performance
P24	David	Performance

were advertised through Project Echo's social media platforms and through communication with Disability sports and advocacy organizations in Canada and Scotland. Additionally, invitations were sent directly to those people already registered on the Project Echo forum.

A total of 24 participants took part in the focus groups; seven of which were members of staff within disability sports organizations, six were performance pathway/ elite para athletes, five were competitive athletes at a non-performance pathway level and six were recreational or casual participants in sport or physical activity (see **Table 1**). Inclusion criteria for participants outlined that all those taking part in the focus groups were either a PwD or were employed in a management or policy role that works on the provision of sport and physical activity for PwDs. The focus group with staff were regional managers and the Senior Program Manager employed by a non-departmental public body Disability sport organization; SDS. They are directly responsible for implementing government policy and in influencing government policy through their advocacy role. The inclusion of this group was therefore deemed important to understand the evidence base they were using for policy decisions around covid-19 and sport participation for PWD. Participants were not excluded on the basis of their level of activity with a broad range of experiences and participation levels sought to gain a broader understanding of the impact of Covid-19.



In order to maximize accessibility in participation, the key focus group questions were emailed to participants prior to the session. Questions were provided on a Microsoft forms document which enabled participants to send answers in advance of the focus group which was seen as particularly useful for those with speech issues or whose disability caused them issues that meant they would be slow to type. Additionally, participants were encouraged to keep cameras on for those who may lip read, closed captioning was provided and use of the chat function was encouraged.

The key questions asked participants about their physical activity levels prior to the Covid-19 lockdown, how the lockdown and restrictions have impacted levels of physical activity, what has been a source of help in taking part in home-based exercises. Questioning also focused on how restrictions may have affected participants in other ways; socially, economically, and culturally as well as how participants felt about the easing of restrictions and beginning to access sport and physical activity again.

Focus groups were recorded using zoom functionality and transcribed verbatim. Each transcript of audio files and chats were analyzed by two members of the research team independently using a thematic analysis as a framework to guide the structure of researcher led analysis prior to discussion and agreement of key themes.

## RESULTS AND DISCUSSION

Following analysis, four key themes have been identified throughout the focus group discussions; creativity, mental well-being, safety, and the exacerbation of disablement. Overall, it was evident from participants that Covid-19 restrictions have placed many different stresses and strains on the lives of PwD, however, despite this, the majority of participants attempted to make the best of the situation and adapt to new ways of working, socializing, and exercising.

### Creativity

A key theme emerging from the research was that of creativity. Adaptation to a new “normal” has become a key component of Covid-19 restrictions for most people with a substantial decrease in excursions outside of the home for reasons other than essential trips. The pandemic has created an environment that heightened self-isolation by reducing physical activity levels (Pinto et al., 2020). It was evident during focus groups that participants had been working on finding new and innovative ways to remain physically active. Using household items such as tins of food as weights and a wall to practice foot movement and shots for racquet sports including tennis and badminton formed were just some examples used by participants. Others also purchased exercise equipment and followed online workouts. Angela has been able to continue with some activity due to living in a rural and reasonably isolated area and has therefore felt comfortable going for runs, however, uneven terrain makes this a safety concern the longer lockdown continues with daylight beginning to fade in the evening.

Interestingly, there was a change in the mindset of some participants to find the positives of lockdown with one suggesting

that she “felt like it was my winter training season indoors” (Catherine) and adapted her training schedule to fit accordingly. From a non-sporting perspective, Chloe found that whilst previously struggling to stay in contact with friends from university, her level of social contact with them has increased and they now stay in contact regularly via Zoom, “we said we can’t believe we didn’t do this before.” This proved an issue for Helen who lived in a very remote area with limited access to strong internet for phone signal which led to the opposite experience to that of Chloe as she felt more isolated from her training squad. She did manage to overcome this through perseverance in finding appropriate places where the signal was the strongest and this helped with both the social aspect of online contact but also in relation to her training as this allowed her to set up a gym in a barn building to take part in online workouts.

Richard outlined that his sport required very specialist equipment which made it difficult to adapt training, however, in order to maintain a social element amongst the club members, “as all clubs were shut down, but what we did manage to do was use an online game... which kept the club spirit alive and there was a lot of tactics involved.” This allowed clubs to run virtual leagues for a social outlet as well as providing athletes the opportunity to work on their tactical knowledge of the sport.

Ryan has found other ways to stay busy and spends most evenings talking on the phone with two older people in his neighborhood who are isolated. It is therefore clear that participants are trying to make the best of the situations they currently find themselves in and are finding creative ways to maintain their levels of activity and also to use their time effectively. Those participants who appeared to manage to maintain their social relationships or indeed grow them during the pandemic, such as Ryan’s developing friendship with the two older gentlemen and the online forums and sessions that the youth athletes took part in through their organizations all exhibited a lack of pessimism in comparison to other participants. The ability to “help others out with shopping and things helps me with my own anxiety and depression” (Kai) has aided the development of a more positive outlook on leaving the house during and post-lockdown.

A lack of social relationships may exacerbate feelings of isolation and loneliness which Hawkey and Cacioppo (2010) link directly to decreases in self-esteem and increases in pessimism. The associated overly cautious behaviors linked with pessimism were exhibited by several participants. Those who did not talk about having social contact with group sessions or conversations with friends expressed more fear and caution over moving out of lockdown restrictions, however, this may also be linked to previous experiences. Gareth talks about how he fears attitudes of people in the street who often “don’t move to the side and bump into people” making social distancing very difficult and that his “worry is, society will be more exclusive” (Gareth). The vulnerability of health conditions makes it a very uncertain transition to post-lockdown with concerns over going out as it “depends on whether we get a vaccine” (Jamie) and that “they don’t understand the practicality for people like me” (Jamie) of going into coffee shops and restaurants where people have

touched many things or where people are wearing face coverings making lip reading very difficult.

However, whilst creativity was evident, it was clear that lockdown was continuing longer than anticipated and that the novelty of finding new training methods was becoming tedious with both Ryan and Mark suggesting that “hitting a ball against a wall is boring” and Angela suggesting that “I don’t really enjoy exercising at home (kind of boring).”

It is not only those in lockdown that have been adapting, organizations have encountered the challenges of no longer being able to deliver sports sessions or have face to face contact with their athletes or people they support. The online content delivered by numerous organizations has been well-received by participants with there “being a different workout everyday” (Grace) available. Providing group sessions to allow athletes to maintain contact with their training groups has been important and beneficial to athletes, however, this is something that hasn’t been as readily available for recreational or casual activity participants with support often being more specific to athletes on performance pathways. As restrictions begin to ease and some sports begin their return to play protocols, support staff are now experiencing difficulties with engagement in their online events “numbers are lower now because some of the guys are back out training” (Nick). Throughout Covid-19 restrictions, staff within SDS have been heavily involved in engaging with athletes from daily or weekly activity sessions online, weekly training plans and “keeping contact through weekly Zoom calls has helped maintain connectivity with (athletes)” (Laura). Amy further added that she has “offered phone calls/ video chats to individual athletes” and has encouraged family members to become involved in activities as a additional support mechanisms to athletes being able to maintain physical activity levels but this has been challenging due to them as staff members facing the same challenges of adapting to new work environments imposed by lockdown.

## Mental Well-Being

Physical activity has been positively associated with greater mental health and well-being (Bize et al., 2007; White et al., 2017) in part due to the positive social environment linked with participating in physical activity or sport, however, Tough et al. (2017) have highlighted that people with disabilities may have fewer opportunities to partake in such social gatherings. During the current pandemic, this enforced isolation from these physical and social settings has exacerbated the gap between people with disabilities and those with no disability. A general consensus emerged from the findings that indicated participants had found the lack of social contact “tough” (Anna) with different factors contributing to this. Chloe indicated a level of fear as, despite being vulnerable, she was the “least vulnerable in her family” therefore leaving the weekly trip to the supermarket to her. However, this element of fear and feeling unsafe will be explored further in later themes.

The words “Anxiety” and “depression” were commonly used throughout the focus groups creating emotive discussions resulting in Mark highlighting “having suicidal thoughts at various points because of the feelings of isolation and anxiety,” however, he has also been able to alter these feelings into more

positive thoughts and this has been helped further by being able to return to sport due to being involved in an individual sport where social distancing is easily maintained “I used to feel suicidal myself, but I’ve just realized there’s nothing you can really do about it and you need to step up a bit and say that it’s better than being not here.” Anxiety and depression were terms also used by Anna and Gareth who both linked these to emotions of fear and isolation which again have been exacerbated by Covid-19 restrictions. Gareth admitted to feeling “anxiety because of Covid” and “finding some days harder than others” and feels “like I am missing out” by not being able to go out and go to work and see people he would normally see.

It is therefore evident that the removal of opportunities to safely navigate society and remain physically active has had a negative impact on the mental well-being of PwD. The uncertain times and potential of a second wave or lockdown of Covid-19 increases the urgency of understanding how to support PwD experiencing feelings of anxiety, depression, or isolation. Linked closely with the positive mindset previously mentioned in relation to creativity, David “firmly believe that athletes will come out stronger, both physically, and mentally when they realize that they can be adaptive when forced into a corner to make those changes.”

## Safety

For many, the lockdown measures have resulted in the closure of recreational facilities. Therefore, the only options are to engage in physical activities in one’s own home or at outdoor public facilities like open fields, parks, and lakes. A common theme that emerged from the participants, was the concept of safety, or a lack thereof. Rimmer et al. (2004) identify emotional and psychological barriers as well as built and natural environment barriers as contributors to perceived safety issues amongst PwD. The concept of feeling unsafe was used by participants to describe a loss of protection from physical harm as well as a fear of being in a situation they could not control. For Angela, the feeling of not being “safe” was associated with the lack of hygienic accessible restrooms at outdoor facilities, particularly because easy access to restrooms was vital to the management of her coexisting condition. Increasing access to accessible and hygienic facilities becomes particularly more important during lockdown periods, as a lack of access has been shown to exacerbate loneliness and stress (Olsen, 2018).

For Jamie, the feeling of being unsafe in the outdoor built environment, existed even before the Covid-19 lockdown.

“For the past 5 years I have been terrified to go out, and I realized I need to get some exercise so obviously I tried to build up my confidence because I have mobility issues. The society is not that safe out there anymore for people with disabilities and I think it really impacted on me because of the potholes, I fell into a pothole, the pavements are not that flat, and it’s very difficult to go out for a walk, ideally where you can walk safely and stuff.” (Jamie)

Studies have shown that the lack of features in the built environment can become facilitators or barriers to physical activity (Rosenberg et al., 2013; Misener et al., 2015; Eisenberg et al., 2017). Feelings of being unsafe have been exacerbated

by the reduced access to hygienic and accessible facilities, including “safe accessible public transportation,” (Jamie) to outdoor facilities.

Angela admitted that the physical and environmental barriers made her “feel nervous,” thus showing a manifestation of biopsychosocial barriers to participation. Gareth and Kai also expressed anxiety in association with not feeling safe. Gareth was afraid that he would start experiencing pain, a symptom of his coexisting condition, while he was outdoors. He shared that “I really need to say to myself, today you need to go out, you will be fine.” Kai, expressed feeling anxiety because she did not feel safe neither in her residence nor outside of her residence. Kai shares a public kitchen with other people in her university residents. She concluded that since her disability is invisible, people around her did not respect the fact, or did not know that she was shielding. She found the behavior of her fellow residents irresponsible and dangerous. Their lack of social distancing and “stay at home” orders, left her feeling anxious about using the kitchen. Unfortunately, she felt like she had no option but to access food from outside, as she felt safer outside than inside.

Staff within SDS have recognized that their members and the athletes they support have faced multiple challenges from a mental well-being perspective with “many now experiencing poor mental health” (Laura) with many experiencing “isolation and change of routine due to shielding/activities stopping; becoming overwhelmed” (Amy). This social and psychological support provision adds to the role of the staff and has increased the importance of their role and it became clear that this contact also helped staff deal with the changes and struggles they were facing as “planned weekly activities, training and events have helped us all” (Karen).

## Exacerbation of Disablement

Gareth and Jamie raised important points about the considerations that need to be made regarding facemasks. Jamie’s concern was that many people need to see her lips to help them understand what she is saying, and so wearing a mask would make things even more difficult for her. Jamie mentioned that she had ordered face visors, but her concerns were not only around her speech, but also her mobility. She feared that going to restaurants now would be tricky as she is prone to bumping into things. She was concerned that the things she bumped into might not be sanitized, also that they would need to be sanitized after she touches them, thus increasing work for the employees of the restaurant. Gareth added that this extra effort for people with mobility issues would further emphasize their perceived disability in public. He also mentioned that not wearing a facemask, when masks are becoming the norm, will soon be considered “antisocial.” Therefore, PwD that cannot wear masks are at risk of further social exclusion, thus perpetuating the “deviant” identity imposed by society (Low, 1996, p. 236).

Anna and Gemma, also noticed an increased need to assert physical distancing from people without a disability, especially since they use a wheelchair. Before lockdown, Gemma was not too bothered by people without a disability using the accessibility ramps, she would even wait for them to walk to the end before she got on. Recently, Gemma has noticed how her patience

for this behavior has waned. Anna also noticed that getting on elevators meant that people without disabilities had to be more accommodating than usual. This sometimes meant missing an elevator because there was not enough space to physical distance. This change in behavior has the potential to undo the shedding of the deviant identity i.e., the ability to pass as less disabled. People in wheelchairs need to demand more physical distance than people without a disability, further highlighting their disability. As we move toward returning to physical sport, this has also led to further implications for clubs. Some sports clubs are able to re-open with increased physical distancing but trying to accommodate wheelchairs or the needs of PwD will take longer as sometimes, for example, there is not enough room on the athletics track, to ensure the safety of PwD and other athletes. This is fine if there is dedicated time for PwD but this is not always the case, thus the return to participation in sport for those PwD will take longer than able bodied athletes.

Scottish Disability Sport have worked with Scottish Young People’s panel who participate in sport and Young Start Team panel aims to get athletes with a disability into coaching and look at career progression and we spoke with them about the changes in direction of funding and the policy shift in terms of what is now seen as a priority. SDS were trying to use their panels to help feed back to Scottish Government in terms of access to sport participation, put daily activities online and ensure they avert isolation and reduced income earning potential for athletes. They were trying to address this exacerbation of disablement. The dual role of this organization in supporting those with a disability to participate in sport but simultaneously respond to government and UN level policy in their advocacy role means they are campaigning to have their voice heard and the rights of athletes with a disability protected as well as provide a daily contact for PwD involved in sport.

## IMPLICATIONS AND CONCLUSION

The UN (2020) outlines that there should be a collaborative approach between governments, health, and social care services, schools, and organizations representing social groups in order to promote and support physical activity at home. Where possible this should involve facilitating online resources, however, “low-tech and no-tech solutions must also be sought for those who currently lack access to the internet. Creating a flexible but consistent daily routine including physical exercise every day to help with stress and restlessness is advisable” UN (2020). This research confirms the UN’s recommendations, by demonstrating the need for governments and agencies to provide affordable and accessible technology that enables continued contact with social networks. People tend to get resourceful and creative with technology, as they adapt to their new circumstances, but to ward off boredom there needs to be constant improvement of the resource. This is particularly true for those PwD at elite level sport, as they require dynamic physical activity.

Concerned parties must therefore, continue to monitor the needs of PwD and the current technologies ability to meet those needs. Numerous organizations have already started to include a

physical activity component, as well as a socializing component, to their online platforms. This research shows that more time and resources need to be invested in augmenting these online features for PwD. Furthermore, these initiatives need to link to central/state government policy as UN (2020) argues for a collaborative approach between key agencies.

Not only are their physical activity levels reduced for elite athletes, but so are their sponsorship potentials, potential records and future livelihoods. This is unlikely to be resolved in the short term so there needs to be a response to helping elite para athletes access training facilities, in the same manner as able bodied have been afforded.

Safety remains a major concern for PwD. Both physical and psychosocial precipitants for not feeling safe, need to be addressed when fashioning initiatives to maintain or increase physical activity levels during lockdowns. This requires policy makers to consider how Covid-19 restrictions can further alienate PwDs by drawing more attention to their disability. Perhaps requiring service providers to wear visors or transparent masks, is a consideration policy makers and organizations need to entertain. Maintaining or increasing accessible, hygienic facilities should be enforced by governments, particularly at outdoor facilities. The need to ensure the rights of PwD to have continued access to physical activity is important, as without this, the evidence from our research has shown this is leading to increased mental health issues, a reduction in participation in physical activity and sport performance for those at elite level sport. Given we will be experiencing some form of physical distancing for a while and our research has shown similar results in Scotland and Canada we recommend there should be a collaborative approach between governments, international agencies and those responsible for the human rights and well-being of people with a disability to adopt an inclusive approach to access for physical activity and sport not just financially for shielding but to aid mental and physical health.

The impact of covid-19 for PwD, who are more at risk of further illness through reduced physical activity as evidenced by the WHO (2020) and our research, suggests the need for specific policy responses to help them maintain physical activity and exercise outdoors as well as indoors with others to reduce isolation. Policy makers, governing bodies, disability groups are all trying but at present those measures are not joined up, a collaborative approach will aid longer term solutions. Research shows that a reduction in physical activity can lead to increased levels of loneliness and mental distress. Our research then goes on to show that Covid-19 lockdowns and

restrictions are also causing feelings of loneliness and mental distress which impact one's ability to be physically active, thus creating a cycle. Approaches to improving governments' Covid-19 response for PwD should therefore tackle the cycle by addressing biopsychosocial barriers to physical activity. Policy makers and agencies should ensure that PwD have access to and feel safe accessing physical activity alternatives like online solutions or outdoor facilities. Further research needs to be conducted on the iterative use and development of technology that mitigates barriers to physical activity. More research also needs to be conducted on how PwD are navigating new public health recommendations (and their subsequent exacerbation of disability), in a desire to remain physically active.

## DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because as the data was recorded by video and audio the participants are identifiable and therefore only available to the approved research team. Requests to access the datasets should be directed to Gayle McPherson, [gayle.mcpherson@uws.ac.uk](mailto:gayle.mcpherson@uws.ac.uk).

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Western Ontario. The patients/participants provided their written and verbal informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

The idea and conceptual framework for the article was that of GM and LM. The design of the fieldwork was GM and LC. LC, GM, and DK conducted the fieldwork. DK conducted the literature review with input from GM and LM on the theoretical model. LC led the analysis with input from GM, LM, and DK. GM and LC wrote the impact and conclusions. All authors contributed to the article and approved the submitted version.

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# Athlete's Perceptions of a "Quarantine" Training Camp During the COVID-19 Lockdown

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Globally, COVID-19-related movement restrictions have caused significant disruption to athlete's training and sporting competitions. "Quarantine" camps are one approach to maintain sport-specific training, whilst minimizing the risk of COVID-19 transmission between athletes and society. This cross-sectional study investigated the effects of a "quarantine" training camp on athlete's routines and wellbeing, performance support, perceived stress and sleep behaviors. A survey was completed at the end of a 30-day "quarantine" camp, by 76 elite athletes (17–46 years), predominantly (~80%) Olympic/Paralympic and/or world championship representatives. Athletes described their experiences in comparison to; pre-lockdown training and/or training during "lockdown" (immediately prior to the "quarantine" camp). Compared to "lockdown," the "quarantine" camp revealed improvements ( $p < 0.05$ ;  $0.33 \leq d \leq 0.90$ ) in access to sport-specific training (28.6%), recovery facilities (22.2%), nutritional choices (17.5%), mental (12.4%) and emotional (11.4%) health, training motivation (20.0%); and perceived stress (7.4%,  $d = -0.27$ ,  $p = 0.026$ ). The camp resulted in a lower sleep duration ( $-8.5\%$ ,  $d = -0.73$ ,  $p = 0.014$ ), but an improved global sleep behavior score ( $-5.6\%$ ,  $d = -0.22$ ,  $p = 0.001$ ). During the camp, the performance support athletes received was not different to pre-lockdown ( $p > 0.05$ ), but there was greater sports massage (20.4%,  $d = 0.39$ ) and physiotherapy usage (18.1%,  $d = 0.36$ ) (both  $p < 0.05$ ). The adverse effects of lockdown were restored during the camp. A "quarantine" camp may offer comparable training experiences to pre-lockdown training, without inducing additional perceived stress. Coaches and sporting organizations may consider this approach as part of a virus mitigation strategy, whilst maintaining sport-specific training.

**Keywords:** coronavirus, home confinement, Olympic Games, Paralympic Games, self-isolation

## INTRODUCTION

In light of the pandemic of coronavirus disease 2019 (COVID-19), the world's sporting calendar has experienced considerable disruption. A notable example is the postponement of the Tokyo Olympics 2020, with further postponements or cancellations affecting the World Athletics Indoor Championships, UEFA European Football Championship and Badminton Thomas Cup. Travel restrictions and closures of sporting facilities have halted the regular training practices of athletes. Many athletes have been unable to perform sport-specific training, due to movement restrictions (Bok et al., 2020). Consequently, athletes have resorted to training at home, often without

supervision or specialist equipment (Mon-López et al., 2020). Despite this emerging evidence demonstrating beneficial effects of home-training, the overall effectiveness of home-training for maintaining optimal levels of sport-specific conditioning remains unclear.

One option for sports seeking to continue sport-specific training, whilst controlling the spread of COVID-19, may be a "quarantine" camp. Here, athletes and support staff can be isolated from the general population for a period of time. In Malaysia, national elite athletes from several Olympic sports under the program of "Road to Tokyo 2020" were permitted to resume training during a 30-day quarantine-style camp in June 2020, whilst national movement restrictions ("lockdown") remained in place. This "quarantine" camp allowed coaches and athletes to return to sport-specific training, use regular training facilities and receive performance support from sports science/medical staff within the camp. It also allows athletes to focus on the quality of training, without having to worry about training facilities and nutritious food, less travel time to the training venue and external "distractions" (e.g., media), all of which will provide a conducive training environment. However, a "quarantine" camp necessitates stringent working and living procedures to maintain a minimized risk of virus transmission. Notably, athletes and staff must be tested upon entry and may not leave the camp throughout the duration of the camp. Therefore, despite the apparent benefit of resuming sport-specific training, a "quarantine" camp may also elicit a psychological strain on athletes, who are restricted in their movements and away from family/friends (Jukic et al., 2020). Living in an isolated environment may also accentuate negative consequences of home confinement such as altered sleep patterns and poor nutrition (Pillay et al., 2020). It remains unclear therefore, whether a "quarantine" camp may be a desirable training solution in the lead up to the postponed 2020 Tokyo Olympics.

At the current time, there is no evidence detailing elite athlete's perceptions of a "quarantine" camp. Such information is warranted in order to facilitate informed decision making by coaches, sport scientists and sporting governing bodies. The present study investigated Olympic and Paralympic athlete's routines and wellbeing, performance support, perceived stress and sleep behaviors during a "quarantine" training camp, relative to the prior period of home confinement (i.e., "lockdown") and "normal" training conditions (i.e., "pre-lockdown"). We hypothesized that a "quarantine" camp would improve athlete's perceptions of training routines and wellbeing, access to performance support, stress and sleep, compared to the prior "lockdown" and "lockdown" period.

## METHODS

### Design

A cross-sectional design was adopted, using questionnaires to assess athlete's perceptions of "before" lockdown, "during" lockdown, and "during" the "quarantine" camp. All data were recorded within a 5-day period following the completion of the 30-day camp and collected using a custom-made Google Form. All athletes attended the camp for at least 23 of the

30-day duration. Data collection occurred across three training venues within the country, all of which were subjected to the same operating procedures/restrictions and requiring COVID-19 testing upon entry and exit.

### Participants

The survey was completed by 76 elite athletes (53 males and 23 females;  $26 \pm 5$  years, range 17–46 years). All participants had between 8 and 22 years of competitive experience in their sport ( $15.5 \pm 6.5$  years). Of these athletes, ~80% have already qualified for the 2020 Olympics or have previously competed at the Olympics or World championships (i.e., highest levels of competition for each sport). Participants were from six able-bodied sports; archery ( $n = 5$ ), badminton ( $n = 16$ ), diving ( $n = 10$ ), gymnastics ( $n = 4$ ), sailing ( $n = 9$ ), swimming (3) and nine Paralympic sports; para archery ( $n = 4$ ), para athletics ( $n = 3$ ), para badminton ( $n = 6$ ), boccia ( $n = 2$ ), para cycling ( $n = 7$ ), para powerlifting ( $n = 2$ ), para swimming ( $n = 1$ ), para table tennis ( $n = 2$ ), and wheelchair tennis ( $n = 2$ ). The total number of participants from able-bodied sports was 47 and 29 athletes were from Paralympic sports. Participants with intellectual disabilities were not recruited. The study was conducted according to the Declaration of Helsinki. Informed consent was obtained from all athletes, with data was processed anonymously. Ethical approval was not sought as these questionnaires were comparable to those they would routinely provide as part of their official duties as national athletes (Winter and Maughan, 2009).

### Survey Questionnaire

The survey contained 6 sections; (i) athlete background and camp ratings, (ii) training routines and wellbeing, (iii) access to sport science support, (iv) perceived stress, (v) sleep behaviors, and (vi) lifestyle. Approximately 15–20 min was required to complete the full survey. To improve the response rate, the completion of parts 5 and 6 were optional, but 1–4 was compulsory. The original survey in English was translated into Malay to facilitate data collection among non-English speaking athletes. A three-step procedure was used to obtain the translation: (a) translation via *Google Translate*; (b) independent proofreading by two bilingual translators; (c) discussion and confirmation of the translation's accuracy by these two bilingual translators. A parallel comparison with the original English questionnaires was included for each question.

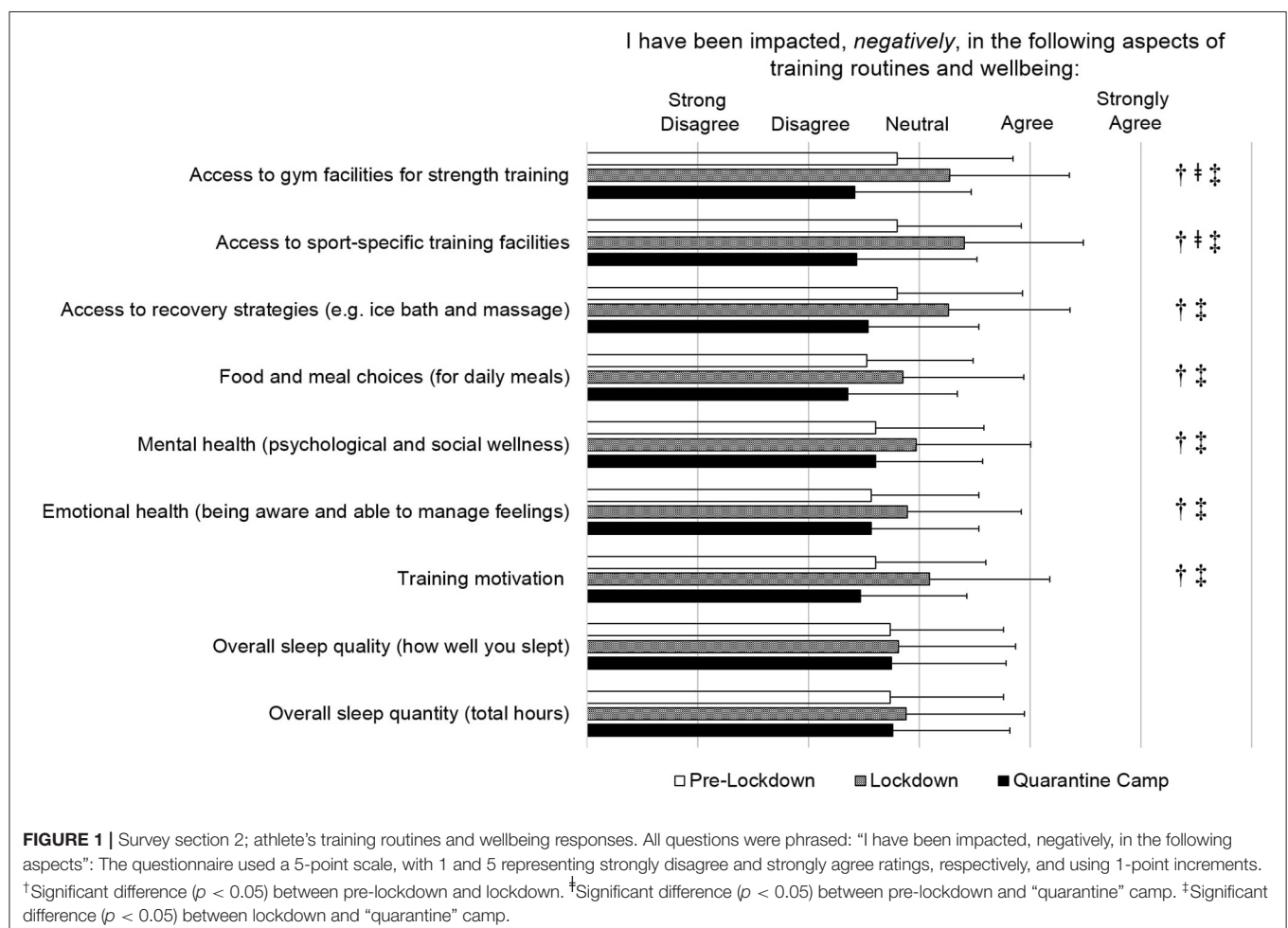
Section 1 pertained to athlete demographics, such as age, sex, sport, and competitive experience. Section 2 focussed on athlete's training routines and wellbeing investigating changes in training from before and during lockdown, as well as the "quarantine" camp usually emphasized in athletes. Section 2 contained nine questions relating to training facilities access, recovery facilitates access, nutritional intake, motivation, mental wellbeing, and sleep patterns. All questions were phrased: "I have been impacted, *negatively*, in the following aspects." Athletes were asked to respond to the statement on a 5-point Likert scale, with 1 and 5 representing *strongly disagree* and *strongly agree* ratings, respectively, 1-point increments. The scores of each question in Section 2 were subsequently reversed to obtain "positive scores," to aid interpretation and reporting of these data (e.g., a

score of 5 was transformed to 1, and 4 to 2). In Section 3, the utilization of performance support (i.e., athlete interaction with sports science/medical staff during pre-lockdown training, and the "quarantine" camp) was assessed using 10 custom-designed questions. The questions are related to training monitoring, recovery practices, mental wellbeing techniques and nutrition monitoring. Athletes indicated how frequently, on a monthly basis, they utilized performance support on a 5-point Likert scale of "0 or never," "1–2 times," "3–4 times," "5–6 times," and "more than 6 times." Section 4 utilized the Perceived Stress Scale (PSS) (Cohen et al., 1983). This involves 10 questions investigating an individual's perception of stress. It was scored on a 5-point Likert scale ranging from 0 (never) to 4 (very often). Positive scores were reversed to allow the calculation of a cumulative total score. PSS scores can range from 0 to 40, with higher scores reflecting higher levels of stress. Section 5 investigated athlete's sleep routines using the Athlete Sleep Behavior Questionnaire (ASBQ) (Driller et al., 2018). This 18-item questionnaire requires participants to indicate how often they engaged in a specific behavior on a 5-point Likert scale from 1 (never) to 5 (always). A higher score in ASBQ is indicative of poor sleep behaviors. Athletes only responded to Section 5 in relation to lockdown and the camp, as pre-lockdown was considered too far in the past

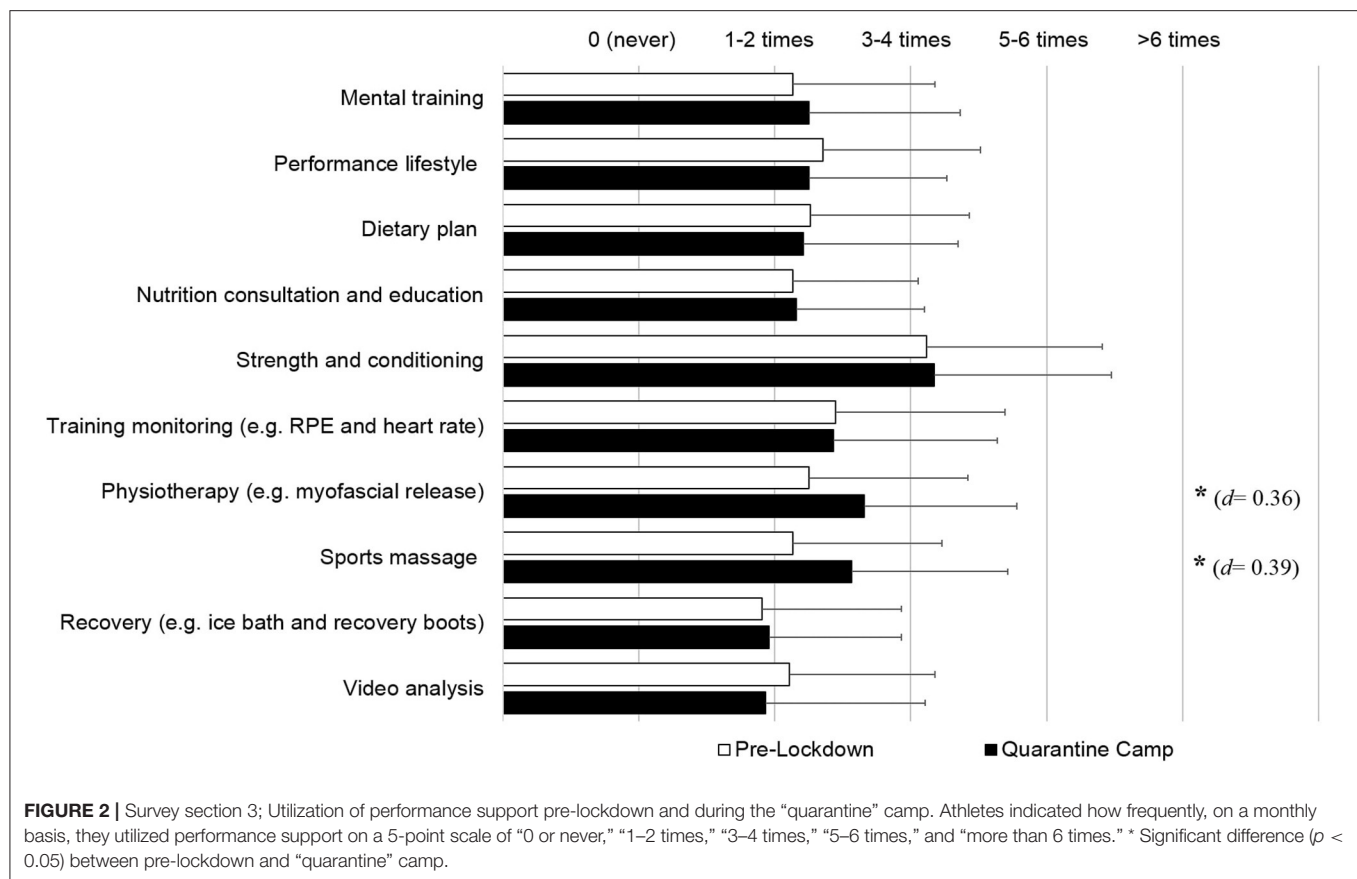
for accurate recall. Section 6 investigated athlete's lifestyle habits including weekly activities and scored on a 5-point Likert scale ranging from 1 (never) to 5 (very often).

## Statistical Analysis

Raw data were downloaded from *Google Forms* and extracted into a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA), for duplication checking and identification of missing data. Normal distribution of data were determined using the Shapiro-Wilks test. This revealed the data not to be normally distributed, therefore non-parametric analysis was adopted. Friedman's ANOVA was used to identify differences across the three time-points; pre-lockdown, lockdown and "quarantine" camp, with Wilcoxon signed rank test used as a post-hoc to identify where differences occurred. For parts of the survey where only two time-points of data were collected (e.g., ASBQ), Wilcoxon signed rank test was again adopted to identify within-subject differences. Cohen's *d* effect sizes were calculated, with the following interpretation boundaries; <0.2 (trivial), 0.2 (small), 0.5 (moderate), and 0.8 (large) with the relevant citation (Cohen, 1988). Data are presented as Mean  $\pm$  SD. Responses from sections 2, 3, 4, 5, and 6 were converted to percent changes to aid interpretation and comparison. The







Spearman correlation coefficient and Chi square test were used to identify the relationships between continuous (i.e., age and competitive experience) and categorical (i.e., sex) variables, respectively. Statistical analysis was performed using SPSS Statistics for Windows, version 16.0 (SPSS Inc., Chicago IL, USA), with the significance level set at  $p < 0.05$ .

## RESULTS

The data of all athletes for both the compulsory and optional sections were included in statistical analysis.

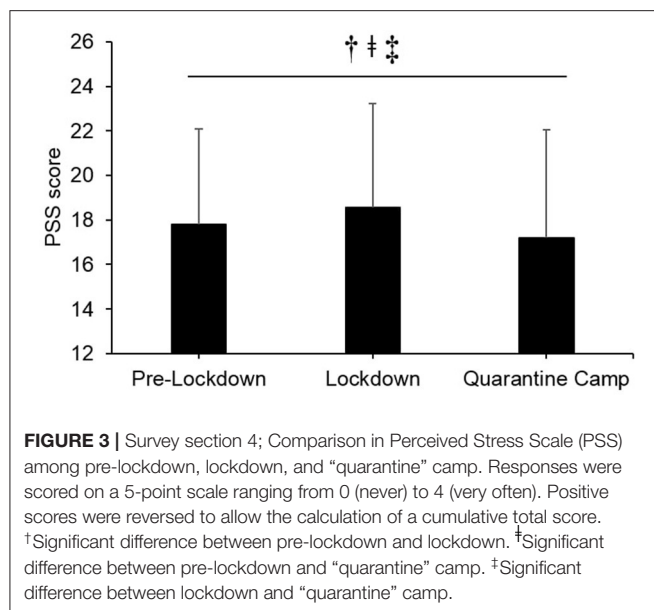
Responses from Section 1 were not statistically different across the three “quarantine” camp locations, allowing a pooled analysis of data. This included no difference in athletes’ ratings of access to training facilities and sports science/medical support across the three locations.

The effects of the “quarantine” camp on training routines and athlete wellbeing (Section 2) are shown in **Figure 1**. A difference between pre-lockdown, lockdown and “quarantine” camp ( $p < 0.05$ ) was observed for 7 out of 9 questions. *Post hoc* analysis found differences between lockdown ( $p < 0.05$ ) compared to “normal” training, but these aspects were not different compared to pre-lockdown and the “quarantine” camp ( $p < 0.05$ ). Differences between pre-lockdown and lockdown were identified for; access to gym facilities for strength training

(pre-lockdown to lockdown:  $-16.9\%$ ,  $d = -0.45$ ; lockdown to “quarantine” camp:  $26.1\%$ ,  $d = +0.80$ ), access to sport-specific training (pre-lockdown to lockdown:  $-21.6\%$ ,  $d = -0.55$ ; lockdown to “quarantine” camp:  $28.6\%$ ,  $d = +0.90$ ), access to recovery services ( $-16.4\%$ ,  $d = -0.41$ ;  $22.2\%$ ,  $d = +0.69$ ), food and meal choices ( $-13.0\%$ ,  $d = -0.32$ ;  $17.5\%$ ,  $d = +0.48$ ), mental health ( $-14.1\%$ ,  $d = -0.37$ ;  $12.4\%$ ,  $d = +0.37$ ), emotional health ( $-12.8\%$ ,  $d = -0.33$ ;  $11.4\%$ ,  $d = +0.33$ ) and training motivation ( $-18.7\%$ ,  $d = -0.47$ ;  $20.0\%$ ,  $d = +0.60$ ). Sleep quality and quantity did not change throughout the assessed periods (rated between “disagree” and “neutral” throughout).

**Figure 2** presents performance support across all timescales (Section 3). Sports massage ( $20.4\%$ ,  $d = 0.39$ ) and physiotherapy ( $18.1\%$ ,  $d = 0.36$ ) usage increased during the “quarantine” camp ( $p < 0.05$ ). The remaining aspects of performance support were not statistically different between pre-lockdown and “quarantine” camp.

A difference in the average PSS total score (Section 4) was observed between pre-lockdown, lockdown and “quarantine” camp ( $\chi^2 = 11.006$ ,  $p = 0.004$ , **Figure 3**). *Post hoc* analysis indicated differences between pre-lockdown and lockdown ( $Z = -2.661$ ,  $p = 0.008$ ), between pre-lockdown and “quarantine” ( $Z = -2.224$ ,  $p = 0.026$ ) and between lockdown and “quarantine” ( $Z = -3.300$ ,  $p = 0.001$ ). The PSS scores for pre-lockdown, lockdown, and the “quarantine” camp were  $17.8 \pm 4.3$  pt,  $18.6 \pm 4.6$  pt, and  $17.2 \pm 4.9$  pt, respectively. The results indicate



increased stress level during lockdown (+4.4%,  $d = 0.17$ ) which reduced during the “quarantine” camp (−7.4%,  $d = -0.27$ ) compared to pre-lockdown. Neither age, sex, nor competitive experience were correlated with the PSS total score for pre-lockdown, lockdown, and “quarantine” camp ( $p > 0.05$ ;  $r = -0.22$  to  $0.62$ ).

Sleep duration (Section 5) was higher during lockdown compared to the “quarantine” camp ( $Z = -2.446$ ,  $p = 0.014$ , −8.5%,  $d = -0.73$ ). The mean change was from  $8:08 \pm 1:27$  during lockdown, to  $7:39 \pm 0:44$  h during the “quarantine” camp. There was a difference in the ABSQ global score between lockdown and the “quarantine” camp ( $Z = -4.470$ ,  $p = 0.001$ , −5.6%,  $d = -0.22$ ). A higher score during lockdown ( $37.0 \pm 9.1$ ) indicated impaired sleep behaviors during lockdown, relative to “quarantine” camp ( $34.9 \pm 9.7$ ). There were no correlations for age, sex, and competitive experience with the ABSQ scores during lockdown and “quarantine” camp ( $p > 0.05$ ,  $r = -0.09$  to  $0.68$ ).

**Figure 4** shows the weekly activities of athletes (Section 6) during the “quarantine” camp. An effect for sex was found in “watch movie” ( $\chi^2 = 25.183$ ,  $p = 0.001$ ), “use social media” ( $\chi^2 = 14.371$ ,  $p = 0.002$ ), and “online education” ( $\chi^2 = 10.917$ ,  $p = 0.028$ ). However, all other aspects of weekly activities were not statistically different.

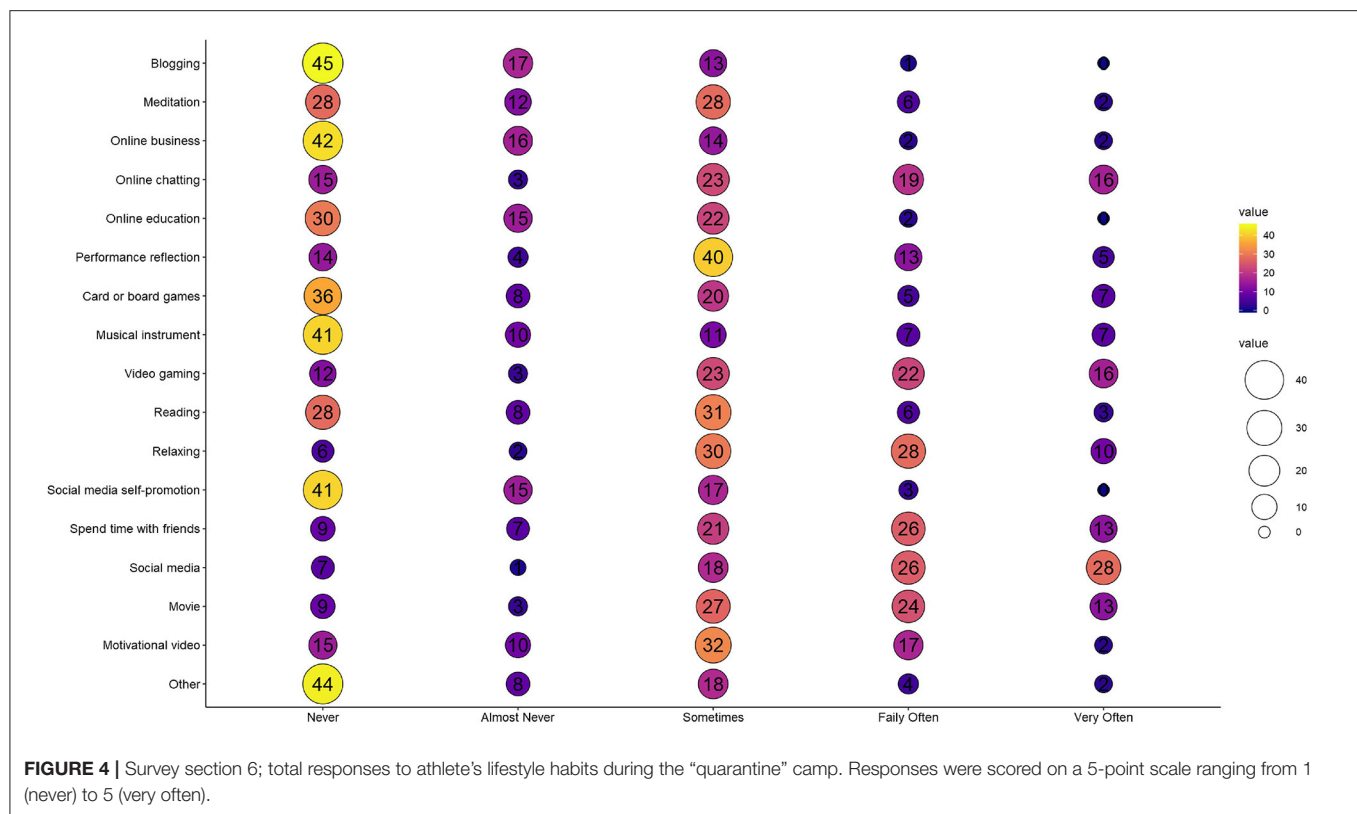
## DISCUSSION

The current study is the first to report athlete perceptions during a “quarantine” training camp. During lockdown, we observed negative effects on athlete’s access to training and recovery facilities, increased mental and emotional stress, fewer nutritional choices, reduced training motivation and increased perceived stress (all *small* to *moderate* effects). However, our findings indicate that these detrimental effects were reversed during the “quarantine” camp (all *small* to *large* effects). The “quarantine”

camps allowed athletes to complete sport-specific training with other athletes, supported by coaches and performance support staff. Compared with lockdown, athlete’s training routines, performance support, and perceived stress improved during the camp, along with sleep behaviors. These outcomes confirmed our hypotheses that the negative effects associated with COVID-19 pandemic lockdown would be reversed during a “quarantine” training camp.

We observed negative effects of lockdown on athletes’ mental (−14.1%) and emotional health (−12.8%), and training motivation (−18.7%) (all *small* effects). This finding concurs with Pillay et al. (2020) who reported one in two athletes to experience depression, feelings of energy loss and a lack of training motivation during lockdown. More recently, Ammar et al. (2020a) have also reported an increased number of people to have experienced negative effects on mental wellbeing and emotional status (10–16.5%, *small* to *moderate* change) as a result of home confinement. Such negative states may be induced by nervousness, preoccupation and apprehension caused by an individual’s perception of the situation (Trigueros et al., 2019). This is likely related to the current COVID-19 pandemic, as athletes experience uncertainty about their return to competition and their performance level (Andreato et al., 2020). We also observed reduced meal or food choices during lockdown, compared with pre-lockdown (**Figure 1**). Recent literature has reported that the confinement associated with the COVID-19 response (e.g., self-isolation or lockdown) can lead to poor diet management (Ammar et al., 2020c; Pillay et al., 2020). Many athletes may perceive eating a wide and varied diet to be an important aspect of their daily routines, which can help to maintain immunity (Yousfi et al., 2020). Therefore, a perceived limitation of nutritional choices is a likely stressor. However, the camp environment improved nutritional choices for athletes (17.5%), whilst athletes also undertook more nutrition and dietary consultations with performance staff (**Figure 2**). Overall, mental wellbeing, emotional wellbeing, training motivation, and nutritional choices were improved during the “quarantine” camp as athletes had full access to all facilities and “regained” their “normal” daily routines. It highlights why a “quarantine” camp during such a period of “catastrophe” is valuable to facilitate “normal life” of athletes, while allowing a systematic performance support to be implemented to enhance athletes’ training routines and psychological well-being.

Sleep quality and quantity appeared unaffected during lockdown, compared to pre-lockdown. Sleep quantity during lockdown (>8 h) was higher than during “quarantine” camp (<8 h), although both remain within the recommended duration for athletes (i.e., 7–9 h) (Watson, 2017). Similarly, increased sleep quantity during lockdown (from 7.2 to 8.0 h) was also observed among handball players, ascribed by mobility restrictions (Mon-López et al., 2020). Nevertheless, the sleep quantity during the “quarantine” camp appears consistent with current literature reporting elite athletes achieving <8 h of sleep per night (Lastella et al., 2015). However, recent data has highlighted the relationship between perceived stress and sleep quality (Altena et al., 2020), which is supported by other recent studies conducted in both China (Li et al., 2020) and Italy (Casagrande et al., 2020)



during the COVID-19 lockdown. Whilst we did not observe reduced sleep quality during lockdown, the ASBQ global score indicated improved sleep behaviors during the “quarantine” camp compared to lockdown ( $-5.6\%$ , *small effect*). This indicates that athlete's sleeping habits were not impacted on by the camp environment, whilst athletes could not sleep in their own bed.

Our data revealed increased perceived stress level during the lockdown, compared to pre-lockdown ( $4.4\%$ , *trivial effect*), (Figure 3). Our data are in agreement with recent research among general population (Ammar et al., 2020b) and Italian athletes (di Fronso et al., 2020). The pandemic has highlighted multiple potential stressors and individual circumstances likely determine the contributing role of each to athlete's perceived stress. COVID-19 has created new strains on elite athletes, who were associated with greater symptoms and disorders of mental health than the general population (Reardon et al., 2020). Event cancellation, contract revision with clubs, among others were likely to contribute to severe psychological state in athletes (di Fronso et al., 2020). However, we observed a reduced stress during the “quarantine” camp ( $-7.4\%$ ) when athletes were able to training “normally.” For centuries, “quarantine” has successfully been used to control the spread of contagious viruses (Hawryluck et al., 2004). Individuals placed in “quarantine” have their movement restricted from other people and report stress from the changes in the living conditions, as well as negative thoughts about one's own health or those in close proximity (Hawryluck et al., 2004). In contrast, the current study

found that the “quarantine” camp to improve the perceived stress level of athletes, possibly due to a different nature of “quarantine.” In the “quarantine” camp, despite stringent operating procedures, athletes lived more “normally” and were able to perform daily routines as an athlete whilst interacting with other athletes and staff. This differs from lockdown, whereby individuals were disconnected from most individuals, including family and friends. It should also be considered that athletes may perceive the threat of transmission of the virus to be lower within the camp, as they remain physically disconnected from the wider public. In summary, a camp environment resulted in a reduction in perceived stress for athletes, compared to lockdown, which is an important observation for those planning training in the lead-up to the delayed Tokyo 2020 Olympics.

Elite athletes are routinely surrounded by a team of professionals dedicated to maximizing performance (Heidari et al., 2019). We found similar usage of performance support services in the camp, compared to pre-lockdown (Figure 2). Interestingly, athletes utilized greater masseur and physiotherapist support during the “quarantine” camp, possibly to enhance recovery from sport-specific training following the generic training that occurred during lockdown. Away from training, a high proportion of athletes spent most of their time using social media (77%), watching movies (68%), and talking with friends (67%) during the camp (Figure 4). This supports similarly high social media use and watching of

television as the primary "home activities" recently reported among athletes during home confinement (Pillay et al., 2020). Those considering implementing "quarantine" camps may therefore wish to consider what other types of socially-distanced activities may be provided as options to athletes residing within a camp.

It should be noted that these data were obtained on a single occasion at the end of the "quarantine" camp. There is therefore the potential for recall bias and subjectivity. However, it was not possible to collect information during earlier periods given the unpredictable development of the pandemic. We also included "bespoke" questions within our survey (e.g., Section 2), for which we cannot demonstrate validity and reliability. Nevertheless, these questions were generic and we believe unlikely to be misinterpreted and as such, enhances our understanding of athlete's experiences within the camp.

To sum up, we observed a variety of negative effects in elite athletes that are associated with home confinement. However, these effects were not maintained during the "quarantine" camp, which appeared to improve aspects of athlete's routines and wellbeing, perceived stress, performance support and sleep behavior. The outcomes of the current study have important implications for policy makers, governing bodies, coaches, sports scientists considering implementing "quarantine" camps in the months leading up to the delayed Tokyo 2020 Olympic Games.

## Practical Implications

- A "quarantine" training camp offers one option for athletes to maintain "normal" training practices, with access to coaching, sports science and medical staff, whilst minimizing the risk of COVID-19 transmission with wider society.
- Following a period of home confinement, athletes may utilize greater physiotherapy/masseur support than usual to assist with the training and recovery process.
- Caution should be taken when interpreting these findings in the context of planning camps that exceed a duration of 30 days.

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## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

The questionnaires were comparable to those the participants would routinely provide as part of their official duties as national athletes. This study was conducted in accordance with high ethical standards, and approved retrospectively by the institutional review board of Institut Sukan Negara (004/2020-005/2020). The participants provided their written informed consent to participate in the study.

## AUTHOR CONTRIBUTIONS

JW: original planning, overall contribution, study conceptual, study planning, data collection, data collation, data analysis, data interpretation, manuscript (first draft), manuscript editing, and critical revision of manuscript. SM: original planning, content contribution, study planning, data collection, manuscript (first draft), and manuscript editing. PL and CC: content contribution, study planning, data collection, manuscript (first draft), and manuscript editing. CJ: overall contribution, study conceptual, study planning, data collection, data interpretation, manuscript (first draft), manuscript editing, and critical revision of manuscript. All authors contributed to the article and approved the submitted version.

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# Impact of COVID-19 Pandemic on University Students' Physical Activity Levels: An Early Systematic Review

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**Purpose:** This systematic review aimed to analyze the impact that the COVID-19 lockdown had on the amount of physical activity performed by university students.

**Materials and Methods:** A systematic electronic search for studies providing information regarding physical activity levels pre and during COVID-19 pandemic in university students was performed up to 20th October 2020 in the databases Cochrane Library, PubMed, SPORTDiscus, and Web of Science. The risk of bias of external validity quality of included studies was assessed by means of those the Newcastle-Ottawa Scale (NOS). The quality of the evidence for main outcomes was graded using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.

**Results and Conclusions:** A total of 10 studies were selected. Physical activity levels were assessed by means of questionnaires (10 studies) and accelerometer (1 study). Risk of bias was regarded as low and high in six and four investigations, respectively. The quality of evidence was downgraded to low. A significant reduction of physical activity levels were observed in 9 studies. Compared to pre-lockdown values, five studies showed a reduction of light/mild physical activity (walking) between 32.5 and 365.5%, while seven studies revealed a reduction of high/vigorous physical activity between 2.9 and 52.8%. Walking, moderate, vigorous, and total physical activity levels have been reduced during the COVID-19 pandemic confinements in university students of different countries. Despite of the reductions, those who met the current minimum PA recommendations before the lockdown generally met the recommendations also during the confinements.

**Keywords:** COVID-19, physically active lifestyle, undergraduate students, college students, tertiary education, lockdown, confinement, quarantine

## INTRODUCTION

The world is experiencing a life-threatening situation due to the COVID-19 pandemic. By 14th October 2020, there have been 37,888,384 confirmed cases, including 1,081,868 deaths (World Health Organization, 2020a). We still do not have silver bullets or shortcuts, and the answer requires to use every single tool in the toolbox (World Health Organization, 2020b). To this purpose, one of the most important strategies is to reduce mixing of susceptible and infectious people through early ascertainment of cases or reduction of contact (i.e., social distancing; Lewnard and Lo, 2020), implementing measures such as quarantines and lockdowns, which have proven highly effective in controlling the spread of the disease (Baker et al., 2020). These extreme measures, nevertheless, not only have economic consequences (Bonaccorsi et al., 2020). Changes in lifestyle such as reduced physical activity (PA) and unhealthy diet (Ammar et al., 2020a), as well as compulsory measures such as social distance derived from the lockdowns, can also affect both the physical and the mental health of the population worldwide (Ammar et al., 2020b; Mattioli et al., 2020).

Physical inactivity is considered as another pandemic by itself (Hall et al., 2020). It is a major cause of non-communicable chronic diseases, responsible for more than three million premature deaths per year worldwide (Lee et al., 2012; Lim et al., 2012) and the conservatively estimated cost for the healthcare systems was \$53.8 billion dollars in 2013 (Ding et al., 2016). Before the COVID-19 outbreak, globally, 23% of adults and 81% of adolescents (aged 11–17 years) did not meet the World Health Organization global recommendations on PA for health (World Health Organization, 2018), and the trend was that physical inactivity was not increasing, while it was time spent on sedentary behavior (Guthold et al., 2018; Du et al., 2019).

Previous studies have identified an increase in physical inactivity during the transition from adolescence to adulthood and throughout the college/university years (Bray and Born, 2004; Jung et al., 2008; Crombie et al., 2009; Pullman et al., 2009; Kwan et al., 2012). Pengpid et al. (2015) estimated that prevalence of physical inactivity among university students in 23 low, middle and high-income countries was 41%.

Social distancing and confinements have largely altered the lifestyle of university students, and it is not clear how the changes in the aforementioned factors are affecting the PA levels of this population. This review aimed to analyze if the PA levels of university students changed during the confinements and their adherence to the current global PA recommendations. Despite existing recommendations, suggesting several potential tactics (i.e. home-based exercise, dance, yoga) to keep active during the lockdown that are available to young populations (Chtourou et al., 2020), we hypothesized that total PA levels would be reduced due to the confinement.

## METHODS

This systematic review was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis

(PRISMA) guidelines (Moher et al., 2009). The PRISMA checklist is presented in Appendix 1 (**Supplementary Material**).

## Search Strategy

A systematic computerized search was conducted up to 20th October 2020 in the databases Cochrane Library, PubMed, SPORTDiscus and Web of Science, following search terms included in Boolean search strategies: (coronavirus OR COVID-19 OR lockdown) AND (physical activity OR exercise OR activity) AND (university OR college OR student). Finally, the reference lists of the studies recovered were hand-searched to identify potentially eligible studies not captured by the electronic searches. Search strategies can be found in online Appendix 2 (**Supplementary Material**).

Two reviewers independently (AL-V and DS-I): (a) screened the title and abstract of each reference to locate potentially relevant studies, and once hard copies of the screened documents were obtained; (b) reviewed them in detail to identify articles that met the selection criteria. A third external reviewer (CA) was consulted to resolve discrepancies between reviewers in the studies selection.

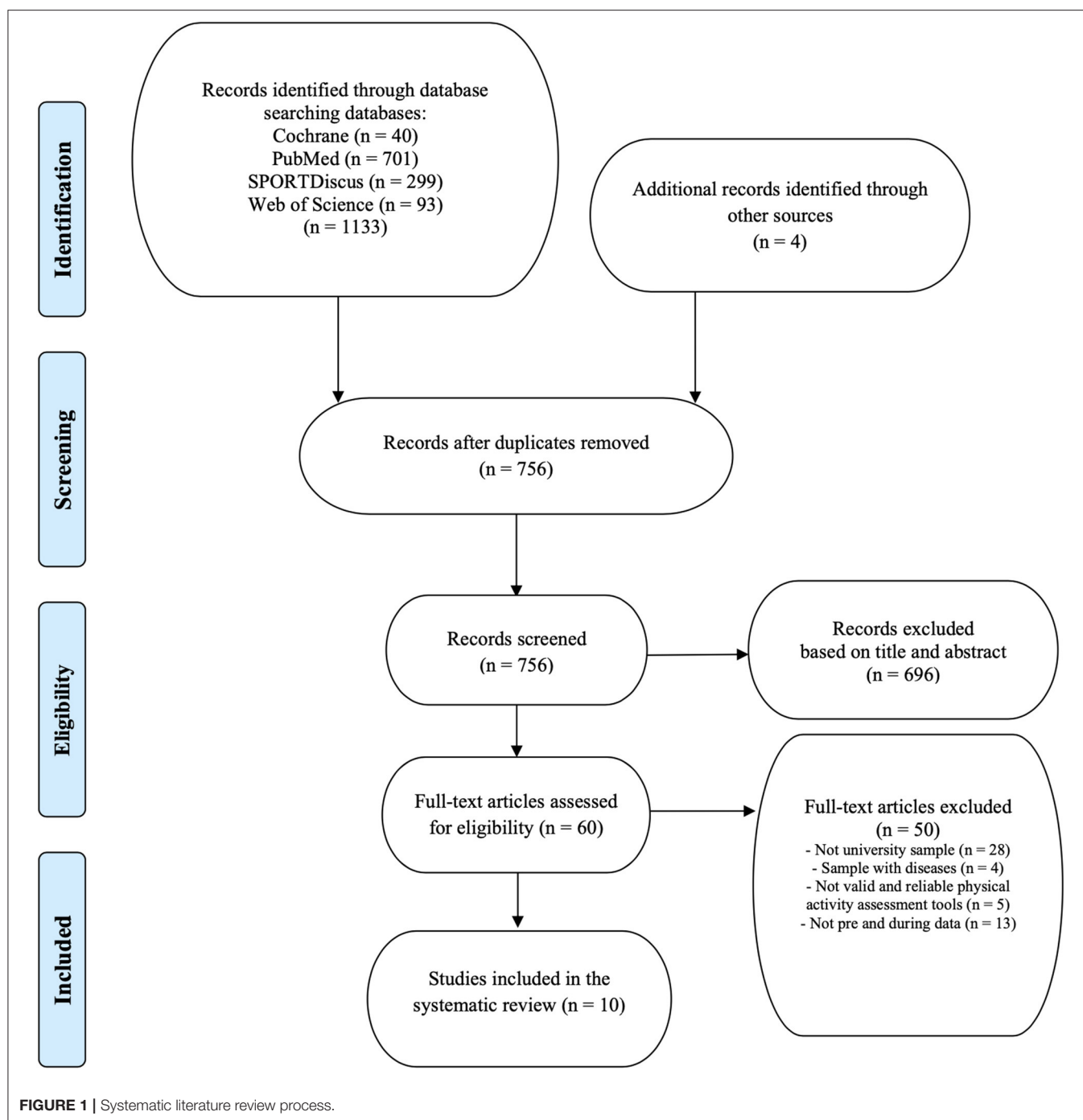
## Study Selection

To be included in this systematic review studies had to fulfill the following criteria: (1) studies had to report PA levels pre and during COVID-19 pandemic in university students; (2) studies had to assess PA level through a valid and reliable tool; (3) studies had to be published in a peer-reviewed journal before 20th October 2020; (4) studies had to be written in English or Spanish. Literature reviews, abstracts, editorial commentaries, and letters to the editors were excluded.

## Risk of Bias and Quality of the Evidence

Two reviewers independently assessed the risk of bias of external validity quality of included studies using the “Newcastle-Ottawa Scale (NOS)” for cohort studies. The original NOS is a quality assessment tool for cohort and case-control studies which contains eight items categorized into three domains (selection, comparability and exposure) and uses a star rating system to indicate the quality of a study (one star for each item within the Selection and Outcome categories, and a maximum of two stars in Comparability category) (Wells et al., 2012). NOS scores categorized into three groups: very high risk of bias (0–3 NOS points), high risk of bias (4–6), and low risk of bias (7–9) (Lo et al., 2014).

The quality of the evidence for main outcomes was graded (high, moderate, low, or very low certainty) using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. Four different GRADE factors were used in this meta-analysis: risk of bias, inconsistency, indirectness and imprecision (Guyatt et al., 2011). The starting point was always the assumption that the pooled or overall result was of high quality. The quality of evidence was subsequently downgraded by one or two levels per factor to moderate, low, or very low when there is a risk of bias, inconsistency, imprecision or indirect results (Balshem et al., 2011).



In order to assess the inter-coder reliability of the coding process, two researchers coded all studies (including risk of bias and quality of the evidence assessment). The inconsistencies between the two coders were resolved by consensus, and when these were due to ambiguity in the coding book, this was corrected. As previously mentioned, any disagreement was resolved by mutual consent in consultation with a third reviewer.

## RESULTS

### Descriptive Characteristics of the Studies

One thousand one hundred thirty-seven references were identified after search process in four databases, of which 10 (Ács et al., 2020; Barkley et al., 2020; Gallè et al., 2020; Gallo et al., 2020; Karuc et al., 2020; Maher et al., 2020; Romero-Blanco



**TABLE 1 |** Characteristics of the included studies in the review.

Study and Country	Design (type study/registration time/assessment)	Final sample	PA assessment tool	Severity of restricted internal movement by country	Levels of PA pre COVID-19 lockdown	Levels of PA during COVID-19 lockdown	Other results
Ács et al. (2020) Hungary	Cross-sectional study April-end of May Q	$N = 827$ students of 10 faculties at the University of Pécs ( $25.3 \pm 8.1$ years old) $\sigma^2 = 182$ $\varphi = 645$	IPAQ	National state of emergency. Universities were ordered to suspend in-person classes and switch to online eLearning courses	Walking, <i>min/week</i> : $342.6 \pm 303.5$ Moderate, <i>min/week</i> : $126.7 \pm 213.7$ Vigorous, <i>min/week</i> : $142.9 \pm 195.7$ Total PA, <i>min/week</i> : $609.8 \pm 499.2$	Walking, <i>min/week</i> : $162.5 \pm 237.8$ ( $\downarrow 52.6\%$ ) [ $p < 0.001$ ] Moderate, <i>min/week</i> : $136.7 \pm 220.6$ ( $\uparrow 7.9\%$ ) [ $p = 0.170$ ] Vigorous, <i>min/week</i> : $138.7 \pm 180.5$ ( $\downarrow 2.9\%$ ) [ $p = 0.484$ ] Total PA, <i>min/week</i> : $435.4 \pm 472.0$ ( $\downarrow 28.6\%$ ) [ $p < 0.001$ ]	Pre-lockdown: vigorous PA was higher among $\sigma^2$ than $\varphi$ ( $p = 0.047$ ) No significant difference was found between genders in comparing total values of PA before and during COVID-19 ( $p = 0.532$ , $p = 0.700$ , respectively)
Alarcón Meza and Hall-López (2021) Mexico	Cross-sectional study DNS Q	$N = 32$ students of the Faculty of Sports of the Autonomous University of Baja California ( $21.4 \pm 3.6$ years old) $\sigma^2 = 17$ $\varphi = 15$	IPAQ	—	Low, % of participants: 3.6% Moderate, % of participants: 5.2% High, % of participants: 91.2 Weekly energy expenditure of PA, MET- <i>min/week</i> : 6,473	Low, % of participants: 10.9 ( $\uparrow 7.3\%$ ) Moderate, % of participants: 6.8 ( $\uparrow 1.6\%$ ) High, % of participants: 82.3 ( $\downarrow 8.9\%$ ) Weekly energy expenditure PA, MET- <i>min/week</i> : 4,297 ( $\downarrow 33.6\%$ ) [ $p = 0.005$ ]	
Barkley et al. (2020) USA	Cross-sectional study May 18–June 3 Q	$N = 100$ undergraduate students ( $26.9 \pm 8.9$ years old)	GSLTPAQ <sup>a</sup>	20 March, the campus (including all fitness facilities) was closed soon thereafter and all students were sent home 22 March, the university's home state issued a "stay at home" order	Mild, <i>Godin score</i> : $16.3 \pm 22.6$ Moderate, <i>Godin score</i> : $15.0 \pm 15.7$ Vigorous, <i>Godin score</i> : $16.0 \pm 22.1$ Total PA, <i>Godin score</i> : $47.2 \pm 40.2$	Mild, <i>Godin score</i> : $10.8 \pm 12.9$ ( $\downarrow 32.5\%$ ) [ $p = 0.015$ ] Moderate, <i>Godin score</i> : $12.9 \pm 12.4$ ( $\downarrow 14\%$ ) Vigorous, <i>Godin score</i> : $14.0 \pm 17.9$ ( $\downarrow 12.5\%$ ) Total PA, <i>Godin score</i> : $37.7 \pm 30.7$ ( $\downarrow 20.1\%$ )	
Gallè et al. (2020) Italy	Cross-sectional study Last three weeks of May Q	$N = 1,430$ students from three Italian universities ( $22.9 \pm 3.5$ years old) $\sigma^2 = 494$ $\varphi = 936$	IPAQ	Localized and national lockdown. Grocery shopping and walking pets were the only activities allowed	Walking, <i>min/week</i> : 480 Moderate, <i>min/week</i> : 199.3 Vigorous, <i>min/week</i> : 138.6 Total PA, <i>min/week</i> : $520 \pm 820$	Walking, <i>min/week</i> : 114.5 ( $\downarrow 365.5\%$ ) [ $p < 0.05$ ] Moderate, <i>min/week</i> : 148.1 ( $\downarrow 51.2\%$ ) [ $p < 0.05$ ] Vigorous, <i>min/week</i> : 108.3 ( $\downarrow 30.3\%$ ) [ $p < 0.05$ ] Total PA, <i>min/week</i> : $270 \pm 340$ ( $\downarrow 50\%$ ) [ $p < 0.0001$ ]	During lockdown: 639 participants (44.7%) remained sufficiently active. Being younger than 22 years old, female, and previously active, attending the universities of Naples and Rome, and having at least one graduate parent were associated with the achievement of recommended levels of PA

(Continued)

TABLE 1 | Continued

Study and Country	Design (type study/registration time/assessment)	Final sample	PA assessment tool	Severity of restricted internal movement by country	Levels of PA pre COVID-19 lockdown	Levels of PA during COVID-19 lockdown	Other results
Gallo et al. (2020) Australia	Longitudinal study Pre: March 19–21 2018 (T <sub>1</sub> ), March 25–27 2019 (T <sub>2</sub> ), and March 29–April 3 2020 (T <sub>3</sub> ) During: May 12–26 (T <sub>4</sub> ) Q	<i>N</i> = 509 students from the University of Queensland (22.5 ± 0.08 years old) $\sigma$ = 214 $\varphi$ = 295	The Active Australia Survey	Localized lockdown 23 March, all but essential services were shut down and universities transitioned all undergraduate learning online 30 March, people were only allowed to leave their homes for work (in an essential service), or to purchase food, receive or provide medical care, or exercise	$\sigma$ Walking, <i>min/week</i> (median ± IQR): T <sub>1</sub> : ~150 ± ~100; ~250 T <sub>2</sub> : ~130 ± ~100; ~220 $\sigma$ Vigorous, <i>min/week</i> (median ± IQR): T <sub>1</sub> : ~245 ± ~110; ~400 T <sub>2</sub> : ~135 ± ~100; ~300 $\varphi$ Walking, <i>min/week</i> (median ± IQR): T <sub>1</sub> : ~125 ± ~100; ~90 T <sub>2</sub> : ~125 ± ~100; ~200 $\varphi$ Vigorous, <i>min/week</i> (median ± IQR): T <sub>1</sub> : ~120 ± ~60; ~220 T <sub>2</sub> : ~120 ± ~55; ~215	$\sigma$ Walking, <i>min/week</i> (median ± IQR): T <sub>3</sub> : ~75 ± ~60; ~145 (T <sub>1</sub> : ↓50%; T <sub>2</sub> : ↓42.3%) [ <i>p</i> < 0.0001 between T <sub>3</sub> and T <sub>1</sub> ] $\sigma$ Vigorous, <i>min/week</i> (median ± IQR): T <sub>3</sub> : 100 ± ~70; ~220 (T <sub>1</sub> : ↓59.2%; T <sub>2</sub> : ↓25.9%) [ <i>p</i> < 0.0001 between T <sub>3</sub> and T <sub>1</sub> ] $\varphi$ Walking, <i>min/week</i> (median ± IQR): T <sub>3</sub> : ~100 ± ~50; ~185 (T <sub>1</sub> : ↓20%; T <sub>2</sub> : ↓20%) [ <i>p</i> < 0.05 between T <sub>3</sub> and T <sub>2</sub> ] $\varphi$ Vigorous, <i>min/week</i> (median ± IQR): T <sub>3</sub> : ~90 ± ~55; ~145 (T <sub>1</sub> : ↓25%; T <sub>2</sub> : ↓25%)	$\sigma$ Time spent walking: T <sub>3</sub> < T <sub>2</sub> (↓52.5 min) [ <i>p</i> < 0.05] T <sub>3</sub> < T <sub>1</sub> (↓87.5 min) [ <i>p</i> < 0.0001] $\sigma$ Time spent in vigorous activity [ <i>p</i> < 0.0001]: T <sub>3</sub> < T <sub>2</sub> (↓60 min) [ <i>p</i> < 0.05] T <sub>3</sub> < T <sub>1</sub> (↓150 min) [ <i>p</i> < 0.0001] $\varphi$ Time spent walking: T <sub>3</sub> < T <sub>2</sub> (↓30 min) [ <i>p</i> < 0.05] T <sub>3</sub> < T <sub>1</sub> (↓30 min) [ <i>p</i> < 0.068] $\sigma$ No differences in time spent in vigorous activity between the time points of the study PA levels T <sub>4</sub> vs. T <sub>3</sub> : No change for the majority of $\sigma$ PA levels T <sub>4</sub> vs. T <sub>3</sub> : increased for >40% of $\varphi$
Karuc et al. (2020) Croatia	Longitudinal survey design April 24–May 8 Q	<i>N</i> = 91 university students $\sigma$ = 32 (21.5 ± 0.3 years old) $\varphi$ = 59 (21.6 ± 0.4 years old)	SHAPES	National lockdown. Government measures to restrict gathering in public places and parks, suspend public transportation, and close institutions. All social gatherings, work in retail and services including sports activities were prohibited	$\sigma$ MVPA, <i>min/day</i> (median ± IQR): 135 ± 127.5 $\varphi$ MVPA, <i>min/day</i> (median ± IQR): 120 ± 227.1	$\sigma$ MVPA, <i>min/day</i> (median ± IQR): 85.7 ± 56.8 (↓36.5%; ↓57.7 <i>min/day</i> [ <i>p</i> = 0.006]) $\varphi$ MVPA, <i>min/day</i> (median ± IQR): 64.3 ± 75.0 (↓46.4%; 64.8 <i>min/day</i> [ <i>p</i> < 0.0001])	$\sigma$ Same PA levels: 31% $\sigma$ Increased PA levels: 19% $\sigma$ Decreased PA levels: 50% $\varphi$ Same PA levels: 25% $\varphi$ Increased PA levels: 19% $\varphi$ Decreased PA levels: 56%
Maier et al. (2020) USA	Cross-sectional study Pre: January 21–March 11 During: April 17–May 5 Q	<i>N</i> = 107 undergraduate kinesiology students (21.7 ± 2.6 years old)	IPAQ-SF	March 13, campus closure March 25, executive orders banning mass gatherings and closure of non-essential businesses for the state March 30–May 8, mandatory stay-at-home orders for the state	MVPA, <i>min/week</i> : 424.6 ± 372.0	MVPA, <i>min/week</i> : 324.7 ± 316.6 (↓23.5%) [ <i>p</i> = 0.02]	

(Continued)

TABLE 1 | Continued

Study and Country	Design (type study/registration time/assessment)	Final sample	PA assessment tool	Severity of restricted internal movement by country	Levels of PA pre COVID-19 lockdown	Levels of PA during COVID-19 lockdown	Other results
Romero-Blanco et al. (2020) Spain	Cross-sectional study Pre: January 15–30 During: April 1–15 Q	$N = 213$ health sciences students ( $20.5 \pm 4.5$ years old) $\sigma = 41$ $\varphi = 172$	IPAQ-SF	Localized and national lockdown March–April, prohibition on going outside to engage in sporting or social activities	Moderate, <i>min/week</i> : $42.8 \pm 48.4$ Vigorous, <i>min/week</i> : $28.5 \pm 54.1$ Total PA, <i>min/week</i> : $223.3 \pm 305.5$ $\sigma$ Total PA, <i>min/week</i> : $226.5 \pm 250.1$ <i>min/week</i> $\varphi$ Total PA, <i>min/week</i> : $222.5 \pm 317.9$	Moderate, <i>min/week</i> : $47.7 \pm 50.8$ ( $\uparrow 4.7\%$ ) [ $p = 0.353$ ] Vigorous, <i>min/week</i> : $30.6 \pm 30.9$ ( $\uparrow 7.4\%$ ) [ $p = 0.07$ ] Total PA, <i>min/week</i> : $383.2 \pm 438.9$ ( $\uparrow 71.6\%$ ) [ $p < 0.001$ ] $\sigma$ Total PA, <i>min/week</i> : $279.9 \pm 446.9$ ( $\uparrow 23.6\%$ ) [ $p = 0.339$ ] $\varphi$ Total PA, <i>min/week</i> : $407.8 \pm 404.8$ ( $\uparrow 83.3\%$ ) [ $p < 0.001$ ]	
Sañudo et al. (2020) Spain	Longitudinal survey design Pre: one week in February During: March 24–3 April Q and accelerometer	$N = 20$ university students ( $22.6 \pm 3.4$ years old) $\sigma = 11$ $\varphi = 9$	IPAQ Wristband	Localized and national lockdown March–April, prohibition on going outside to engage in sporting or social activities	Walking, <i>min/week</i> : $362 \pm 262$ Moderate, <i>min/week</i> : $441 \pm 487$ Moderate-to-vigorous, <i>min/week</i> : $797 \pm 822$ Vigorous, <i>min/week</i> : $356 \pm 381$ <i>min/week</i> Objectively measured PA, <i>steps/day</i> : $8,525 \pm 3,597$	Walking, <i>min/week</i> : $27 \pm 47$ ( $\downarrow 92.5\%$ ) [ $p < 0.0001$ ] Moderate, <i>min/week</i> : $178 \pm 155$ ( $\downarrow 59.7\%$ ) [ $p = 0.028$ ] Moderate-to-vigorous PA, <i>min/week</i> : $346 \pm 341$ ( $\downarrow 56.6\%$ ) [ $0.005$ ] Vigorous, <i>min/week</i> : $168 \pm 228$ ( $\downarrow 52.8\%$ ) [ $p = 0.006$ ] Objectively measured PA, <i>steps/day</i> : $2,754 \pm 1,724$ ( $\downarrow 67.7\%$ ) [ $p < 0.0001$ ]	Participants meeting the PA guidelines (WHO): 84% at pre-lockdown, 74% during lockdown
Savage et al. (2020) England	Longitudinal cohort study Pre: October 14–20 2019 ( $T_1$ ), January 28–February 3 2020 ( $T_2$ ) During: March 20–26 March ( $T_3$ , 1st week of lockdown), 27 April 27–May 3 ( $T_4$ , 5th week of lockdown) Q	$N = 214$ students from East Midlands university (20 years old) $\sigma = 60$ $\varphi = 154$	EVS	People in the United Kingdom were required to stay at home as much as possible and were only allowed to leave once per day for exercise	$\sigma$ MVPA, <i>min/week</i> : $T_1: 296 \pm 254$ $\varphi$ MVPA, <i>min/week</i> : $T_1: 231 \pm 232$	$\sigma$ MVPA, <i>min/week</i> : $T_4: 220 \pm 252$ ( $\downarrow 25.7\%$ ) $\varphi$ MVPA, <i>min/week</i> : $T_4: 222 \pm 208$ ( $\downarrow 3.9\%$ )	At all-time points: average MVPA > 150 min/week During $T_3$ – $T_4$ : $\downarrow 28$ min/week of moderate to vigorous PA (on average) The reduction in PA was more pronounced in $\sigma$ than $\varphi$

–, Not information available; min, minutes; DNS, date not specified; EVS, Exercise Vital Sign questionnaire; GSLTPAQ, Godin-Shephard Leisure-Time Physical Activity Questionnaire; IPAQ, International Physical Activity Questionnaire; IPAQ-SF, International Physical Activity Questionnaire-Short Form; SHAPES, School Health Action, Planning, and Evaluation System questionnaire; MET, metabolic equivalent; MVPA, moderate-vigorous physical activity; PA, physical activity; Q, questionnaire/survey.

<sup>a</sup>A score for each intensity is calculate using the following equations: times per week participating in strenuous  $\times 9$ , moderate  $\times 5$ , mild  $\times 3$ . Each of these individual scores was then summed for a total physical activity score.  $\varphi$ , female;  $\sigma$ , male;  $\uparrow$ , increase;  $\downarrow$ , decrease/decline.

**TABLE 2 |** Risk of bias assessment of the studies (Newcastle-Ottawa scale).

Study	Criteria for assessing risk of bias								Total
	1	2	3	4	5	6	7	8	
Ács et al. (2020)	*	*	*		*	*	*		6
Alarcón Meza and Hall-López (2021)	*	*	*		**	*	*		7
Barkley et al. (2020)	*	*	*		*	*	*		6
Gallè et al. (2020)	*	*	*		*	*	*		6
Gallo et al. (2020)	*	*	*		*	*	*	*	7
Karuc et al. (2020)	*	*	*		*	*	*		6
Maher et al. (2020)	*	*	*		*	*	*	*	7
Romero-Blanco et al. (2020)	*	*	*		*	*	*	*	7
Sañudo et al. (2020)	*	*	*		**	*	*	*	8
Savage et al. (2020)	*	*	*		*	*	*	*	7

Criteria for assessing risk of bias: (1) representativeness of the exposed cohort; (2) selection of the non-exposed cohort; (3) ascertainment of exposure; (4) demonstration that outcome of interest was not present at start of study; (5) comparability of cohorts on the basis of the design or analysis (A maximum of two stars can be allotted in this category); (6) assessment of outcome; (7) was follow-up long enough for outcomes to occur; (8) adequacy of follow-up of cohorts.

\*Star(s) awarded for each criterion.

et al., 2020; Sañudo et al., 2020; Savage et al., 2020; Alarcón Meza and Hall-López, 2021) met the inclusion criteria. **Figure 1** shows the flow chart of the selection process of the studies. The main characteristics of the studies included in this systematic review are presented in **Table 1**. Two studies were carried out in Spain, two in The United States of America, one in Australia, one in Croatia, one in England, one in Hungary, one in Italy and one in Mexico. The total sample size was larger than 3,500 university students.

Six out of ten studies used International Physical Activity Questionnaire (IPAQ) as tool to assess the level of PA performed by university students, while the Godin physical activity questionnaire, the Active Australia Survey, the School Health Action, Planning, and Evaluation System (SHAPES) questionnaire and Exercise vital sign (EVS) questionnaire were used in the rest of studies. Only one study (Sañudo et al., 2020) used an objective tool to assess PA (accelerometer). Regarding the level of the lockdown by country, most of the studies (Alarcón-Meza's study did not indicate the country's measures regarding PA during lockdown), reflected that national lockdown included a restriction for outdoor PA.

With regards to the reporting risk of bias of the studies, NOS scale showed that six studies had low risk of bias, while four studies got 6 stars, so they show a high risk of bias. The quality of evidence according to GRADE was downgraded to low (risk of bias, and indirectness). The detailed data for NOS and GRADE scales are presented in **Tables 2, 3**, respectively.

## Physical Activity Levels

Nine out of the ten studies included in the systematic review showed significant decreases in PA levels during lockdown, both in questionnaires as accelerometers. Surprisingly, one study (Romero-Blanco et al., 2020) showed significant increases in

PA levels among university students during lockdown. Romero-Blanco et al. (2020) showed that Health Sciences university students performed significantly higher minutes/week of total PA (+71.6%) and vigorous PA (+7.4%), both males (+ 83.3%) as females (+ 23.6%). On the other hand, Sañudo et al. (2020) showed an objective reduction in PA with 67.7% fewer steps per day during the lockdown. In the same line, five studies showed a reduction of light/mild PA (walking) between 32.5 and 365.5% compared to the period prior to confinement (Ács et al., 2020; Barkley et al., 2020; Gallè et al., 2020; Gallo et al., 2020; Sañudo et al., 2020), three studies found a decrease in moderate PA levels (from 14–59.7%) (Barkley et al., 2020; Gallè et al., 2020; Sañudo et al., 2020) and four studies in moderate-to-vigorous PA (MVPA) (from 3.9–56.6%) (Karuc et al., 2020; Maher et al., 2020; Sañudo et al., 2020; Savage et al., 2020). Finally, seven studies also revealed a reduction of high/vigorous PA between 2.9 and 52.8% compared to pre-lockdown (Ács et al., 2020; Barkley et al., 2020; Gallè et al., 2020; Gallo et al., 2020; Romero-Blanco et al., 2020; Sañudo et al., 2020; Alarcón Meza and Hall-López, 2021) and two studies showed a decrease of total PA (28.6 and 50%) (Ács et al., 2020; Gallè et al., 2020). Regarding gender differences, two studies found a higher reduction of walking, vigorous and MVPA in males (Gallo et al., 2020; Savage et al., 2020), while only one study showed a higher reduction in females (Karuc et al., 2020). Otherwise, Romero-Blanco et al. (2020) found that women had performed more PA (min/week) than male during lockdown. The main results of the studies included in this systematic review are presented in **Table 1**. According to the reported data, those students who met the PA recommendations before the confinement took place, were still classified as physically active during the lockdown period.

## DISCUSSION

This review aimed to analyze if PA levels of university students changed during the confinements in different countries. Our results are of interest from a public health perspective to the purpose of addressing the impact of the confinements on health-related habits such as PA and how we could help to reduce it and its derived problems.

We found that total of nine out of the ten included studies reported significant decreases in PA levels during the confinements. These results are in line with the findings from previous studies in both adults and children. Castañeda-Babarro et al. (2020) reported significant decreases in self-reported vigorous PA and walking time of 16.8 and 58.2%, respectively; whereas time spent in sedentary behavior increased during the confinement in Spain. The student group (from children to university students) showed the highest decrease in moderate, vigorous, and waking activities. In the mini-review from Arora and Grey (2020) the authors reported that increased social isolation is associated with higher rates of physical inactivity and sedentarism in adults. Dunton et al. (2020) reported that the COVID-19 pandemic has also negatively affected the PA levels of children living in the United States.



**TABLE 3 |** Summary of findings (GRADE).

N° of studies	Certainty assessment						Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	
Physical activity level pre-during COVID lockdown							
10	Observational studies	Serious <sup>a</sup>	Not serious	Serious <sup>b</sup>	Not serious	Very strong association	⊕⊕○○ LOW

<sup>a</sup>Four studies reported high risk of bias (assessed with the Newcastle Ottawa Scale). <sup>b</sup>The information provided by two studies does not answer completely the main question about levels of physical activity. These circles represent the degree of certainty of the variable analysed on the GRADE scale. A circle with a "+" symbol inside represents a very low certainty of this variable, two circles with the "+" symbol inside represent low certainty, three circles with the "+" symbol indicate moderate certainty and the four circles with the symbol "+" represent a high certainty of this variable.

University students generally reduce its PA levels compared to their childhood. Factors affecting the decline of PA levels during this life stage include changes in psychosocial aspects and residency (i.e. distance to the university; Van Dyck et al., 2015) and greater time demands, such as work and class time (Calestine et al., 2017). Our findings expand this previous knowledge by suggesting that the reduction in total PA levels has been exacerbated during the confinements.

This finding is important for two main aspects. First, because it has been reported that the confinements developed to fight COVID-19 have increased mental health problems in both adults (Guo et al., 2020; Holingue et al., 2020; van Tilburg et al., 2020) and young populations (Arora and Grey, 2020; Jiao et al., 2020; Savage et al., 2020). Our results confirm that PA levels were generally reduced during the lockdowns compared to the previous situation. Efforts should be made to increase PA levels in this situation not only for the sake of physical health but also psychological well-being. Furthermore, incentivizing a routine through daily at-home PA could help maintaining a certain sense of routine and organization, helping to maintain mental health during the lockdown and also facilitate the routine back to university (Burtscher et al., 2020). Second, because it is well-known that sedentary behavior and insufficient PA patterns in childhood are likely to persist into adulthood, increasing the risk of major health complications (i.e. being overweight or obese, type II diabetes or hypertension; 2018 Physical Activity Guidelines Advisory Committee, 2018) and university students are transitioning within these two life stages.

Another interesting finding from our review is that, generally, those that were sufficiently active before the confinement (i.e., achieving current minimum recommendations for adults of at least 150 min per week of MVPA; U.S. Department of Health Human Services, 2018), were also sufficiently active during the lockdown, despite the reduction in PA levels. This finding, which has been reported also in adults (Castañeda-Babarro et al., 2020), could suggest that achieving the recommendations on MVPA help in creating a stronger habit of being physically active, which seemed not to be affected to a large extent by the confinements imposed due to COVID-19.

Our study has some strengths and limitations than need to be considered. First, while we included more than 3.500 university students from eight different countries, the pandemic affected

differently each country and the level of restrictions may not be generalizable to other countries that were not represented in our review. Second, while we had some studies using direct measurements of PA, data were mostly collected from self-report, which is susceptible to cognitive bias. Third, we included six studies with low risk of bias following our methodological quality assessment, but the other 4 were considered to present high risk of bias. Fourth, a meta-analysis was not performed due to the heterogeneity of measurement tools, analyses and populations in the included studies, as well as in their methodological quality. Fifth, the heterogeneity in the analyses carried out in these studies did not allow to draw firm conclusions on how PA levels were differently affected for men and women. Finally, we included people from generally high-income countries.

Taken together, our findings suggest a decrease in PA levels from before to during the COVID-19 outbreak in university students of Australia, Croatia, England, Hungary, Italy, Mexico, Spain, and USA. In times of pandemic crisis, government and university leaders across these countries need to implement measures and advice to encourage this population to increase and maintain adequate levels of PA, as recently suggested by the WHO (Bull et al., 2020). In this context, a set of practical recommendations on how to be active outdoors and indoors during the current and ongoing COVID-19 pandemic can be applied to university students (Bentlage et al., 2020; Ammar et al., 2021). Physical activity programs, individually tailored to the participant's fitness level, should be developed. These programs could be delivered through gamification, communication and interactive coaching technologies (Ammar et al., 2021). For instance, group-based interventions using active videogames seem to be a motivating, enjoyable easy-to-use strategy for reducing social isolation among younger age groups (Viana and de Lira, 2020). This is of particular concern given the experience of loneliness tends to be most common in young adults (Beam and Kim, 2020). However, professional physical guidance, especially in the context of online PA sessions, is needed for university students (Deng et al., 2020). Hence, the work of exercise professionals would be essential to ensure that PA programs are properly designed, monitored and implemented, which is of most importance to guarantee safety and efficacy of exercise training and long-term PA adherence (Natalucci et al., 2020).

## CONCLUSION

Walking, moderate, vigorous, and total PA levels have been reduced during the COVID-19 pandemic confinements in university students of different countries. Despite of the reductions, those who met the current minimum PA recommendations before, generally met the recommendations also during the confinements.

## DATA AVAILABILITY STATEMENT

The original contributions generated for the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

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## AUTHOR CONTRIBUTIONS

DS-I and CA contributed in the conception and design of the study. AL-V and DS-I took part in the acquisition and analysis of data. AL-V, MAS-L, and CA contributed drafting the article. DS-I, AL-V, and CA approved the last version to be published. All authors were involved in interpretation of the data. All authors critically revised the article for important intellectual content.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2020.624567/full#supplementary-material>

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# Change in Soccer Substitutions Rule Due to COVID-19: Why Only Five Substitutions?

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## INTRODUCTION

Soccer has a high rate and percentage of injuries (Elias, 2001; Wong and Hong, 2005), and more injuries have been observed in soccer than in several other sports (Yde and Nielsen, 1990; Wong and Hong, 2005). Interestingly, the injury rate is markedly higher (~10 times) during matches than training sessions (López-Valenciano et al., 2020), due to several factors such as higher overall demands (e.g., number of contacts/collisions), higher fatigue (e.g., competing against opponents in matches instead of teammates in training) would potentiate these discrepancies (Ekstrand et al., 2011a,b; López-Valenciano et al., 2020). Additionally, the incidence of injuries increases toward the end of each half, indicating that fatigue is involved in injury etiology (López-Valenciano et al., 2020). In training sessions, coaches control the load (e.g., the number of sprints, duration of the session), but load management is much more difficult due to external factors and the nature of the match. Therefore, beyond all previous preparation of the players (e.g., training plan, nutrition, recovery strategies), it is reasonable to consider that “a better” match management (e.g., changes in the rules) might support injury prevention.

From a scientific mindset, the rules of each sport are the cause (independent variable), and the “way to play” is the effect (dependent variable). For example, the recent change in the goal kick rule in soccer: i.e., now the ball no longer has to leave the penalty area before it can be played (FIFA.com, 2020a), has changed the strategies of the teams, and consequently preparation for matches. Analyzing the rules may be fundamental to making rule changes, aiming to enhance a sport (Vamplew, 2007), making the sport safer (e.g., shin guards), healthier (e.g., timeouts for hydration), fairer (e.g., video assistant referee), or more entertaining (i.e., advantageous to sponsors and fans).

Recently we showed that elite soccer has singularly higher overall rule-induced physical demands than other elite team sports, and changes in the substitutions rules might mitigate overall soccer demands (Mota et al., 2020). In March of 2020, soccer seasons were interrupted worldwide to avoid spreading the new coronavirus disease (COVID-19). Leagues resumed the seasons, without fans at the arenas, after several weeks of interruption, causing overlay of schedule. This overlay has caused “even more” congested schedules (e.g., five matches during 14 days), eventually developing accumulated fatigue on players (Silva et al., 2018; Gimenes et al., 2019), and possibly raising injury risk (Ekstrand et al., 2004; Bengtsson et al., 2013; Dellal et al., 2015). To minimize the overload of matches and potential physical issues, the *Fédération Internationale de Football Association* (FIFA) has (temporarily) authorized the increment of up to five substitutions for each team per match instead of three, as per the regular rule (FIFA.com, 2020b). Remarkably, there is limited scientific debate about changes in substitutions rules in soccer which might minimize the impact of congested schedules (exacerbated by the pandemic) and improve injury prevention. Therefore, here we

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present possibilities to enhance soccer overall, and to improve player welfare, by discussing the substitution rules due to COVID-19 and encouraging constructive discourse.

## SOCCKER DEMANDS, FATIGUE, AND INJURY RISK

Although sports injuries are multifactorial, accumulated fatigue has an important role (Bengtsson et al., 2013; Gabbett, 2016; Silva et al., 2018). A single soccer match causes fatigue, which is connected with significant match-induced inflammatory responses and muscle damage lasting at least 72 h post-match (Silva et al., 2018). Indeed, Souglis et al. (2015) found greater inflammatory and muscle damage markers after soccer matches than other team sports, concluding that soccer is “the most demanding.” The laws of the game itself, especially the small number of substitutions allowed, is a major contributing factor to the high demands of soccer (Mota et al., 2020). Additionally, soccer has higher total physical demands measured by time-motion studies (e.g., running distances in high-speed), when compared to other team sports (Taylor et al., 2017), and an increase in soccer demands have been revealed over time (Barnes et al., 2014). Research following seven soccer seasons found an impressive increment of ~30% in the sprint distance, as well as technical variables (Barnes et al., 2014). Because high-speed running and injuries are associated (Gabbett, 2016; Buchheit et al., 2019), such physical increment is a concern. Eventually, soccer overload during the player career is linked with a significant loss of time from involvement, early retirement (Knapp et al., 1998), premature osteoarthritis, and a reduced quality of life following retirement (Roos, 1998; Arliani et al., 2014).

Modern soccer has several matches with 72–96 h between matches, generating congested schedules; an issue for clubs and medical staff (Ekstrand et al., 2004; Dellal et al., 2015). Now, with seasons resuming, this issue is exacerbated as most soccer clubs are involved in upwards of two matches each week. We estimate that Liverpool FC (the current World Championship) will face ~25% more matches in comparison to the same period of the prior year (no COVID-19), meaning 25% more load on players, almost certainly increasing injury risk (Gabbett, 2016). For instance, higher muscle injury rates were found in matches with short periods of recovery ( $\leq 4$  days) vs. longer recovery periods ( $\geq 6$  days) (Bengtsson et al., 2013). A study showed that two matches/week resulted in a substantially higher injury rate compared with the non-congested period (one match/week), only during the matches (mean 43.3 vs. 18.6). Unlike, when counting both matches and training sessions no differences were found (Dellal et al., 2015), evidence that the “problem” is in the match. Thus, during the “COVID-19 calendar,” most soccer clubs will face a potentially negative injury prevention scenario. In other words, players will face a “high dose” of risk (matches) associated with “low doses” of prevention (i.e., proper fitness training) (Gabbett, 2016; López-Valenciano et al., 2020). Indeed recommendations to return to soccer training and competition after lockdown caused by COVID-19 point out the issues are

manifold, such as the loss of performance and the increase of injury risk (Bisciotti et al., 2020). Therefore, we are watching an experiment without a control group!

The potential decrement in injury risk during soccer matches would also benefit team performance. A study following 11 years in the UEFA Champions League found that injuries deteriorate team performance (Hägglund et al., 2013). If the purpose to increase two more substitutions per match in soccer, due to the COVID-19 pandemic, was/is to avoid injuries (FIFA.com, 2020b), why not to do that regularly?

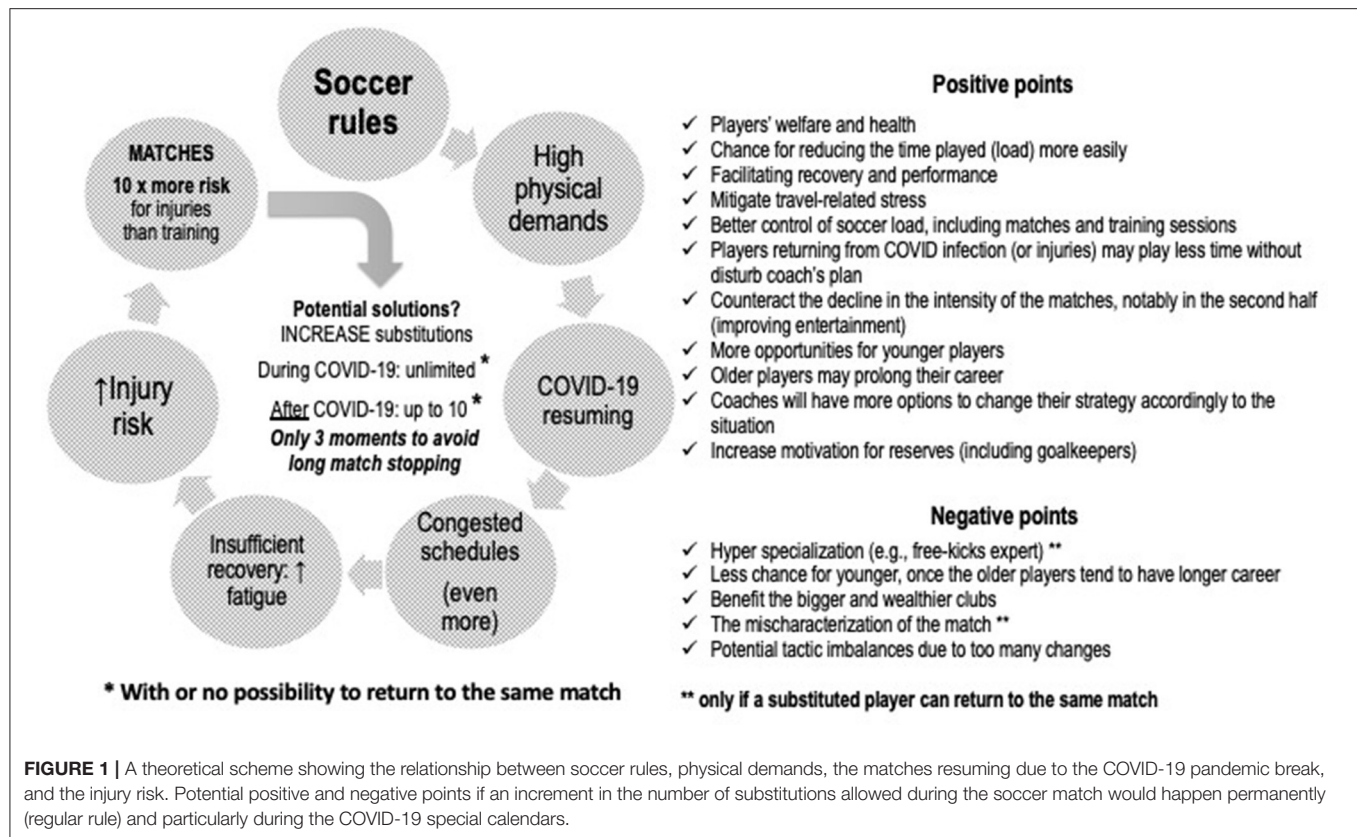
## WHICH SOLUTIONS DO WE HAVE FOR SUCH ISSUES?

Although several strategies (i.e., training and recovery) have been studied and applied to address the issues mentioned (Nédélec et al., 2013; Gabbett, 2016; Pavin et al., 2019; Rey et al., 2019), we suggest a simple strategy of allowing many (e.g., unlimited) substitutions.

Fewer matches to increase time for proper recovery and better fitness preparation (Nédélec et al., 2013; Gabbett, 2016; Silva et al., 2018) or including more substitutions during the matches to make it possible to “dose” the load during matches. We believe fewer matches are essential for players’ welfare. However, considering the real-world scenario, involving the COVID-19 overlap of matches, more substitutions might be necessary. Despite this suggestion, we acknowledge that changing rules may result in several other effects. **Figure 1** shows the potential positive and negative points of allowing more substitutions.

## RULES, PHYSICAL DEMANDS, AND SUBSTITUTIONS

Normally, soccer coaches can make three substitutions. Due to the COVID-19 changes in the calendar season, up to five substitutions were allowed. During international and official matches, soccer coaches have 12 available substitute players. Therefore, the regular law of the game allows “only” ~13% of substitutions (3 players out of 23 available). This is too few compared, for example, with other popular invasive team sports (e.g., handball), which can replace 100% of players, with substituted players allowed to re-enter the game. The increase in soccer substitutions due to the COVID-19 (five players) increases the percentage to ~21.7%, but it is still small considering the high physical demands (Mota et al., 2020). Additionally, the substituted player cannot return to the match in soccer, even in the case of serious injury. An old study comparing injuries in soccer vs. handball reported that ~80% of soccer players continued to play when injured because the limit of substitutions was already met, presumably aggravating the injuries (Jørgensen, 1984). This situation tends to be even worse currently, as modern soccer is significantly more demanding (Barnes et al., 2014; Souglis et al., 2015; Silva et al., 2018). Recently the International Football Association Board (IFAB) has discussed concussion substitutes in soccer (FIFA.com, 2020c), which are in line with this article (e.g., safer and healthier sport).



Unlike other team sports (e.g., futsal), soccer has no time-outs, limiting the opportunity for brief recovery, and has the offside rule. To prevent offside, soccer players must move back and forth during the match. Such circumstances (i.e., restricted substitutions, no time-out, and offside law) overload soccer players even more during the matches. Considering that soccer matches have ~10 times higher injury rates than training sessions (López-Valenciano et al., 2020) and fatigue is associated with injuries (Ekstrand et al., 2004; Bengtsson et al., 2013; Gabbett, 2016; Silva et al., 2018), the increment (up to five substitutions) due to the COVID-19 seems insufficient.

A recent paper showed that substitutes who participated in the matches (non-starters) presented a lower workload, contemplating both matches and training sessions, during six matches in 21 days (i.e., congested schedules) (Gualtieri et al., 2020). These data suggest that matches are crucial in the training process, meaning that substitutes may be detrained. Typically, the coach has 12 substitutes players available, but only 25% of them (three) can participate in the match. The other nine (75%) could be investing the time to train and thus avoid detraining (Gualtieri et al., 2020) and prevent injuries (Gabbett, 2016). It is a poor use of time and demotivating for reserves players (Hills et al., 2018), and a waste of financial resources for the clubs (e.g., hotels, travels). A “game-changer” would be to increase soccer substitutions (Figure 1). This update on the rules is simpler and easier than other solutions, (e.g., fewer competitions) since economic impact would be another issue (Ahlert, 2001).

Increasing substitutions during a match, while keeping the current practice of allowing only three moments to avoid several stops in match action (Figure 1), might be a bright decision. If such changes do not happen now, especially during the COVID-19 resuming period, the issue of congested schedules (Bengtsson et al., 2013; Dellal et al., 2015), and consequently the incorporated fatigue and a higher risk of injuries (Bengtsson et al., 2013; Dellal et al., 2015), will continue. In addition to the possible health and financial benefits (i.e., high costs of an injured player) from increasing substitutions on soccer, it would probably improve match intensity, increasing the entertainment value for fans and sponsors, as substitute players covered a larger running distance at higher intensities (Carling et al., 2010; Bradley et al., 2014).

## FINAL CONSIDERATIONS

Although we are advocating an increase in substitutions, especially during the special COVID-19 calendar, we acknowledge that the regular calendar should be reviewed to avoid “kill the goose that lays golden eggs.” Also, according to Figure 1, only one point may have a deep impact (positive or negative). Therefore, such possibilities must be considered deeply implementing changes.

Considering that injury risk are much higher during matches (vs. training) (López-Valenciano et al., 2020) and that the soccer match itself is very demanding (Silva et al., 2018; Harper et al., 2019; Mota et al., 2020), increasing the number of substitutions in

elite soccer is a simple strategy to mitigate relevant concerns such as high injury rates and congested schedules, especially through the COVID-19 pandemic. Implementing more substitutions in elite soccer may result in benefits in player welfare and great entertainment for fans and sponsors. A real game-changer!

## AUTHOR CONTRIBUTIONS

GM and MM made substantial contributions to the conception, design, and drafting of the work, as well as the analysis and interpretation of data for the work. GM, IS, and MM revised it critically for important intellectual content, provided approval for publication of the content, and agreed to be

accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

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# The Impact of Covid-19 on Women's Experiences of and Through Football in Buenos Aires

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This research report explores the impact of Covid-19 on women's football in Buenos Aires. The suspension of all forms of football in Argentina as part of the country's hard lockdown measures threatens to undo significant gains made in women's football in recent years. By focussing on the experiences of key actors in a feminist Civil Society Organization (CSO) and a newly professional women's team, respectively, we examine what the pandemic has meant for women's football and for women football players at different levels of the game. We also consider the potential impact of the current situation on the future of women's football in Argentina, representative of wider social advances for women in the country.

**Keywords:** women, football, feminism, Argentina, La Nuestra Fútbol Feminista, Club Atlético Huracán, coronavirus, COVID-19

## INTRODUCTION: COVID-19 AND FOOTBALL IN ARGENTINA

The first case of Covid-19 in Argentina was identified on 3 March 2020, with the first death on 7 March, both involving men in Buenos Aires who had returned from Europe. On 11 March, the same day that the WHO declared a pandemic, President Arturo Fernández announced a 14-day quarantine for anyone arriving from high-risk countries, followed on 19 March by the nationwide introduction of one of the strictest lockdowns in Latin America. This lockdown was in place until 26 April, when restrictions were relaxed in some parts of the country, where infection rates were low. However, the capital remained in lockdown until mid-July, with an initial limited relaxation overturned and redoubled after a spike in cases saw the country pass 100,000 cases and 1,900 deaths on 13 July, with 49.7% of cases in the capital, which is home to 7.2% of the population (Ministry of Health, 2020). Within Buenos Aires, the large informal settlement of Villa 31—home to feminist football CSO La Nuestra Fútbol Feminista (henceforth La Nuestra)—became 'the epicenter for infection over several weeks' (Acuña, 2020), accounting for almost 50% of new cases in Buenos Aires during late May (Primera Edición: el Diario de Misiones, 2020). During the strict lockdown, no physical exercise outside the home was allowed, and when there was some relaxation of this in early June, the leader of Buenos Aires local government explicitly banned group activities while also acknowledging the risks to women of exercising alone (Infobae, 2020a). Despite maintaining the world's longest-running lockdown through to November 2020 in many parts of the country, including the capital Buenos Aires, Argentina's Ministry of Health announced on 19 October 2020 that they had passed one million confirmed cases of Covid-19, with 26,716 Covid-related deaths to that date (Ministry of Health, 2020). Just over half of the cases, and of the deaths, had been recorded in the province of Buenos Aires, home to the great majority of the country's women's football teams.

Even before the country entered lockdown, the government had announced the suspension of all categories of football in Argentina from 17 March, with the Argentinian Football Association (AFA) announcing in mid-October a scheduled return to action for women's football on 21 November 2020, three weeks after the restart of the first division of men's football and a month after the return of Argentina's top clubs to the Copa Libertadores. In recognition of the financial impact of these measures, AFA and the Argentinian Players' Association (FAA) reached an agreement to pay the salaries of players between July and December 2020 in cases where contracts expired at the end of June, as well as social security for the players and their families. This was applicable to the top four tiers of the men's leagues and to the first division of the three-tier national women's league (Palazzo, 2020). However, the minimal requirements for the professionalization of women's football, discussed further below, meant that the first two footballers in Argentina to test positive for Covid-19, both of whom live in Villa 31, were not covered by these provisions. Stephanie Rea, the goalkeeper for Club Atlético Excursionistas, was not one of the eight players awarded a contract by the club, and Camila Godoy plays in the reserve team of River Plate, excluded from the provision agreed by the AFA and FAA several weeks after both had tested positive (Infobae, 2020b,c). Their situation is illustrative of the extremely challenging situation, and the lack of various forms of support, facing women football players across the country in the pandemic.

## MATERIALS

### Women and Football in Argentina

Football is by far the most popular sport in Argentina for men and women, both as spectators and—increasingly for women—players. It has been played by women since at least 1923, when the first women's club, Río de la Plata, was founded in Buenos Aires, consisting of three teams, two of which played against each other at the Boca Juniors ground in October that year (Pujol, 2019: 265-74; Elsey and Nadel, 2019: 28-29). During the same decade, football became closely linked to notions of masculinity and national identity and numerous respected studies of football in Argentina over recent decades have focused exclusively on the men's game while overlooking entirely the presence of women's football (Archetti, 1994, 1999; Frydenberg, 2011). In doing so, they have perpetuated and augmented the myth of the national game as a male domain while symbolically excluding female players from arguably the most significant mode of national discourse. Women's football in Argentina has received a degree of institutional support since October 1991, when the AFA started a Women's Football Championship involving eight teams, all from the Province of Buenos Aires. This followed in the wake of the first Women's South American Championship, organized by CONMEBOL earlier that year, and preceded by a month the inaugural Women's World Cup organized by FIFA. Only recently has this history and presence of the women's game in Argentina been recognized (Román Lozano, 2018; Santino, 2018; Wood, 2018; Elsey and Nadel, 2019; Garton, 2019; Pujol, 2019; Saralegui and Rodríguez, 2019), with the profile of women's football greatly

enhanced by the strong performance of the national team at the 2019 Women's World Cup in France.

The increased visibility of women's football in Argentina has been particularly evident in the capital and has occurred within the framework of powerful grass-roots feminist activism that has drawn on the country's tradition of human rights protests to achieve an impact that extends well beyond Argentina (Figure 1). Of particular significance here is the Ni Una Menos movement, whose protest against local femicides and gender violence first came to international prominence through a mass demonstration in central Buenos Aires attended by an estimated 300,000 people on 3rd June 2015, with simultaneous demonstrations in some 80 cities across Argentina and highly effective use of social media since then (Accossatto and Sendra, 2018; Castro Riaño, 2018). From the outset, a wide range of feminist organizations were involved in the movement, including two of the co-authors of this piece, with the support of various other prominent sporting figures, such as Lionel Messi and Juan Martín Del Potro. The movement quickly spread across Latin America and beyond, with the annual Buenos Aires demonstration in 2017 having as a key demand the release of "Higui" De Jesús, a football player with La Nueva who was imprisoned for defending herself against a gang rape to "correct" her lesbianism (Pujol, 2019: 149-59).

The close connections between feminist activism and football are exemplified by the case of Macarena Sánchez Jeanney, the first woman in Argentina to sign a professional contract as a football player. After taking her club and AFA to court to gain recognition as an employee, having been released halfway through the 2018–19 season with no possibility of joining another team, AFA announced on 16 March 2019 that the national first division of women's football would be made professional. However, clubs would only have to offer contracts to eight players, with salaries pegged to those of players in the men's national fourth division, resulting in semi-professionalism for some players at best. Reflecting on her experience, Sánchez stated that in Argentina "women's football is intrinsically feminist" as "women's movements look to claim realms previously destined exclusively for men" (Sánchez Jeanney, 2019: 222). Prior to the national lockdown triggered by Covid-19, football had become an important means through which girls and women in Argentina, and especially Buenos Aires, accessed physical activity, public spaces and national discourses as football players.

## METHODOLOGY: ACTION RESEARCH AND CULTURAL AGENCY

To respond to the consequences of the Covid-19 lockdown for the women's football clubs that serve as our case studies, and to provide perspectives on the pandemic's impact on women coaches and players, this report will use an essentially qualitative approach that is aligned with action research (AR) and the concept of cultural agency. Our approach to AR is based on an understanding of it as "not so much a *methodology* as an *orientation to inquiry* that seeks to create participative communities of inquiry in which qualities of engagement, curiosity and question posing are brought to bear on significant



**FIGURE 1 |** Las Martas Fútbol Feminista at NiUnaMenos rally, Sante Fe, Argentina, 3 June 2018 (Credits: Belén Altamirano, CC-BY-SA-4.0; the image is unchanged from the original, which is available at [https://commons.wikimedia.org/wiki/File:Niunamenos\\_-\\_3J\\_-\\_2018\\_-\\_Santa\\_Fe\\_-\\_Argentina0-50.jpg](https://commons.wikimedia.org/wiki/File:Niunamenos_-_3J_-_2018_-_Santa_Fe_-_Argentina0-50.jpg)).

practical issues” (Reason and Bradbury, 2008: 1). This approach corresponds closely with the practice of La Nuestra as a football community, as discussed below. We furthermore emphasize the nature of AR as context-specific and focussed on a particular problem, on which researchers and participants work together as part of a process of change (Waterman et al., 2001). The co-authors have been collaborating, as Principal Investigator and Project Partners, respectively, on an international research network to explore the practice and representation of women’s football, funded by the UK Arts and Humanities Research Council and involving researchers and practitioners from the UK, Argentina, Brazil and Colombia. For our purposes, we draw on the manner in which cultural agency “pursues the tangents of daily practices to multiply creative engagements with power” (Sommer, 2006: 20), understanding power to be present in Argentina in football as a national discourse; in the institutional structures that influence football and the state’s response to the Covid-19 pandemic; and in the production of knowledge. In this latter regard especially we recognize cultural agency’s value as “a reciprocal dynamic between cultural activists and scholars [that] works productively [to] inspire an original scholarly essay” (Sommer, 2006: 9).

In the presentation of results and discussion below, the use of the first-person plural responds to our emphasis on

the collaborative nature of our work as AR (Waterman et al., 2001) and to our “collective sense of intersubjective agreement” (Sommer, 2006: 14) as practitioners of cultural agency. In material below on La Nuestra Fútbol Feminista it also speaks to the positioning of Santino and Román as integral members of that community, activist participants as well as native researchers, with Wood a marginal native able to convey the material effectively from Spanish into English. The emotional investment in the project of Santino and Román in particular informs discussion of the results in relation to La Nuestra and Club Atlético Huracán, respectively, at the same time making explicit the ‘intersubjective agreement’ on which the report is based. In this sense, and to borrow Spivak’s important distinction, this essay represents—rather than re-presents—the community to which it relates and from which it speaks (Spivak, 1988).

## RESULTS

### La Nuestra Fútbol Feminista Before Covid-19

Since 2007, the Civil Society Organization La Nuestra Fútbol Feminista has devoted its praxis to football in the district of Padre Mugica—Villa 31 in Buenos Aires, Argentina. La Nuestra has traditionally been used to refer to a style of play and a





**FIGURE 2 |** Players taking the pitch used by La Nuestra at Villa 31, Buenos Aires, Argentina (Credits: Sub.Coop; original image available at <http://www.sub.coop/es/historias/el-sueno-de-las-pibas-es>).

performance of national culture with its origins in the 1920s, when local football teams sought to distinguish themselves from the British “fathers” of the game in Argentina (Archetti, 1999). By appropriating the term *La Nuestra* to name our organization we reject the historic exclusion of women from Argentina’s traditional style of play and claim our place as participants in the national game, in which women have also been active for a century. *La Nuestra* expresses pride in our identity as a group and alludes to possession of the ball and to the fact that playing football is not only about results but is an important opportunity to bring people together. Our activities are aimed at all young and teenage girls, as well as young and older women, opening up the game to any woman, self-identified woman or other non-conformist identity, who wants to play football. Activities are free to all and are underpinned by a coaching staff made up entirely of women. Our practice is based upon a pedagogy of popular education, with a community-based and feminist perspective, rooted in a particular location, and is delivered via the articulation of two days per week of training with a group workshop. Through this dual focus, the sport becomes a space for support, reflection and expression in which the women participate, as well as a space in which to construct our own way of talking about things, to shape an identity that is characteristic

of football played by women. In this sense, *La Nuestra* seeks to guarantee for all participants a space of belonging, from which they can build relationships, challenge the forms of oppression they experience and deploy strategies that allow for the individual and collective empowerment of women, all based on the desire to play football (**Figure 2**).

*La Nuestra* is conceived, constructed and inhabited by all the players who take part, building in a collective and horizontal fashion a space where they can all exercise their right to play, to free time, to a life without violence. The training sessions and workshops also see the provision of spaces where participants can assume new challenges, such as coordinating skills development sessions, workshops, talks, production of theoretical and audio-visual materials, and coaching. One of the players once said that “I stand tall on the pitch as I do in life,” which we believe offers a synthesis of part of our work, in which participants are not simple recipients, but rather protagonists of the organization: through their suggestions and actions they inhabit and transform the project, turning it into something they consider to be “their place,” “their crowd.”

Over the course of the Organization’s 13 years, we can point to several milestones that speak to our collective efforts, to the empowerment of women players and to the achievement of





**FIGURE 3 |** Girls from La Nuestra play on a small pitch adjacent to shops and market stalls in Villa 31 (Credits: Sub.Coop; original image available at <http://www.sub.coop/es/historias/el-sueno-de-las-pibas-es>).

our objectives. Keeping our training sessions going on the most heavily used pitch in the neighborhood, which is also a public space, was the first example of resistance to the oppression we suffered, and to the negation of this space, in order to exercise our right to play. For the last few years, the football pitch in Güemes has been known as “the women’s pitch.” As a result of our visibility in the neighborhood, and of our resistant presence on the pitch that we had come to occupy, girls and young women began to demand their own space where they could train. This demand was met by the Organization, and those girls who years ago asked for their rights are now reference points for the youngest girls (Figure 3). In 2007, about 12 teenage girls were involved in the project; in 2020 there are more than 120 players of different ages who support La Nuestra’s activities, part of—and feeling that they are part of—the project.

At the same time, given the constant process of questioning and reflection that we carry out from our particular perspective when we play football, we came to recognize that our practice entails a deep pool of knowledge and that we needed to build links with other groups and organizations in order to broaden the landscape of women’s football. As a result, in recent years we have made a collective effort to develop theory based on our practice, systematizing our shared experiences within the spaces of our workshops. What arose from this rethink was the need to propose

new meeting spaces, leading to the promotion of workshops and festivals with other collectives and organizations, something that all the participants in La Nuestra took on as a goal.

## The Impact of Covid-19 on La Nuestra Fútbol Feminista

The current circumstances have highlighted the difficult conditions and profound inequalities that the inhabitants of Padre Mugica district—male and female—face on a daily basis. The lack of access to health provision, to basic services such as water and electricity, and the high levels of unemployment exacerbate historic conditions of marginality and abandonment by the state. The policy of compulsory social isolation because of Covid-19 has proved especially difficult and painful as women and girls often have not only to live with their aggressors but also do so in crowded and precarious conditions. Living together in a family bubble is made all the more difficult for teenage girls and young women, many of whom have been going through a process of individual and collective empowerment by being part of La Nuestra. As a result of the social isolation measures they have been obliged to (re)take traditional gender roles under the new family dynamics that mean more time spent living together and more use of the shared domestic space. Many of the players from La Nuestra have expressed their anxiety and

sadness at experiencing this resurgence and reinforcement of those traditional roles and demands that years of struggle on the pitch had helped to unpick. At the same time, the prejudices toward the inhabitants of the informal settlements and popular districts of Buenos Aires have been intensified because of the exponential rise in Covid-19 cases that was evident in mid-2020 as a result of eight days without the provision of any water. Many residents lost their jobs and others were forced to stay at home without being able to go out to seek their daily sustenance.

In the face of this new context, in which the struggle for life and dignity comes first, we have seen our organization called upon to modify its practices and dynamically adapt our *modus operandi* in response to emerging priorities. While we have organized ourselves around the health crisis facing the district in which we have been working for the last 13 years, we have at the same time been challenged by the profound changes that sports in general are undergoing, and especially sport practiced by women. During this pandemic we have seen how inequality and social injustice have become even more obvious and have deepened, and for our organization the decision to support our players and their families with food and other basic necessities has had a big emotional and political impact. Organizing a campaign for donations to enable the delivery of food, cleaning products and disinfectant reinforced the fabric of new support strategies on behalf of women's networks. Thanks to these alliances that are being created and strengthened, we have been able to maintain this support for 22 weeks and will continue to do so for as long as we are able.

From the sporting perspective, we have adapted our training sessions to the virtual world while bearing in mind the various issues and challenges that the players face, such as lack of internet connectivity, the limited space available to many and the absence of computers or mobile phones that can enable us to meet online. Above and beyond these difficulties, we have adapted so we can stay close to each other, facing up to the pandemic together and standing tall on this new pitch as we stand tall in life.

## Reflections on the Experience of La Nuestra Fútbol Feminista

A social and health crisis exploded in our district in May 2020. The main causes were the lack of drinking water, inadequate living conditions and long-standing structural problems in the informal settlements of Buenos Aires that no government has resolved with effective policies. Against this backdrop, it is women who occupied the front line to confront the crisis, maintaining communal cooking and eating spaces as well as the care of children and the elderly. Many women were also the first to put their lives at risk, with some of them contracting the virus and subsequently dying.

For La Nuestra, this very difficult, unprecedented and complex situation leaves the organization facing new challenges. Our thirteen-year journey in the neighborhood, cemented through close and powerful affective bonds, means that the starting point from which we confront this uncertain panorama is strong. Feminist networks, the power to organize and women's capacity to work are the best evidence of the strengths that this social collective possesses, and these tools will have to serve us on

the new paths and scenes that present themselves. Recovering the football pitch, making it once again a territory that is desired, fought for and shared with more women, and gradually reintroducing face-to-face training sessions, will allow us to rebuild with the same conviction that made La Nuestra an organization with such a presence.

Collective endeavor and efforts to exercise the right to play football turned our ideas into fully-fledged convictions that will not be abandoned. We see our sporting practice as a mode of empowerment to eradicate gender violence and in this new setting we will have to redouble our efforts so as not to lose any of the ground gained on the pitch as a space of freedom and in the deconstruction of established prejudices in relation to what is expected of bodies and behaviors.

## The Argentinian Women's First Division/ Club Atlético Huracán Before Covid-19

Following the creation of the Women's Football Championship on 26 October 1991, Buenos Aires-based Club Atlético Huracán took part for the first time in 1999, since when it has remained an ever-present member of the Championship. From the outset, the existence of Huracán's women's team has owed more to the desire, commitment and efforts of certain individuals than to institutional investment and support for women's football as a project. Since 1999 the conditions for training, the quality of the coaching staff (often lacking formal accreditation), the lack of access to club facilities, of travel funds, of medical staff, of adequate kit, among other factors, has been reflected in the team's performance: Huracán has consistently been in the bottom half of the table, with the exception of the 2010/11 season, when they finished in third place.

The process of professionalization of women's football, which began in Argentina in March 2019, has not resulted in significant changes for Huracán in terms of investment or support for the discipline. In these regards, the club fulfilled the minimum requirements stipulated by AFA to be able to compete in what is now Argentina's Professional First Division of Women's Football. The first professional squad of women's football that was registered by Club Atlético Huracán consisted of 32 players, of which eight (the minimum requirement) were awarded the contracts paid for by AFA, with no further investment by the club. As a result, only the eight players who signed professional contracts would have access to medical insurance and to social security provided by the FAA; the remainder of the squad enjoyed no such rights. At the same time, the club maintained the minimum salary (c.\$250, equivalent to salaries in the men's fourth division) for the eight players with a contract, with no supplements or increases. Of the seventeen teams that played in the women's professional league in 2019/20 only four had a coaching team led by a woman, and only one—Huracán—a coaching team consisting of two women.

## The Impact of Covid-19 on Club Atlético Huracán and the Women's First Division

As a result of the declaration of a pandemic by the World Health Organization on 11 March 2020, the President of Argentina put in place 'preventative and obligatory social distancing' for all the



country's inhabitants. Arising from the lockdown that came into force, citizens were prohibited from taking to streets, paths and public spaces and there was also a ban on all types of sporting activities carried out in groups. In the face of this situation the coaching team had to redesign not only the ways in which coaching sessions were carried out, via a virtual platform, but also the ways in which social relations, support and communications with the players were to be conceived.

The process of adaptation was gradual and had various stages of trial and refinement. It is worth pointing out that players' participation in the virtual training sessions was heavily affected by lack of access to a computer, or to a mobile phone with capacity to download the app being used, as well as the lack of access to an internet connection for almost half of the squad. As lockdown progressed it became increasingly obvious that most of the players and the coaching staff were experiencing a sense of profound marginalization, a situation that aggravated the ongoing inequality of structural conditions that the club had developed over the years for the women players and coaching staff.

Most of the players earn their living from informal jobs or live with their family, who assume their living costs and who in turn have no access to stable employment. Because of the lockdown that came with Covid-19, many players lost any work they had and with it their primary source of income. On a related note, since the start of the (semi-)professional women's championship, the income of seven of the eight contracts awarded to Huracán players were shared among all 32 members of the squad, which provided each player with a minimal travel allowance, although this brought with it no employment rights. During the initial period of the lockdown this situation worsened considerably as the club fell behind by three months on salary payments and when eventually payments were made, many players could not access the small amount of shared funds as they were unable to meet up with their teammates because of the ongoing travel restrictions within Buenos Aires.

Over the course of several months, the players and coaching staff endured considerable uncertainty as there was a lack of regular communications from the club and no clear sense of what would happen with players' contracts or continuity of the squad and coaching staff. Following intense negotiations between the FAA and AFA, AFA released a briefing that ensured the extension of players' contracts until December 2020 and also gave the possibility for clubs to extend the contracts of coaching staff until December 2020. With certainty on that front, but no official communication from the club amid ongoing questions, the squad continued to work until 22 June 2020, training from Monday to Friday and holding online meetings twice a week. During the week of 22 June the Head of Women's Football at Club Atlético Huracán told the coaching team via a zoom call that they were unable to renew their contract, although "they assured us that it was simply down to economics for if it was a question of sporting principles the club would have hired a male coaching team from the outset."

## Reflections on the Experience of Club Atlético Huracán

Club Atlético Huracán is an example of what is happening in many football clubs in Argentina. Women in the realm of football still face deep inequalities that are maintained and reinforced by institutional practices at every level, and which this pandemic has rendered even more visible. The small number of women who have secured a contract as a football player, not only at Huracán but in all teams, face a huge salary gap when compared to their male peers. Most players do not have medical insurance nor access to basic services in order to practice their sport in adequate conditions. The pandemic has reinforced this marginal status of women players in terms of access to healthcare for them and their families. Fewer than five percent of women players in Argentina live solely on their income from football, which is why women footballers have to resort to a double (or even triple) working day or emigrate to be able to develop as players and make a living from the sport. Over the first 6 months of the pandemic, at least 10 Argentinian women footballers, from the best teams in the country, have moved abroad, mostly to Europe, given that local teams were unable to guarantee adequate salaries or a prompt and safe return to training and competitive matches.

For women coaches the outlook is similar or even worse. Both practically and symbolically, football is constructed as a masculine domain, which translates, among other things, into an absence of women in the labor market for roles in football. The salary gap between male and female coaches working in the men's and women's first division is huge, but even so wage cuts and sackings during Covid-19 have fallen primarily on women coaches. The impact of Covid-19, and all the restrictions and changes that it has entailed for football in Argentina, reveals the highly precarious position of women players, women coaches and other women working in the sport in terms of their daily experiences and their working conditions.

While there have been formal changes aimed at creating spaces that are free from discrimination against women in daily life as in sport, these changes are not reflected in women's daily experiences in the various domains of football. At the same time, it is vital to point out that the immediate changes in day-to-day life that the pandemic triggered for women in football (loss of employment, support and basic needs), as well as the key decisions and structural reforms that have been introduced during the first 6 months of lockdown in Argentina, have consistently revealed a patriarchal logic as far as agendas and priorities are concerned. For example, in June 2020 CONMEBOL decided to suspend the clause that required clubs competing in the (men's) Copa Libertadores to provide investment and support for their women's teams. This, and various other examples, reveal how high-level decisions result in backward steps in relation to the attainment of spaces and visibility, as well as to rights that had been secured, all to the detriment of the development and quality of life of women who are footballers, coaches and referees, or who occupy other roles in the field of women's football.

In order to be able to imagine a post-Covid-19 development of football for all, and especially to be able to contemplate the sport as a space free from discrimination and various forms of

violence, there is a need for concrete actions within footballing institutions so that more women and a greater diversity of gender perspectives are present in decision-making, in knowledge-sharing and in policy design. Only then will it be possible to talk of real changes in the development of the sport for women.

## DISCUSSION OF RESULTS

Following the (limited) professionalization of the women's game in March 2019 and the national team's performances at the Women's World Cup in July 2019, women's football in Argentina had made significant gains in terms of media coverage and institutional support, and these achievements were being reflected in wider social attitudes to it as an important element of the feminist movement. As is evident from the experiences of La Nuestra and Club Atlético Huracán, Covid-19 has had a profound impact on the practice of women's football in Buenos Aires and Argentina more widely, both at the newly professional level as well as for amateur clubs, grass-roots organizations and all of their players.

The pandemic, of course, had an impact on men's football too, but the structural inequalities that were only starting to be addressed in terms of salaries, access to medical provision, equipment and facilities have re-emerged in force, magnifying the impact of the pandemic on women playing for and working in clubs in the nation's top three divisions. In contrast with their male counterparts, only a handful of those women players who receive a salary from their First Division club are able to live exclusively on that income, with clear consequences for living arrangements and the ability to maintain social distancing, resulting in higher risks of infection from the virus. The symbolic capital that women's football was rapidly gaining before the pandemic has been lost for the time being: with women's league football still to resume at the time of writing (November 2020), and the Women's Copa Libertadores postponed indefinitely, men's football has returned to dominate exclusively the media as the group stage of the Copa Libertadores resumed with a flurry of matches from mid-September and the (men's) First Division played its first round of matches at the end of October 2020. Below the women's First Division, where players do not receive salaries, support is limited to AFA's provision of Covid-19 testing and arranging permits so that players can make their way to future matches on public transport.

As the experience of La Nuestra has shown, the impact on women's grass-roots football has been even more acute. In addition to the material challenges of the pandemic in relation to access to basic services such as food, drinking water and healthcare, the many women and girls who play football in the crowded informal settlements of Buenos Aires face considerable challenges to be able to keep fit, train and practice. Of even greater potential significance, however, is the social, emotional, and mental impact of the pandemic and the hard lockdown that it has entailed. Women and girls for whom football provided a space of empowerment to question and challenge traditional structures, roles and bodily practices have been forced to return to the confines of domestic spaces in which traditional gender roles may be retained and reinforced. In a country where 54.2% of men over the age of 14 take no part at all in domestic

tasks (Anuario Estadístico de la República Argentina, 2020: 197), many girls and women who found expression on a football pitch find themselves expected to (re)adopt roles as cooks, cleaners, and carers.

At this stage it is impossible to evaluate the long-term impact on the physical, emotional and mental health of women football players in Argentina, but for now it is clear that the pandemic has seen the rolling back of numerous gains made by and for women in recent years, in football as in society more widely. Our hope is that women's football is able to resume its recently secured practical and symbolic position within the country as quickly as it has been lost over recent months: many people involved in women's football will be doing all they can to ensure that this is the case.

## RECOMMENDATIONS FOR WOMEN'S FOOTBALL IN LIGHT OF COVID-19

In relation to the findings discussed above, we make a series of recommendations that may serve to address the issues identified therein:

- Extended availability and accessibility of wi-fi services and online platforms to enable the retention and continued development of established communities and networks;
- More effective communication of information in relation to public health measures and support offered by state institutions (medical centers, access to subsidies, reporting gender violence);
- Development of feminist networks and of alliances with other organizations both within and beyond the neighborhood to share lessons learned toward common goals;
- Development of closer relations with the families of women football players in order to provide more effective support for their sporting activities;
- Retain the limited gains made for women's football in national sporting institutions rather than decoupling it from support for the men's game as a response to Covid-19;
- Provision of salary and access to medical insurance for all players in the Argentinean Women's Football Championship;
- Access to facilities for training and matches that is equal to that enjoyed by men's teams;
- Provision of public security measures to protect women from gender violence when practicing football and other sports in public spaces;
- Equal access to all roles within football (e.g. playing, coaching, management, refereeing), according to qualifications and experience, and regardless of gender;
- Media reporting and public discussion of women's football on the same terms as men's football, i.e. not as a sexualised spectacle subject to a gender hierarchy;
- Appointment of women to positions of authority within football and inclusion of a greater diversity of voices and experiences within decision-making and policy forums.

The implementation of these measures would bring about a step change in the experience of women playing football, and of Argentinean women more widely, addressing a series of issues



that have been highlighted and exacerbated as a result of the Covid-19 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 author/s.

## AUTHOR CONTRIBUTIONS

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

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# The Impact of COVID-19 and Homeschooling on Students' Engagement With Physical Activity

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The COVID-19 pandemic forced an unprecedented global shutdown that closed schools for months. In many nations, schools were closed to students, and teachers directed educational activities remotely via digital devices or homeschooling resources. This article explores how these months of homeschooling have affected the physical activity of Norwegian students in Grades 1–10. All Norwegian students are supposed to have at least 60 min of physical activity every day in school. We draw on data from two surveys, one with parents ( $N = 4,624$ ) and the other with teachers ( $N = 726$ ), to provide an indication of the daily physical activity students engaged in during the period of homeschooling. An important finding from the teacher survey is that the degree to which schools prioritized physical education among the school subjects varied greatly between schools and teachers. Key findings from the parent survey were that reported time spent on physical activity increased with the age of the students, that many parents expressed concerns about increased sedentary behavior, and that the most active students were those who showed the greatest engagement and effort in schoolwork in general. Our findings raise the questions of whether students were given too much responsibility for their own physical activity during this period and whether teachers should provide their students with more digital workout sessions and instructional videos.

**Keywords:** education, home-schooling, remote teaching, COVID-19, physical activity (exercise)

## STUDENTS' PHYSICAL ACTIVITY DURING DIGITAL HOMESCHOOLING

The COVID-19 pandemic has forced an unprecedented global shutdown that has greatly changed what it means to be a teacher, a student, and even a parent in the months that schools have been closed. While most school systems normally require daily physical attendance during week days and bring students together in large groups to learn in a collective endeavor, the closing of schools and the months of social distancing have shifted the site of learning to the home, where learning happens primarily alone or with the help of family members through the technologies available. Physical education (PE) and organized active recess time that would normally take place in school have been either canceled completely or made a part of digital homeschooling. Social distancing measures, in Norway, require people to stay at least 1 meter apart from each other and avoid gatherings with anyone other than their closest family members. These measures have resulted in the cancellation of all organized afterschool sporting activities. Across the world, millions of students have experienced the disruption of their normal routines for learning and physical activity

(PA). As Krumsvik (2020) noted, it is important for educational researchers to investigate different aspects of the educational consequences of the COVID-19 crisis, in order to avoid the domination of anecdotal evidence about how the shutdown has impacted students' lives. This is particularly important as the World Health Organization (WHO, 2020) has predicted more global pandemics in the future.

This article sheds light on how COVID-19 and the closure of schools impacted young people's physical activity (PA) during the periods with closed schools and home schooling. Previous research has documented that PA plays an important role in physical and psychosocial health and wellbeing for children and young people (Biddle et al., 2019). Research has shown that a sedentary lifestyle in students is associated with chronic diseases later in life, as well other health-related risk behaviors such as unhealthy dietary patterns (Carson et al., 2016; Tremblay et al., 2016). Globally, there is general concern about the low amount of PA and the increase in sedentary behavior in young people as well as child obesity (UNICEF, 2019). While COVID-19 is a global pandemic leading to a global shutdown, it is also evident that the pandemic has affected different nations, regions, and sociodemographic groups in different ways and with different intensities. Young people's education has been affected in ways, which are as yet not fully appreciated.

In this article, we report on how school shutdown has affected the PA of students in Grades 1–10 across Norway. Teachers throughout the country were asked to perform their teaching from home, through digital devices and remote teaching (Krumsvik, 2020). As in other countries, Norwegian teachers and school leaders were not prepared to go digital overnight, despite good technological infrastructure (Blikstad-Balas and Klette, 2020). Drawing on surveys administered to both parents ( $N = 4,642$ ) and teachers ( $N = 726$ ) about how digital homeschooling was organized, we have investigated what kind of (digital) attendance school has required from students in different grades during the shutdown and the estimated PA they have engaged in during the period of homeschooling. We also mapped what parents and teachers considered to be the main challenges and benefits of homeschooling. In this article, we mainly emphasize challenges and benefits regarding the students' opportunities to stay physically active.

## COVID-19 AND EDUCATION: GREAT VARIATION WITHIN NATIONS AND SCHOOLS

In April 2020, the United Nations Children's Fund (UNICEF) reported that about 3 billion people were in lockdown around the world and that almost 90% of the student population was cut off from school (Winther and Byrne, 2020). Closing schools has a range of adverse consequences, ranging from disrupted learning, food insecurity for children who rely on open schools for access to healthy food, and increased exposure to violence and exploitation alongside the challenges of creating, maintaining, and improving distance learning (UNESCO, 2020).

Around the world, attempts to continue providing education to students varied greatly, due to significant differences in access to technologies, which could support remote teaching, such as books, TV, smartphones, and the internet. For example, while children in Rwanda received pedagogical content through the use of radio, several countries, including Côte d'Ivoire, arranged TV classrooms, an initiative including taping lessons to be aired on national TV (Miks and McIlwaine, 2020). Many international providers of educational tools made their resources free of charge during the pandemic, and UNICEF launched the #LearningAtHome initiative, which provided activities every day that parents could adapt and share with others, given that they had internet access (Miks and McIlwaine, 2020). Although, little is known about what kind of schooling children actually took part in during the pandemic, it appears that most countries attempted to provide relevant tasks for children to do at home, often in combination with pedagogical content provided through TV, radio, or the internet.

Inadequate digital infrastructure in schools and society are key barriers to the successful implementation of educational information and communications technology (ICT) strategies (Bingimlas, 2009; Gil-Flores et al., 2017). Therefore, Norway is a particularly interesting case when it comes to education and COVID-19, due to the vast technological infrastructure available. Internet access at home in the population has repeatedly been measured at 98% (e.g., Statistics Norway, SSB, 2020a). ICT infrastructure is an obvious prerequisite for integrating digital technology into instruction, something that would greatly facilitate teaching when students are distanced from their classrooms. Since the 1990s the question of access has dominated the discourse around ICT in many countries, and many schools have reported pressure to provide one-to-one (1:1) access for all their students, that is, one digital device per student provided by the school (Blikstad-Balas and Davies, 2017). However, several studies have shown that access is not a reliable predictor of teachers' actual implementation and uptake of digital technology (Gil-Flores et al., 2017; Blikstad-Balas and Klette, 2020). The newest Teaching and Learning International Survey (TALIS) report from Norway highlighted as critical the discrepancy between merely providing access for students and preparing teachers to actually utilize the technology in their everyday teaching (Throndsen et al., 2019). The overall access to technology for students in Norway has been consistently high and significantly above the European average for the student-per-laptop ratio (OECD, 2015).

Both primary and secondary students and teachers in Norway have access to digital technologies (Dalaaker et al., 2012; Egeberg et al., 2012; Fjørtoft et al., 2019). While 1:1 access is the norm in upper secondary schools, lower secondary schools can also either provide permanent 1:1 access or lend students laptops or tablets for use in a specific lesson. In summary, the access to ICT in Norwegian schools enables broad use of ICT in the classroom, and the national curriculum explicitly places this responsibility on all teachers across all grades. However, previous classroom research has revealed that the actual uptake of technology varies and is largely dependent on individual teachers. This backdrop provides important contextualization when investigating the

degree to which students and parents report that they prioritized PA during the COVID-19 outbreak.

Norwegian teachers have considerable autonomy in deciding how to teach their subject by determining matters such as what pedagogical methods and resources, such as apps and software, to include (Mølsted and Karseth, 2016; Sivesind and Wahlström, 2016). Thus, the general differences between the teachers' practices may be significant within the same school district and even the same school. For better or worse, each teacher has great freedom in determining the pedagogical choices in their classroom. This freedom extends to the use of ICT for pedagogical purposes. Previous research from Norway has found that, even though access to ICT is high and the curriculum is the same, there are big differences in how digital technology is used between schools and also between teachers within the same school (Hatlevik et al., 2009; Egeberg et al., 2012, 2016).

## PA AMONG STUDENTS IN NORWAY

As in many other countries and in line with international recommendations, the Norwegian education system places expectations on schools regarding PA through the subject of physical education (PE) and by stressing that children should be active during the school day (Schmidt et al., 2020). In fact, in 2017, the Norwegian parliament decided that all school children should have at least 60 minutes of PA during the school day, every day. This decision resonates not only with all the research showing general health benefits from PA, but also with research suggesting that PA can have positive effects on students' behavior in class and even on academic outcomes (Norris et al., 2015, 2018). This expectation for PA during the school day is fairly new, and systematic research is necessary to determine how schools are meeting these new requirements. At present little is known about how the time available for PA is used and what forms of PA schools organize for students. It is therefore not possible to precisely estimate the total amount of PA students engage in at different grade levels across Norway, but in addition to general PA, the PE subject has 478 hours per year in Grades 1–7 (students aged 6–12) and 223 h per year in Grades 8–10 (students aged 13–16).

Despite the lack of detailed knowledge about the general PA level among students in Norway across different grade levels, previous studies have indicated that Norwegian students will engage in PA as a direct consequence of schooling during traditional open schools (not distance learning). There are several reasons for this. Only one of four children aged 6–12 are taken to school by car by their parents daily. Two of three walk or use a bicycle, and the rest take public transportation due to the long distance between school and home (NHI Norsk Helseinformatikk, 2015). Students have recesses and play time during the school day, and they have PE as a subject every week (normally between 1.5 and 2.5 h a week). Additionally, many teachers give their students short PA breaks both in the classroom and outdoors, especially in the lower grades. With the exception of inner-city schools, many Norwegian schools are situated in rural surroundings or near wooded areas and parks,

which are often used for outdoor teaching. Furthermore, the vast majority of 6–15-year-old students participate in afterschool organized sports one or more days a week (Hammer, 2017). Therefore, while schooling may contribute to more PA, some research has indicated that traditional classroom lessons are the most sedentary and least active segment of a young person's day (Nettlefold et al., 2011; Bailey et al., 2012). This latter point is particularly interesting for this study, as homeschooling could decrease the school-related PA. But it could also give teachers and families the chance to prioritize PA to a larger extent due to the removal of physical barriers to PA at school, such as the number of students in the same physical classroom and the tight schedule of curriculum activities from many teachers.

Even though Norwegians in general are rather healthy compared with many other countries (National Institute of Public Health, 2018), there are also concerns about the general decline in PA in the Norwegian population. For example, Dalene et al. (2018) conducted a longitudinal study with representative samples of 9- and 15-year-old students and identified a large decline in PA for the participants followed from age 9 to 15 years. Several reports on health and wellbeing among young people have found that PA declines with age (Samdal et al., 2016; Hammer, 2017; Bakken, 2019). Further, they have identified a tendency for students with lower socioeconomic status to quit organized PA after school and to have difficulties staying as active as when participating in football, skiing, bicycling, or other forms of organized afterschool PA (Bakken, 2019).

## METHODS

The authors developed two surveys about homeschool for children in primary and lower secondary school during the COVID-19 outbreak, one for parents and one for teachers. Both surveys were anonymous and followed the ethical guidelines for participation regulating research in Norway.

The surveys were distributed to parents and teachers digitally because the timing of the survey was crucial: we wanted parents to respond during the period of homeschooling and school lockdown, not in retrospect. Our inclusion criteria were parents with students in Grades 1–10 and teachers teaching in Grades 1–10. There is no systematic way to assemble a traditional random probability sample of people who fit the criteria through the internet, and all internet surveys thus rely on contacting relevant respondents, for example by email or social media, and asking them to complete the survey. As with many other one-time internet surveys, we had to opt for a non-probability convenience sample (Fowler, 2009; Patton, 2015) where we invited participation from whoever saw the survey invitation online. We recruited teachers and parents either through their school owners, who sent out emails to all teachers in their school area offering the possibility to participate, or through social media groups for teachers and parents on Facebook or Twitter. As with any non-probability-based sample, the greatest limitation is the unknown relationship between the sample and the population and the missing theoretical basis for estimating the repetitiveness of the sample. We have included several



background variables about the respondents (e.g., where they live and their educational background) to systematically monitor these variables in our samples and compare them with nationally representative samples.

The teacher survey was answered by 726 teachers from most parts of the country. The teacher survey did not include items directly addressing the students' PA or the teaching of PE during lockdown, except for one question about whether any subjects received less attention than usual during the period of homeschooling. Therefore, we primarily draw on data from the parent survey and only report the findings of teachers' responses on the one item concerning school subjects.

The parent survey was answered by 4,642 parents from all over the country. A total of 262 of the country's 365 municipalities were represented with good geographical distribution, and the respondents represented different categories of large and small towns, municipalities, villages, and rural areas. If the parents had several children in primary or lower secondary school, they chose one of their children prior to starting the survey and answered all questions for that child.

The main ambition of the surveys was to investigate all aspects of homeschooling, including what kind of remote teaching students were offered and how parents and teachers experienced the homeschooling situation. The parent survey had background questions about the school location, the student's gender and grade, and the parent's level of education and work situation during the period (work outside home, home office, laid off/unemployed, and stay-at-home parent). After completing the background information, parents answered 24 questions related directly to the homeschool situation, such as digital equipment, attendance requirements, communication with teachers, tasks, subjects, students' engagement and efforts toward schoolwork, and the parent's own experience during the period of homeschooling.

One question in the parent survey directly addressed PA and was used to investigate possible differences in physical activities between groups of students. The question was "How much time does the student spend being physically active during a typical homeschool day, in addition to any exercises in PE?" The response alternatives were "No PA," "15 min or less," "15–30 min," "30–60 min," and "More than 60 min." Two open-ended questions asked about concrete positive and challenging experiences during this period. These questions were not aiming at particular aspects (e.g., concerning PA), but 65 parents mentioned PA under the positive rubric, and 109 parents mentioned PA under the challenging rubric. We will provide examples from these responses in the result section.

In this article, we have investigated possible differences between groups based on grade, gender, parents' education and school location in terms of students' voluntary PA. One composite variable describing students' engagement and effort in schoolwork was also analyzed in relation to students' voluntary PA.

For the background variables grade, gender, parents' education, and school location, we used descriptive statistics to calculate the percentage of distribution of time spent on PA among groups within each variable. Practically meaningful

differences between groups were chi-square tested to determine statistical significance ( $p < 0.01$ ).

The composite variable measuring engagement and effort was constructed by means of eight items describing students' engagement and effort—or lack of such—regarding schoolwork in this period. For each item, the parents reported on the following five-point Likert scale ranging from "Never" to "Always" to describe how frequent what was described in each item occurred. In order to measure mean values related to PA, the scale was treated as a quasi-interval scale with values from 1 (*never*) to 5 (*always*). Four items described positive engagement and effort, and four items described lack of engagement and effort.

The items regarding positive engagement and effort were the following:

*The student works well with tasks at home.*  
*The student has immersed him/herself in schoolwork.*  
*The student has liked/enjoyed schoolwork better than usual.*  
*The student has been able to read and write more based on interests.*

The items regarding lack of engagement and effort were the following:

*The student skips schoolwork.*  
*The student postpones schoolwork until the parents push him/her to do it.*  
*The student is struggling to get started with schoolwork.*  
*The student finds it difficult to do the schoolwork without help.*

We created a composite score for these eight items as an expression of students' engagement and effort in schoolwork. First, we reverse coded the four items describing lack of engagement and effort. Second, Cronbach's alpha (Cronbach, 1951) was used to measure internal consistency, or how closely related the eight items within the concept were as a group. Cronbach's alpha ( $\alpha = 0.86$ ) indicated that the combination of items had acceptable internal consistency (George and Mallery, 2016). The mean value for the concept was standardized to 0 and a standard deviation of 1. 95% confidence interval is marked with  $1.96 \times \text{SE}$  (standard error) in each direction from the mean (**Figure 4**). ANOVAs were used to test whether students' engagement and effort varied across levels of PA.

We coded the open-ended questions in the surveys qualitatively using conventional content analyses (Hsieh and Shannon, 2005), where patterns in responses were identified and aggregated before examples illustrating typical responses were selected. Two of the authors coded all the open-ended questions together and checked for consistency in the coding during this process. Further, any borderline cases or responses that were difficult to code were discussed before deciding on final coding.

## RESULTS

### Background Variables

**Table 1** shows the number of students on each grade level in the parent survey. A total of 52% of the respondents represented

**TABLE 1** | Distribution of students on each grade level.

	1st grade	2nd grade	3rd grade	4th grade	5th grade	6th grade	7th grade	8th grade	9th grade	10th grade	Total
<i>N</i>	566	589	667	580	568	455	370	348	251	248	4,642
%	12.19	12.69	14.37	12.49	12.24	9.80	7.97	7.50	5.41	5.34	100.0

**TABLE 2** | Parents' education level in the sample.

	<i>N</i>	Percent	Valid percent
Completed grade 10 or less	49	1.1	1.1
Completed grade 13	445	9.6	9.6
Vocational or technical certificate	260	5.6	5.6
Bachelor's degree	1,156	24.9	24.9
Master's degree	2,499	53.8	53.9
Doctoral degree	225	4.8	4.9
Total	4,634	99.8	100.0
Missing	8	0.2	
Total	4,642	100.0	

**TABLE 3** | Distribution of respondents in population groups.

	<i>N</i>	Percent	Valid percent
City with more than 300,000 inhabitants*	1,030	22.2	22.3
Towns or municipals 65,000–300,000 inhabitants	987	21.3	21.3
Town 15,000–65,000 inhabitants	454	9.8	9.8
Town 5,000–15,000 inhabitants	1,024	22.1	22.1
Village or rural area with less than 5,000 inhabitants	1,129	24.3	24.4
Total	4,624	99.6	100
Missing	18	0.4	
Total	4,642	100	

\*Only Oslo with 700,000 inhabitants.

students at the primary school level (Grades 1–4), 30% students at the intermediate level (Grades 5–7), and 18% students at the lower secondary level (Grades 8–10). Additionally, 96% of respondents had children in public schools and 4% in private schools. The gender distribution showed that parents' responses were about more boys (54%) than girls (46%). In the following analyses, we have divided the students into the following three groups: Grades 1–4, Grades 5–7, and Grades 8–10.

As a measure of socioeconomic status, we asked parents about their highest level of education (Table 2). Compared to the national average for parents between 25 and 50 years, which we assume represents most of the parents in our sample, our sample has a higher percentage of parents with a master's degree or a PhD and a lower percentage of parents with lower levels of education (SSB, 2020b).

A total of 4,642 parents across the country answered the survey. When the municipalities of the respondents were divided into groups according to population, they were distributed as shown in Table 3.

A vast majority of Norwegian students go to public schools. In our sample, 4% of the parents reported that their child went to a private school, which is exactly the same percentage as for the country as a whole (SSB, 2020c), again suggesting that the sample reflects the national variation on important measures.

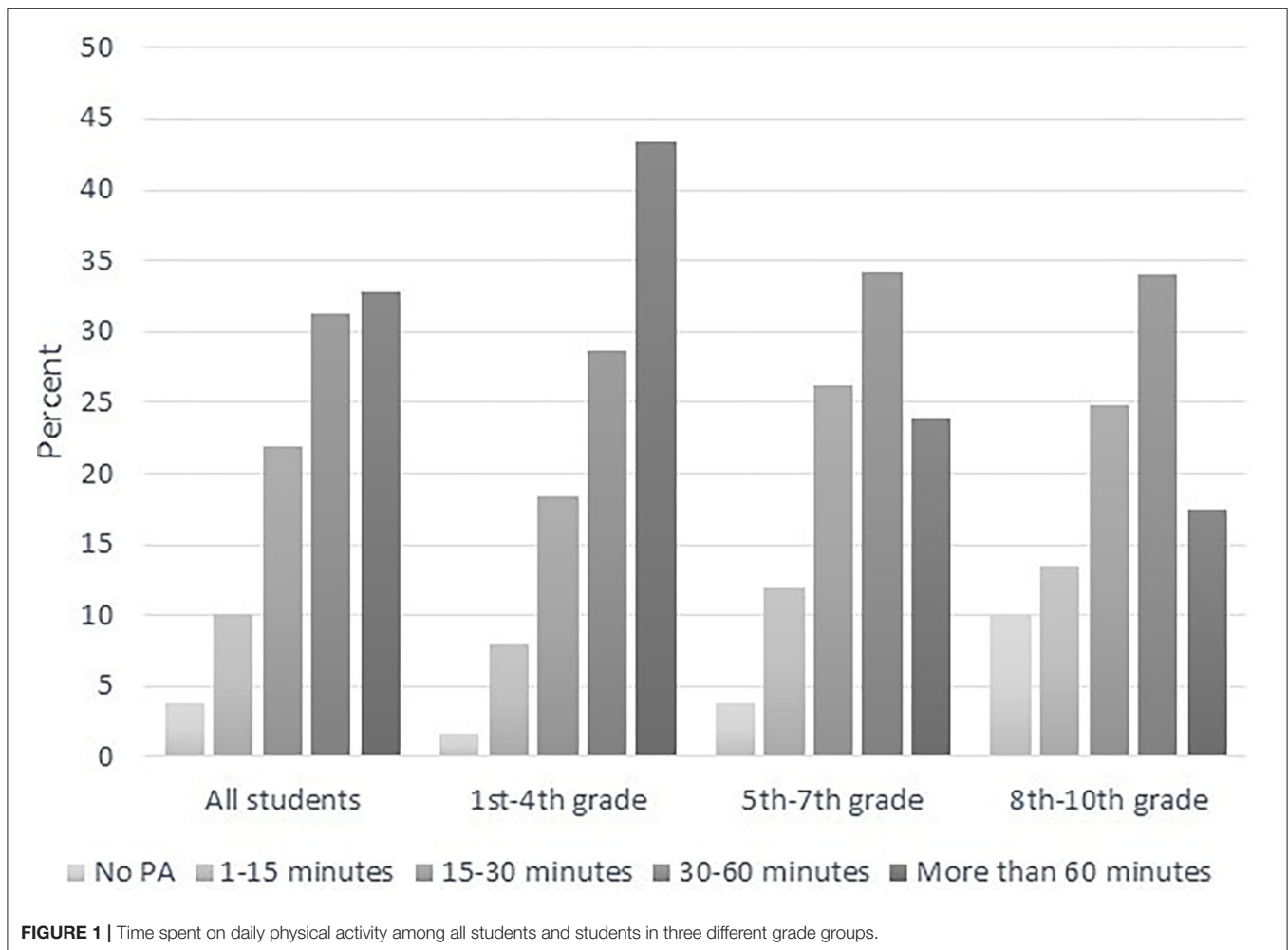
## PA During Homeschooling

The percentages presented in the tables and figures are based on the number of respondents who answered the questions. For the closed-ended questions presented in this article, the missing percentages were very low; specifically, some items were missing regarding parents' education level (0.8%), students' gender (1%), and time spent on PA (0.9%). The percentage of missing answers to the eight items that reflected students' engagement and effort in schoolwork ranged from 0 to 8%. For the two open-ended questions, missing percentages were 35.8% for positive experiences and 32.6% for challenging experiences.

Figure 1 shows the percentage distribution of responses for each alternative for all parents and for the three grade groups to the question: "How much time does the student spend being physically active during a typical homeschool day, in addition to any PE tasks or exercises given by the teacher as part of homeschool?" The figure shows that only one-third of all parents reported that their child had been physically active for at least 60 min, and more than one-third answered that their child had been active for <30 min. For the group of grades 1–4, however, 43 % of the parents reported that the child had been active for 1 h or more, while this applied to only 17% of the lower secondary students. We ran a  $\chi^2$  test and found that the difference in PA between the three grade groups was statistically significant,  $\chi^2$  (8,  $N = 4,599$ ) = 353,  $p < 0.01$ .

When we divided the respondents into groups according to the size of the municipality, a  $\chi^2$  test showed that differences between groups based on the size of the municipality was statistically significant,  $\chi^2$  (16,  $N = 4,581$ ) = 392,  $p < 0.01$ . Further investigation showed differences of less than two percentage points between the groups, in terms of time spent on PA, with one exception: in the big city, 38% reported that their children were physically active for more than 60 min, compared to 30–32% in the other groups.

A  $\chi^2$  test showed no statistical difference in time spent on PA between private and public schools,  $\chi^2$  (4,  $N = 4,596$ ) = 2,  $p = 0.724$ . Due to the low number of respondents with only 10 years of schooling, we divided the parents into the following three groups to investigate possible differences in students' PA related to the parents' educational level: no higher education, bachelor's degree, and master's or doctoral degree (Figure 2). A  $\chi^2$  test showed no statistical difference between groups of students based on their parents' education,  $\chi^2$  (8,  $N = 4,591$ ) = 13,  $p = 0.13$ .



**Figure 3** shows some instances of gender differences showing that the boys were more active; however, for most response categories, the differences were four percentage points or less. Exceptions were Grades 1–4 where a higher percentage of boys (46%) than girls (40%) were physically active for more than 60 min daily and Grades 5–7 where a higher percentage of boys (61%) than girls (54%) were physically active for at least 30 min per day. In Grades 8–10, however, we found no noteworthy gender differences. As in **Figures 1, 3** also emphasizes the gradual decline in time spent being physically active from primary to lower secondary school.

The composite variable which was based on eight items describing students' engagement and effort toward schoolwork was standardized to a total mean of 0 with a standard deviation of 1. **Table 4** shows that students in grades 5–7 on average represented the total mean, while students in grades 1–4 on average were scored 0.14 standard deviation below the total mean and students in grades 8–10 were scored 0.33 standard deviation above the total mean. A  $\chi^2$  test showed that the difference in students' engagement and effort in schoolwork between the three grade groups was statistically significant,  $\chi^2 (64, N = 3,596) = 181, p < 0.01$ . Thus, the older the students were, the more

engagement and effort they showed in schoolwork, according to their parents. It is imperative to bear these differences between the grade groups in mind when we present the relationship between PA and this variable in the following:

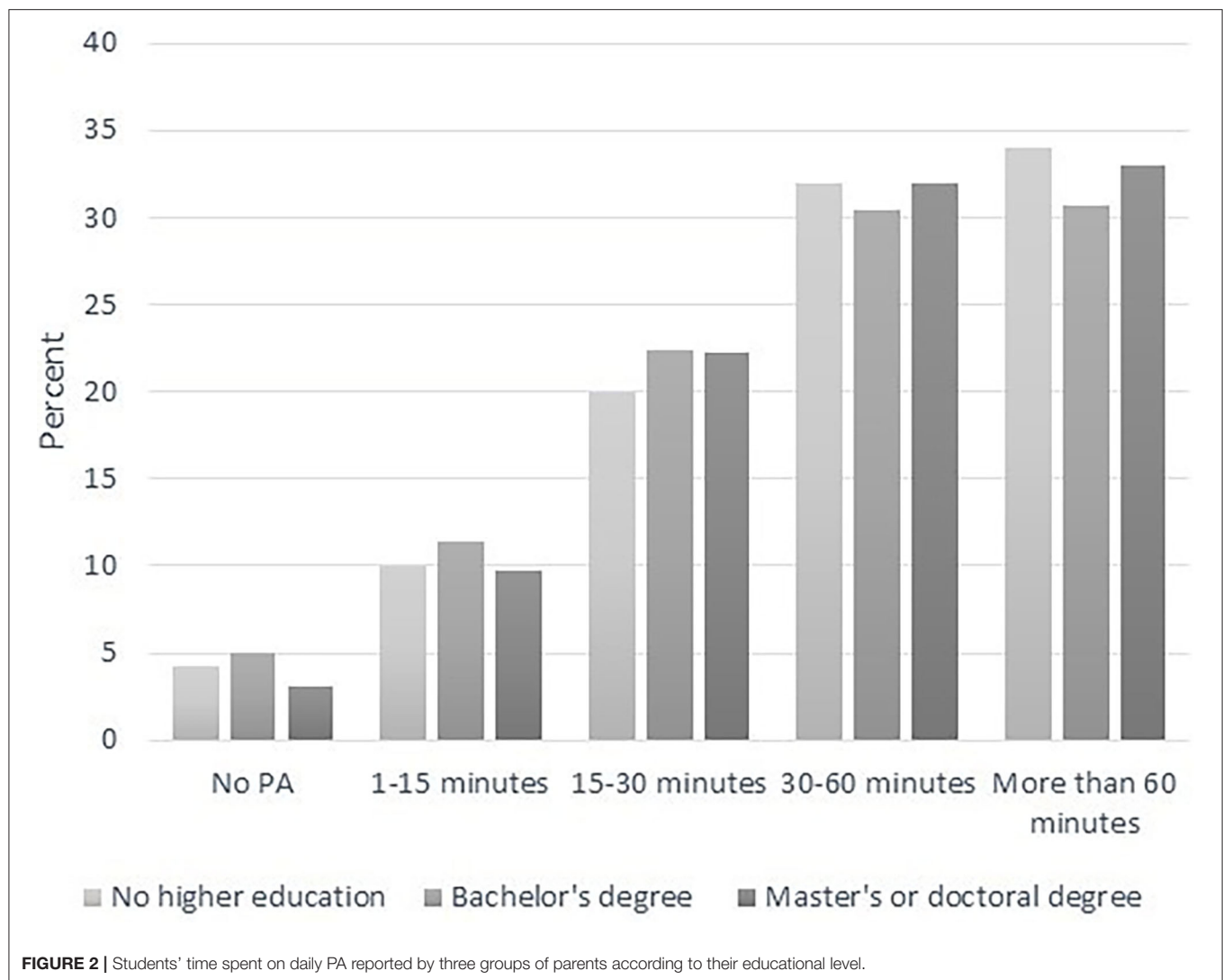
We ran ANOVAs to test whether students' engagement and effort varied across levels of PA. For students in all the three grade groups the relationship was statistically significant:

1st–4th grade:  $F(4, 1,834) = 9.43, p < 0.01$ .

5th–7th grade:  $F(4, 1,104) = 16.87, p < 0.01$ .

8th–10th grade:  $F(4, 616) = 15.41, p < 0.01$ .

**Figure 4** shows the mean values for the concept of engagement and effort in schoolwork related to time spent on PA for the three groups of students. For all grade groups, we found a positive relationship between time spent on PA and students' engagement and effort related to schoolwork. Specifically, the more time they spent being physically active, the more engagement and effort they showed toward schoolwork. Further, students in each grade group who had lower reported levels of PA also were scored lower on engagement and effort in schoolwork than students who were physically active. For students in Grades 8–10, who on average were scored above the total mean in terms of engagement and



effort, we found that those who were not physically active were scored significantly below the total mean. This is particularly interesting—and alarming—for this group of students, where one in 10 students were reported to be physically inactive (see Figure 1).

## SHORT SUMMARY OF THE QUANTITATIVE ANALYSES

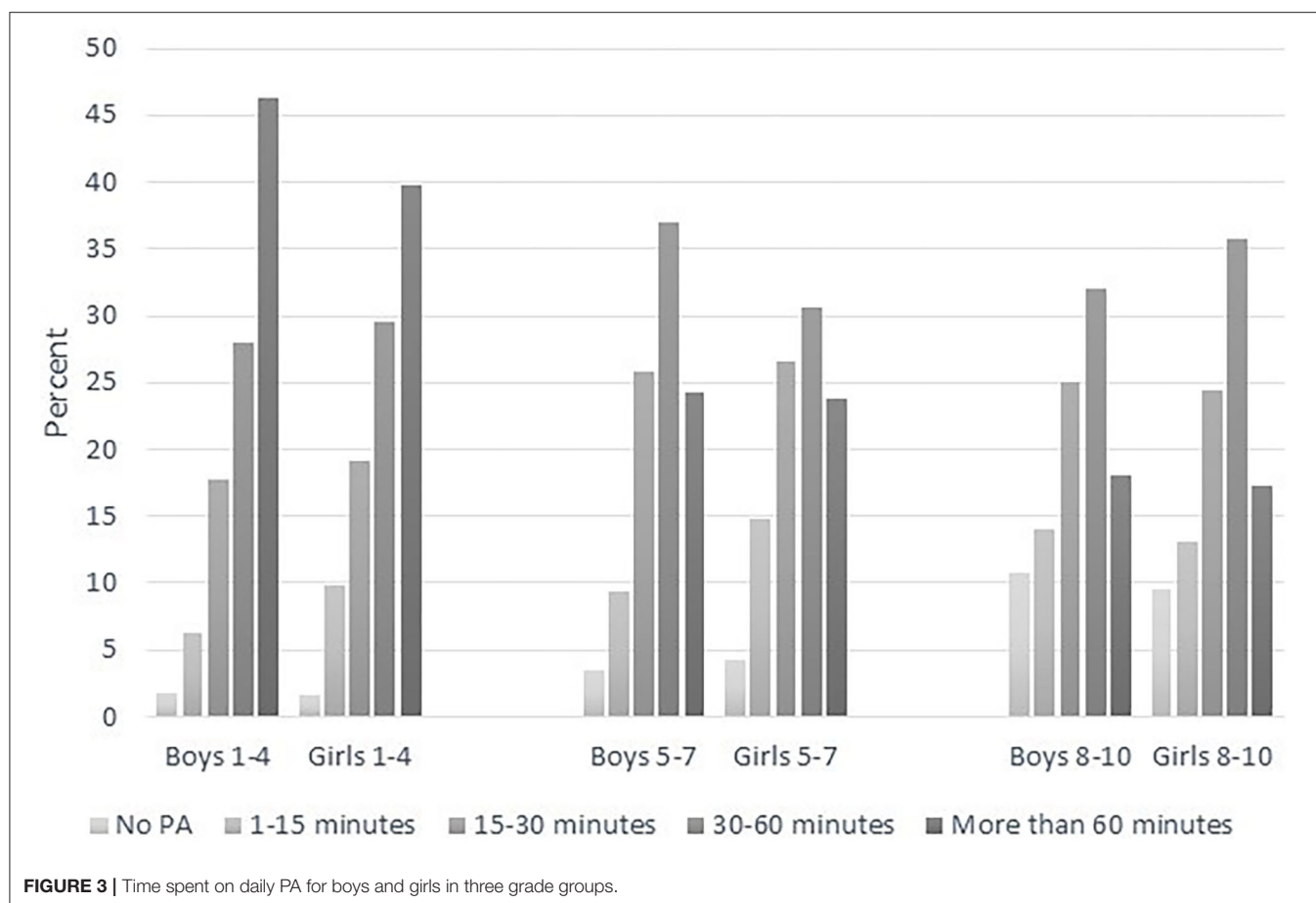
An important finding is thus that, according to the parents, 23% of the students in lower secondary school have been physically active for less than 15 min each day during school hours, with the exception of potential physical exercises given by their PE teacher. Students in Grades 1–4 (5–10 years of age) were the most active, and 43% of these parents stated that their child was physically active for more than 60 min each day. The same was true for only 18% of the students in lower secondary school. Although the youngest students were less engaged in schoolwork than the older children, the analyses showed a clear

positive relation between time students spent being physically active during a school day and their engagement and effort toward schoolwork.

## QUALITATIVE ANALYSES OF THE OPEN-ENDED QUESTIONS

There were two open-ended questions in the survey that allowed parents to elaborate on what they thought had been the main benefits and challenges during the homeschool period. A total of 2,892 (62%) reported different benefits, and 3,032 (65%) reported different challenges. In addition, 174 parents chose to write about PA as either a main benefit or a main problem during the COVID-19 homeschool period. Of these responses, 65 participants reported that homeschooling had been especially positive because their child had more time to be active compared with the time for PA and PE during normal school days. One of the benefits these parents reported had to do with flexibility regarding when different schoolwork should be done, which





allowed them to choose the student's pace and approach to schoolwork. Many of the parents saw this flexibility as an opportunity to provide more PA, and they reported that students had more time to play and to be active outdoors, and emphasized that they had more time to go on different walking, hiking, and trekking tours together as a family and to use the natural environment for teaching purposes. The following responses from parents illustrate these ideas:

*We have been able to adapt the homeschooling activity according to both the child's mood and the weather. We have often done the schoolwork down at the shoreline or on a hiking tour in the woods. (Parent of a boy, Grade 2)*

*It was nice that there was some flexibility in relation to when the tasks had to be completed, so we had the opportunity to take a break in the middle of the day and go for longer cross-country skiing trips. (Parent of a girl, Grade 2)*

*He has become more interested in physical activity, including running, strength training, and skiing with us. (Parent of a boy, Grade 8)*

*The student is very interested in the tasks and spends a lot of time on schoolwork, in addition to being able to exercise a lot every day (especially skiing). (Parent of a girl, Grade 10).*

Quite a few of the parents who reported benefits related to PA highlighted that their child was given

the opportunity to do practical work like carpentry, chopping wood, cooking, looking after younger siblings, gardening, and helping with different types of farm work during the period with homeschooling, as shown by the following examples:

*[We had] more time together to do practical tasks: cooking, tidying and gardening, sowing seeds, field trips, canoe trips, cabin building, etc. (Parent of a girl, Grade 2)*

*More time to do physical activity, more time for creative projects, more crafts and practical work (carpenter chopping wood, draining birch sap, putting up a fence, etc.). (Parent of a boy, Grade 2)*

*She has been helping us more with cooking, and we have been able to sleep outside in the woods on the weekends because we have no other plans. (Parent of a girl, Grade 4)*

*[We had] more time for outdoor activities. It was good to start the day at 09:00, have a good breakfast and a morning walk with the dog every day. (Parent of a boy, Grade 5)*

*My child is a lot outside, walks in the mountains, rides her bike, goes running, jumps on the trampoline, cooks, looks after her little brother, and takes responsibility. And she is social on video meetings too! (Parent of a girl, Grade 10).*

Overall, these findings show that parents who reported positively about PA viewed the opportunity for more

**TABLE 4 |** Mean values for three groups of for parents' reporting of the extent to which students have engagement and effort in schoolwork.

	Mean	Std. deviation	Std. error of mean
1st–4th grade	–0.14	0.98	0.02
5th–7th grade	0.04	0.99	0.03
8th–10th grade	0.33	1.01	0.04

The total mean was set to 0.

flexibility, time for PA, and more family time as main benefits of the homeschooling situation regarding students' PA.

Altogether, 109 of the 174 parents who wrote about PA in the open-ended questions mentioned the lack of PA and increased passivity as main challenges with homeschooling. These parents reported that the period of homeschooling had led to more passivity and a more sedentary lifestyle for their child. Thirty-four of these parents emphasized that their child was playing video games or using a device (e.g., smartphone, computer, and tablet) during most of the day. The responses below illustrate parents' concerns that children were less physically active as a result of lockdown:

*Lots of screens and games, and less physical activity than usual.* (Parent of a boy, Grade 4)

*I wish there were more assignments that did not require students to sit in front of a screen, but be outside. The assignments and the entire school day are now over before 11 am, and the rest of the day is spent on games and TV.* (Parent of a girl, Grade 5)

*There have been no assignments in physical education before this week, and physical activity is really important during these pandemic times. Even though I expect him [the student] to be a little outside in the fresh air every day, it is really hard to get him and his friends to do it. My impression is that they stay inside, gaming. The parents are really not good at getting their children to be outside.* (Parent of a boy, Grade 9).

The remaining 75 responses in this category claimed that it was difficult to both carry out and complete the physical assignments or that it was challenging and hard to motivate their child to be physically active.

*Several of the tasks have required the parents to play games, walk in the woods, etc., which has been very challenging because we have our own job to take care of.* (Parent of girl, Grade 2)

*It is difficult to get the child to perform tasks he does not want, like tasks in Physical Education (PE).* (Parent of a boy, Grade 6)

*Little physical activity. It had been helpful to have digital activity sessions led by the teacher.* (Parent of a boy, Grade 6)

*It is a challenge that there is so little physical activity during a day. A 14-year-old will not participate in walks in the forest, and there is a lot of sedentary sitting inside. This goes for all his friends, too. From participating in practice three times a week and matches during the weekends to zero physical activity is not a positive development.* (Parent of a boy, Grade 8).

These examples from the open-ended questions elaborate on the quantitative findings, which suggest that the students have been

less physically active during the period of homeschooling than they usually are when they attend school. The older the students are, the more they have had a sedentary lifestyle involving little or no PA. As discussed below, the teacher survey also confirmed that PE has not been a priority to the same extent as other subjects, again suggesting less PA for a majority of the students.

## TEACHER SURVEY

In their survey, the teachers were asked to report if any subject was given lower priority than during normal schooling. Multiple answers were possible. **Table 5** shows the percentage of teachers who reported that different subject were given lower priority than usual.

Teachers' responses to the open-ended questions about challenges they faced during homeschooling and remote teaching included statements about the practical difficulties of remotely teaching, PE, music, and arts and crafts, as demonstrated below:

*It is challenging not to be able to ask students to collaborate as I usually would. I use physical activities in my teaching. Now I can't. Some things are more difficult to show students online than when we are in the same physical space together.* (Teacher, Grade 8)

*It has been challenging with arts and crafts, music, voluntary subjects and PE. These subjects rely on what you do in class and require equipment.* (Teacher, Grade 8)

*In PE, it is difficult to get insight into what they do when it comes to exercise and activities.* (Teacher, Grade 8)

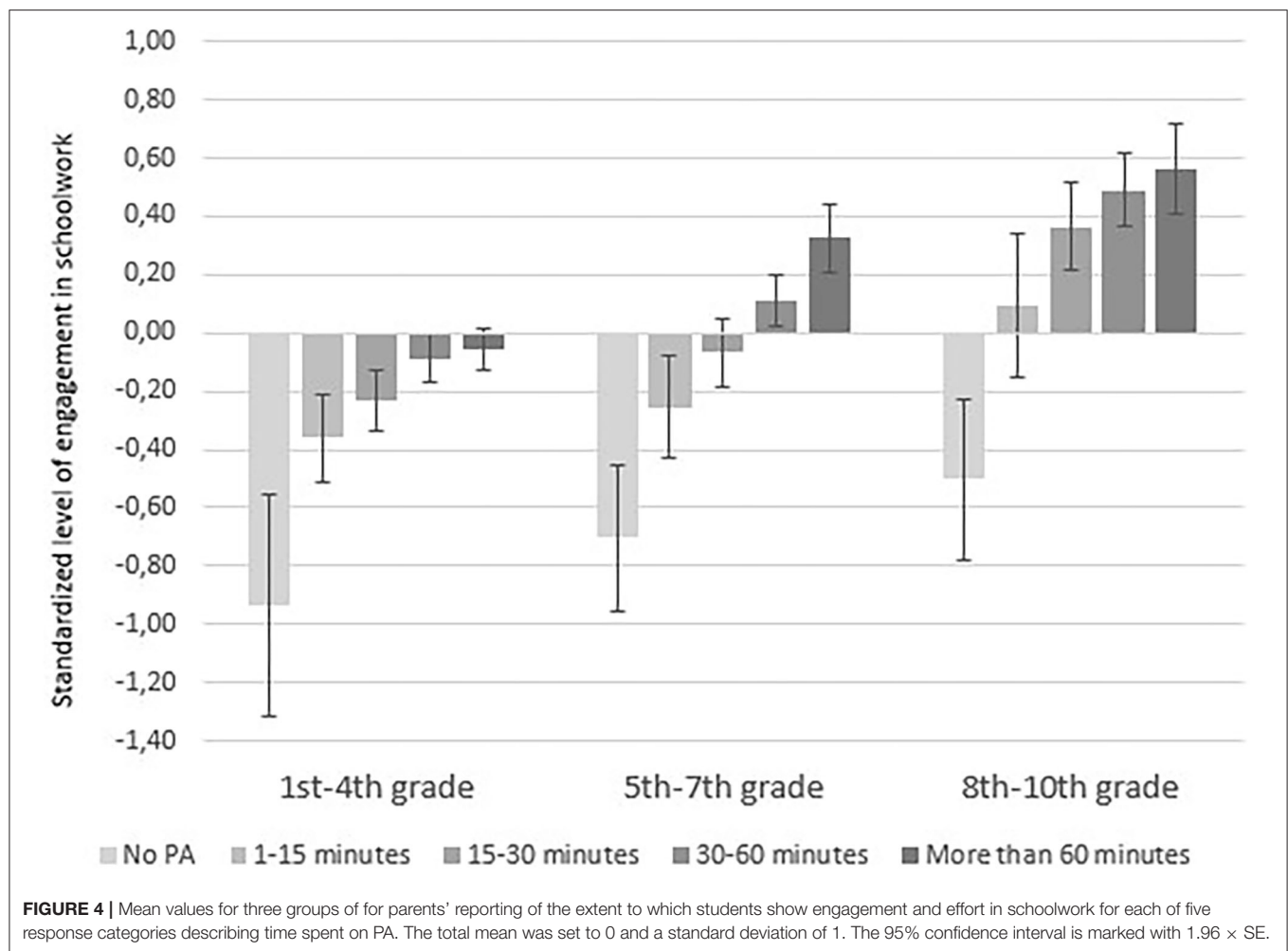
*PE has been challenging. To give individual guidance and get an overview of what the students can actually do at home and how they do it (if they even do it). We have to rely on trust and believe that they do things we tell them.* (Teacher, Grade 10)

*PE has been hard. I try to give them different assignments that can be motivating and try to get them to stay active. I have also conducted PE lessons through Teams. I guess it worked really well for some students, but I also have a suspicion that some students do not really participate in these sessions (but appear as visible in the Teams meeting).* (Teacher, Grade 10)

*Science and PE have been difficult to teach because these are really practical subjects.* (Teacher, Grade 1)

*It has been hard not to be able to help students while they are working. Some things cannot be done. Physical education and physical activity become dependent on the home and the parents' efforts.* (Teacher, Grade 1).

These responses show that several teachers across grades pointed to difficulties in teaching PE when distant from the students. Further, they stated that it was hard to follow up what students were doing, and even the teachers who tried to do PE through platforms like Teams had challenges. As the final teacher quote suggests, PA during closed schools has relied heavily on the parents' initiative or ability to follow up the intended PE provided by the schools.



## DISCUSSION: WHAT SEEMS TO IMPACT PA DURING HOMESCHOOL?

A key finding about PA during homeschool is that the most active students were those who also worked well with remote schooling in general. This was especially the case with older students. Parents who reported that their children had difficulties following the activities suggested by the school were the same parents who estimated low PA for their child.

The results also suggest that in general, during this period, students had been less physically active than they would have been during open school. In addition to the lack of the expected 1 hour of daily PA schools should provide, students have stayed at home instead of walking to and from school, going in and out of classrooms, and playing in the schoolyard during breaks. Further, the vast majority of 6–15-year-olds do organized sports one or more days a week (Hammer, 2017; Bakken, 2019), which they have not been able to because of the shutdowns. Due to these factors, it is plausible that prior to the pandemic, students would have attained 1 hour of PA on an average weekday, or would have had the opportunity to do so before the restrictions imposed because of COVID-19.

**TABLE 5 |** Percentage of teachers who reported that the subject was given lower priority than usual ( $N = 726$ ).

	Less than with open schools (%)
Mathematics	8
Language Arts	9
English	9
Natural Science	17
Food and Health	18
Social Science	21
PE	23
Religion	28
Music	30
Arts and Crafts	31

For the younger children, parents reported higher degrees of PA than the parents of older children, which is consistent with prior research showing that younger students are more active (Hammer, 2017; Bakken, 2019). This finding also reflects that teachers in the lower grades have followed up the students in a less structured way, with few requirements for attendance, which has given families the possibility to prioritize PA every

day. An important point to be made here is that there was great variation in what kind of educational activities the teachers provided for their students (Roe et al., 2020). Given that the parents viewed “flexibility to structure the day” as one of the main advantages, especially for younger children, it is reasonable to assume that a lot of the PA among the youngest children was initiated by the parents, not the teachers.

Prior research has determined that PA plays an important role in both physical and psychosocial health and wellbeing for children and young people (Biddle et al., 2019), and there is ample evidence that a sedentary lifestyle in students is associated with chronic diseases later in life and other health-related risk behaviors such as unhealthy dietary patterns (Carson et al., 2016; Tremblay et al., 2016). Research has also shown that the amount of PA declines with age and is associated with socioeconomic background (Hammer, 2017; Bakken, 2019). Our survey suggests that the home situation (e.g., two parents at home, flexibility from the school) allowed some families to really prioritize PA during COVID-19 outbreak. Further, the survey shows that, although the youngest students were less engaged in schoolwork than the older children, there was a clear positive relation between time students spent being physically active during a school day and their engagement and effort toward schoolwork. It seems that, for many families, the time during the COVID-19 pandemic provided more flexible days, where some systematically chose to include more PA. Some parents reported in the open-ended questions that their child was happier and more content than normal during homeschooling.

An important implication of our findings is that, in times of homeschooling, policymakers and educators alike need to discuss whether the degree of PA should be a result of parents' initiative or if the schools to a larger degree could provide students with tasks and assignments requiring them to systematically engage in PA at home. Previous research has shown how socioeconomic status is directly associated with health and PA, making this question all the more important. A major point to be made about the homeschool situation in Norway is that the types of activities schools have provided have varied greatly, as has how much different teachers have followed up their students (Roe et al., 2020). Some parents in the survey reported that their children were asked to use specific apps in PE during homeschool, but results from both the parent and the teacher survey as well as previous research on teachers' digital repertoires (Røkenes and Krumsvik, 2016; Blikstad-Balas and Klette, 2020) have indicated that there is room for improvement when it comes to using all the digital possibilities for educational purposes. Digital tools enable, for example, joint digital workout sessions, digital tracing of exercises, and a number of instructional videos that students could use. Previous research from Norway has suggested that teachers rarely use these forms of digitally innovative ways of teaching (Blikstad-Balas and Klette, 2020). Our materials present a clear trend of teachers prioritizing tasking students with individual assignments that require sedentary work.

This study suggests that many students were given too much responsibility for their own PA during this period, making PA dependent on their parents' priorities and the parents' possibilities to follow up. A pedagogical implication from this work is that teachers should consider providing their students with more digital workout sessions and instructional videos, as well as using apps and tracking devices that actually document students' degree of PA. Given that the digital infrastructure is present, we are somewhat surprised that the digital repertoire of the teacher revolved so heavily on giving individual tasks and so little on joint real-time instruction. A number of digital possibilities exist to measure students' activity, given that all relevant permissions are provided and rules such as the General Data Protection Regulation are followed. Such possibilities could be used to ensure that PA is not something that relies on parent initiative alone. This discussion is particularly important as WHO (2020) predicts more situations where homeschooling could be necessary in the future.

An important limitation with the survey data we presented in this article is that the survey was developed as a holistic measure of the homeschool experience for parents and teachers, not solely focusing on different aspects of PA during homeschool. It also relies on parents' perceptions of how physically active their children have been. Another significant limitation is that we lack accurate measures of how active the students would be during normal school days. Further, we also lack systematic and representative data from PE teachers mapping which digital tools they used in PE and how frequently these were used at different grade levels. Despite these limitations, we believe the present study provides important insight into how parents have prioritized PA in the time of COVID-19 and how the PA levels of children during homeschooling were greatly influenced by their parents' initiative.

## DATA AVAILABILITY STATEMENT

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

## 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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# The Impact of the Closure and Reopening of Golf Courses in the United Kingdom on Wellbeing During the COVID-19 Pandemic: A Multi-Study Approach

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The purpose of this multi-study was to assess what impact the closure and reopening of golf courses had on: personal competence; sense of belonging; enjoyment; self-esteem; self-confidence; resilience; social connections; wellbeing and life satisfaction (hereafter referred to collectively as “key variables of interest”) during the COVID-19 pandemic. Golfers (Study 1:  $n = 298$ , Study 2:  $n = 124$ )  $\geq 16$  years old residing in the UK participated in this study which collected data using online surveys. Study 1 was conducted during a period of quarantine restrictions (4–12th May 2020), whilst study 2 took place following the easing of the COVID-19 quarantine restrictions (6–14th July 2020). Within study 1 and study 2, key variables of interest levels were also collected to investigate the association with golf related activities. The findings of study 1 highlighted that negligible and non-significant correlations were observed between golf physical and sedentary activities and key variables of interest ( $r < 0.3$ ,  $p > 0.05$ ) except sense of belonging and sedentary golf activities ( $r = 0.178$ ,  $p = 0.003$ ). Study 2 highlighted that sense of belonging, enjoyment and wellbeing were significantly associated with outdoor golf course activity ( $r = 0.186$ – $0.252$ ,  $p \leq 0.05$ ). Furthermore, when comparing study 1 and study 2, sense of belonging and life satisfaction significantly improved ( $p < 0.05$ ,  $d = 0.2$ ). Based on these findings, playing golf on outdoor golf courses appears to be positively related to sense of belonging, enjoyment and wellbeing. Also, with the reopening of golf courses life satisfaction improved which, together, highlights the beneficial impact that outdoor golf can impart.

**Keywords:** coronavirus, exercise, physical activity, SARS-CoV-2, sport

## INTRODUCTION

Golf is played in 206 countries worldwide (The Royal Ancient, 2019), including the United Kingdom (UK), with 870,996 registered golfers (Lange, 2019). Golf is normally played outdoors on 9 or 18-hole courses and requires individuals to perform intermittent bursts of walking and multiple golf shots of varying distances (Versteegh et al., 2008). As a result of these aspects, golf

is a popular sport across varying age groups and enables individuals with varying levels of fitness and mobility to participate (Arkkari et al., 2000; Murray et al., 2017).

Golf provides individuals with opportunities to increase or maintain light to moderate intensity physical activity (PA) levels (Luscombe et al., 2017). Golf is predominantly recognised as a moderate intensity activity, with a general metabolic equivalents (METs) of 4.8 (Ainsworth et al., 2011). Accordingly, golf can provide possible health benefits for those individuals who participate (Murray et al., 2017; Sorbie et al., 2020b), whilst also facilitating the opportunity to improve mental health and wellness (Murray et al., 2017; Breitbarth and Huth, 2019). Specifically, golf offers the prospect to improve social relations, sense of belonging, self-esteem, life satisfaction, personal competence, and personal wellbeing (Stenner et al., 2016; Wheatley and Bickerton, 2017; Sorbie et al., 2020b). In addition to the above, golf is normally played outdoors, which can also promote life satisfaction due to the outdoor environment (Zhang et al., 2014; Silva et al., 2018).

On March 23rd 2020, golf courses in the UK closed for between 8 and 10 weeks (the variation was dependent on different UK countries) as a result of the COVID-19 pandemic caused by SARS-CoV-2 coronavirus (United Kingdom Government, 2020). Although golf courses were closed, it was possible for individuals to perform golf-related activities within their home environment. We recently reported on golf-related engagement pertaining to physical (e.g., practising full golf swings, chipping, and putting) and sedentary (e.g., watching TV and online tutorials and listening to podcasts) activities during an 8-day period of restricted movement as a result of the COVID-19 pandemic (Sorbie et al., 2020a). Forty-eight percent of golfers completed physical golf-related activities within the home environment during a period of quarantine (4–12th May 2020). The most commonly-performed sedentary golf activity was watching golf on television (71%). Whilst informative, the implications of these activities during a period of restricted movement are not known, particularly in relation to personal competence, sense of belonging, enjoyment, self-esteem, resilience, social connections, and wellbeing. Indeed, behavioural strategies to alleviate the impacts of psychosocial stresses during quarantine restrictions have recently been recommended (Ricci et al., 2020). Moreover, the reopening of golf courses within the UK on 13–29th May 2020 enabled the opportunity to investigate the association between markers of personal wellbeing and golf-related activity both at home and on outdoor golf courses, importantly within the same individuals.

Taken together, the closure and reopening of golf courses during a unique and unprecedented period presented an opportunity for insightful implications for golf to be investigated. Therefore, the overarching purpose of this multi-study was to assess what impact golf-related engagement during the COVID-19 quarantine restrictions had on: personal competence; sense of belonging; enjoyment; self-esteem; self-confidence; resilience; social connections; wellbeing; and life satisfaction (hereafter referred to collectively as “key variables of interest”). In order to achieve this, we conducted studies within two distinct and significant time periods during the COVID-19 pandemic.

Study 1 aimed to ascertain the correlations between golf-related activities performed within the home environment and the key variables of interest during the COVID-19 quarantine restrictions (4–12th May 2020). It was hypothesised that home-based golf activity (physical and sedentary) would be positively associated with all key variables of interest.

Study 2 aimed to first ascertain the correlations between golf-related activities performed on golf courses and driving ranges/practise areas and the key variables of interest following the easing of the COVID-19 quarantine restrictions (6–14th July 2020). It was hypothesised that home-based (physical and sedentary) golf activities and those on golf courses and at driving ranges/practise areas would be positively associated with all key variables of interest. Secondly, study 2 aimed to compare key variables of interest between studies 1 and 2 with hypothesised improvements.

## METHODS

### Participants Inclusion Criteria

In order to be eligible for the present studies, participants were required: to be 16 years of age or older; to consider themselves either a social, handicap or professional golfer; to reside within the UK and have played at least two rounds of golf in 2019. A minimum of two rounds of golf in 2019 was added within the eligibility criteria to ensure golfers could be categorised as a social golfer. Full ethical approval was granted from Abertay University School of Health Sciences prior to data collection.

### General Methodological Procedures

The same methodological procedures were used for both studies 1 and 2. Online surveys were used to collect data between 4 and 12th May 2020 (Study 1) and then subsequently between 6 and 14th July 2020 (Study 2). The surveys contained questions relating to three strands. Firstly, participants answered questions relating to what golf activities they performed during these two time periods. Golf-related questions included: what physical golf activities (i.e., full golf shots, chipping, putting, physical virtual reality golf games, participating in golf coaching sessions) were performed and what sedentary golf activities (i.e., reading golf magazines, listening to golf related podcasts or audiobooks, watching golf on TV) were engaged with. The days per week and time spent participating in these activities in the previous 7 days were recorded. Only activity bouts of at least 10 min were recorded. Specific to study 2, in accordance with re-opening of golf-courses, questions were asked relating to golf activity on courses, driving ranges, and practise areas between 6 and 14th July 2020. Data were also collected pertaining to the days per week and time spent participating in these activities in the previous 7 days.

Secondly, PA was measured using the International Physical Activity Questionnaire short form (IPAQ-SF). Although the recommended age range for using the IPAQ-SF is 15–69 years of age, we elected to use this assessment tool for older adults given the anticipated range in ages relating to golfers. The IPAQ-SF has previously been shown to have acceptable reproducibility (Craig et al., 2003), including older adults (Tran



et al., 2013). We intended to use PA data derived from IPAQ-SF as a potential covariate to golf-related activity, depending on associated changes in PA from study 1 to study 2. In addition to the standard example, we supplied additional exemplar activities with a focus on typical behaviours likely to be experienced during restricted movement conditions to guide participants in accordance with known metabolic equivalents (METs) for each category of intensity (Ainsworth et al., 2011). Similarly, we calculated golf-related PA on outdoor courses and at driving ranges/practise areas using a 7-day recall in line with the IPAQ-SF.

Thirdly, participants completed a total of 18 questions relating to: personal competence (McAuley and Duncan, 1989); sense of belonging (Postmes et al., 2013); self-esteem (Robins et al., 2001); self-confidence (Bandura, 2006); resilience (Ungar and Liebenberg, 2011); social connections (Perlman and Peplau, 1981); wellbeing (Abdel-Khalek, 2006) and life satisfaction (Office of National Statistics). These questions have been commonly used within the respected areas, are validated measures and were answered on a 5-point scale, which ranged from strongly disagree (1) to strongly agree (5). Internal consistency was determined for variables of interest which were derived from multi-item questions, including personal competence (Cronbach's  $\alpha = 0.80$ ), resilience (Cronbach's  $\alpha = 0.83$ ), and social connections (Cronbach's  $\alpha = 0.81$ ).

## Data Analysis and Qualification of Activity

Physical activity data were processed in accordance with IPAQ-SF recommendations for each of the three intensities (vigorous, moderate, and walking) in order to calculate the MET.min<sup>-1</sup>.week<sup>-1</sup>. Total activity was then calculated to represent the sum of all intensities. For an extended and detailed method of data processing used in these studies, see **Supplementary Material 1**. The same processes were used to determine golf MET.min<sup>-1</sup>.week<sup>-1</sup> on golf courses and at driving range/practise areas within the last 7 days. The METs of general golf on golf courses were deemed to be 4.8 and at the driving range/practise area, 3.0.

## Statistical Analysis

Statistical analyses were performed using Jamovi (Version: 1.2.12) (The Jamovi Project, 2019). All data were measured for normality using the Shapiro-Wilk test. For study 1 and 2, all data were not normally distributed; therefore, non-parametric Spearman's Rank Correlations were conducted to determine relationships between golf-related activity and key variables of interest. Correlation coefficients of 0–0.3 were categorised as negligible, 0.3–0.5 low, 0.5–0.7 moderate, 0.7–0.9 high, and 0.9–1 very high (Hinkle et al., 2009). Based on data collected in study 1, Cronbach's  $\alpha$  was used to assess internal consistency for personal competence, resilience, and social connections which had multi-item questions.

For study 2, all data were not normally distributed; therefore, non-parametric Spearman's Rank Correlations were conducted to determine relationships between golf-related activity conducted on golf courses or driving ranges/practise

areas and key variables of interest. In addition, non-parametric Wilcoxon signed-rank tests were carried out to compare golf-related engagement within the home environment, PA, and key variables of interest between study 1 and study 2. All data are presented as mean  $\pm$  standard deviation (SD),  $p$ -value and effect sizes using Cohen's  $d$  (Cohen, 1988). Effect sizes of  $<0.2$  were considered negligible, 0.2–0.5 small, 0.5–0.8 medium, and  $>0.8$  large (Cohen, 1988). In all instances,  $p \leq 0.05$  was considered to be statistically significant.

## RESULTS AND DISCUSSION

The results for study 1 are presented below, followed by a relevant discussion for study 1. Study 2 is presented in the same format as study 1. Following the results and discussion for study 1 and study 2, a general discussion is presented at the end of this section.

### Study 1—Results

A total of 298 golfers (14% Females; 86% Males) volunteered to participate in study 1. Golfers ranged in age from 16 to 89 years (Mean  $\pm$  SD:  $53 \pm 15$  years). Ninety-five percent had a handicap index; 3% were social golfers and 2% were professional golfers. The handicap index ranged from 0 to 50 (Mean  $\pm$  SD:  $14 \pm 8$  handicap index). At the time of the restricted movement period (4–12th May 2020), 34% were not working, 30% were working from home, 18% were working as normal, and 18% were retired. Of the included golfers for study 1, individuals had completed  $73 \pm 26$  (range 2–250) rounds of golf in 2019. All golfers provided informed written consent before participating in study 1 and study 2.

**Table 1** provides Spearman's correlation coefficients and  $p$ -value for correlations between golf-related engagement questions and key variables of interest. Negligible and insignificant correlations were observed between physical golf activities and all key variables of interest ( $r = -0.084$ – $0.088$ ,  $p > 0.05$ ). Sedentary activities within the home environment were significantly associated with sense of belonging ( $r = 0.178$ ,  $p = 0.003$ ). Negligible and insignificant correlations were observed between all other key variables of interest and sedentary golf activities ( $r = -0.115$ – $0.079$ ,  $p > 0.05$ ). For extended descriptive data relating to the key variables of interest and physical and sedentary activities, see **Supplementary Material 2**.

### Study 1—Discussion

As a result of the majority of the correlations between golf-related activity and key variables of interest being negligible and non-significant, the hypothesis for study 1 was rejected. This contrasts with existing work, where it has been previously reported that golf offers the prospect to improve social relations, sense of belonging, self-esteem, life satisfaction, and personal competence which, in turn, can lead to an overall enhancement in personal wellbeing (Stenner et al., 2016; Wheatley and Bickerton, 2017; Sorbie et al., 2020b). Initially it was assumed that our disparate findings to others could be a result of the strict quarantine restrictions that were in place during the data collection period of study 1 (United Kingdom Government, 2020). However,

**TABLE 1** | Spearman's correlation coefficients (*r*) and *p*-value for golf-related engagement questions when measured against key variables of interest in study 1 (during the covid-19 quarantine restrictions).

Golf-related questions	Correlation analysis	Key variables of interest								
		Personal competence	Sense of belonging	Enjoyment	Self-esteem	Self-confidence	Resilience	Social connections	Wellbeing	Life satisfaction
Physical golf activities	Spearman's <i>r</i>	0.047	0.088	0.071	−0.058	−0.084	−0.054	−0.007	0.004	−0.025
	<i>p</i> -value	0.436	0.114	0.242	0.334	0.161	0.370	0.908	0.943	0.682
Sedentary golf activities	Spearman's <i>r</i>	0.069	0.178	0.067	0.011	0.079	−0.001	−0.013	−0.019	−0.093
	<i>p</i> -value	0.244	<b>0.003</b>	0.264	0.848	0.185	0.992	0.833	0.754	0.123

*Bold values indicate statistical significance. Significance granted at  $p < 0.05$ .*

we recently reported that the common physical golf activities performed within the home environment included full golf swings, chipping, and putting (Sorbie et al., 2020a). Although these physical golf activities form a part of the game of golf, these skills do not replicate the outdoor environment that golf courses offer, as they do not include the walking element of the sport and the social interactions the sport provides. These aspects have been shown to promote personal wellness (Fox, 1999; Silva et al., 2018); therefore performing these physical golf activities within the home environment could aid skill development, but is unlikely to impact key variables of interest investigated within this study.

Moreover, we observed that sedentary golf activity and sense of belonging were significantly and positively associated. This suggests that those who engaged in sedentary golf activities for longer periods of time presented with a greater sense of belonging, even during a time when significant quarantine restrictions were imposed. We recently reported that the most commonly-performed sedentary golf activities during the COVID-19 quarantine restrictions were watching golf on television and watching online tutorials (Sorbie et al., 2020a). In support, it has been shown in other sports that spectating through media such as television can increase or create a sense of belonging for individuals (Williams, 2007). Whilst engagement in sedentary activities may provide a sense of belonging, these activities are likely conducted without face-to-face interaction, which was reduced given the concurrent movement restrictions. Accordingly, this may provide some insight to the lack of association observed between sedentary golf engagement and social connexion. These results suggest that engaging with golf on television or through online tutorials can provide individuals with a sense of belonging during a period of strict quarantine restrictions and with limited social interactions.

## Study 2—Results

A total of 124 golfers (17% Females; 83% Males) volunteered to participate in study 2. These golfers were recruited from the same pool of golfers that participated in study 1. Golfers ranged in age from 20 to 89 years (Mean  $\pm$  SD: 54  $\pm$  15 years). Ninety-four percent had a handicap index; 5% were social golfers and 1% were professional golfers. The handicap index ranged from 0 to 50 (Mean  $\pm$  SD: 14  $\pm$  9 handicap index). Of the included golfers

for study 2, individuals had completed 82  $\pm$  47 (range 2–250) rounds of golf in 2019.

**Table 2** provides Spearman's correlation coefficients and *p*-value for correlations between golf-related engagement questions and key variables of interest obtained from study 2. In relation to golf activity on golf courses (MET.min<sup>−1</sup>.week<sup>−1</sup>), sense of belonging ( $r = 0.186$ ,  $p = 0.041$ ), enjoyment ( $r = 0.234$ ,  $p = 0.010$ ), and wellbeing ( $r = 0.252$ ,  $p = 0.005$ ) were significantly associated with these types of golf activity. All other key variables of interest and golf activity on golf courses (MET.min<sup>−1</sup>.week<sup>−1</sup>) and golf practice (MET.min<sup>−1</sup>.week<sup>−1</sup>) performed at the driving range/practice area were negligible and not significantly related ( $r = -0.084$ – $0.171$ ,  $p > 0.05$ ).

Physical and sedentary golf activities within the home environment were significantly associated with sense of belonging ( $r = 0.226$ ,  $p = 0.014$ ,  $r = 0.277$ ,  $p = 0.002$ ). Negligible and insignificant correlations were observed between physical and sedentary golf activities within the home environment and all key variables of interest ( $r = -0.032$ – $0.116$ ,  $p > 0.05$ ) (**Table 2**).

When comparing key variables of interest between studies 1 and 2, sense of belonging ( $p = 0.044$ ,  $d = 0.167$ ) and life satisfaction ( $p = 0.026$ ,  $d = 0.223$ ) significantly increased. No statistical significance was reported for all other key variables of interest between studies 1 and 2 ( $p > 0.05$ ) (**Table 3**).

Physical golf activities within the home environment significantly reduced when comparing studies 1 and 2 ( $p < 0.001$ ,  $d = 0.425$ ), whereas no significant difference was observed between sedentary golf activities between studies 1 and 2 ( $p = 0.550$ ,  $d = 0.126$ ) (**Table 4**). Furthermore, moderate and vigorous PA significantly reduced between studies 1 and 2 ( $p < 0.001$ ,  $d = 0.181$ ,  $p = 0.024$ ,  $d = 0.203$ ), whereas no significant difference was reported for light PA between studies 1 and 2 ( $p = 0.342$ ,  $d = 0.048$ ). For extended descriptive and statistical data relating to PA, see **Supplementary Material 2**.

## Study 2—Discussion

Due to multiple correlations observed between golf-related activity and key variables of interest, the original hypotheses for study 2 were partially accepted. Specifically, study 2 reported significant and positive correlations between golf course activity (MET.min<sup>−1</sup>.week<sup>−1</sup>) and enjoyment, wellbeing and sense of belonging. This demonstrates the advantages of spending more

**TABLE 2 |** Spearman's correlation coefficients (*r*) and *p*-value for golf-related engagement questions obtained from study 2 (following the easing of COVID-19 quarantine restrictions) when measured against key variables of interest.

Golf-related questions	Correlation analysis	Key variables of interest								
		Personal competence	Sense of belonging	Enjoyment	Self-esteem	Self-confidence	Resilience	Social connections	Wellbeing	Life satisfaction
Golf activity (MET.min <sup>-1</sup> .week <sup>-1</sup> )	Spearman's <i>r</i>	0.091	<b>0.186</b>	<b>0.234</b>	0.093	0.026	0.148	0.138	<b>0.252</b>	0.171
	<i>p</i> -value	0.314	<b>0.041</b>	<b>0.010</b>	0.305	0.775	0.102	0.128	<b>0.005</b>	0.059
Golf practise (MET.min <sup>-1</sup> .week <sup>-1</sup> )	Spearman's <i>r</i>	−0.069	−0.042	−0.028	−0.084	−0.034	0.091	−0.021	−0.083	−0.046
	<i>p</i> -value	0.470	0.667	0.773	0.376	0.726	0.340	0.826	0.384	0.629
Physical Golf Activities	Spearman's <i>r</i>	0.056	<b>0.226</b>	−0.013	0.053	0.049	0.083	0.041	−0.001	−0.013
	<i>p</i> -value	0.541	<b>0.014</b>	0.885	0.566	0.592	0.365	0.655	0.995	0.855
Sedentary Golf Activities	Spearman's <i>r</i>	0.076	<b>0.277</b>	0.027	0.092	0.048	0.116	0.027	−0.032	0.073
	<i>p</i> -value	0.405	<b>0.002</b>	0.767	0.312	0.599	0.203	0.772	0.729	0.424

Bold values indicate statistical significance. Significance granted at  $p < 0.05$ .

**TABLE 3 |** Key variables of interest between study 1 and study 2 using a 5-point Likert scale with *p*-value and Cohen's *d* effect sizes.

Key variables of interest	Study 1	Study 2	<i>p</i> -value	Effect size (Cohen's <i>d</i> )
Personal competence ( $n = 124$ )	2.77 ± 0.83	2.85 ± 0.77	0.162 <sup>a</sup>	0.1
Sense of belonging ( $n = 120$ )	3.50 ± 1.08	3.67 ± 1.01	<b>0.044<sup>a</sup></b>	<b>0.2</b>
Enjoyment ( $n = 120$ )	4.42 ± 1.07	4.34 ± 0.99	0.332 <sup>a</sup>	0.1
Self-esteem ( $n = 124$ )	3.55 ± 1.14	3.55 ± 1.03	0.938 <sup>a</sup>	0.0
Self-confidence ( $n = 123$ )	3.83 ± 1.07	3.90 ± 1.00	0.387 <sup>a</sup>	0.1
Resilience ( $n = 124$ )	3.66 ± 0.85	3.59 ± 0.74	0.093 <sup>a</sup>	0.1
Social connexion ( $n = 124$ )	3.65 ± 0.91	3.80 ± 0.92	0.057 <sup>a</sup>	0.2
Wellbeing ( $n = 122$ )	3.68 ± 0.99	3.78 ± 0.94	0.508 <sup>a</sup>	0.1
Life satisfaction ( $n = 121$ )	3.52 ± 1.11	3.79 ± 0.91	<b>0.026<sup>a</sup></b>	<b>0.2</b>

Data are mean ± SD. Bold values indicate statistical significance. <sup>a</sup>Non-normally distributed analysis. Significance granted at  $p < 0.05$ .

**TABLE 4 |** Golf-related activities between study 1 and study 2.

Golf-related activity	Study 1	Study 2	<i>p</i> -value	Effect size (Cohen's <i>d</i> )
Physical (min.week <sup>-1</sup> ) ( $n = 113$ )	88 ± 166	27 ± 54	<b>&lt;0.001<sup>a</sup></b>	<b>0.4</b>
Sedentary (min.week <sup>-1</sup> ) ( $n = 117$ )	151 ± 217	200 ± 367	0.550 <sup>a</sup>	0.1

Data are mean ± SD. Bold values indicate statistical significance. <sup>a</sup>Non-normally distribute analysis. Significance granted at  $p < 0.05$ .

time on golf courses playing golf. These positive findings are in agreement with existing research that has investigated the impact that golf has on various psychosocial markers of health (Murray et al., 2017; Breitbarth and Huth, 2019). Collectively, these findings reinforce the importance of engaging with golf activities on outdoor golf courses. Further support for actually playing golf on outdoor courses as the mediator is clear when considering that practice/driving range activity (MET.min<sup>-1</sup>.week<sup>-1</sup>) was not associated with any markers of belonging, enjoyment, competence, resilience, social connections, wellbeing, or life satisfaction. Therefore, although practice area/driving range

activities provide opportunities to enhance skill level and increase PA levels, these types of activities were not related to key variables of interest herein.

Importantly, there were also insignificant correlations between golf course activity (MET.min<sup>-1</sup>.week<sup>-1</sup>) and other key variables of interest, including social connections, personal competence, and self-confidence. It has been previously highlighted that golf is associated with increased social connections (Berlin and Klenosky, 2014); however, the disagreement in this study may be a result of the partial restrictions imposed on the return of golf during the time of study 2. For example, social distancing, playing with a limited number of golfers and no hand shaking at the end of a round (England Golf, 2020). This may provide a plausible explanation as to why social connections and golf course activity were not significantly associated.

In relation to personal competence and self-confidence, these measures were not significantly associated with golf course activity (MET.min<sup>-1</sup>.week<sup>-1</sup>). These results could be due to the extended period that golf courses were closed, which resulted in golfers being unable to play on outdoor courses. Specifically, during the initial restrictions set by the UK government, golf courses were closed for 8–10 weeks (United Kingdom Government, 2020). It is possible that this

absence from golf courses may have imposed a negative effect on personal competence and self-confidence upon returning to the sport. Although under different conditions, this is supported by previous literature that highlights athletes' competence and confidence is adversely impacted when injured for a prolonged period of time (Clement et al., 2015).

## GENERAL DISCUSSION

The aim of this multi-study was to investigate the impact of golf-related engagement on: personal competence; sense of belonging; enjoyment; self-esteem; self-confidence; resilience; social connections; wellbeing and life satisfaction during the COVID-19 pandemic within a cohort of golfers. The principle findings were that: (1) during quarantine restrictions (study 1) there were negligible correlations between golf activity within the home environment and key variables of interest.; (2) Following the reopening of golf courses (study 2), positive correlations were observed between golf course activity ( $\text{MET} \cdot \text{min}^{-1} \cdot \text{week}^{-1}$ ) and sense of belonging, enjoyment and wellbeing; (3) When considering both studies and the transition from quarantine restrictions to being able to play outdoor golf, significant improvements were observed in sense of belonging and life satisfaction. Taken collectively, this multi-study provides insight into golf-related activities during an unprecedented time during a global pandemic and how these can facilitate superior perceptions of sense of belonging, wellbeing and life satisfaction when golf is conducted on outdoor courses.

When considering both studies and the transition from having quarantine restrictions in place to being able to play golf on golf courses, small yet significant improvements were observed in relation to sense of belonging. Although many golfers during studies 1 and 2 were able to engage in physical golf activities within their home environment, these skills do not fully-reflect the sport of golf. This is supported by the lack of correlations between physical and sedentary golf activities within the home environment and key variables of interest in both studies 1 and 2. In particular, the skills that were being performed within the home environment do not reflect the outdoor environment that golf courses offers, including the element of walking and the competitive nature of the sport; accordingly, it is likely attributed to the act of play on outdoor golf courses, which agrees with previous research. Specifically, Stenner et al. (2016) reported that golf, within the natural golf environment, can have a positive impact on an individual's sense of belonging; therefore, the reopening of golf courses most likely explains the significant increase in sense of belonging between studies 1 and 2.

Additionally, life satisfaction also increased between studies 1 and 2. The reopening of golf courses alongside less-restrictive quarantine measures may have facilitated this improvement. Playing golf on courses enables individuals to play the sport in a natural environment, which is known to increase life satisfaction (Zhang et al., 2014). Whilst we cannot completely disentangle PA from physical golf activity, we are confident that the improved life satisfaction reflects the re-opening of golf

courses and less-restrictive measures, as opposed to changes in PA levels. Indeed, total PA ( $\text{MET} \cdot \text{min}^{-1} \cdot \text{week}^{-1}$ ) levels (which did not include golf activity) significantly reduced, therefore, the previously reported psychological benefits of increased PA (Hartfiel et al., 2011) would not appear to be a principle factor in the enhancement of life satisfaction; although the contrary is also true, and it must be recognised that concomitant alterations in social interaction could have contributed. Nonetheless, this observation may indicate a situational change in life satisfaction, with concurrent increases in outdoor golf course activity being performed. The positive association between golf course activity ( $\text{MET} \cdot \text{min}^{-1} \cdot \text{week}^{-1}$ ) and wellbeing, as reported in study 2, however, may better reflect that specific time period of being able to play golf. Therefore, when taken together we recommend that, where possible, golf should be played on outdoor courses even if there are future quarantine restrictions put in place by governments to ensure improved life satisfaction, and individuals should be encouraged to spend more time on golf courses ( $\text{MET} \cdot \text{min}^{-1} \cdot \text{week}^{-1}$ ) for an association with greater wellbeing. These findings may also be comparable to other sports that display similarities to golf in regards to the required METs score between 4.0 and 5.0 for activities that include but are not limited to: archery, basketball shooting, cricket, table tennis, track and field throwing events, and doubles tennis (Ainsworth et al., 2011).

When comparing both studies, no significant differences were observed in all other variables of interest. However, social connections tended to increase from study 1 to study 2 (Table 3). Although we would expect that the reintroduction of golf courses would significantly enhance social connections based upon previous research (Berlin and Klenosky, 2014), strict restriction measures were still in place when golf courses reopened. These restrictions included restricted locker room and clubhouse access (England Golf, 2020). Although golfers were able to play on golf courses with other golfers, these strict restrictions may help to explain why the social connections between studies 1 and 2 were not statistically significant, yet a small effect was observed. It would be of interest to see if social connections are enhanced if and when all restrictions are removed. The present findings may be applicable to other sports that are dependent on the closure and reopening of sporting facilities.

No significant differences were found in personal competence, enjoyment, self-esteem, and self-confidence when comparing studies 1 and 2. We feel that these findings could be a result of golfers being unable to play on golf courses for an extended period of time. As a result, this time away from the sport may have impacted on performance levels, which may have resulted in no change being observed in personal competence, enjoyment, self-esteem, and self-confidence. Indeed, when comparing the present findings with previous research, time away from sporting competition in sports such as football and baseball has been previously shown to have an impact on these measures (Clement et al., 2015). Future research may be required in order to measure the impact that personal competence, enjoyment, self-esteem, and self-confidence can have when golfers have been playing for an extended period without an unanticipated time away from the sport.



Strengths of this multi-study include the timeframe that the surveys were implemented. This ensured that the UK government guidelines in relation to golf were captured at similar levels for all individuals across the two studies. In addition, the golfers within this multi-study are representative of the numbers of registered golfers in the UK, including age (Sorbie et al., 2020b), golf handicap index (Golf Care, 2016), and gender (Lange, 2019). In relation to gender, 81% of registered golfers in the UK are male and 12% are female (Lange, 2019). This distribution in gender is representative of golfers that participated within this multi-study (Study 1: 86% Male and 14% Female, Study 2: 83% Male and 17% Female). Additionally, an important and novel aspect of this multi-study is the follow-up nature and collection of data within the same individuals during an unprecedented time.

As a result of this multi-study being conducted during the COVID-19 pandemic, the findings should be contextualised as a result of the methodological limitations. Specifically, there were significant relaxations in quarantine restrictions during the data collection of study 1 and study 2, such as increased contact with family and friends (United Kingdom Government, 2020); therefore, it remains unclear to what degree golf participation contributes to the improvements in the measures within this study. In addition, the significant and positive correlations observed within studies 1 and 2 were categorised as negligible or small; however, we do anticipate that other uncontrollable factors associated with the pandemic may have influenced these relationships.

At the time of writing, it is uncertain if or when the COVID-19 pandemic will recede, and there may be a need for quarantine measures to be reintroduced at some stage. If this were to happen, there would likely be an impact on many sports. Based on the current findings, however, we would recommend that on-course golf activity should be introduced at an early stage of any restrictive period, with safety measures already having been put in place by governing bodies responsible for golf. In addition, the current study focused on the psychosocial benefits of participating in golf, which is a low to moderate PA, during the COVID-19 pandemic. Whilst we did not investigate age related differences, future research may wish to do so based on the different exercise intensities of walking an 18-hole golf course is experienced by young, middle-aged and elderly golfers (Broman et al., 2004). In addition, future research is required to investigate if the benefits of participating in this type of activity are translatable to other sports with similar intensities, as well as to investigate whether or not higher

intensity sports further enhance psychosocial measures during an unprecedented period.

## CONCLUSION

The principle findings of this multi-study were that there were negligible correlations between golf activity within the home environment and key variables of interest. Following the reopening of golf courses, positive correlations were observed between golf course activity ( $\text{MET} \cdot \text{min}^{-1} \cdot \text{week}^{-1}$ ) and sense of belonging, enjoyment and wellbeing. When considering both studies, significant improvements were observed in sense of belonging and life satisfaction, which may be crucial during the current pandemic, or even future pandemics. Accordingly, this study has provided insight during a global pandemic with regards to the association between golf activity conducted indoors and on outdoor courses, and the benefits of the latter on sense of belonging and life satisfaction.

## 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 Abertay University. 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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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fspor.2021.622171/full#supplementary-material>

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# Continuity and Discontinuity of Sport and Exercise Type During the COVID-19 Pandemic. An Exploratory Study of Effects on Mood

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Involvement in sport and exercise not only provides participants with health benefits but can be an important aspect of living a meaningful life. The COVID-19 pandemic and the temporary cessation of public life in March/April/May 2020 came with restrictions, which probably also made it difficult, if not impossible, to participate in certain types of sport or exercise. Following the philosophical position that different types of sport and exercise offer different ways of “relating to the world,” this study explored (dis)continuity in the type of sport and exercise people practiced during the pandemic-related lockdown, and possible effects on mood. Data from a survey of 601 adult exercisers, collected shortly after the COVID-19 outbreak in Finland, were analyzed. Approximately one third (35%) of the participants changed their “worldmaking” and shifted to “I–Nature”-type activities. We observed worse mood during the pandemic in those who shifted from “I–Me,” compared to those who had preferred the “I–Nature” relation already before the pandemic and thus experienced continuity. The clouded mood of those experiencing discontinuity may be the result of a temporary loss of “feeling at home” in their new exercise life-world. However, further empirical investigation must follow, because the observed effect sizes were small.

**Keywords:** exercise behavior, being-in-the-world, lockdown, worldmaking, profile of mood states, existential philosophy, affect

## INTRODUCTION

The governmental lockdowns (i.e., restrictions of travel and closures of schools, workplaces, exercise/sport facilities instituted as a safety measure) following the Coronavirus outbreak from early 2020 onwards imposed drastic changes in people’s daily lives, with possible physical, social, and psychological consequences. Although the lockdowns prevented the explosive spread of the virus in many countries, there were side effects. Commentaries have warned that imposing a sudden and strict lockdown can bring a radical discontinuity to people’s routines and lifestyle, including participation in sport and exercise (Begović, 2020; Hammami et al., 2020). Whereas some studies have reported a decrease in adults’ physical activity since the onset of the pandemic, for example in the US (Meyer et al., 2020), in Australia (Stanton et al., 2020), and in an international

sample from 14 countries (Wilke et al., 2020), different studies have observed maintenance or even increases in physical activity during the pandemic. Based on an analysis of Google Trends in the UK, the USA, and Australia, Ding et al. (2020) found that the public interest in exercise surged quickly following the first lockdowns, and other studies have shown behavioral changes toward increased physical activity and exercise. For example, Smith et al. (2020) showed that during the first lockdown in early 2020 more adults (75%) in the UK have met the physical activity guidelines, compared to the situation before the lockdown (between 58 and 66%). According to an international study with more than 13,000 participants from 18 countries worldwide, 31.9% reported having started exercising more frequently during the lockdown, whereas 44.2% reported no change, and only 23.7% reported a decrease of usual exercise frequency (Brand et al., 2020). At first glance, some of these results seem to be contradictory. This impression is put into perspective, however, as soon as one takes into account that the various studies have in fact measured different aspects of physical activity and exercise (e.g., cumulated moderate and vigorous physical activity minutes per day, frequency and duration of walking, or exercise session frequency per week).

Scholars have noted that potential negative psychological effects of pandemic-related lockdown may include post-traumatic stress symptoms, anxiety, depression, anger, and confusion (Qiu et al., 2020). However, on the other hand, positive responses such as trust, collective solidarity, and altruism have also been seen (Barkur et al., 2020; Sun et al., 2020). Emerging studies have shown an association between reduced amounts of physical activity during the pandemic and symptoms of stress and depression (Meyer et al., 2020; Stanton et al., 2020). Brand et al.'s (2020) findings from the large international study concluded that those who exercised most during the lockdown reported better mood.

Until now, most of the studies have focused on changes in amounts of physical activity or exercise, and not whether people have changed the type of activities. In this study, we used the Finnish subsample of the large international study conducted by Brand et al. (2020) to explore whether maintaining or having to change one's usual form of exercise in the wake of a sudden lockdown (due to the unexpected closure of exercise facilities and restrictions of gatherings) would impact people psychologically. We focus on the effect of (dis)continuity, i.e., the question of whether the continuation or sudden change in exercise or sport type is related to general mood. Our approach is theoretically based on the existential philosophical conceptualizations of mood (Ratcliffe, 2013; Freeman, 2014) and the idea of sport and exercise as a way of worldmaking (Breivik, 2020). If we change—or are forced to change—the way we engage with the world through our sport or exercise, this different way of being-in-the-world might also have an impact on mood.

## Exercise and Mood

Mood is a much-studied and often measured concept in sport and exercise psychology, but the elusive and complex foundations of moods' philosophical meanings are rarely explained.

In the following, these two different analytical approaches (psychological, philosophical) to mood are briefly described.

Conceptualizations of mood are similar in the parent discipline of psychology and sport and exercise psychology (e.g., Ekkekakis, 2013). While emotion is typically short, intense, and “about something” (i.e., emotions are always a response to a specific stimulus), mood has a longer duration, is of lower intensity, and does not need to be about anything in particular (Ekkekakis, 2013). Moods are primarily seen as indicators of psychological disturbance or well-being, and almost always as a reaction of the individual to the world outside.

On the other hand, in philosophy, there is a more existentialist perspective to the understanding of mood and its constitutive role in human lives. From this perspective experiencing moods is not only a reaction to encounters of our daily going-about, but rather part of the individual's constructive access to the world: Mood is the basic mode through which the world discloses itself to us, and how we experience the world (Freeman, 2014). Drawing on Heidegger, Ratcliffe (2013) suggested that “moods constitute how we *find ourselves in the world*” (p. 157) or “*belong to a world*” (p. 158). Moods are neither simple inner psychological states, nor “out there” in the world. They are something “in-between,” giving us “a sense of being part of a world that is pre-subjective and pre-objective” (Ratcliffe, 2013, p. 157).

According to this philosophical perspective, moods concern the way we are practically immersed in our world, and what we find important or irrelevant. These matterings are shaped by cultural webs of significance, such as how sport and exercise are generally understood in our cultural environment. Action and world are interwoven by moods. The COVID-19 pandemic has likely changed the existential background of our lives, which in turn is likely to affect the way we are and feel in this “new world.”

Despite the different ways of how mood has been conceptualized in philosophy and how measures of mood have been used in psychological research, the two perspectives may also be related to each other. Empirical studies showed that aerobic as well as resistance exercise may both have acute and long-term positive effects on mood (Berger and Motl, 2000; Chase and Hutchinson, 2015). It has been emphasized, however, that some individuals may experience little or no psychological benefits due to situational, personal, or activity-related other factors (Rocheleau et al., 2004). For example, individuals who do not exercise regularly might experience only limited improvement in their mood from a bout of exercise compared to trained individuals (Hoffman and Hoffman, 2008). Findings like these highlighted that mood is connected to our already established relationship with exercise and is not a simple, automatic response to physical exertion.

This is further supported by findings from the international study of which this study is a part (Brand et al., 2020). Exercise frequency before the COVID-related lockdown was a protective factor for mood during it, in the way that those who only started during the lockdown and exercised infrequently did not report better mood. Expectations about the outcomes from exercise, stemming from previous personal experiences and cultural frameworks of meaning surrounding exercise, seem to



play a role in how an exercise session impacts mood (Anderson and Brice, 2011; Mothes et al., 2017). In contrast to popular beliefs, the “feel good” effect of exercise is not automatic, but there can be marked interindividual differences in how we experience exercise and how it impacts our well-being (Ekkekakis and Brand, 2019).

## Does the Type of Exercise Matter?

Earlier psychological studies already sought to investigate whether different types of exercise, typically aerobic or resistance training, are differentially related to mood outcomes (e.g., Chase and Hutchinson, 2015). In contrast to these earlier studies, we choose the more philosophically-informed theoretical perspective. We are interested in whether and how different ways of exercising might offer different ways of relating to the world or “worldmaking” (Breivik, 2020).

Breivik focused on participation in sports as a way of exploring the enviroing world and one’s possibilities. He proposed that different sporting activities (e.g., running on the track, playing football, boxing, and kayaking) operate on different primary, ontological relationships that are constitutive of these activities. The relations were termed “I–Me,” “I–You,” “I–Society,” and “I–Nature.” According to Breivik, they are the basis for involvement in sporting activities and contribute to the individual’s “worldmaking.” We believe that this framework can be applied to noncompetitive physical exercise as well.

The I–Me relation refers to our own relationship with ourselves and how we find out about our capabilities and limitations through involvement in sport and exercise. Related to competitive sports, this comes with questions like: How fast can I run? How far can I throw? How much can I lift? In the exercising context, respective questions may be: Can I increase my physical fitness? Can I shape my body? In the I–Me relation, the subject remains his or her own reference point. The focus is on exploring and extending one’s boundaries and possibilities, while the presence of others is not necessary for the activity to be pursued. Most typically, this relation ideally manifests in individual sports, such as athletics, gymnastics, or weightlifting; however, it is also relevant to non-competitive activities, and even group exercise classes, when the activity is meant to relate to one’s personal concerns first of all (e.g., health, body shape, strength, endurance; and not in relation to other participants).

The I–You relation refers to testing ourselves against others in contest or combat, that is, “encounter” sports. Here, the question is about my capacities in relation to your capacities: My cleverness, skill, and strength are measured against yours. The presence of the opponent is a necessity for the activity. Breivik (2020) mentions various martial arts, table tennis, squash, and badminton as examples. Importantly, the nature of the encounter is of rivalry and conflict (and therefore sports dance is not included in this dimension). One person wins, the other loses. However, both parties may still gain benefits from involvement in these activities, and they may be carried out in a friendly manner (e.g., playing recreational tennis).

The I–Society relation concerns our relation to the collective other: being a team member, belonging to a group. This relation manifests in team sports that offer us possibilities for cooperation

(but also conflict) and that we may achieve more together than we can achieve alone. For these activities, the presence of the group or team is a necessity. The lockdowns following the COVID-19 outbreak has likely brought the heaviest disruption for those preferring this type of relating to the world, given that group and team sports exercising and training, as well as competitions, ceased in many countries worldwide.

Finally, I–Nature refers to those activities where human beings explore and experiment with their relationship to the natural world. In contrast to a stadium, gym or sports hall, nature is not a stable and predictable arena for testing one’s capacities; it can be uncontrollable and perhaps takes the moving person by surprise. The waves in the sea (for the surfer), snow conditions (for the snowboarder), rain, wind, obstacles, or animals on the path (for the runner) present unanticipated encounters for the moving person. Nature is alive and can be acting on us; but always incidentally, and not intentionally as opponents as in the I–You and I–Society types would.

Breivik (2020) noted that this fourfold framework presents ideal types that cannot always be neatly separated from each other in reality. For example, cycling is an activity that may be experienced by the individual as an I–Me relation (as an individual sport; e.g., a time trial on track), an I–Society relation (team sport; e.g., the Tour de France), or an I–Nature relation (outdoor sport; e.g., mountain biking), or as a combination of all those relations. In addition, not all activities that are carried out in nature *necessarily* prioritize the I–Nature relation. Citing Howe (2012), Breivik notes that it is possible to approach activities in a “nature–instrumental” attitude, where nature is seen simply as the platform for one’s self-project (e.g., improving fitness or winning a fell running competition). Approaching an activity with a “nature-directed” attitude, where we place value on connecting and resonating with nature, is different from that. Despite these complications, Breivik (2020) argued that the fourfold framework of I–Me, I–You, I–Society, and I–Nature can help identify what is *necessary* and *sufficient* for different sport and exercise activities to be realized. We believe that it can well expand our basic understanding of how we *are* in the sporting world.

## Situating the Study: The Nordic and Finnish Context

The Nordic region is characterized by strong physical activity, “sport for all,” and outdoor life cultures (Bergsgard et al., 2019). In addition to volunteer-based sport clubs, outdoor physical activity has been an important part of the Nordic movement culture heritage and is enabled by the “everyman’s right” of access to both public and private forests (Neuvonen et al., 2018). Finland has a low population density and cities are relatively green compared to many other European cities. Most Finnish people engage in physical activity in outdoor spaces, and it has been found that having access to green spaces improved self-rated health through an increase in participation in outdoor physical activity (Pietilä et al., 2015). However, although Finland ranks high in international comparisons and the level of leisure-time physical activity has increased, more than half of the adult population still

does not meet the official recommendations for physical activity (Wennman et al., 2019). Wennman et al. (2019) also reported that young and highly educated adults are more physically active than older and less-educated adults.

A national survey in 2009–2010 (Suomen Kuntoliikuntaliitto, 2010) indicated that most of the top-10 forms of exercise and sport activities (in terms of participation rate) among Finnish adults are self-organized and can be undertaken alone. Thus, in Breivik's (2020) terms, they can be categorized into I–Me or I–Nature activities. Walking (1,790,000 participants), cycling (845,000 participants), and weight training at a gym (713,000) were the three most popular types of exercise in Finnish adults, with cross-country skiing, jogging/running, swimming, gymnastics (including aerobic), and Nordic walking also included in the top-10 activities. In addition to these, only one I–You (badminton) and one I–Society (floorball) activity were included in the top-10. This said, 72% reported that they took part in two or more different types of activities. However, some activities are seasonal (e.g., skiing or skating in the winter, kayaking or orienteering in the summer), and for athletes, their second type of activity (e.g., weight training) might rather represent a necessary means to improve performance in their primary sport.

## This Study

While the main objective of Breivik's (2020) philosophical discourse was not to categorize different sport and exercise activities into the proposed four basic "relations to the world," he mentioned that the fourfold framework may be applied in that way in other studies. This is what we tried to do here. Of course, we fully recognize the empirical complications that come with this approach in terms of classifying the different activities, and the challenge of inferring people's intentions from survey data (i.e., whether participants adopted, for example, a nature-instrumental or nature-directed attitude toward their activities). However, since our focus is on continuity and discontinuity in people's behavioral preferences, and not on the analysis of subjective experiences, we find the fourfold framework useful in giving us indication of whether the mode of participants' exercise or sport activities has meaningfully changed in response to the COVID-19-related lockdowns.

We used the Finnish subsample from a larger international study (Brand et al., 2020) as data for our explorations. Following Breivik's (2020) fourfold framework, we categorized the participants' preferred type of relating to the world through sport or exercise, before and during the pandemic. We expected that as a result of the lockdown, many participants who had been involved in indoor exercise and/or group activities before (e.g., an I–Me relation, such as visiting gyms, I–You relations, such as doing martial arts, or I–Society relations, such as playing football), were forced to change their primary mode of engagement. Assuming that such shifting would affect our participants' worldmaking, we explored whether these shifts would indeed affect their moods as measured with a psychological scale. Given the explorative nature of this approach, we did not set up hypotheses about the direction of possible changes.

## MATERIALS AND METHODS

The data we used for the present study were collected as part of a worldwide survey with more than 16,000 participants from all over the world, which was conducted in a joint effort of the International Research Group (IRG) on COVID and exercise (Brand et al., 2020). All members of IRG are listed, and the exact methodology of the study, is described in detail in the International Study Report. The Finnish data we are investigating here were collected between April 8, 2020, and May 31, 2020.

### Participants

We analyzed the data of 601 adults aged 18–73 years (227 men, 367 women, 7 other; mean age of the total sample was  $41.8 \pm 11.4$  years) residing in Finland. Most of them had a university master's degree or had received higher education (426), were working full time (447), and reported having a medium or high income (497). An about equal number of participants reported living in an urban (245 participants) or a suburban region (267). Fewer participants reported residing in a rural region (88).

### Data Collection and Ethics

As part of the international study, the Unipark™ web-based survey-software was used for data collection, with Finnish participants being recruited by convenience sampling. We advertised the study and contacted potential participants via social media platforms (Twitter, LinkedIn, Facebook), and used the authors' private and professional networks (e.g., email lists). We followed the General Data Protection Regulations (EU) and the American Psychological Association (APA) Ethical Guidelines for Research, and participants provided informed consent prior to the study. The questionnaire was anonymous, and it was also possible to skip questions or stop participating at any point.

### Study Variables

#### Exercise

Exercise was defined for the participants of this study in the way that "Exercise in a broader sense includes all movement activities that you choose to do as "your exercise." This includes, for example, purposefully undertaken walks as well as fitness training, workouts at home, football, swimming, and others." Participants were also informed that any physical activity that was part of their occupation should not be included when answering this question (unless they were a professional fitness coach or had a similar profession).

The two questions asked were: "How often did you exercise in the weeks before COVID-19?" and "How often have you exercised lately (during COVID-19)?" Possible answers were "never" or "less than once a week" (these two categories were collapsed for statistical analysis), and then from "1 day per week" in single-day steps up to "every day." Those reporting exercise were asked to type in their answer to the question "What type of exercise did you complete on most of these days?"

Usual exercise intensities before and during the pandemic were asked about with the question "What would you say the intensity of this exercise was each time you did it?" (low,

moderate, or high intensity). With regard to session durations, we asked whether these exercise sessions had been “on average shorter or longer than before COVID-19?” Possible answers to this question were “shorter,” “longer,” or “they were of about the same duration.”

## Mood

Selected items from the Profile of Mood Scale (POMS) (McNair et al., 1971) were used for measuring our study participants' general mood state during the lockdown. The 16-item version of POMS used in the present study is based on a German short screening version (Petrowski et al., 2020), which has been psychometrically tested in a large, representative German sample (list of items available upon request from the corresponding author of this article). German items were matched with the English items as accurately as possible by Brand et al. (2020), and then translated to Finnish by authors 1–3 of the present study.

The POMS presents a list of adjectives that describe experiential states people can have (e.g., “fatigued” and “active”). In our study, we asked the participants to report how they felt “in the last few days, during COVID-19.” They rated each item by indicating whether they experienced the respective feeling “not at all,” “a little,” “moderately,” “quite a lot,” or “extremely” now and/or in the past few days.

The 16 items of the German POMS-16 version can be assigned to the four subscales of depression/anxiety, vigor, fatigue, and irritability. However, for our Finnish translation (which was created from the original German version that was translated into English by Brand et al., 2020) only the more robust POMS-16 total score was used (as any other procedure would have required closer psychometric testing with separate samples, which were not available to us). For the analyses presented here, all items were coded such that higher POMS score indicates better mood. The scale reliability achieved in our sample for the total score was very good (internal consistency; Cronbach's  $\alpha = 0.88$ ).

## Personal Information

Demographic questions included age, gender, education, and current place of residence. Also, we asked about the presence of COVID-19 symptoms or a positive diagnosis to exclude these individuals from the statistical analyses.

## Data Coding: Type of Exercise

Participants entered their primary type of exercise as free text. The first author of this article manually coded and interpreted the answers according to Breivik's four relations I–Me, I–You, I–Society, and I–Nature. For example, participants reported gym, crossfit, and pilates, which were coded as I–Me relations. Examples for I–You are badminton, tennis, and kickboxing; for I–Society, football, volleyball, and ice hockey; for I–Nature, jogging/running, orienteering, and hiking. The coding was reviewed by the third author, and ambiguous cases were discussed and subsequently resolved. The full list of exercise types and how they were coded is available in Table 1 of the **Supplementary Material** to this article.

We recognized that the distinction between I–Me and I–Nature in particular is ambiguous and requires interpretation. As an example, a jogger in outdoor spaces could be focused

on the I–Me relation (i.e., jog solely to improve fitness) or I–Nature relation (i.e., jog to enjoy being outdoors), or conceivably often values both (being in natural environments *and* improving fitness). Finnish people in cities also typically have access to green spaces for exercising (Pietilä et al., 2015), and nature areas have been reported to be the most common favorite places for Finnish adults (Korpela et al., 2010). We, therefore, classified walking and jogging/running as I–Nature activities, which was further justified by research indicating that being in nature seems to act *on us* regardless of our intentions e.g., the proximity of green spaces can provide a buffer for stressful life events; Van den Berg et al. (2010). This highlights that we are not merely producing our experiences by intentional activity, but we respond to the world and what is “disclosed” to us (Breivik, 2020).

## Statistical Explorations

All variables were checked as to whether they met the requirements for statistical testing (e.g., normal distribution with Shapiro-Wilk tests and by visual inspection of QQ- and density plots, homogeneity of variance with Levene's test). If violated, non-parametric tests were used for further analysis.

The proportions of how many participants remained or shifted from one relation to another were inspected by cross-tabulating this information. Main flows were inspected with a Sankey diagram. From this analysis, change groups (e.g., from I–Me before the lockdown to I–Nature during the lockdown), and maintenance groups (e.g., I–Nature before and also during the lockdown) were formed, which we will refer to as continuity/discontinuity patterns.

We then inspected the continuity/discontinuity patterns with regard to exercise characteristics. In order to explore differences in exercise frequency (days per week) before and during the lockdown, a Wilcoxon signed ranked test for paired samples (non-parametric) was calculated. The same test was used to explore changes in exercise intensity. A Kruskal-Wallis test (non-parametric) was employed for exploring differences in “exercise duration,” as this variable was measured as a difference variable in the survey (no separated pre–post measures available).

Possible differences in mood between participants from the continuity/discontinuity patterns were explored by ANOVA with “mood” as the dependent variable, and “exercise continuity/discontinuity pattern” as a factor. Univariate outliers were evaluated with boxplot methods. All detected outliers represent psychologically meaningful POMS scores, and deleting them did not change our main results. Therefore, we decided not to remove them from the analyzed data. Tukey *post hoc* tests were used for pairwise comparisons to further explore differences between continuity and discontinuity patterns, for significant ANOVAs. Additional ANCOVAs were calculated to check whether possible results are influenced by exercise frequency, session duration, or intensity.

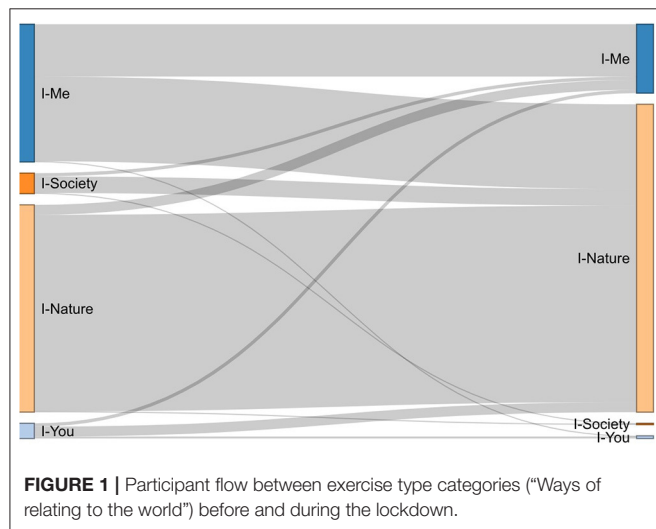
## RESULTS

### Changes Between Exercise Type Categories Following the Lockdown

**Table 1** shows the distribution of participants in the four groups of exercise types (i.e., relations to the world) before and during

**TABLE 1** | Shifts between exercise type categories ("Ways of Relating to the World").

Exercise type category before the pandemic	Exercise type category during the pandemic				Total
	I-Me	I-You	I-Society	I-Nature	
I-Me	38% (79)	0% (1)	0% (0)	62% (128)	100% (208)
I-You	22% (5)	13% (3)	0% (0)	65% (15)	100% (23)
I-Society	16% (5)	0% (0)	3% (1)	81% (25)	100% (31)
I-Nature	5% (15)	0% (0)	0% (1)	95% (297)	100% (313)
Total	18% (104)	1% (4)	0% (2)	81% (465)	100% (575)



the lockdown. **Figure 1** illustrates the flows from and to the four types. Most of the participants were initially and remained in the I-Nature group during the lockdown (I-Nature continuity pattern: 297 participants). The second most typical pattern was a change from I-Me to I-Nature, that is a shift from indoor exercise (e.g., gym training) to exercising or doing sports in natural environments (I-Me/I-Nature discontinuity pattern: 128 participants). A smaller number of participants remained in I-Me (I-Me continuity pattern: 79 participants) or changed from I-Nature to I-Me (I-Nature/I-Me discontinuity pattern: 15 participants).

The majority of our study participants were exercising (before and after) in the I-Me and the I-Nature type of activities. Due to the comparatively small proportions of participants in other relations, we decided to focus our statistical explorations on those within the I-Me and I-Nature relations.

## Differences Between Continuity/Discontinuity Patterns in Exercise Intensity, Frequency, and Duration

Means and standard deviations are given in **Table 2**. Differences and similarities in exercise intensity, frequency, and duration are illustrated in **Figure 2**.

### Intensity

Participants in the I-Me continuity pattern ( $V = 412.5$ ,  $p = 0.008$ ,  $r = 0.30$ ; medium effect) and those in the I-Me/I-Nature discontinuity pattern ( $V = 3590$ ,  $p < 0.001$ ,  $r = 0.69$ ; large effect) reported lower exercise intensity during the lockdown as compared with their exercise intensity before the lockdown. No significant changes were evident in the other patterns (**Figure 2A**).

### Frequency

Exercise frequency was higher during the lockdown in all four groups, that is in the I-Me continuity pattern ( $V = 266$ ,  $p = 0.006$ ,  $r = 0.29$ ; small effect), the I-Nature continuity pattern ( $V = 2983.5$ ,  $p < 0.001$ ,  $r = 0.40$ ; moderate effect), and in the I-Me/I-Nature ( $V = 1706$ ,  $p = 0.004$ ,  $r = 0.23$ ; small effect) and I-Nature/I-Me discontinuity patterns ( $V = 10.5$ ,  $p = 0.049$ ,  $r = 0.54$ ; large effect) (**Figure 2B**).

### Duration

Exercise duration was significantly different (small effect) in the four continuity/discontinuity patterns,  $H(3) = 25.9$ ,  $p < 0.001$ ,  $\eta^2 = 0.04$ . *Post-hoc* multiple comparisons (Dunn-Bonferroni) revealed significant differences between the I-Me and the I-Nature continuity patterns ( $z = 4.75$ ,  $p < 0.001$ ), and between the I-Me/I-Nature discontinuity and the I-Nature continuity pattern ( $z = 2.96$ ,  $p = 0.031$ ) (**Figure 2C**).

## Differences in Mood Between Participants From the Continuity/Discontinuity Patterns

We found a significant (small effect) of "type-shift" on "mood,"  $F(3, 515) = 3.01$ ,  $p = 0.030$ ,  $\eta^2 = 0.02$ . The *post hoc* tests indicated that this effect is caused by only one significant contrast. Those in the I-Me/I-Nature discontinuity pattern reported worse mood than those in the I-Nature continuity pattern ( $q = 0.17$ ,  $p = 0.030$ ). Calculated means and standard deviations are given in **Table 2**, and the data is illustrated in **Figure 2D**).

None of the ANCOVAs controlling for the potential covariate effects of exercise frequency, session duration, and intensity were significant. Detailed results of these tests are available upon request from the corresponding author.

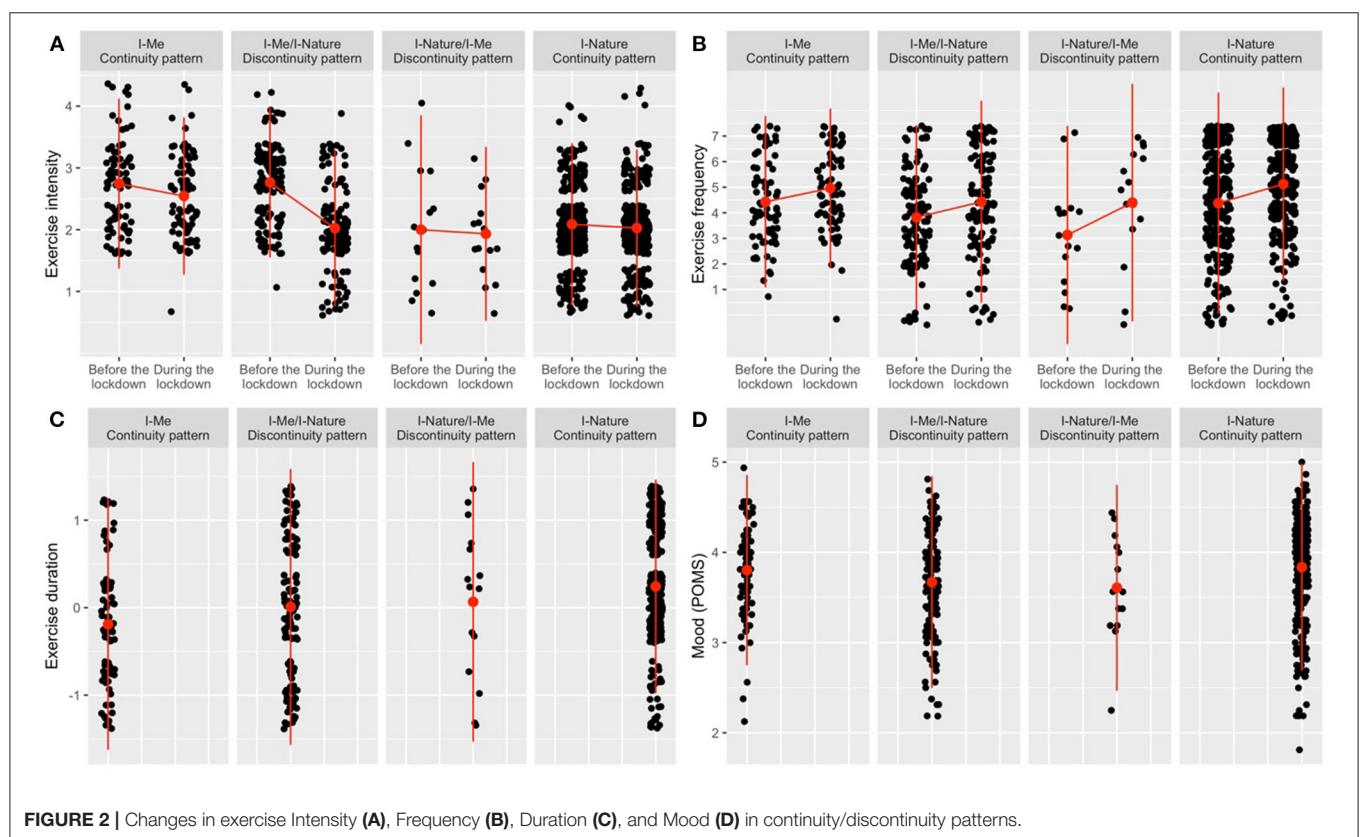


**TABLE 2** | Means and standard deviations of exercise outcomes and mood in continuity/discontinuity pattern groups.

Continuity/dis-continuity pattern	Time	n	Exercise frequency M (SD)	Exercise intensity M (SD)	Exercise duration <sup>a</sup> M (SD)	Mood <sup>b</sup> M (SD)
I-Me/I-Me	Before	79	4.43 (1.68)	2.75 (0.69)		
	During	79	4.96 (1.56)	2.54 (0.64)	−0.19 (0.72)	3.80 (0.53)
I-Me/I-Nature	Before	128	3.82 (1.80)	2.77 (0.61)		
	During	128	4.43 (1.98)	2.02 (0.63)	0.01 (0.79)	3.67 (0.59)
I-Nature/I-Me	Before	15	3.13 (2.13)	2.00 (0.93)		
	During	15	4.40 (2.32)	1.93 (0.70)	0.07 (0.80)	3.61 (0.57)
I-Nature/I-Nature	Before	297	4.38 (2.16)	2.09 (0.66)		
	During	297	5.12 (1.89)	2.03 (0.64)	0.24 (0.62)	3.84 (0.57)

<sup>a</sup>Exercise duration was measured as a difference score (less, similar or longer), negative values indicate less exercise during the lockdown.

<sup>b</sup>Mood was measured only once, during the lockdown.

**FIGURE 2** | Changes in exercise Intensity (A), Frequency (B), Duration (C), and Mood (D) in continuity/discontinuity patterns.

## DISCUSSION

Following the philosophical assertion that different types of exercise are related to different ways of “worldmaking,” this study sought to understand whether probable discontinuities in types of exercise participation following the COVID-19 pandemic manifest in the way people find themselves in the world as indicated by their mood. The main findings of this study were that (1) approximately one third of active Finnish adults changed their type of exercise/sport participation during the lockdown in the early weeks of the pandemic; (2) the most typical change

was from I-Me to I-Nature-type activities; and (3) those who shifted from I-Me to I-Nature reported lower mood compared to those who remained in I-Nature. However, the effect on mood was small.

Our findings on the changes between exercise type categories following the lockdown are unsurprising. That is, when exercise facilities (e.g., gyms, swimming pools, sports halls) were closed and team sport activities put on hold, many people oriented themselves to outdoor activities, such as walking, jogging, and cycling. On average, our study participants from Finland were exercising more frequently during the lockdown than before the

lockdown, which aligns with the findings of the international study (Brand et al., 2020). Previous studies indicate different patterns in how participation in physical activity and exercise has changed in different countries, which is probably related to various factors including the type of questionnaires used as well as how strict lockdown measures have been implemented. Notably, there were no restrictions on access to nature in Finland in April-May when we collected our data. At the same time, not having to commute to work may have provided extra time for exercising more frequently for many people.

The intensity of exercise decreased significantly for those who shifted from I-Me to I-Nature and for those who remained in I-Me. For example, those who had been used to exercising at a gym might have lacked the equipment or a motivating instructor to maintain the same intensity of exercise and replaced their previous exercise routines with less intense activities such as walking. However, for those who remained in the I-Nature category, and who assumedly had been mainly exercising without an instructor or equipment also before the pandemic, the intensity did not decrease. Interestingly, those who remained in I-Me reduced duration, those who remained in I-Nature increased it, and those who shifted the type of activity from I-Me to I-Nature reported no change. This indicates that there were also some changes in the two continuity patterns, as people were adapting to the new world under the pandemic. It is likely that a number of unobserved factors (e.g., type of work, family life, etc.) had an impact on the identified patterns.

Despite its small effect size, the observed effect on mood might be interesting. It has been shown in previous studies that forced abstinence from a chosen type of exercise can be associated with mood disturbances (Chan and Grossman, 1988; Szabo and Parkin, 2001). However, while Chan and Grossman's (1988) study included injured runners and Szabo and Parkin's (2001) participants (martial artists) were instructed not to participate in any strenuous physical activity for seven days, our study extends these findings by showing that even if participants in the I-Me/I-Nature discontinuity pattern exercised more frequently than before discontinuity, they still reported lower mood compared to those in the I-Nature continuity pattern. Therefore, not only the quantity, but also the quality of our involvement in exercise may matter in sustaining positive mood.

From an existential philosophical perspective that underpins Breivik's (2020) discussion of different ways of worldmaking through sport and exercise, it could be argued that it takes time to immerse oneself in a particular exercise/sport life-world before it feels one's "own." Kretchmar (2000) argued that meaningful movement experiences often arise as a result of long-term practice and familiarity with the activity, so that the participants "have transcended fear, confusion, awkwardness, movement mechanics, and all other introductory aspects of an activity" (p. 23). If moods form the existential background to our lives and relate to whether things and experiences in the life-world matter to us (Ratcliffe, 2013), it could be that the new exercise routine (e.g., changing from weightlifting to jogging) often does *not* immediately make embodied sense, which then reflects in our mood. Our sense of "life is OK" is tacit and embodied: A runner experiences a different sense of vigor, soreness, and fatigue than

a weightlifter, and these bodily cues normally tell us that life is "as it should be." In a bodily sense, a certain level of intensity in our favorite exercise feels "at home" and familiar to us, and it can take us time to be "at home" in a different mode of physical activity. Furthermore, involvement in certain sport or exercise can be an important life project to participants also in non-elite levels and previous studies show that the inability to continue in this specific activity can have detrimental effects on well-being (Allen Collinson and Hockey, 2007; Ronkainen et al., 2014). Just as spending time in "favorite places" has been associated with psychological benefits (Korpela et al., 2010), "favorite exercise" might function as a symbolic place that we can go to and that gives us comfort and reinvigorates us. Future research could explore whether "favorite exercise" is a protective factor for maintaining a positive mood under pandemic or other disruptive experiences, as well as in life in general.

While the philosophical conceptualizations of "worldmaking" and mood as well as our findings on the negative impact of discontinuity on mood can open up a new perspective on understanding the meaning of exercise in people's lives, the effect sizes were small. Our findings must therefore be considered preliminary. One of the reasons for the small effect size may be that the way we find ourselves in the world is shaped by a variety of our involvements besides exercising. Furthermore, the psychological measure that we used in our empirical research might not optimally operationalize what is captured by the more philosophical concept of mood. With these cautions in mind, our finding provides an interesting hypothesis for future studies: The mode of exercise/sport people have chosen as their "own" could be a key exercise-related protective aspect that can support positive mood. If this findings was to be confirmed in future studies, this would indicate that it is important to help people to continue their preferred mode of exercise or sport participation. Simply keeping active in any means possible might not provide the same benefits to mood.

Finally, to broaden the discussion to recent debates on the role of exercise during COVID-19 pandemic, Malcolm and Velija (2020) highlighted that the public messages about the importance of staying active under lockdown have intensified people's feelings of guilt if they are not exercising. If people cannot engage in their preferred mode of exercise, they might choose another way of keeping active to avoid the negative feelings associated with inactivity. From the survey data, we are unable to infer our participants' intentions and whether part of their involvement in the new types of activities was a response to social pressure to keep active. However, we can speculate whether avoiding guilt could have contributed to lower mood in those participants who had to change their type of exercise from I-Me to I-Nature (even if being in nature has been reported to give psychological benefits overall; Van den Berg et al., 2010). Taken together, our finding highlights previous arguments that mood improvement is not an automatic reaction to exercise or sport participation, but seems to be a more complex process that concerns how we relate to exercise and sport and our world through being physically active.

## Limitations of the Study

The findings here should be interpreted with several limitations in mind. We were forced to utilize convenience sampling due to available resources and time limits for data collection. Consequently, our sample is not representative of the general population in that it mostly included well-educated participants who had a rather high-income status and who exercised or played sport 4–5 times per week. As Park and Kang (2008) noted, more educated individuals are more likely to exercise regularly. Smith et al. (2020) also reported that adults in the UK with lower income were less likely to be active during this pandemic-related lockdown. Although it was impossible to investigate this effect in our study, it is likely that for our participants their exercise and sport routines might be more important than for less active adults and be more strongly related to their mood. The season was changing during the data collection period, which could also have affected exercise and sport behavior. Furthermore, we were not able to collect mood data before the lockdown and therefore we do not have information on how participants' mood changed in response to the lockdown.

There can be several other factors that threaten mood during a lockdown. From this perspective, the small effect size of this finding is not very surprising, given that exercise behavior is only one aspect of daily life and one's identity. From the two discontinuity types analyzed, only one of them, the shift from I–Me to I–Nature, was significantly different from the I–Nature/I–Nature continuity pattern, suggesting that the type of discontinuity can matter, and this should be tested in larger, balanced samples. Any nonsignificant differences may be real, or due to lack of statistical power for these particular comparisons, which was not designed a priori. Furthermore, I–You and I–Society type of activities had an insufficient number of participants and were removed from the analysis. Therefore, these findings apply only to comparing changes between the categories we included in the final data and do not tell about other exercise type categories and the impact of (dis)continuities in them.

Finally, Breivik's (2020) fourfold framework is not a stable model but more like an exploration of ideal types of exercise/sport and their underlying "world relations." Assigning certain activities such as jogging to either the I–Me or I–Nature category is certainly not clear cut. However, the main finding that changing your preferred type of exercise/sport is associated with different psychological outcomes compared to continuing a routine within the same type provides us with an indication that the type of exercise might matter in terms of our mood.

## CONCLUSIONS

From our findings, it could be suggested that people have their own mode of exercising or doing sport that is associated

with their well- or ill-being. While researchers have reported an association between outdoor exercise in green spaces with subjective well-being (Pietilä et al., 2015), our research indicated that starting to exercise outdoors following lockdown was not associated with better mood. Perhaps being forced to disengage from the "favorite" activity (e.g., going to the gym) and the rupture of habits has a more negative influence on people's attunement to the world than outdoor activities can "repair." While we cannot know the practical significance of the measured differences in mood variables between the groups in participants' everyday lives, the study provides an interesting hypothesis for future studies; that is, our engagement with a specific mode of exercise/sport, rather than just any exercise or physical activity available, can be important for our well-being. Given the COVID-19 pandemic is likely to result in further closures of exercise/sport facilities and disruption of group exercise and team sports also in the future, attempts to help people build some degree of continuity in their exercise/sport life-world is a practical recommendation stemming from the study.

## 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 participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

NR framed the theoretical considerations for this study. NR and RB cooperatively developed the exact research question for the article. All authors (NR, AP, OT, and RB) made additional substantial, direct and intellectual contributions to finalization work, and approved it for publication.

## ACKNOWLEDGMENTS

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2021.622876/full#supplementary-material>

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# COVID-19–Considerations for the Female Athlete

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The SARS CoV-2 virus (COVID-19) caused the whole sporting calendar to be paused. As we embark on the challenge of navigating through the return to play (RTP) process, there is a necessity to consider the needs of all athletes. This commentary specifically considers recommendations and requirements for the female athlete with a physiological emphasis during and following the COVID-19 pandemic, however, it will be relevant for any similar future scenarios that may present. It is important to acknowledge that there remain many unknowns surrounding COVID-19 and the female athlete both in the short- and long-term.

**Keywords:** athlete, coronavirus, return-to-play (return-to-sport), menstrual cycle, women

## BACKGROUND

As we continue to navigate through the SARS CoV-2 virus (COVID-19) pandemic, sports science and sports medicine colleagues are concerned with maximizing the safety of athletes in the return to play (RTP) phase and minimizing all short- and long-term health risks. The objective of this paper is to provide sports medicine and sports science practitioners RTP considerations specifically pertaining to the female athlete based on current research.

To date, the vast majority of sex-disaggregated data suggest that more men than women are dying from or experiencing more adverse outcomes as a result of COVID-19 infection (Griffith et al., 2020). A number of underlying behavioral, cultural, and biological causes have been proposed to explain this trend. Firstly, men are more likely to smoke (Liu et al., 2017), drink alcohol, be less vigilant with risk-reducing strategies such as handwashing, and have comorbidities (e.g., hypertension and diabetes) associated with a greater risk of a worsened outcome from COVID-19 (Gerds and Regitz-Zagrosek, 2019; Mellström, 2020). Secondly, distinct immunological differences exist between men and women, expressed upon activation with a virus (Klein and Flanagan, 2016). This has, in part, been attributed to the X chromosome, which appears to have a role in innate and adaptive immunity (Conti and Younes, 2020). More specifically, genes encoded by the X chromosome are associated with a lower viral load and less inflammation. It has been suggested that sex hormones can also have divergent effects on the immune system; estrogen and progesterone may have immune-protective and anti-inflammatory properties (Sue, 2017). Menstruating women have greater numbers of CD4+ T cells, and typically produce more antibodies on viral infection when compared to men (Conti and Younes, 2020). The influence of sex also appears relevant in the

context of viral entry of COVID-19 via the angiotensin-converting enzyme 2 (ACE-2) receptor (Li et al., 2020). The sex differences in the renin-angiotensin-aldosterone system could additionally have a role in the highlighted differences in infection severity. Although research is still in its early stages, the differences in sex hormones appear to modulate the expression of ACE-2 and transmembrane serine protease 2 (TMPRSS2), both of which are involved in determining viral entry and viral development of COVID-19 (Foresta et al., 2020; Li et al., 2020).

Recent research has suggested that infection rates in 10- to 50-year-old women are higher compared to men in the same age bracket, but lower in girls under the age of 10 and in women over the age of 50 when compared to boys and men of the same ages (Mauvais-Jarvis et al., 2020). This could be attributed to several factors, including cultural roles and gender norms such as work, childcare, social interactions, all of which are also likely to be influenced by geographical location. The potential role of the ovarian sex hormones here is interesting; the ovarian sex hormones have been hypothesized to have protective qualities against fatal infection, but given that ages 10–50 years represents the typical reproductive window, further research needs to explore how the sex hormones may alter viral susceptibility (Marina and Piemonti, 2020). The role sex hormones may play in infection rate and infection severity may be ascertained through studying these factors across the female lifecycle, as hormonal profiles are significantly different in prepubertal girls, reproductive-aged women, peri-menopausal and post-menopausal women. However, future research must account for the many external lifestyle, behavioral, and cultural factors that could confound findings.

Research to date suggests that typically young, fit, healthy female athletes without comorbidities are at lower risk of experiencing severe symptoms and a fatal outcome if infected with COVID-19 compared to their male counterparts (Wu and McGoogan, 2020). However, as our understanding of the virus and its effects are still nascent, both the potential short- and long-term effects of COVID-19 infection in addition to the impact that periods of “lockdown” have had on female athletes remain largely unknown. It is also essential to better understand transmission, particularly in those who may be more vulnerable, including older support staff and co-habiting family members of athletes.

Other emerging risk factors associated with the virus include ethnicity, vitamin D status, hyperandrogenism, and inflammation (Kyrou et al., 2020). Those with underlying conditions associated with any of these factors should be flagged as being higher risk, regardless of sex. Similarly, polycystic ovary syndrome warrants specific attention, as recently highlighted (Kyrou et al., 2020). This dysfunction affects 4–12% of the female population and is associated with all the aforementioned risk factors, however, any associated risk between COVID-19 and polycystic ovary syndrome remains speculative with no available data as yet. It is also important to consider that those with underlying medical conditions that require regular treatment are likely to be disproportionately affected by the COVID-19 lockdown. For example, those with menstrual dysfunctions such as endometriosis, who require regular treatment, may not have been able to access medical services, particularly in certain

countries where lockdown restrictions may have been tougher (Alviggi et al., 2020). It is also important to appreciate that there may have been a reluctance to seek medical support on the athlete's part due to concern over infection.

While understanding the sex differences associated with risk of COVID-19 infection is essential, other impacts as a result of the enforced lockdown also need to be considered through a sex and gender lens, particularly, in the context of canceled or postponed major sporting events and leagues, and factors associated with lockdowns.

## EMERGING FROM LOCKDOWN: RETURN TO PLAY AND “THE NEW NORMAL”

The sporting community has or is pushing for RTP in many countries, if they have not done so already, albeit in a state of “new normal” [e.g., with physical distancing measures and regular polymerase chain reaction (PCR) testing in place]. However, this is associated with substantial risk, particularly as social distancing measures are highly challenging or impossible to implement in many sports training and competition environments. Rapidly diagnosing cases of COVID-19 in athletes and staff and isolating them from the team environment is essential to avoid further disruption. Robust immuno-protective strategies and a specific focus on recovery processes appear necessary. In team sports, detraining of important physical qualities associated with performance, a reduction in competitive match fitness and sport-specific skill and contact training, together with a congested schedule once competitive sport is resumed, are likely to result in a higher incidence of injury (Table 1). In individual sports, the physical and psychological impact of the competitive environment can cause added stress, particularly when individuals have not been in these scenarios for a prolonged period of time. This could also increase injury risk and cause additional mental stress.

## COVID-19 TESTING AND SYMPTOM TRACKING

Comprehensive strategies for regular nucleic acid amplification (molecular) for COVID-19 antigen are warranted, together with daily monitoring of COVID-19 symptoms. The molecular tests will identify athletes with an active COVID-19 infection, allowing appropriate interventions to be put in place to manage the course of illness and to prevent onward transmission. Future use of serological antibody tests could identify athletes who have previously been exposed to the virus, which serves two purposes. Firstly, it would help identify those who have not been exposed and are therefore susceptible to infection. Secondly, it would identify those athletes with neutralizing antibodies and potential immunity, which could, in the future be essential in terms of managing COVID-19 restrictions. Asymptomatic athletes presenting with a negative molecular test and a positive antibody test are unlikely to be contagious and may have protective immunity against COVID-19, although further data are needed. There is evidence to suggest that immunity and the

**TABLE 1 |** Key points table for consideration on return to play in female athletes.

While in isolation	Considerations
COVID-19 infection, or presence of symptoms in line with COVID-19	Mild symptoms: undertake a 10-day period of rest with a gradual RTP, which is monitored throughout.  Hospitalization: undertake a comprehensive biomarker and cardiac screening with a gradual RTP only when key markers are back to normal.
Exercise training and injury risk	Where the situation allows, attempt to maintain physical fitness. "Maintenance" maybe a more appropriate goal than "progression" to avoid placing excess stress on the immune system and reduce risk of injury during a period where sports medicine support is severely limited. Individualize training plans based upon previously identified strengths and weaknesses.  Where relevant and possible, consider the specificity of the training stimulus.  Telehealth should be utilized where possible to increase access to sports medical services and decrease risk of transmission.
Mental health	Make mental health resources available to athletes.  Maintain regular communication with athletes.
Menstrual cycle monitoring	Tracking of cycles and symptoms; where significant abnormalities are seen, attempt to identify and manage causation, alongside modification of training.
General health and well-being	Place extra attention on following a varied and sufficient diet, meeting sleep requirements and optimizing recovery.  Avoid a state of low energy availability.
<b>Return to play</b>	
Testing and monitoring in elite athletes	Conduct <i>regular</i> molecular (amplification e.g., PCR) testing. If antibody testing is better established, athletes with a negative molecular and a positive antibody test, provided they have no other signs or symptoms of viral disease, should be considered safe to resume training and social contact. Seronegative athletes should be monitored closely as they are most susceptible to infection. Athletes with a positive molecular test should be isolated and managed/monitored for illness severity.  Daily monitoring of body temperature and symptoms (alongside menstrual cycle monitoring to account for natural physiologic changes) should be performed.  Where possible, weekly monitoring of biomarkers, such as those of oxidative stress and inflammation should be done.  Deploy cardiac screening as appropriate.  Administer a routine battery of sport-specific physical fitness tests to ascertain the level of detraining and physical readiness in individual athletes.  Conduct a health screen of athletes prior to RTP, capturing any alterations or concerns around sleep, menstrual cycle status, nutrition, and mental health.
Exercise training and injury risk	Where training was compromised, a musculoskeletal review should be undertaken to ascertain state of readiness to return to "typical" training.  A graded re-implementation of sport-specific physical fitness training should be conducted to address deficits during the lockdown period. Use rated perceived exertion and wellness monitoring to gauge fatigue and training adaptation.
Mental health	Make mental health resources available to athletes and consider use of online platforms to increase accessibility.
Menstrual cycle monitoring	Continue tracking menstrual cycle and symptoms; where significant abnormalities are seen, attempt to identify and manage causation, alongside modification of training.
General health and well-being	Continue to focus on sleep and nutrition, with a priority on recovery, particularly in circumstances where scheduling is more congested. A state of low energy availability should be avoided. Nutritional support should be considered, particularly for those most vulnerable or with a history of an eating disorder or disordered eating. Sleep monitoring may also be considered, particularly in those identified to have experienced regular sleep disturbances. Remain vigilant with social distancing practices.

RTP, return to play; PCR, polymerase chain reaction.

immune response changes across the menstrual cycle (Oertelt-Prigione, 2012), and recent case studies have demonstrated potential inaccuracies of the antigen test based on menstrual cycle phase (Zheng et al., 2020). Two cases have been reported whereby women experienced positive PCR tests alongside COVID-19 symptoms during menstruation, but the symptoms disappeared post menstruation and subsequent PCR tests were negative. However, symptoms returned alongside a positive PCR test when both individuals started their next menstruation (Zheng et al., 2020). While clearly much more data are needed to

better understand how ovarian hormones may affect the clinical course of COVID-19 infection, practitioners should be mindful of timing in the menstrual cycle when conducting testing.

Athletes commonly underreport symptoms, particularly when this may prevent or delay RTP training (McDonald et al., 2016); therefore, capturing biomarker data relating to general wellness and recovery, for example inflammation and redox homeostasis, could be advantageous. Indeed, it is noteworthy that increased oxidative stress has recently been reported in both injured and ill elite athletes when longitudinally monitored (Lewis

et al., 2020). Where full recovery has not been accomplished prior to resumption of habitual training, the subsequent risk of overreaching (progressing to non-functional overreaching and overtraining), further illness, and musculoskeletal injury is increased. While daily molecular testing is not feasible for all sport participation, at a minimum, frequent monitoring of symptoms and temperature should be implemented, and COVID-19 secure bubbles should be created to reduce risk of an outbreak within a sports team or training environment. Those athletes reporting symptoms in line with COVID-19 should be instructed to self-isolate, and depending on the severity, training may need to be temporarily halted (Hull et al., 2020). Other markers such as resting heart rate and heart rate variability may also be useful for tracking recovery. In menstruating women, it is important to account for physiological changes in basal body temperature and resting heart rate when undertaking daily measurements because fluctuations in ovarian hormones influence these parameters (Tenan et al., 2014; Bull et al., 2019). There is also the potential for concurrent menstrual symptoms and COVID-19 symptoms (e.g., achiness, fatigue, nausea, and headaches) (Bruinvels et al., 2020; Centers for Disease Control and Centers for Disease Control Prevention, 2020). Tracking menstrual cycles and symptoms alongside temperature, heart rate, and potential COVID-19 symptoms would reduce risk of ambiguity.

## CARDIOPULMONARY

The systemic nature of COVID-19 emphasizes the need for comprehensive medical screening of athletes prior to RTP. Recommendations for screening of cardiac and respiratory health of athletes have been published with no differentiation between approaches for males and females (Baggish et al., 2020; Hull et al., 2020). Hull et al. (2020) recommend that those who have been hospitalized due to COVID-19 infection should undergo full cardiac screening prior to return to physical activity and those who had mild symptoms should undertake a prolonged rest period and conservative RTP strategy (10-day period of rest from onset of symptoms plus seven days after symptom resolution). While this strategy is recommended to minimize the possibility of viral myocarditis in athletes returning to full training too early (Hull et al., 2020), performing less strenuous activity during this recovery period is consistent with the guidelines published for the general population and has been recommended to promote anti-viral immunity and hasten viral resolution (Simpson and Katsanis, 2020).

Comprehensive cardiac screening should be performed in athletes who have been hospitalized with COVID-19. Failing to identify COVID-19-related heart scarring or latent myocarditis could result in an increase in exertional sudden cardiac death in the future, and we have an opportunity to study and prevent this upon reintroduction to sport across both sexes. Interestingly, some research suggests that the incidence and outcome of pneumonia and myocarditis can be more favorable in women vs. men with COVID-19 (Fairweather et al., 2013; Al-Baadani

et al., 2019), however, there are currently too many unknowns for divergent sex-specific post-infection cardiac screening.

## MENTAL HEALTH

During uncertain and life-changing times, such as the COVID-19 pandemic, increased susceptibility to undesirable states of anxiety and stress are likely (Weinberg and Cooper, 2012) therefore the impact of the COVID-19 pandemic on psychological and emotional health must also be considered. The 2003 SARS outbreak in Hong Kong was shown to have detrimental long-term consequences on mental health (Mak et al., 2009). Regardless of sex and gender, changes to competition scheduling, alterations to training regimens, reduced access to facilities and social isolation all have the potential to create a significant degree of uncertainty. A study evaluating the impact of COVID-19 on semi-elite and elite South African athletes found females to be more likely to report depressive feelings, energy loss and a lack of motivation when compared to male equivalents (Pillay et al., 2020). Similarly, other studies evaluating the effects of the recent COVID-19 period have found female athletes to be more likely to report higher scores of perceived stress and dysfunctional psychobiosocial states ( $n = 1137$ ; di Fronso et al., 2020), and female footballers to be more likely to experience neuroticism and psychological inflexibility, while also having more concern about the impact of lockdown on sports performance ( $n = 175$ ; Clemente-Suárez et al., 2020). There have been, and still are, ostensible geographical differences in the duration of and severity of lockdown, which is and likely to be reflected in access to facilities, sports medicine support and competition. Inevitably this “uneven playing field” has the potential to create significant anxiety for those competing internationally. Regardless, travel restrictions have been implemented globally to some degree and all international athletes are affected by changes to competition scheduling.

A survey completed by FIFPRO in March and April 2020 found almost twice the number of female soccer players exhibited depressive symptoms compared to men (FIFPRO, 2020). A recent systematic review also concluded that elite female athletes are more susceptible to anxiety than their male counterparts (Rice et al., 2019). It is therefore possible that the impact of isolation and other aspects of the pandemic on mental health is greater in women. This is of particular significance given the common lack of funding in women's sport. In many situations, women's sport is not the priority in terms of access to support services and training facilities, and concern has been raised in the mainstream media (Sports, 2020).

Women's sport is also under substantial financial strain. In some sports, professional athletes were furloughed (Sanders, 2020), and in others, the absence of competition has resulted in no or very limited income, clearly causing a significant degree of anxiety. While these issues are not exclusive to women, the likelihood is that more women will fit into this category. It is particularly important to consider that many of the industries in which job losses are common are dominated by women (e.g., hospitality, retail, tourism), therefore this may impact financial



security, increasing levels of anxiety in female athletes (Ramos, 2020). Further, women are more often primary caregivers for children, making them more likely to have to compromise on their working status and training patterns (Ramos, 2020). Given the protective role that exercise can play in mental well-being, where possible, participation in physical activity should be consistently encouraged (Faulkner et al., 2020). The extent to which this is relevant is again likely to be highly influenced by the rules pertaining to specific geographical locations. Resources to support mental health should be made readily available, as highlighted in **Table 1**, with more comprehensive advice for practitioners outlined elsewhere (Reardon et al., 2020).

## INJURY RISK/FACILITIES

Specialist attention needs to be given to ensuring that the resumption of training is carefully managed and progressed. For a variety of reasons, women are less likely to have access to specialist facilities and equipment to maintain their fitness during isolation (Bowes et al., 2020). Many women are also less likely than their male counterparts to have access to the specialist sports medicine support to facilitate recovery when competition is resumed. It is also well-established that sudden increases in load increase injury risk, while also compromising the immune system (Schwellnus et al., 2016). Therefore, when training has been compromised, a graded return to full training is warranted. In sports that have already been through the RTP process, a disproportionately large number of injuries have been observed; for example, it has been highlighted that an abnormally large frequency of anterior cruciate ligament (ACL) injuries occurred (12 ACL injuries) across the preseason and first five games (of a 22-game season) in the Swedish Women's League (Eriksson, 2020). An earlier study found 13 first-time ACL injuries across the entire 2012 season (Johnson et al., 2016). A study investigating sleep in early onset of lockdown in Spain found women to report a greater reduction in sleep quality compared to their male counterparts (Mon-López et al., 2020). Given the known relationship between sleep and injury risk, this risk factor should also be considered (Watson, 2017). This clearly highlights the need for extra consideration of sex and gender and the lockdown environment when evaluating requirements for RTP (**Table 1**). Sleep monitoring could be considered to support athletes through the RTP process.

Research in elite women's soccer, youth soccer, collegiate female soccer, lacrosse, and basketball, has shown an increase in non-contact injury prevalence either in the first month after preseason, or in the early part of the season (Jacobson and Tegner, 2007; Gall et al., 2008; Anderson et al., 2019). One study attributed this to the levels of physical and physiological fitness not being appropriate to withstand the intensity and frequency of competitive games. An increased risk of injury has also been shown in female athletes after a 2- to 3-week winter holiday break (Ruiz-Pérez et al., 2019). The present COVID-19 scenario has no historic parallel in male or female sport, but the 2011 National Football League

(NFL) lockout that lasted nearly 19 weeks offers clues about the imminent risks of injury. Upon resumption of training and competition, 12 Achilles tendon ruptures occurred, 10 of which were in the first 12 days, and this was double the number expected based on historical averages across the whole season (Myer et al., 2011).

Epidemiological studies in women's soccer show that women are less likely to sustain an injury than men, however, where injuries are sustained, severity is greater and RTP is longer in women (Larruskain et al., 2018). Specific risk areas for the female athlete in team sports are ankle and knee injuries (Larruskain et al., 2018). Therefore, a focus on risk reduction strategies targeted at preventing these injuries is warranted during this period of isolation and during the early phase of RTP (**Table 1**). Increased psychological stress and negative life event stress are also associated with an increased risk of injury (Soligard et al., 2016), further delineating the importance of managing load and monitoring mental health where possible (**Table 1**).

Women's sports facilities and training areas are typically smaller, and budgets inferior to those in men's sports. This may make following best practice/government guidelines (i.e., social distancing and ensuring appropriate processes are followed to reduce risk of virus transmission) more challenging. Ideally, advanced planning should be used to facilitate as smooth a RTP as possible (**Table 1**). Telehealth should be considered as an alternative option, bridging the gap and increasing access while also minimizing risk of transmission.

## MENSTRUAL CYCLE MONITORING

The menstrual cycle is often termed a "vital sign," providing an indication of overall health status (American Academy of Pediatrics Committee on Adolescence et al., 2006). A regular menstrual cycle is associated with an adaptive physiological state and provides a robust indication that the hypothalamic pituitary gonadal (HPG) axis is functioning correctly, and not exposed to excessive stress (Sokoloff et al., 2016). Examples of common stressors known to disrupt the HPG axis include inadequate fueling strategies, psychological stressors, excess physical stress or significant alterations to physical stress, travel, and sleep (Gollenberg et al., 2010; Iwasa et al., 2017). These stressors can result in a state of functional hypothalamic amenorrhea (FHA) or could increase the severity of symptoms. The COVID-19 pandemic has increased the likelihood of sleep disturbances, caused changes to exercise behaviors and negatively affected mental health (Bowes et al., 2020; Pillay et al., 2020; Ramos, 2020), with significant concern around the pandemic and COVID-19 infections both exacerbating existing eating disorders and increasing risk of disordered eating behaviors (Reardon et al., 2020; Touyz et al., 2020). In fact, 24.7% of elite Australian athletes have experienced menstrual cycle changes (McNamara et al., 2020) because of the pandemic. Again, geographical location should be considered here; it is plausible to suggest that

disturbances could well be higher in countries where COVID-19 lockdowns have been more severe and numbers of fatalities higher.

Practitioners should therefore be mindful of the potential for changes to menstrual patterns, and where possible, monitor cycles and symptoms throughout the RTP process, using this as an indicator of readiness and overall wellness (Table 1). This is particularly relevant in light of the increased risk of illness and injury associated with FHA (Melin et al., 2019), and the positive association between inflammatory markers and menstrual symptoms (Bertone-Johnson et al., 2014), again potentially increasing susceptibility to illness and injury. Low energy availability in particular is associated with a delay in recovery from illness, injury, and general exercise training, thus it is important to avoid a calorie deficient state during this time (Melin et al., 2019).

Two recent studies found combined hormonal contraception users have higher blood concentrations of certain inflammatory markers (Cauci et al., 2017), and markers of oxidative stress compared to non-users (Kowalska and Milnerowicz, 2016). However, the impact this may have on viral activation and response is not known. Another study demonstrated viral immunosuppression in cell cultures from women using medroxyprogesterone, but not other forms of progestin (Huijbregts et al., 2014). Although it is clear that more research is needed here, it would be advisable to take extra care when monitoring training load and wellness in those using hormonal contraception.

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## CONCLUSIONS

While the threat of COVID-19 remains, even during the rollout of widespread vaccination, applying a physiological lens, it is essential to undertake daily monitoring of athletes to capture any symptoms that are consistent with COVID-19 infection, including raised body temperature. Symptom screening is a minimum precaution to protect athletes, support staff and their families and to prevent further competition- and league-wide competition shutdowns. Frequent monitoring of resting heart rate, biomarkers of inflammation and oxidative stress, where possible, and menstrual cycle tracking, would further augment female athlete care while sports adapt to a new normal and the influence of COVID-19 gradually subsides. Historically, there has been a lack of inclusion and consideration of female-specific needs in scenarios (Mantovani et al., 2020; Wenham et al., 2020), but there is an opportunity to use this scenario as a chance to provide essential parity in athlete care, with attention to sex and gender differences, across sports as they emerge from this unprecedented hibernation. Where resources are limited, practitioners should be directed to undertake comprehensive medical evaluations of athletes who have suffered significant symptoms or hospitalization.

## AUTHOR CONTRIBUTIONS

All authors contributed to and reviewed the final draft of this manuscript.

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**Conflict of Interest:** GB, NL, and CP are consultants or are employed with Orreco, creators of the FitrWoman app.

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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# Case Report: Return to Sport Following the COVID-19 Lockdown and Its Impact on Injury Rates in the German Soccer League

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The Bundesliga made headlines for becoming the first major sports league to return to sport worldwide following COVID-19 lockdown. To-date, there lacks retrospective studies on longitudinal injury rates to elucidate the effect isolation measures had on the health and safety of professional athletes. This study sought to compare injury rates experienced by Bundesliga athletes before and after the COVID-19 lockdown. Data was collected from public injury and player reports regarding the Bundesliga, with injury defined as trauma resulting in loss of game time. Descriptive statistics were used to present differences in injury incidence between all Bundesliga Match days pre- and post-lockdown. Between the league's resumption and completion on May 16 and June 27, 2020, injuries occurred in 21 forwards (FW), 11 central midfielders (CM), 12 wide midfielders (WM), 16 central defenders (CD), 6 fullbacks (FB), and 2 goalkeepers. Players had 1.13 (95% CI 0.78, 1.64) times the odds of being injured following the COVID-19 lockdown, with a 3.12 times higher rate of injury when controlling for games played compared to injury rates pre-lockdown (0.84 injuries per game vs. 0.27 injuries per game). The most frequent injury group was muscular injuries with 23 injuries total, with 17% of athletes experiencing injury during their first competitive match following lockdown. Injury rate increased over 3-fold following COVID-19 lockdown. Athletes did not experience an increased rate of injury with more cumulative competitive matches played. High injury incidence for players yet to complete their first competitive match may imply suboptimal sport readiness following home confinement.

**Keywords:** COVID-19, Bundesliga, injury risk, return to sport, workload optimization, reduce injury burden

## INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has spread globally, forcing governing bodies to close commercial activities to avoid social gatherings in early 2020 (Pillay et al., 2020; Sarto et al., 2020). Elite sport leagues and major international sporting events have been suspended or delayed as part of this response worldwide (Pillay et al., 2020). While COVID-19 itself poses many potential health deficits to the infected athlete returning to play (Phelan et al., 2020), we are only beginning

to understand the physical, social, and psychological impact of training during the pandemic. Emerging calls to action by sports scientists are warning returning sports leagues of an additional reason to exercise extreme caution: an elevated injury risk for the isolated athlete (Casais-Martinez et al., 2020; Sarto et al., 2020).

In response to insufficient training stimulus, some experts suggest a drop in athlete work capacity will occur in proportion to the length of time in isolation. Athlete detraining, defined as a partial or complete loss of training-induced morphological and physiological adaptation, occurs in the short- and long-term. Short term detraining (<4 weeks) includes a rapid decline in maximal oxygen uptake ( $VO_{2max}$ ), maximal cardiac output, and reversal of training-induced changes in fluid-electrolyte regulating hormones (Mujika and Padilla, 2000a). While muscle strength may not be affected in the short-term, training-induced changes in skeletal muscle cross-sectional area also reversed rapidly, which may predispose athletes to increased injury risk (Mujika and Padilla, 2000a; Sarto et al., 2020). Symptoms of long-term detraining (>4 weeks) include marked decreases in  $VO_{2max}$  and endurance performance, lower lactate thresholds, and gradual reduction of muscle force production (Mujika and Padilla, 2000b). A recent study by Sarto et al. postulated that detraining experienced by the confined athlete will result in impaired athlete performance and higher injury risk without appropriate rehabilitation and reconditioning (Sarto et al., 2020).

The closest direct translation of these predictions was the 4.5-month 2011 NFL Lockout, where Myer et al. reported a spike of 12 Achilles tendon injuries during the NFL preseason alone, compared to a full season average of 8 Achilles injuries (Myer et al., 2011). Sports league lockouts resulting from collective bargaining agreement negotiations give us insight into an offseason without normal access to a team's facilities, healthcare and strength & conditioning professionals, and coaches, a scenario similar to the COVID-19 lockdown (Myer et al., 2011). Unique to the COVID-19 lockdown and the history of sports competition, however, is the reduced workload or absence of training likely experienced by many players due to stay at home orders implemented worldwide (Casais-Martinez et al., 2020).

While the pandemic influenced lockdowns across Europe and the rest of the world (Oltermann, 2020), the elite German soccer league, *Bundesliga*, surprised sports fans and healthcare experts alike when it announced it would end its postponement, the first professional sporting organization to do so (Figure 1). The duration of the league lockdown (>4 weeks) would have resulted in both short- and long-term detraining of Bundesliga athletes, as the lockdown prevented access to organized team training activities (Mujika and Padilla, 2000a,b). Due to the increase in match frequency and hypothesized increase in internal and external player workloads (Seshadri et al., 2019a), the Bundesliga league expanded the number of in-game player substitutions (from 3 to 5 players) to mitigate the high risk of injury already present in the sport (Askling et al., 2013; Chena et al., 2019; Leventer et al., 2019). The 2019–2020 season injury rate in the Bundesliga prior to league suspension is known, with sports scientists describing the injury rate as 0.27 injuries per game (The Bundesliga Blueprint: early lessons from the return of German football TRACKADEMIC, 2020). Thus, the early return of the

Bundesliga presents a challenge and a unique opportunity for sport scientists to better understand the impact of a long-term lockdown on athlete injury risk in a physically-demanding sport.

Therefore, the purpose of the present retrospective study was to compare injury rates of elite-level athletes before and after the Bundesliga COVID-19 lockdown. As a result of short- and long-term detraining, and more frequent competitive matches, the authors of this study hypothesized that the Bundesliga injury rate would increase following season suspension.

## METHODS

### Participants

Five-hundred and thirty-seven players from the 2019–2020 Bundesliga season were represented in our dataset. Player game-loss injury reports were retrieved from publicly available data *transfermarkt* (<https://www.transfermarkt.us/>), a methodology previously used to quantify injury rates in Bundesliga players (Leventer et al., 2019). Player positions were categorized into forwards (FW), central midfielders (CM), wide midfielders (WM), central defenders (CD), fullbacks (FB), and goalkeepers. This study utilizes the definition of injury from the *transfermarkt* report [Bundesliga - Injured players (Detailed view), 2020], where injury was defined as any trauma or musculoskeletal injury causing loss of game time. This is notably a variation in the definition of injury as proposed by Fuller et al. (2006). Injury data was excluded for players whose date of injury was reported prior to May 16 – the date of season resumption – or following June 27 – the date of season completion. A detailed description of players injured and their respective injuries was recorded (Supplementary Table 1).

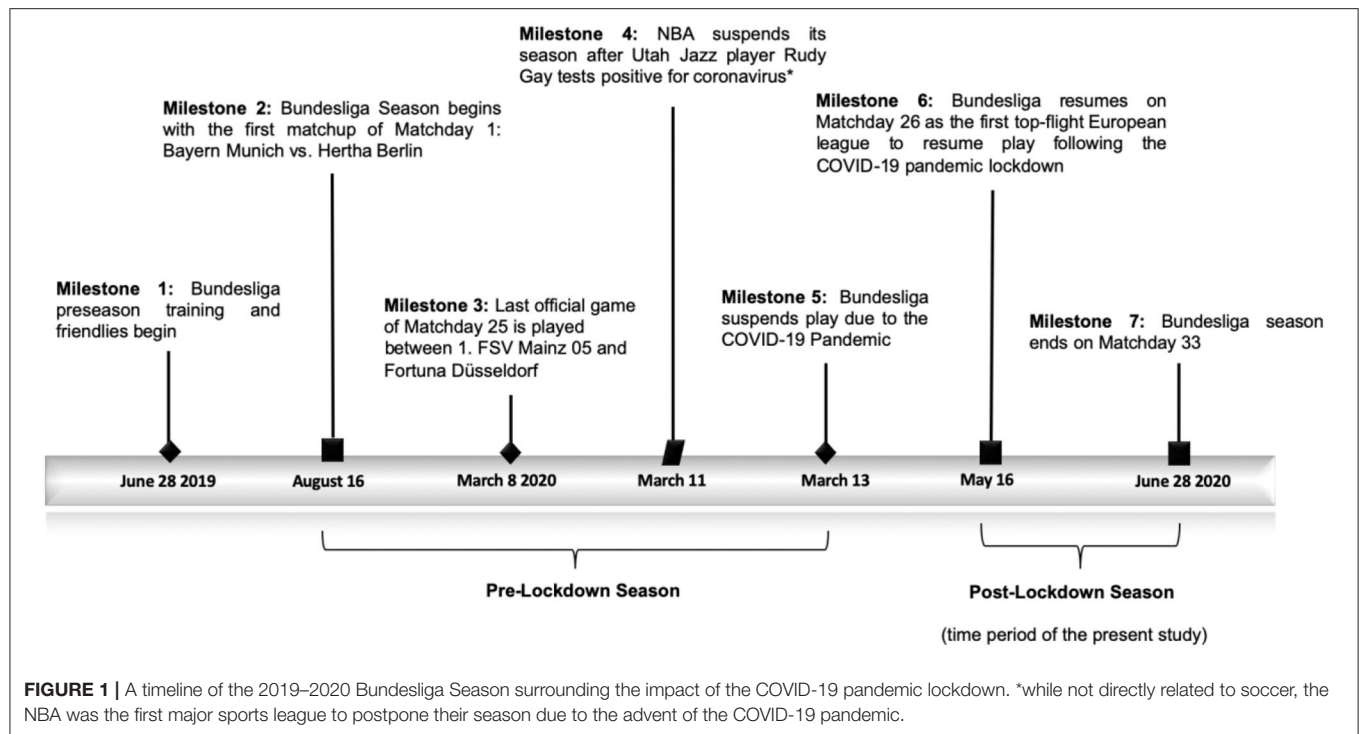
### Data Collection and Statistical Analysis

An odds ratio and 95% confidence interval was calculated for the likelihood of injury before and after the COVID-19 lockdown. Injury rate per game was inferred using the 82 remaining games of the season between Match days 26 and 34, with a total of 537 athletes studied. For these groups, a chi square analysis was performed to compare respective injury rates per game. For this analysis, the expected injury rate per game was set as 0.27, a number previously described for the initial 224 games of the season between Matchdays (e.g., a unit of time comprising all weekly matches) 1 and 25.

Using public gameplay reports for each injured player generated by the *SportsFan Ltd*-owned website *footballcritic* (FootballCritic - Football, 2020), the number of matches each player participated in prior to injury was recorded. A linear regression was performed representing the number of matches played prior to player injury. Chi square analysis was performed using the statistical programming language R. Figures were constructed using MATLAB\_R2016b (The MathWorks, Inc, Massachusetts, USA).

## RESULTS

The mean age of injured players was  $26.8 \pm 4.4$  years with a mean body-mass-index (BMI) of  $23.2 \pm 1.2$  (Height: 1.84



$\pm 0.06$  m, Weight:  $78.5 \pm 6.9$  kg). Seventy total game loss injuries were reported over the final 82 games played following league suspension, with 68 unique players reported injured ( $\sim 12.6\%$  of all athletes in the 2019–2020 Bundesliga league, compared to  $11.2\%$  of all athletes pre-lockdown). The odds ratio (95% Confidence Interval) suggesting the likelihood of a post-lockdown injury was 1.13 (0.78, 1.64). Injuries occurred in 21 forwards (FW), 11 central midfielders (CM), 12 wide midfielders (WM), 16 central defenders (CD), 6 fullbacks (FB), and 2 goalkeepers.

The injury rate per game following the COVID-19 lockdown was calculated to be 0.84 compared to 0.27 per game prior to the onset of COVID-19 ( $12.6\%$  of 537 athletes in 82 games following the COVID-19 lockdown vs.  $11.2\%$  of athletes injured in 224 games). Athletes were  $3.12\times$  more likely to have sustained injuries resulting in removal from play following the COVID-19 lockdown. Chi-square analysis demonstrated a significant difference between the injury rate post-lockdown with the injury rate pre-lockdown ( $\chi^2 = 164.84$ ,  $p < 0.001$ ).

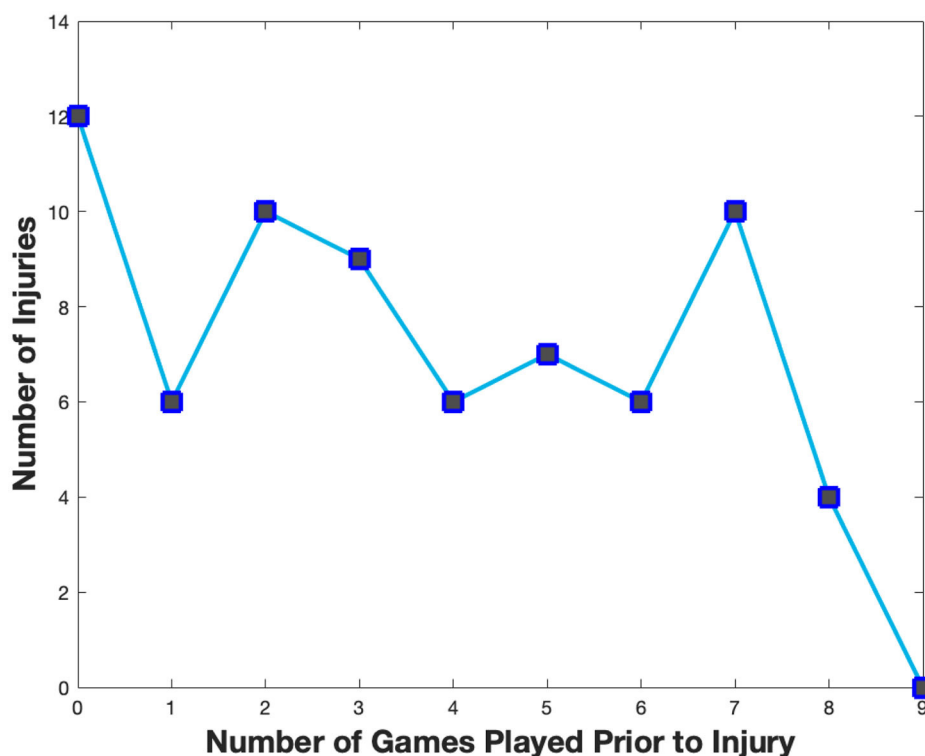
$17.3\%$  of all injuries occurred prior to competitive play initiation or during their first competitive match. The overall model fit for a linear regression between injury incidence and number of matches played prior to player injury was  $r^2 = 0.42$  (Figure 2). Muscular injuries (defined as: any report listing a muscle strain, tear, or problems associated with a muscle group or non-descript muscular injury) were the most common injuries noted among the Bundesliga athletes following the restart of the season (Table 1). Of these injuries,  $57\%$  were classified as non-descript in the affected muscle group; however, adductor or groin injuries were the next most common injury location at  $21.7\%$  of all muscular injuries.

## DISCUSSION

This descriptive epidemiology study sought to assess whether the COVID-19 lockdown and subsequent stay-at-home orders initiated worldwide affected athlete performance in an adverse manner following the restart of the 2019–2020 Bundesliga season. At the time of writing, this retrospective study represents the first analysis informing orthopedic surgeons, team physicians, athletic trainers, and sports scientists of the impact the COVID-19 lockdown has had on the injury profile of elite-level athletes.

The increased rate of injuries is multifactorial in origin (Stern et al., 2020). One must consider, however, the influence of deconditioning from a prolonged competition holiday, training in a restrictive environment due to home confinement, an expedited preparatory phase, and a condensed competitive season on injury risk (Sarto et al., 2020). In order to improve, we must continue to find ways to measure data that meaningfully informs training staff on the physical condition of their athletes and their risk for injury (Seshadri et al., 2021). Interestingly, we found a proportionally high number of injuries in athletes either attempting to play in or train for their first match post-COVID. While it is not possible to draw a strict conclusion from this data, it may suggest a general miscalculation of athlete readiness for competition as a result of their RTP program (Gabbett, 2016).

While the overall injury rate both pre- and post-lockdown in the Bundesliga was relatively low, the data does provide professional and collegiate sports teams information to guide safe RTP protocols to mitigate injuries manifesting from over- or under-training. Changes in injury-risk have been previously studied among the Bundesliga league. Leventer et al. studied players with a first team contract in one of the 18 clubs in the first



**FIGURE 2** | Comparative plot quantifying the number of matches played per each athlete before the onset of injury ( $r^2 \sim 0.46$  linear regression).

**TABLE 1** | The relative percentage breakdown of injury group by position, where colors, ranging from green (low) to red (high), represent injury incidence per position (FW, Forwards; CM, Central Midfielder; WM, Wide Midfielder; CD, Central Defender; FB, Fullback).

	All*	FW	CM	WM	CD	FB
Injury type	Percentage					
Muscle	33%	24%	24%	33%	38%	50%
Knee	17%	14%	14%	33%	6%	17%
Ankle	13%	14%	9%	0%	25%	17%
Unknown	11%	19%	9%	8%	6%	17%
Fitness**	7%	14%	0%	0%	13%	0%
Hip	6%	0%	9%	8%	6%	0%
Foot	6%	0%	0%	8%	6%	0%
Back	4%	5%	0%	8%	0%	0%
Concussions	3%	10%	0%	0%	0%	0%

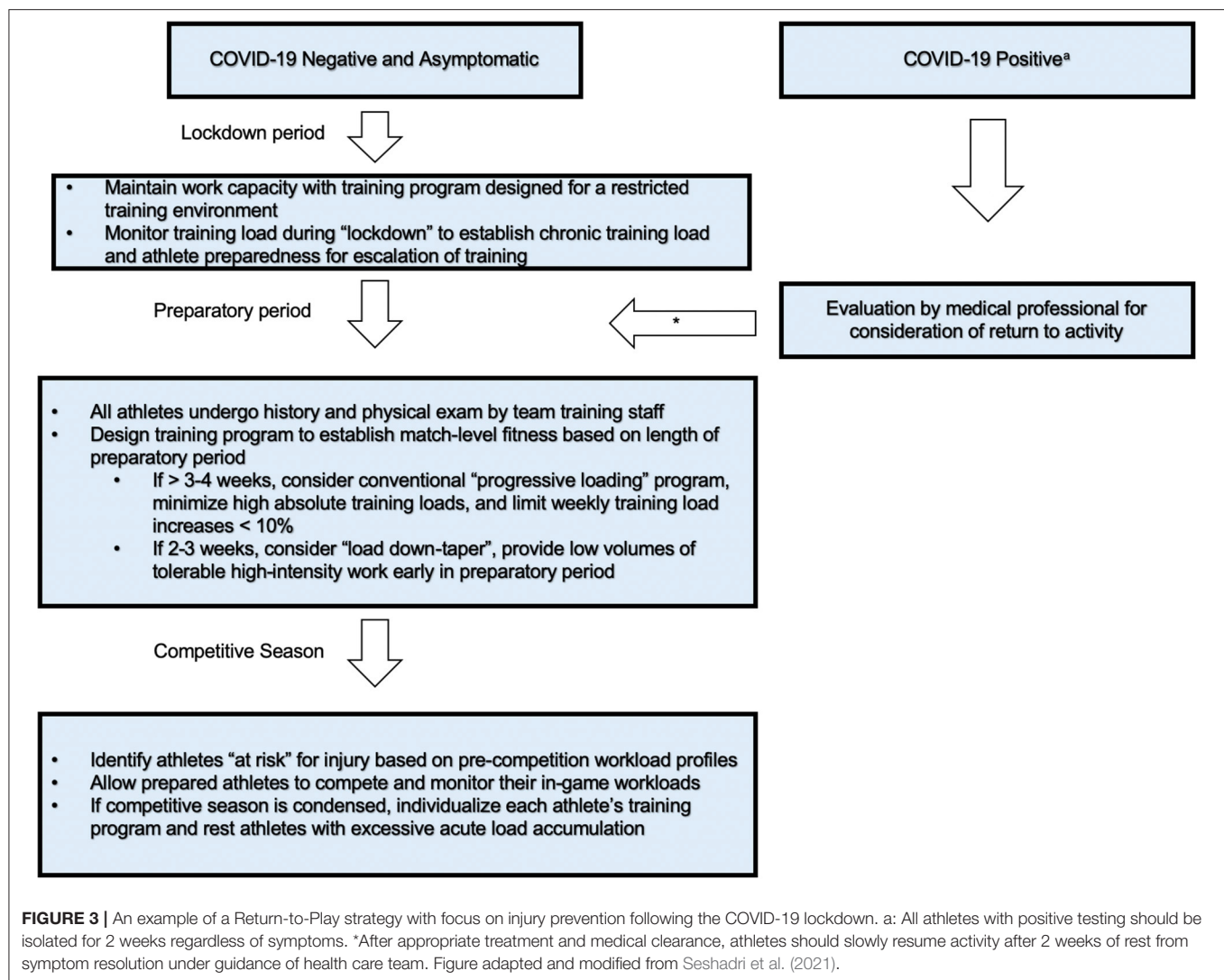
\*Includes the two injured goalkeepers, both with back injuries ( $n = 70$  injuries in 68 athletes,  $\sim 12.6\%$  of all athletes in the Bundesliga league). \*\*Player or coaching decision to discontinue play following inadequate game aerobic fitness.

division of the Bundesliga league over a six-season period (3,438 injuries were documented; 40.6% match injuries and 59.4% training injuries) (Leventer et al., 2019). The IRR was significantly higher in the competitive season compared to pre-season across match (IRR: 2.00, 95% CI: 1.30–3.00) and training (IRR: 1.27,

95% CI: 1.11–1.43) injuries. Supporting and complementing the findings found in the literature (Leventer et al., 2019) and by our team suggest that further research is needed to confirm if players train in the preparatory phases in ways that might predispose them to an increase injury-risk as observed by the carry-over effect heading into matches.

Learnings from the 2011 NFL lockout suggested that there may have been an increase in relative reinjury risk during early sports reintegration, attributed to the greater residual biomechanical and neuromuscular deficits from deconditioning, prior injuries, or surgeries (Myer et al., 2011). Importantly, youth athletes many may go even longer periods of time (compared to the Bundesliga) before re-engaging in high-level sporting activity (Kelly et al., 2020). Specific athlete age, gender, and sport specializations have their own unique set of pre-dispositions to injury and they should be evaluated and rehabilitated appropriately prior to resuming competitive play (Post et al., 2019; Jayanthi et al., 2020). While the elimination of sports-related injuries is an unrealistic goal, the design of individualized conditioning protocols may help reduce the likelihood of sports-related injuries in all athletes. As the pandemic continues to have a global impact, it is important to pursue retrospective studies to provide team personnel with objective data on the biomechanical and physiological impacts of the COVID-19 pandemic on athlete performance and safety (Phelan et al., 2020; Sarto et al., 2020).





## Practical Application and Recommendations

Due to this increased injury rate following the COVID-19 lockdown, the authors of this study suggest an approach toward designing and monitoring RTP protocols for athletes following the lockdown and athletes who have tested positive for the virus using wearable sensor technology (Figure 3). Recent advancements in wearable sensor technology have utility in monitoring the internal, external, and physiological profile of athletes of all ages (Seshadri et al., 2021). In studying professional NFL athletes over a given season, Li et al. found that athletes who had an acute to chronic workload ratio (ACWR) higher than 1.6, as measured by tri-axial accelerometry data, were 1.5 times more likely to sustain an injury relative to time- and position-matched controls (64.6 vs. 43.1%;  $P = 0.004$ ) (Li et al., 2017). We believe that the adoption of wearable sensor technology would enable a non-invasive, unobtrusive, and continuous modality for team physicians and athletic trainers to objectively assess the condition

and health of professional, collegiate, and youth athletes as they RTP prior to the start of their respective season (Seshadri et al., 2019a,b; Seshadri et al., 2020). While further prospective studies are needed, wearable sensor technology and workload monitoring may play an effective role in injury prevention.

## Limitations of This Study

Our study is not without limitations. Data collection from public databases has inherent challenges with accuracy and specificity of reported data. As a result, our study may be inflating the incidence of certain injury types due to non-specific injury reporting. Additionally, without access to team data, the true number of injuries may be over- or under-estimated. When defining injury analogous to professional sporting organizations (Fuller et al., 2006) the injury rates derived from this descriptive epidemiology study are similar to those recently reported in unpublished studies. While the total number of injuries seen in the present study is relatively small relative to a typical

Bundesliga season (Fünten et al., 2014), this report is the first of its kind, using the best available data to describe injury rate following the COVID-19 lockdown. Additionally, this study did not investigate, or correct for, the effect of increasing maximum in-game player substitutions.

## CONCLUSION

Bundesliga players were more likely to have sustained injuries following the COVID-19 lockdown, with many athletes experiencing injury during their return to competitive play. As professional sporting organizations continue to grapple with the repercussions of the pandemic, athletic trainers and coaching staff must be aware of a potential increase in risk for all injury types, with an emphasis on those of musculoskeletal origin. An increase in subjective and objective monitoring of the isolated athlete may mitigate the risk of injury related to both COVID-19 and its consequential physiological detraining during isolation.

## DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: <https://www.transfermarkt.us/bundesliga/verletzte-spieler/wettbewerb/L1/plus/1>; <https://www.footballcritic.com/>.

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## AUTHOR CONTRIBUTIONS

MT performed the data collection and analysis. DS, MT, and EH contributed to the writing of the manuscript, while CD and JV advised the project and contributed heavily to the editing of the manuscript. 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/fspor.2021.604226/full#supplementary-material>

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# Maximal Strength, Sprint, and Jump Performance in High-Level Female Football Players Are Maintained With a Customized Training Program During the COVID-19 Lockdown

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**Introduction:** The COVID-19 outbreak with partial lockdown has inevitably led to an alteration in training routines for football players worldwide. Thus, coaches had to face with the novel challenge of minimizing the potential decline in fitness during this period of training disruption.

**Methods:** In this observational pre- to posttest study involving Norwegian female football players ( $18.8 \pm 1.9$  years, height  $1.68 \pm 0.4$  m, mass  $61.3 \pm 3.7$  kg), we investigated the effects of a prescribed home-based and group-based intervention, implemented during the COVID-19 lockdown, on maximal muscular force production and high velocity variables. Specifically, maximal partial squat strength one repetition maximum (1RM), counter movement jump (CMJ) and 15 m sprint time were assessed 1 week prior to the lockdown and 12 weeks after the onset of lockdown. We also collected training content and volume from the prescribed training program and self-reported perceived training quality and motivation toward training.

**Results:** We observed no change in 1RM [pretest:  $104 \pm 12$  kg, posttest:  $101 \pm 11$  kg ( $P = 0.28$ )], CMJ height [pretest:  $28.1 \pm 2.3$  cm, posttest:  $26.8 \pm 1.9$  ( $P = 0.09$ )], and 15 m sprint time [pretest:  $2.60 \pm 0.08$  s, posttest:  $2.61 \pm 0.07$  s ( $P = 0.52$ )].

**Conclusion:** Our findings suggest that a prescribed home-based and group-based intervention with increased training time devoted to strength, jump, and sprint ability, and regulated to obtain a sufficient infection control level is feasible and effective to preserve strength, jumping, and sprinting abilities of high-level female football players during a ~ 3-month period of a pandemic-induced lockdown.

**Keywords:** resistance training, sprint, soccer, counter movement jump, squat, COVID-19



## INTRODUCTION

In 2019 and 2020, the COVID-19 outbreak resulted in country lockdowns where both the general population and athletes were exposed to unexpected behavioral restrictions (e.g., social distancing, closure and/or limitation of non-essential activities such as gyms and training grounds, and ultimately, self-isolation). Strict quarantine rules were introduced following national/international travel, after direct exposure to the virus or if showing COVID-19 symptoms. Consequently, athletes were enforced to cancel and/or postpone their competitions and to abruptly adjust their training routines (Sarto et al., 2020). In Norway, these regulations were imposed for all sports and were introduced during football teams' pre-season preparations. This led to a rapid shift in training plans and training practice with for example, some teams prescribing home-based training for their players (Sarto et al., 2020).

Football fitness includes both aerobic and anaerobic-capacity, and explosive muscle actions (Bangsbo et al., 2006). For example, dynamic muscle strength such as partial squat one repetition maximum (1RM) is suggested to reflect functional strength of football players (Wisloff et al., 1998), which is associated with muscular power (Stølen et al., 2005) and the ability to perform football specific actions (Wing et al., 2020). Mimicking the movement patterns in football during training was challenged during the lockdown period, which may have led to declines in football-specific physical fitness (Mohr et al., 2020).

One of the main intentions of the pre-season period in football is to optimize physical performance including jumping and sprinting ability, and maximal strength (Rønnestad et al., 2011). However, how these abilities are affected when the pre-season is unexpectedly interrupted, is mostly unknown. Several researchers have suggested negative effects of self-isolation following the COVID-19 lockdown (Mohr et al., 2020; Sarto et al., 2020), suggesting that it may result in lower training volume and quality, and in turn, decreased physical fitness (Girardi et al., 2020; Sarto et al., 2020). Indeed, a number of studies have reported reduced physical activity (Xiang et al., 2020; Zheng et al., 2020) and training hours during the COVID-19 lockdown (Mon-López et al., 2020; Zinner et al., 2020), and there are already findings of decreased cycling performance in cyclists (Muriel et al., 2020) and reduced hamstring strength in football players (Moreno-Pérez et al., 2020). However, some have presented the potential of maintaining physical fitness in multidisciplinary sports such as football, by performing circuit-based training (Latella and Haff, 2020). This was recently shown in a male football team, where jump height was preserved following 15 weeks of isolated training (Cohen et al., 2020).

Longer periods without strength training (12 weeks) may lead to reduced strength of 7–12% in strength trained individuals (Mujika and Padilla, 2000). Importantly, small quantities of training can attenuate the strength loss following complete training cessation in high levels athletes (García-Pallarés et al., 2010). Our planned data collection involving female football players was abruptly interrupted by the pandemic. Thus, we had the opportunity to investigate whether a change in prescribed training designed to limit COVID-19 infection during

lockdown (home-based, group based, and without normal football play), could preserve 1RM partial squat strength, counter movement jump (CMJ) and 15 m sprint time. To the authors' knowledge, the effect of COVID-19 related training adjustments on strength and strength derivatives is only available in male football players (Cohen et al., 2020; Moreno-Pérez et al., 2020). Thus, the aim of our study was to assess the effects of a prescribed unsupervised 12-week home- and group-based training program without gym facilities on 1RM partial squat strength, CMJ and 15 m sprint time in female high-level football players during a period without full contact football training.

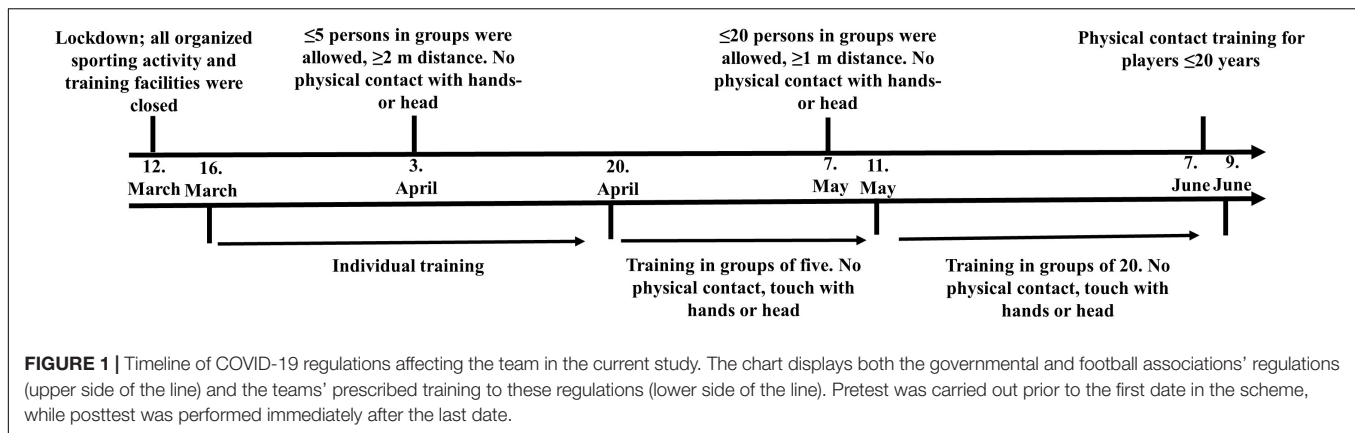
## MATERIALS AND METHODS

### Design, Subjects, Procedure, and Questionnaires

Our study is a longitudinal 12-week observational study with a pretest posttest design. Two female football teams playing at level three in Norway were originally invited to another study, whose main aim was to investigate the association between high-force/power tests and physical performance derived from tracking data during football match play. Since the COVID-19 lockdown was imposed by national authorities 1 week following pretest start, and 1 day prior to pretest the second team ( $n = 13$ ) (Figure 1), the team that completed the lab tests ( $n = 13$ ) involved in that study were invited to participate in a new data collection (posttest) 12 weeks after the first visit to the laboratory. Four players had left Tromsø for personal reasons during the lockdown period, thus nine players attended the follow-up measurements and were eligible for this study (Table 1). The lockdown was introduced 4 weeks prior to the planned start of the competitive season for the team. Data for eight players is reported for the force data acquisition in the CMJ test and eight players for 1RM, due to incomplete force data recording in the CMJ for one player at pretest and a hand injury at posttest for another player. Eight players are included in the dexta-scan data. All the other variables are reported for pre- and posttest for all nine players. The training plan information was retrieved from the team's coaches (Table 2).

According to the Helsinki declaration, all participants were informed of the potential benefits, risks, and procedures of the study, both orally and in writing, before signing an informed consent. The original study and the data storage protocol was approved by the Norwegian Center for Research Data (NSD) (approval reference number: 989024), and approved our changed aim and a new data collection period in June (correction reference number: 768380), without any further ethical approval per institutional and national guidelines for research on sport and exercise science.

At pretest, the players answered one custom-made question about their experience with strength training in the squat exercise with answering option 1, No experience; 2, Some experience (<1 year); and 3, A lot of experience (>1 year). Two months after posttest in June 2020, the players received an individual custom-made questionnaire about their pre-season training habits before

**TABLE 1 |** Baseline participant characteristics (mean  $\pm$  SD).

Age (year)	18.8 $\pm$ 1.9
Body mass (kg)	61.3 $\pm$ 3.7
Height (m)	1.68 $\pm$ 0.4
Lean mass (kg)	44.5 $\pm$ 2.0
Bone mass (kg)	2.66 $\pm$ 2.0
Body fat (%)	24.88 $\pm$ 0.04
Fat mass (kg)	14.9 $\pm$ 3.5
Leg lean mass (kg)	15.4 $\pm$ 8.6

Body composition is measured by a dual-energy X-ray absorptiometry machine (dexa-scan) (Lunar Prodigy; GE Medical Systems, Buckinghamshire, United Kingdom).

**TABLE 2 |** Changes in prescribed training from pre- to posttest, before and during lockdown.

	During normal pre-season training before lockdown	During lockdown	%-change
Total training (min)	291 $\pm$ 77	233 $\pm$ 47	-20
Football training (min)	207 $\pm$ 55	95 $\pm$ 106	-54
Strength training (min)	28 $\pm$ 27	40 $\pm$ 39	43
Speed and jump training (min)	6 $\pm$ 13	26 $\pm$ 19	333
Endurance training, running (min)	0 $\pm$ 0	45 $\pm$ 39	NA
Individual training (sessions)	0.3 $\pm$ 0.5	2.0 $\pm$ 2.0	567
Group/team training (sessions)	3.6 $\pm$ 0.7	1.8 $\pm$ 1.7	-50

Weekly training prescribed by the coaches to their players during the spring 2020. The data is presented as average minutes  $\pm$  SD.

and during the lockdown. This consisted of six questions where the first reflected their adherence to the training prescribed by the coaches during the lockdown, in a bipolar five-unit Likert-scale. The second and third question were about their perceived quality of training and motivation to training, respectively, answered on a bipolar three-unit Likert scale. These three questions were first addressed for the pre-season period prior to the lockdown, and subsequently for the period after the lockdown. The questionnaire was designed by two researchers (SP and SAP), and later discussed by additional two researchers (BW and TH)

where the final version was developed with consensus from all four researchers.

Prior to pretest, all the participants underwent 3–4 supervised familiarization sessions to the partial squat exercise over 2 weeks, in order to perform the movement safely and technically sound (Ploutz-Snyder and Giamis, 2001). All tests and familiarization sessions started with the same standardized warm-up routine consisting of 5 min of self-selected low intensity cycling on an ergometer bike (Pro/Trainer, Wattbike Ltd., Nottingham, United Kingdom) and followed by 5 min low intensity running of self-selected speed in the gym. The participants were recommended to not perform strenuous physical exercise 24 h prior to testing. Pretests of physical fitness (e.g., 1RM, CMJ, and 15 m sprint) were conducted in the laboratory between 17:00 and 19:00 on two separate occasions, separated by 3 days. During the first day, the sprint tests were carried out first followed by the CMJ test; thereafter half of the players underwent the dexa-scan. On the second day, the players underwent a 1RM test, followed by a dexa-scan for the second half of the players.

## Strength

The participants underwent a 1RM test in the partial back squat exercise for the assessment of maximal dynamic strength. An Olympic barbell (T-100G; Eleiko, Halmstad, Sweden) was used for both familiarization and the main experimental testing. During the 1RM trials, the participants were instructed to lift the bar from the rack, step one step back, go slow into the descending phase of the movement, followed by a maximal intended velocity during the concentric phase. The participants initiated the concentric phase as response to an orally “go” by the researcher measuring the 90° knee angle at the knee joint with a goniometer (Pedersen et al., 2019). The same researcher measured knee angle for all the participants during both pre- and posttest. The participants warmed up with 10 repetitions by lifting the bar (20 kg), followed by 10 repetitions of the participants' perceived  $\sim$ 50% 1RM. The starting 1RM attempt consisted of one repetition at a high load, which the participants knew they could manage. Each following attempt was completed with 5–10 kg additional load until failure. All players had a minimum of 3 min rest between each lift. The highest load lifted by the participants was defined as their 1RM.

## Sprint

Prior to the sprint test, in addition to the general standardized warm up, the participants performed three 15 m strides at their subjective effort of 85–90% of maximal acceleration speed. Thereafter, the participants performed three, 15 m sprints with 3 min rest between each attempt. The sprint times were measured by single-beam electronic photocells (ATU-X, IC control AB, Stockholm, Sweden) mounted to the floor and walls. The starting photocell was placed 20 cm above the ground, while the 5, 10, and 15 m photocells were placed 100 cm above the ground. Self-initiated, the players started the sprint in a static position placing their front foot 30 cm behind the starting line. The fastest 5, 10, and 15 m split times were included in the analyses.

## Counter Movement Jump

Standing on the force platform (Hur-Labs, ALU4, Finland), the participants were instructed to perform a CMJ with the aim to jump as high as possible, with the hands fixed on the hips during the entire movement. Force data were recorded with bespoke software (Force platform software suite, HURLabs oy, Kokkola, Finland). The software calculates jump height as the center of mass displacement calculated from the force developed and measured body mass. Each player performed two trials with a minimum 3 min rest between the two trials. The highest jump was taken for analysis.

## Statistical Analyses

The Shapiro–Wilk test and visual inspection of Q–Q plots were used to assess normality distribution of data. For 1RM, CMJ, and 15 m sprint times we used Student paired sample *t*-tests to determine the change from pre- to posttest. For training and questionnaire data, non-parametric tests were used for analyses as these variables were considered non-normally distributed. For the questionnaire data (e.g., training adherence, quality, and motivation), we used a non-parametric signed rank tests to assess

the direction of the data from pre-post lockdown (Roberson et al., 1995). All data are presented as mean  $\pm$  standard deviation (SD), or 95% confidence intervals (CI). Alpha level was set to 0.05. The Statistical Package for the Social Sciences (SPSS, Version 26, IBM, Armonk, NY, United States) was used for the statistical analyses.

## RESULTS

Six of the players reported to have some experience with strength training using the squat exercise, while the three remaining players reported to have a lot of experience.

The pre- and posttest results are presented in **Table 3**, with the individual percentage changes illustrated in **Figure 2**. No significant changes were observed for absolute- and relative 1RM partial squat strength ( $P > 0.05$ ), CMJ jump height ( $P > 0.05$ ), force production variables in the CMJ test (all  $P > 0.05$ ), or in 15 m sprint times ( $P > 0.05$ , in all cases) from pre- to posttest.

Change in perceived adherence to the prescribed training and perceived level of motivation toward training were both non-significant ( $P > 0.05$ ), while perceived quality of training was significantly reduced from pre- to posttest ( $P < 0.05$ ) (**Figure 3**).

## DISCUSSION

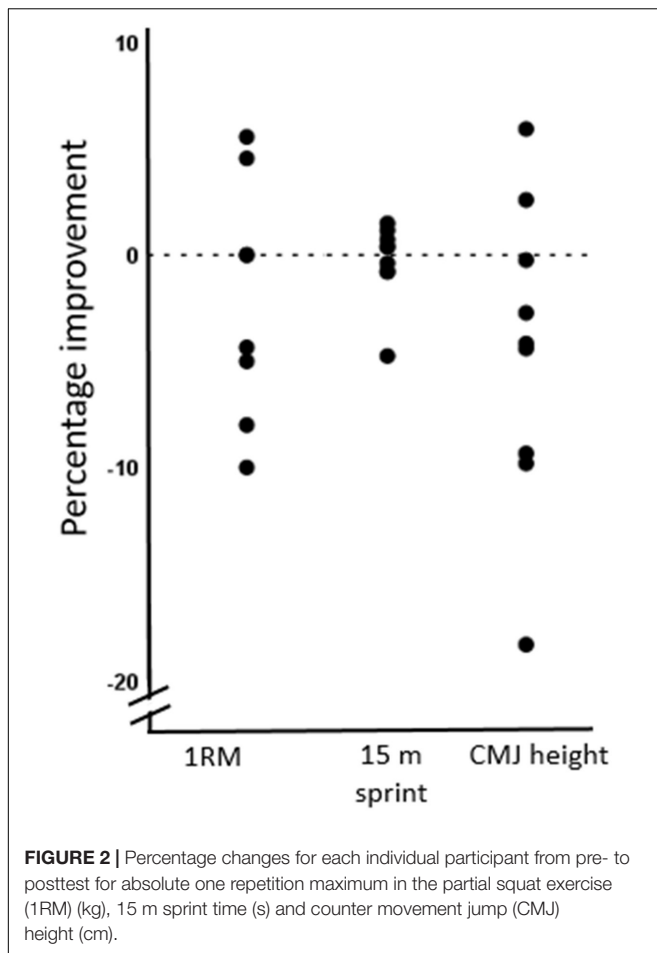
Our study describes the effects on partial squat 1RM, CMJ, and sprint performance in female football players during a period of a global pandemic, which resulted in comprehensive adjustments of players' training routines. Our main findings were that maximal strength, sprint time and jump performance did not decrease during lockdown.

Researchers have speculated that COVID-19 induced restrictions will lead to training cessation and consequently physiological detraining during (Girardi et al., 2020), where football players first trained in solitude, followed by a second

**TABLE 3** | Changes in selected parameters from pre- to posttest.

	Pre (mean $\pm$ SD)	Post (mean $\pm$ SD)	Change (mean and 95% CI)	<i>P</i> -value
<b>Partial squat 1RM</b>				
1RM (kg)	104 $\pm$ 12	101 $\pm$ 11	3 (3; 8)	0.28
1RM (kg·m <sub>b</sub> <sup>-1</sup> )	1.69 $\pm$ 0.24	1.65 $\pm$ 0.23	0.03 (– 0.05; 0.12)	0.39
<b>15 m sprint test</b>				
5 m (s)	1.03 $\pm$ 0.04	1.04 $\pm$ 0.05	0.01 (– 0.05; 0.03)	0.52
10 m (s)	1.86 $\pm$ 0.05	1.88 $\pm$ 0.05	0.01 (– 0.04; 0.01)	0.28
15 m (s)	2.60 $\pm$ 0.08	2.61 $\pm$ 0.07	0.01 (– 0.04; 0.03)	0.68
<b>CMJ</b>				
Jump height (cm)	28.1 $\pm$ 2.3	26.8 $\pm$ 1.9	1.4 (– 0.26; 2.98)	0.09
Takeoff velocity (m s <sup>-1</sup> )	2.34 $\pm$ 0.10	2.29 $\pm$ 0.08	0.05 (– 0.03; 0.13)	0.17
Maximum force (N)	1274 $\pm$ 70	1265 $\pm$ 73	9 (– 58; 77)	0.75
Maximum power (W)	2665 $\pm$ 167	2605 $\pm$ 109	60 (– 96; 216)	0.40
Flight time (ms)	490 $\pm$ 26	485 $\pm$ 18	5.6 (– 15; 26)	0.57
Average power (W)	628 $\pm$ 89	591 $\pm$ 76	36 (– 8; 81)	0.10
Average force (N)	763 $\pm$ 37	747 $\pm$ 37	16 (– 8; 40)	0.15

CMJ, counter movement jump; 1RM, one repetition maximum. *P*, the *P*-value from the paired sample *t*-test from pre- to posttest.



stage in which training was performed in small groups with contact restrictions (Mohr et al., 2020). The team in our study had a total weekly training volume of  $\sim 5$  h prior and  $\sim 4$  h during the lockdown, which was a decreased total training time ( $\sim 1$  h). This is less than the  $\sim 3.5$  h reduced training time recently reported for female football players in the three highest leagues in Spain during the lockdown (Mon-López et al., 2020). The participants in our study tended to perform more strength training during the lockdown, potentially compensating for the loss of sports specific training during this period. This increase in strength training time did not increase strength, jump, or sprint performance, but rather maintained it. Importantly, our results reflect the prescribed training from the coaches, and not the reported training performed by the players, as in the study by Mon-López et al. (2020). However, their initial training volume was probably much higher than in the current study, as their self-reported weekly training pre-lockdown was 12 h. The training volume in our study is much lower than for elite players. Self-reported training data from the first and second placing team in the highest division in Norway last season, showed that the players trained  $9.2 \pm 2.5$  weekly hours during the preseason (unpublished results).

We did not expect that reduced football training *per se* would lead to a marked strength loss, as football training do not seem to

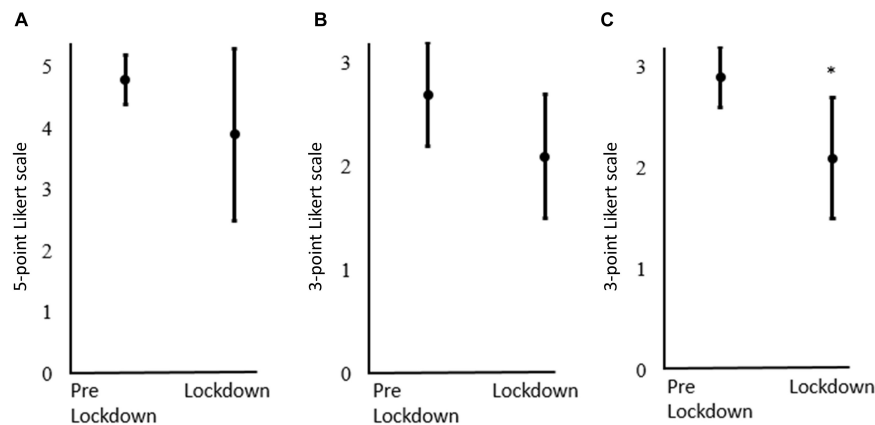
influence maximal strength (Rønnestad et al., 2008). We rather expected that no access to the team's- and commercial gyms might have a negative influence on maximal strength during the COVID-19 period. Recently, one study found that a group of semi-professional male football players reduced hamstring muscle strength following 25 days of home confinement due to the COVID-19 lockdown (Moreno-Pérez et al., 2020). However, these findings are not directly comparable as the muscles, exercise modality and muscular contraction type (Nordic hamstring, an eccentric contraction exercise) were different for the strength test in the study by Moreno-Pérez et al. (2020) than in our study. Eccentric strength is more susceptible to decline compared to other neuromuscular factors (Mujika and Padilla, 2001). This may explain the discrepancy between our study and the study by Moreno-Pérez et al. (2020), as the partial squats in our study emphasize concentric strength.

Highly strength trained athletes are more susceptible to decrements in strength following training restriction compared to less trained (Rønnestad et al., 2011). The prescribed training by the team in our study prior to the lockdown consisted of little time devoted to strength training (Table 2). Hence, pretest 1RM was likely not influenced by systematic maximal strength training in the players in our study. For example, our study's players' 1RM was similar to the baseline 1RM partial squat strength in another study of female football players, which increased their 1RM squat strength by 30% following 5 weeks of strength training (Pedersen et al., 2019). However, although the players in our study reported to have some experience with the squat exercise, it may be that their exercise modalities were ineffective or non-specific, thus their maximal partial squat strength was relatively low compared to the levels expected following systematic strength training (Pedersen et al., 2019).

The sprint time for 15 m accompanied by split times at 5 and 10 m did not change during the lockdown. A study by Sporis et al. (2011) showed that starters in official matches improved sprint performance more than non-starters over a season. Specific small-sided games are typically used as training drills during normal football training. Small-sided games are shown to both provoke high maximal acceleration distance during play (Ade et al., 2014) and improve sprint performance (Hammami et al., 2018). However, sprinting is an uncomplicated movement pattern to carry out outside the football field where especially short sprints can be trained almost anywhere without the use of equipment, and consequently lead to improvements in acceleration (Spinks et al., 2007), or sprint performance maintenance, as found in our study, being in line with earlier findings (Mujika et al., 2009). The sprint training effect is usually not superior when a supervising coach is included compared with individual unsupervised sprint training (Haugen et al., 2015). Thus, sprint-training effect solely relies on the players themselves, where the players in our study performed sufficient amounts to preserve sprint performance. The prescribed volume of sprint and jump training time showed a tendency to increase during the lockdown (Table 2), and may have compensated for the reduced specific football training.

The CMJ height was preserved during the lockdown. This is in line with recent findings in male football players





**FIGURE 3 | (A)** Perceived adherence to proportion of the prescribed training plan [y-axis, 1. to a little degree (0–20%), 2. to some degree (21–40%), 3. approximately half (41–60%), 4. to a large degree (61–80%), 5. almost all (81–100%)]. **(B)** Perceived degree of motivation for training (y-axis, 1. highly motivated, 2. average motivated, 3. low motivated). **(C)** Perceived level of quality of the training conducted (y-axis, 1. high quality, 2. average quality, 3. low quality). The figure displays the mean ± SD. \*Indicates a significant difference ( $P < 0.05$ ) from pre lockdown to lockdown, derived from the Signed rank test.

(Cohen et al., 2020). Jump performances as during heading situations are observed in large sided football games (Owen et al., 2014). In order to follow the regulations by the authorities, both large sided and small-sided games were not performed by the team in the current study during the lockdown. With total training cessation, jump height decrements are reported following 4 weeks in adult males (Izquierdo et al., 2007), but not following 3 weeks in adolescent males (Gavanda et al., 2020). Maximal power is likely better preserved than maximal force (Bosquet et al., 2013). Importantly, the reduction is shown to be more profound as the training cessation duration increases, where maximal force declines are reported following 3 weeks of training cessation (Bosquet et al., 2013).

Others have found reduced jump height after an off-season training program (Koundourakis et al., 2014). The same is shown for sprint performance (Clemente et al., 2021). However, if the players are given an exercise plan during the off-season with gym sessions implemented, sprint and jump maintenance is possible (Requena et al., 2017). In our study, the players had not access to gyms, and were thus no able to implement proper maximal strength training in line with previous recommendations (Rønnestad et al., 2008; Helgerud et al., 2011). However, they still managed to implement a feasible training regimen sufficient to preserve strength levels. In total, the preserved strength, jump, and sprint performance during the COVID-19 lockdown in the team in our study is likely an effect of adhering to a well-designed physical training program, which according to our questionnaire was well implemented by the participants. For players of this level, strength training in the gym or full contact football trainings are not necessary to maintain maximal strength, running speed or jump ability.

## Limitations

The main limitation in the current study is the low sample size, which increases the possibility of a statistical type 2 error, and such a consequence cannot be conclusively ruled out. However,

to our knowledge this is the first study to report pre- and posttest prior and following the COVID-19 lockdown in female football players. Due to the uncontrolled design of our study, it should be considered descriptive and thus report changes in acceleration and jump height over the COVID-19 training period. Unfortunately, this design does not allow for causality inference (i.e., why we observed no change in performance). This information is highly relevant for football coaches. Second, although the training was described by the coaches, we do not know whether the players adhered to the training regimen, which we measured in retrospect with a subjective rating on the Likert scale.

## CONCLUSION

Maximal partial squat strength, CMJ, and sprint performance were preserved in female football players during a 12-week period of absence from normal football training and gym facilities during the COVID-19-induced lockdown. Thus, all the variables reflecting maximal and rapid muscular force production remained unchanged, likely due to adherence to a well-designed home-based and group-based training program by the team's coaches.

## Future Steps and Recommendations

Furthermore, as football is a complex sport in its requirements for different physical aspects, coaches should consider breaks like those that we have experienced due to COVID-19 as opportunities, and prioritize endurance, speed and power training in lieu of specific football training.

## 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

SP: in charge of the writing process, conceptualization and design, and data collection. SAP and DJ: conceptualization and design, and critical manuscript revision. AW and ES: contribution to

data collection, statistical analyses, and manuscript revision. BW: conceptualization and design, contribution to statistical analyses, and critical manuscript revision. MR and AC: contribution to critical manuscript revision. All authors contributed to final approval of the version to be published.

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# Physical Activity Protects Against the Negative Impact of Coronavirus Fear on Adolescent Mental Health and Well-Being During the COVID-19 Pandemic

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**Background:** The severity of the Coronavirus pandemic has led to lockdowns in different countries to reduce the spread of the infection. These lockdown restrictions are likely to be detrimental to mental health and well-being in adolescents. Physical activity can be beneficial for mental health and well-being; however, research has yet to examine associations between adolescent physical activity and mental health and well-being during lockdown.

**Purpose:** Examine the effects of adolescent perceived Coronavirus prevalence and fear on mental health and well-being and investigate the extent to which physical activity can be a protective factor against these concerns.

**Methods:** During United Kingdom lockdown restrictions, 165 participants (100 female, aged 13–19) completed an online questionnaire assessing perceived Coronavirus prevalence and fear, physical activity, and indicators of mental health and well-being (stress, anxiety, depression, fatigue, vitality, and perceived health). Separate hierarchical multiple linear regression analyses (with age, gender, perceived Coronavirus prevalence, and fear entered in step 1, and physical activity in step 2) were run to predict each well-being outcome.

**Results:** Regression analyses indicated that in general, while Coronavirus fear was a negative predictor, physical activity was a positive and stronger predictor of enhanced mental health and well-being outcomes.

**Conclusion:** Findings suggest that physical activity during the Coronavirus pandemic can counteract the negative effects of Coronavirus fear on adolescent mental health and well-being. Therefore, physical activity should be promoted during lockdown to support good mental health and well-being.

**Keywords:** anxiety, COVID-19, exercise, fatigue, stress, youth



## INTRODUCTION

The first cases of the COVID-19 Coronavirus (SARS-CoV-2) were discovered in Wuhan Province of China at the end of December 2019, and by 11th March 2020, the WHO declared this new Coronavirus a pandemic (World Health Organization, 2020). To combat the spread of the virus, unprecedented regulations were put in place for people displaying symptoms (self-isolation) or having been in contact with people with symptoms (quarantine), and most countries applied community-wide restrictions on movement and daily activities (commonly referred to as lockdowns). For example, during the United Kingdom lockdown, people were only allowed to leave the house for basic necessities (e.g., seeking medical attention and food shopping), to go to work if this was essential and could not be done from home, and to exercise once a day (UK Government, 2020). While these measures were deemed necessary to limit the spread of the Coronavirus, such restrictions are likely to have a negative impact on mental health.

Quarantine and larger scale lockdowns led to separation from loved ones, fear over the health of oneself, family, and friends, and a need to cope with the new situation (Cava et al., 2005). All these things can influence mental health and well-being. Indeed, research shows that restrictions during previous epidemics and pandemics have led to increased stress (and even post-traumatic stress disorder), depression, anxiety, emotional exhaustion, and fear (Brooks et al., 2020; Jiménez-Pavón et al., 2020; Xiang et al., 2020). Individuals also experienced numerous stress-evoking factors during lockdown and quarantine such as fear of infection and death, loss of social contacts, confinement, helplessness, as well as experienced stress, depression, anxiety, panic attacks, and even suicidality (Brooks et al., 2020; Jiménez-Pavón et al., 2020; Xiang et al., 2020). Emerging studies relating to the COVID-19 Coronavirus pandemic observe similar patterns, in that large proportions of healthcare workers and the general public surveyed have reported symptoms of depression, anxiety, and distress (Huang and Zhao, 2020; Lai et al., 2020; Rodríguez-Rey et al., 2020).

Specifically, fears and concerns surrounding pandemics during lockdowns and quarantine (e.g., fear of infection and fear of becoming ill) can have a particularly negative impact on mental health and well-being. Research shows that fear of becoming ill was evident in over 20% of people who had been quarantined during severe acute respiratory syndrome (SARS) epidemic (Reynolds et al., 2008). In line with this, perceived severity of the current Coronavirus, as well as being in close contact with someone diagnosed with the Coronavirus have both been found to be associated with increased stress, anxiety, and depression in adults (Rodríguez-Rey et al., 2020). Furthermore, fear of the current Coronavirus was associated with higher levels of anxiety in the general population (Harper et al., 2020). This research suggests that concerns about the current Coronavirus are likely to be detrimental to mental health and well-being.

Most research relating to the COVID-19 Coronavirus has focused on adult populations, with less attention to adolescent populations. This is somewhat surprising given the high

prevalence of mental health problems in adolescents (Sadler et al., 2018). Furthermore, lockdown restrictions leading to sudden school closures, a switch to online and more independent learning, and the cancelation of end of year final exams were all likely to contribute to stress and anxiety. Adolescents were also confined to home, organized sports, and group physical activity stopped and they were no longer able to socialize in person with others outside their household. It is, therefore, not surprising that initial Coronavirus pandemic research in adolescents found a high prevalence of depressive and anxiety symptoms (Chen et al., 2020; Zhou et al., 2020). Therefore, it is important that effective strategies are identified to promote mental health and well-being to protect adolescents against the negative effects of the Coronavirus.

One effective way to enhance mental health and well-being is physical activity. More physically active individuals exhibit lower levels of stress, anxiety, depression, and fatigue as well as greater vitality and well-being in adults and adolescents (Petrusello et al., 1991; O'Connor and Puetz, 2005; Stults-Kolehmainen and Sinha, 2014; Biddle et al., 2019; Rodríguez-Ayllon et al., 2019; Gianfredi et al., 2020). Physical activity can have a beneficial effect, equal to or greater than, a range of common mental health treatments, such as cognitive behavioral therapy for anxiety (Wipfli et al., 2008), and is comparable to antidepressant medication for depression (Dinas et al., 2011). Importantly, it is not only more physical activity that can improve mental health. A sudden decrease in physical activity can negatively impact on depressive symptoms, anxiety, fatigue, and energy levels (Weinstein et al., 2017). In sum, there is ample evidence that being and staying physically active results in benefits for mental health and well-being.

Previous research suggests that during the Coronavirus pandemic, physical activity could contribute to better mental health and well-being in adolescents. Moreover, physical activity's importance has been acknowledged by governments in several countries, by allowing physical activity to be one of the few reasons people could leave their homes during lockdown. Despite this, lockdown restrictions make physical activity more challenging, with research suggesting reduction in adult physical activity levels during the Coronavirus compared to pre-Coronavirus (Ammar et al., 2020). However, research conducted during the Coronavirus pandemic on adults has shown that physical activity is related to better mental health, such as lower levels of depression, stress, and anxiety (Rodríguez-Rey et al., 2020). Additionally, self-reported reductions in physical activity since the onset of the Coronavirus have been associated with higher stress, depression, and anxiety (Stanton et al., 2020). Conversely, in a sample of less physically active individuals, those who report engaging in more physical activity during lockdown restrictions report lower anxiety than those who report being less physically active during lockdown (Lesser and Nienhuis, 2020).

When investigating physical activity, mental health, and well-being, it is important to take gender differences into consideration. For example, there is evidence that males are more physically active than females (Bann et al., 2019). Furthermore, females tend to report higher levels of anxiety,

depression, and stress than their male counterparts (Murray et al., 2011; Sadler et al., 2018). In addition, in the context of Coronavirus, there is evidence for higher stress and anxiety levels in females (Fitzpatrick et al., 2020; Lai et al., 2020; Mazza et al., 2020). Consequently, when examining the associations between physical activity and mental health and well-being, it is important to investigate the impact on gender.

In sum, although there is substantial evidence of the detrimental effects of quarantine and lockdown on mental health and well-being, less is known about the factors impacting mental health and well-being in adolescents. While concerns related to the Coronavirus may adversely affect mental health, physical activity is likely to be beneficial. However, this is yet to be examined in an adolescent population. Therefore, the present study aimed to examine the effects of Coronavirus concerns on mental health and well-being in adolescents and the extent to which physical activity can protect against the negative impact of these Coronavirus concerns on mental health and well-being during lockdown. A secondary aim was to investigate the effect of gender on these variables.

## MATERIALS AND METHODS

### Participants

In total 100 female and 65 male participants aged between 13 and 19 years old ( $M = 15.90$ ,  $SD = 1.48$ ) took part in the study, 94.6% identified their ethnicity as white. Participants were recruited predominately through emails to schools, sports clubs, and other organizations targeted at adolescents (e.g., Scouts) across the United Kingdom. The study was also advertised via the social media of the research team. All participants lived in England. None of the participants reported as having tested positive for COVID-19. The study obtained ethical approval from the University ethics committee, and all participants, and where appropriate, a parent/guardian, provided informed consent. Power analyses showed that a sample of 165 participants would allow for the detection of a small to medium effect with power at 0.90 (Faul et al., 2009).

### Procedures

Data collection took place from 1st May 2020 to the 25th May 2020 in the United Kingdom using an online questionnaire platform (SmartSurvey). Participants then completed an online questionnaire pack including the demographic information, and measures to assess perceived fear and prevalence of the Coronavirus, physical activity, perceived stress, anxiety, depression, fatigue, vitality, and general health. Coronavirus restrictions and school closures had been in place for 5 weeks at the onset of data collection and remained unchanged during data collection.

### Questionnaires

All questionnaires were phrased so that the time period they related to was during the last month, which coincided with the period of the United Kingdom lockdown restrictions.

### Coronavirus Inventory

The Coronavirus inventory was developed for the present study by modifying the Swine Flu Inventory (SFI) items (Wheaton et al., 2012). The SFI is a 10-item questionnaire which assessed things such as individuals' concerns about the spread of H1N1 influenza, perceptions of likelihood of contracting the infection, and severity of the infection. Items were modified in the present study to refer to the Coronavirus that causes COVID-19 rather than H1N1 influenza, and any reference to the United States was altered to refer to the United Kingdom (e.g., "How quickly do you believe contamination from Swine Flu is spreading in the U.S.?" was modified to "How quickly do you believe the Coronavirus is spreading in the U.K.?""). Small wording modifications were also made to ensure that items were understandable by an adolescent population. Two further items "to what extent has the threat of the Coronavirus influenced your well-being" and "to what extent has the threat of the Coronavirus increased your stress levels" in order to better tap some of our variables of interest, namely stress and well-being and how they relate to the threat of the Coronavirus (see **Supplementary Table S1** for all items). Participants rated the extent to which they agreed with each item on a 5-point Likert scale ranging from 0 (very little) to 4 (very much).

To reduce the items to a number of meaningful factors, principle axis factoring with oblimin rotation was conducted on the 12 items (Tabachnick and Fidell, 2013). The initial solution identified four factors with eigenvalues ranging from 1.02 to 3.92, collectively accounting for 63.67% of the variance. However, one item (item 6) failed to load onto any factor and one item (item eight) cross loaded highly on more than one factor. These two items were removed from the second iteration which revealed three factors. The third factor consisted of only two items which poorly loaded on their subscale (items 9 and 10). These two items were dropped for the third run which yielded a final two factor solution with eigenvalues of 1.34 and 3.25, accounting for 57.36% of the variance. Each factor consisted of four items and factor loadings were all above 0.45 (Tabachnick and Fidell, 2013). One factor contained items assessing perceived prevalence and likelihood of becoming infected with the Coronavirus (e.g., "How likely do you think it is that you could become infected with the Coronavirus?"). This subscale was named *perceived Coronavirus prevalence*. The other factor contained items tapping concerns about the coronavirus and impact it could have on health and well-being (e.g., "If you did become infected with the Coronavirus, to what extent are you concerned that you will be severely ill?"). This subscale was named *Coronavirus fear*. The final eight items and their factor loadings are reported in **Table 1**, Cronbach alpha coefficient values demonstrated good reliability for Coronavirus concerns (0.78) and slightly low reliability for perceived Coronavirus prevalence (0.68). Mean scores for each subscale were calculated, so a higher score indicated a greater perceived Coronavirus prevalence or Coronavirus fear.

### Physical Activity

Physical activity was measured using a single item in which participants selected which level represented their physical activity (Jurca et al., 2005). The question asked participants to rate their

**TABLE 1 |** Coronavirus inventory factor loadings for a two-factor solution.

Item	Coronavirus fear	Coronavirus prevalence
To what extent has the threat of the Coronavirus increased your stress levels?	0.817	
To what extent are you concerned about the Coronavirus?	0.690	
To what extent has the threat of the Coronavirus influenced your well-being?	0.679	
If you did become infected with the Coronavirus, to what extent are you concerned that you will be severely ill?	0.483	
How quickly do you believe the Coronavirus is spreading in the United Kingdom?		0.634
To what extent do you believe that the Coronavirus is prevalent in the United Kingdom?		0.601
How likely do you think it is that you could become infected with the Coronavirus?		0.546
How likely is it that someone you know could become infected with the Coronavirus?		0.495

usual pattern of activity. In the present study, this was altered to ask participants their usual pattern of activity in the last month. Participants selected one of five possible levels with each increasing level indicating a higher amount of physical activity [Level 1: “Inactive or little activity other than usual daily activities”; Level 2: “Regularly ( $\geq 5$  days/week) participate in physical activities requiring low levels of exertion that result in slight increases in breathing and heart rate for at least 10 min at a time”; Level 3–5: participation in “aerobic exercises such as brisk walking, jogging, or running at a comfortable pace, or other activities requiring similar levels of exertion” for 20–60 min per week (level 3), 1–3 h per week (level 4) or over 3 h per week (level 5)]. The item has been used as an element of a non-exercise estimate of cardio-respiratory fitness (CRF) which was found to be a good estimation of CRF when compared to actual exercise testing (Jurca et al., 2005). Single item physical activity measures have been found to provide reliable and valid assessments of physical activity in adolescents (Scott et al., 2015).

### Perceived Stress Scale

The 10-item Perceived Stress Scale (PSS; Cohen et al., 1983) assessed how stressed individuals felt over the past month. Participants read each item (e.g., “How often have you felt nervous and ‘stressed’?”) and respond on a 5-point Likert scale from 0 (never) to 4 (very often). Positively worded items are reverse scored, and a mean score is calculated of all items so that a higher score indicates a higher level of perceived stress. The PSS has been reported to have good internal reliability in adolescent populations (Carlozzi et al., 2010). The present study demonstrated good internal reliability ( $\alpha = 0.88$ ).

### Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983) assessed general levels of anxiety (seven items, e.g., “I get sudden feelings of panic”) and depressive symptoms (seven items, e.g., “I feel as if I am slowed down”), with items being scored on a scale of 0–3. Each subscale is

summed with scores ranging from 0 to 21, with higher scores indicating higher levels of anxiety or depressive symptoms. The HADS has been validated for use in adolescents to assess anxiety and depressive symptoms (White et al., 1999). The present study demonstrated good internal reliability for anxiety ( $\alpha = 0.84$ ) and depression ( $\alpha = 0.81$ ).

### Multidimensional Fatigue Inventory

The 20-item Multidimensional Fatigue Inventory (MFI-20; Smets et al., 1995) was used to measure general fatigue (e.g., “I feel tired”), physical fatigue (e.g., “Physically I feel only able to do a little”), reduced activity (e.g., “I get little done”), mental fatigue (e.g., “It takes a lot of effort to concentrate on things”), and reduced motivation (e.g., “I do not feel like doing anything”). Each subscale consisted of four items. Participants rated the extent to which they agree or disagree with each item on a 5-point Likert scale from 1 (no, that is not true) to 5 (yes, that is true). Positively worded items were reverse scored and scores for each subscale were summed to create a total score for each subscale with higher scores representing greater fatigue. The MFI-20 is a valid and reliable measure to assess fatigue (Smets et al., 1995), used successfully in adolescent populations (Vantieghem et al., 2018). The present study demonstrated good internal reliability for all subscales ( $\alpha \geq 0.75$ ).

### Subjective Vitality Scale

The Subjective Vitality Scale (SVS; Ryan and Frederick, 1997) is a 5-item questionnaire (e.g., “I feel I have a lot of energy”) assessing how energetic a person feels. Participants rate the extent to which they agree with each statement on a 7-point Likert scale from 1 (not at all true) to 7 (very true). Items are then averaged with higher scores indicative of greater vitality. The SVS has been found to be a valid and reliable measure of vitality in adolescents (Reinboth et al., 2004). The current study demonstrated a good internal reliability ( $\alpha = 0.89$ ).

### General Health

Perceptions of general health was measured using a single item taken from the Short Form Health Survey-12 (Ware et al., 1996). Participants rated their perceived health on a 5-point scale: poor, fair, good, very good, and excellent. This single item measure for perceived health has been found to be as valid and reliable as a multi-item scale (Macias et al., 2015) and has also been used effectively in adolescents (Herman et al., 2015).

### Data Analysis

All data were analyzed using SPSS (IBM, Version 26). First, data were screened and cleaned to check for missing data and outliers. As Little’s MCAR test showed that less than 5% of data were missing at random ( $p > 0.05$ ), the expectation maximization method was used to complete the data set (Tabachnick and Fidell, 2013). Inspection of the Mahalanobis distance at  $p < 0.001$  identified no multivariate outliers so all data were retained for the analysis. Descriptive statistics were generated for males and females and a series of one-way



ANOVAs conducted to examine gender differences in all relevant outcomes. Pearson correlations were then run to examine the relationships between perceived Coronavirus prevalence, Coronavirus fear, and physical activity, with each other, as well as the mental health and well-being outcomes (i.e., perceived stress, anxiety, depressive symptoms, different fatigue subscales, vitality, and perceived general health). Finally, separate hierarchical multiple linear regressions were run to predict each well-being outcome. To determine the extent to which perceived Coronavirus prevalence and Coronavirus fear predicted each well-being outcome, these two variables were entered in step 1 along with control variables gender and age. Then physical activity was added at step 2 to determine if it was an independent predictor of each mental health and well-being outcome. The alpha level was set at 0.05 for all analyses and standardized beta values are reported for all regression analyses.

## RESULTS

### Participant Characteristics

Means and SDs of perceived Coronavirus prevalence, Coronavirus fear, physical activity, and mental health and well-being outcomes for both males and females are reported in **Table 2**. One-way ANOVAs revealed that males reported significantly lower Coronavirus fear, perceived stress, anxiety, general fatigue, physical fatigue, and mental fatigue, as well as higher vitality and general health. There was no significant difference in physical activity levels between male and female participants.

### Correlational Analyses

Correlation analysis between perceived Coronavirus prevalence, Coronavirus fear, physical activity, and well-being outcomes are displayed in **Table 3**. Perceived Coronavirus prevalence was associated with higher levels of Coronavirus fear, but physical activity was not associated with either perceived Coronavirus prevalence or Coronavirus fear. Coronavirus fear was associated with higher levels of perceived stress, anxiety, depressive symptoms, general fatigue, reduced activity, mental fatigue, and reduced motivation, and was associated with lower levels of vitality and general health. Coronavirus prevalence was not associated with any of the well-being outcomes. Higher levels of physical activity were associated with lower levels of perceived stress, depressive symptoms, and all five fatigue subscales, as well as higher levels of vitality and perceived general health.

### Multiple Linear Regressions

Results of the multiple linear regression analyses are reported in **Tables 4** and **5**. Step 1 of these analyses explored the independent associations between Coronavirus fear and perceived coronavirus prevalence with the different measures of mental health and well-being, while correcting for age and gender, with physical activity being added as a predictor at step 2. Results for all regressions, except when predicting depressive symptoms, showed that perceived Coronavirus prevalence was not independently associated with any mental health and well-being outcomes.

**TABLE 2 |** Mean (SD) of perceived Coronavirus prevalence, Coronavirus fear, physical activity, and well-being outcomes for male and female participants.

	Male mean (SD)	Female mean (SD)	F value	p value
Perceived Coronavirus prevalence	2.39 (0.876)	2.57 (0.67)	2.17	0.143
Coronavirus fear	1.62 (0.96)	2.19 (0.97)	14.44	<0.001
Physical activity	3.41 (1.35)	3.42 (1.3)	<0.01	0.958
Perceived stress	1.85 (0.691)	2.32 (0.67)	18.73	<0.001
Anxiety	6.62 (3.55)	9.35 (4.71)	16.13	<0.001
Depressive symptoms	5.17 (3.78)	6.27 (3.92)	3.23	0.074
Vitality	3.94 (1.40)	3.28 (1.32)	9.66	0.002
General health	3.44 (0.906)	3.08 (1.13)	4.59	0.034
General fatigue	11.33 (3.28)	12.66 (3.96)	5.11	0.025
Physical fatigue	8.79 (3.53)	10.25 (3.91)	5.99	0.015
Reduced activity	11.67 (4.31)	11.88 (4.54)	0.09	0.763
Mental fatigue	12.33 (3.55)	13.92 (3.74)	7.45	0.007
Reduced motivation	11.52 (3.97)	12.39 (4.09)	1.87	0.173

Degrees of freedom: 1, 164, F value relates to gender differences ANOVA.

**TABLE 3 |** Correlations between perceived Coronavirus prevalence, Coronavirus fear, physical activity and well-being outcomes.

	Perceived Coronavirus prevalence	Coronavirus fear	Physical activity
Perceived Coronavirus prevalence	1		
Coronavirus fear	0.41**	1	
Physical activity	0.01	-0.09	1
Perceived stress	0.10	0.40**	-0.26**
Anxiety	0.11	0.47**	-0.15
Depressive symptoms	-0.10	0.17*	-0.31**
Vitality	0.02	-0.18*	0.34**
General health	-0.05	-0.25**	0.33**
General fatigue	0.07	0.24**	-0.38**
Physical fatigue	0.11	0.25**	-0.58**
Reduced activity	<-0.01	0.07	-0.54**
Mental fatigue	0.01	0.20**	-0.23**
Reduced motivation	0.09	0.19*	-0.32**

\* $p < 0.05$ .

\*\* $p < 0.001$ .

Step 1 and step 2 of the regressions predicting stress, anxiety, and depressive symptoms accounted for a significant portion of the variance (except anxiety step 2). Coronavirus fear was a significant predictor in step 1 and step 2, with higher levels predicting more perceived stress, anxiety, and depressive symptoms. Physical activity was a significant negative predictor for stress and depressive symptoms, with higher levels of physical activity predicting lower levels of these outcomes.

The regressions for the fatigue subscales showed step 1 accounted for a significant portion of the variance and Coronavirus fear was a significant positive predictor of these subscales (with the exception of reduced activity and reduced motivation). Step 2 accounted for a significant proportion of the variance and physical activity was a significant negative predictor of all five fatigue subscales. Furthermore, Coronavirus fear became a nonsignificant predictor in all regressions except general fatigue.



**TABLE 4 |** Regressions between perceived Coronavirus prevalence and fear, physical activity, stress, anxiety, depressive symptoms, vitality, and general health.

	Perceived stress		Anxiety		Depressive symptoms		Vitality		General health	
Step 1	$\Delta R^2 = 0.23$ , $F = 11.72^a$ , $p < 0.001$		$\Delta R^2 = 0.27$ , $F = 14.59^a$ , $p < 0.001$		$\Delta R^2 = 0.08$ , $F = 3.35^a$ , $p = 0.012$		$\Delta R^2 = 0.11$ , $F = 4.89^a$ , $p = 0.001$		$\Delta R^2 = 0.09$ , $F = 4.18^a$ , $p = 0.003$	
	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$
Gender	0.25	0.001	0.19	0.010	0.11	0.187	-0.23	0.004	-0.13	0.114
Age	0.13	0.071	0.05	0.504	0.06	0.445	-0.18	0.021	-0.14	0.059
Perceived Coronavirus prevalence	-0.09	0.263	-0.11	0.136	-0.21	0.014	0.12	0.144	0.08	0.366
Coronavirus fear	0.36	0.000	0.47	<0.001	0.23	0.009	-0.16	0.068	-0.24	0.006
Step 2	$\Delta R^2 = 0.05$ , $F = 10.55^b$ , $p = 0.001$		$\Delta R^2 = 0.01$ , $F = 2.50^b$ , $p = 0.12$		$\Delta R^2 = 0.08$ , $F = 15.87^b$ , $p < 0.001$		$\Delta R^2 = 0.10$ , $F = 20.62^b$ , $p < 0.001$		$\Delta R^2 = 0.09$ , $F = 17.20^b$ , $p < 0.001$	
Gender	0.25	0.001	0.19	0.009	0.11	0.142	-0.24	0.002	-0.13	0.080
Age	0.11	0.096	0.04	0.564	0.04	0.575	-0.16	0.030	-0.13	0.083
Perceived Coronavirus prevalence	-0.07	0.340	-0.10	0.162	-0.19	0.020	0.10	0.203	0.06	0.485
Coronavirus fear	0.33	0.000	0.45	<0.001	0.19	0.022	-0.12	0.154	-0.20	0.016
Physical activity	-0.22	0.001	-0.11	0.116	-0.29	<0.001	0.32	<0.001	0.30	<0.001

<sup>a</sup>Degrees of freedom are 4,161.<sup>b</sup>Degrees of freedom are 1,160.**TABLE 5 |** Regressions between perceived Coronavirus prevalence and fear, physical activity, and fatigue.

	General fatigue		Physical fatigue		Reduced activity		Mental fatigue		Reduced motivation	
Step 1	$\Delta R^2 = 0.10$ , $F = 4.50^a$ , $p = 0.002$		$\Delta R^2 = 0.09$ , $F = 3.86^a$ , $p = 0.005$		$\Delta R^2 = 0.04$ , $F = 1.66^a$ , $p = 0.16$		$\Delta R^2 = 0.07$ , $F = 3.21^a$ , $p = 0.015$		$\Delta R^2 = 0.04$ , $F = 1.75^a$ , $p = 0.14$	
	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$
Gender	0.14	0.074	0.14	0.072	0.04	0.670	0.17	0.034	0.07	0.418
Age	0.17	0.023	0.10	0.173	0.19	0.018	0.05	0.550	0.06	0.476
Coronavirus prevalence	-0.04	0.601	<-0.01	0.984	-0.05	0.569	-0.09	0.292	0.01	0.902
Coronavirus fear	0.22	0.012	0.21	0.017	0.07	0.417	0.19	0.030	0.16	0.064
Step 2	$\Delta R^2 = 0.12$ , $F = 25.36^b$ , $p < 0.001$		$\Delta R^2 = 0.31$ , $F = 83.40^b$ , $p < 0.001$		$\Delta R^2 = 0.28$ , $F = 65.15^b$ , $p < 0.001$		$\Delta R^2 = 0.04$ , $F = 7.94^b$ , $p = 0.005$		$\Delta R^2 = 0.09$ , $F = 17.02^b$ , $p < 0.001$	
Gender	0.15	0.043	0.16	0.016	0.05	0.491	0.18	0.026	0.07	0.345
Age	0.15	0.032	0.07	0.258	0.16	0.021	0.03	0.659	0.04	0.617
Coronavirus prevalence	-0.02	0.798	-0.04	0.598	-0.01	0.853	-0.07	0.365	0.03	0.705
Coronavirus fear	0.17	0.034	0.14	0.055	<0.01	0.952	0.16	0.058	0.13	0.139
Physical activity	-0.35	<0.001	-0.56	<0.001	-0.22	<0.001	-0.21	0.005	-0.31	<0.001

<sup>a</sup>Degrees of freedom are 4,161.<sup>b</sup>Degrees of freedom are 1,160.

Step 1 and step 2 of the regressions predicting vitality and general health accounted for a significant proportion of the variance. In step 1 and step 2, Coronavirus fear was a significant negative predictor of general health but not vitality. In step 2, physical activity was a positive predictor of both variables so that higher levels of physical activity were associated with greater vitality and perceived health.

## DISCUSSION

This study aimed to examine the extent to which Coronavirus prevalence and Coronavirus fear predicted adolescents' mental

health and well-being during lockdown, and the extent to which physical activity can protect against the negative impact of these Coronavirus concerns on mental health and well-being. Despite perceived Coronavirus prevalence and fear being associated with each other, higher Coronavirus fear was associated with higher levels of stress, anxiety, depressive symptoms, and fatigue, as well as lower vitality and general health, which is in line with research in adults (Brooks et al., 2020; Harper et al., 2020; Rodríguez-Rey et al., 2020). Perceived Coronavirus prevalence was only significantly associated with lower depressive symptoms. The seemingly surprising negative relationship between perceived Coronavirus prevalence and depressive symptoms could perhaps be explained by behavioral disengagement (Horwitz et al., 2011):

adolescents with higher depressive symptoms may not engage with media related to Coronavirus, making them less aware of its prevalence. Collectively, the findings demonstrate that Coronavirus fear is a more consistent predictor of poorer mental health compared to perceived Coronavirus prevalence. This is similar to research in adult populations demonstrating fear of the current Coronavirus to be associated with higher anxiety and depressive symptoms, and fear of infection during periods of quarantine from other viruses to be associated with stress (Brooks et al., 2020; Harper et al., 2020). By extending these relationships into other indicators of health and well-being, the results of the present study suggest that it is not the prevalence of the Coronavirus but rather the fear of the impact it could have on health which is associated with poorer adolescent mental health.

An important novel finding of the current study is that physical activity counteracted the negative impact of Coronavirus fear on mental health and well-being in adolescents. Moreover, the size of the beta weights in the regressions predicting depression, vitality, perceived health, and fatigue (particularly physical fatigue and reduced activity) demonstrate that physical activity was a stronger predictor than Coronavirus fear. Indeed, physical activity is suggested to impact mental health in different ways, and some of these pathways might be especially relevant during the Coronavirus pandemic (Mikkelsen et al., 2017; Matias et al., 2020). For example, physical activity can have an immediate positive effect on mood and feelings of energy (Liao et al., 2017) and physical activity can be a distraction from negative thoughts and stress related to the Coronavirus fear (Mikkelsen et al., 2017). Physical activity can also bring a structure or daily routine to life, which is likely to be heavily disturbed as a result of the lockdown. As such, it can provide a sense of control and mastery, which can also impact on well-being (Mikkelsen et al., 2017).

The associations between physical activity and more positive mental health and well-being may in part be due to the environment of the activity. Although physical activity location was not assessed in the current study, in other studies during the Coronavirus, outdoor physical activity has been reported in over 90% of individuals (Lesser and Nienhuis, 2020). During the data collection in the present study, physical activity was one of the few reasons adolescents could leave the house. Furthermore, data from May to July 2020 indicate that more adolescents were being active outdoors, with the number of people going for a walk and cycling for fun or fitness being higher compared with the same period in 2019 (Sport England, 2021). Consequently, it could be suggested that a number of the study participants may have been doing most of their physical activity outdoors. Outdoor physical activity is generally associated with lower depression, tension, anger, and confusion compared to indoor physical activity (Bowler et al., 2010; Dunton et al., 2015), and has been associated with improved emotional well-being, including in adolescents (Pasanen et al., 2014). Moreover, adults who spent more time doing physical activity outdoors during the current Coronavirus displayed better well-being (described as “flourishing”; Lesser and Nienhuis, 2020). Therefore, the simple act of being able to leave the confinements of the house to exercise may have had an additional benefit to mental health. However, data also suggest an increase in adolescent participation in gym and fitness during

this same time compared with 2019 (Sport England, 2021). Considering that public gyms were closed as part of lockdown restrictions, it is likely that these gym and fitness activities were undertaken at home (e.g., live streamed workouts). Given that the location of the physical activity was not assessed in the present study, these suggestions are purely speculative.

Although physical activity significantly predicted lower perceived stress, Coronavirus fear was the strongest independent predictor of stress. This is not surprising given that literature shows infection fear can induce stress during periods of quarantine or lockdown (Brooks et al., 2020). A bi-directional relationship between stress and physical activity has been reported, with stress leading to less physical activity and less physical activity leading to more stress (Stults-Kolehmainen and Sinha, 2014). Importantly, the present study shows that despite the strong association between Coronavirus fear and perceived stress, physical activity was still a significant negative predictor of stress. Interestingly, during the SARS outbreak in Hong Kong in 2003, especially those who experienced more stress at home and worry about the virus reported to have increased their time spend being physically active (Lau et al., 2005, 2006). Therefore, it is possible that physical activity is also used by adolescents as a way to cope with the stress of the COVID-19 Coronavirus and to have a sense of control over their health.

A somewhat surprising result from the present study was that physical activity was not associated with anxiety. This contradicts work outside of pandemic settings, where higher levels of physical activity are associated with lower anxiety in children and adolescents (Ahn and Fedewa, 2011). During the current Coronavirus pandemic, the associations between physical activity and anxiety appear complex. Similar to the present study, other Coronavirus related studies have shown no association between anxiety and physical activity (Zhang et al., 2020), and no difference in anxiety between those who are active and non-active (Lesser and Nienhuis, 2020; Zhang et al., 2020). However, other studies have shown that those who are more physically active during the pandemic displayed lower levels of anxiety (Antunes et al., 2020). It is difficult to know why the relationship between physical activity and anxiety appears to be inconsistent during the current Coronavirus, but it may be that anxiety experienced during this time is different in nature to the anxiety typically experienced in the absence of such pandemics. During disease outbreaks, a number of people experience clinical levels of fear and anxiety (Taylor, 2019), and recent research suggests that individuals can experience specific dysfunctional Coronavirus anxiety (Lee et al., 2020). Although findings in the current study do not suggest specifically high levels of anxiety compared to non-pandemic situations, anxiety may be caused by other factors which influence its associations with physical activity. Other studies during the Coronavirus pandemic have shown that a reduction in physical activity compared to pre-Coronavirus is associated with higher anxiety, and inactive people who became more active during the Coronavirus displayed lower anxiety than those who become less active (Lesser and Nienhuis, 2020), suggesting that it could be the change in physical activity that is more closely associated with anxiety in such times. However, further research is needed to fully understand the relationship between physical activity and anxiety during lockdowns due to pandemics.

Coronavirus fear, perceived stress, and anxiety were all significantly higher in females, which is in line with Coronavirus research in adult populations (Fitzpatrick et al., 2020; Lai et al., 2020; Mazza et al., 2020). As adolescent females have been found to have higher levels of stress and anxiety (Murray et al., 2011; Sadler et al., 2018) under regular circumstances, it is perhaps expected that their levels would also be higher under a pandemic scenario. The present study suggests that females may also display greater fear associated with the Coronavirus. In addition, general, physical, and mental fatigue were higher, and vitality lower in females, which has been reported before in adults (Engberg et al., 2017), but not during the Coronavirus pandemic. To our knowledge, this is the first study to find this in adolescents. Interestingly, there was no gender difference in physical activity. This is perhaps surprising given that a number of studies report males displaying significantly higher levels of physical activity compared with females (Bann et al., 2019). However, other studies (albeit in college students) have also found no gender differences in certain types of physical activity during lockdown (Zhang et al., 2020). Thus, commonly reported gender differences in adolescent physical activity (Bann et al., 2019) could be influenced by lockdown restrictions – indeed, research suggests that most individuals report experiencing a reduction in physical activity compared to pre-lockdown (Stanton et al., 2020).

The findings of the study indicate the clear benefits of physical activity to help to counteract the negative mental implications of Coronavirus fear in adolescents. The data suggest positive benefits for mental health with physical activity in adolescents. United Kingdom physical activity guidelines recommend adolescents to participate in 60 min of moderate to vigorous physical activity per day (Department of Health and Social Care, 2019). Although the measure of physical activity used in the current study does not allow for comparison of levels of physical activity against the physical activity guidelines, it does confirm with general physical activity guidelines that being more physically active is associated with better (mental) health.

Despite its novel contributions, the study is not without limitations. First, the cross-sectional design cannot imply causation. The study also uses a self-report single item measure of physical activity; however, this method has been previously validated (Jurca et al., 2005; Scott et al., 2015). Third, our measure of Coronavirus prevalence and fear was designed for the purpose of the study and has thus not been extensively validated. However, items underwent exploratory factor analysis based on the recommendations in the literature and the results support the existence of two separate subscales (Tabachnick and Fidell, 2013). Finally, our sample's ethnicity

was predominately white. Given the reported ethnicity differences in risk of mortality relating to the Coronavirus (Price-Haywood et al., 2020), it would be interesting to explore these associations in a wider range of ethnicities.

In conclusion, the present study found that while Coronavirus fear was associated with higher levels of stress, anxiety, depressive symptoms, fatigue, and lower vitality and general health, physical activity was an independent predictor of lower stress, depressive symptoms, and fatigue, and higher vitality and perceived health. Moreover, physical activity was often a stronger predictor than Coronavirus fear. Therefore, this was the first study to show that physical activity during the Coronavirus pandemic can counteract the negative effects of fear of the Coronavirus on adolescent mental health and well-being. Findings highlight the significance of physical activity during the Coronavirus pandemic and emphasize the importance of governments letting individuals continue to leave the house for physical activity during periods of lockdown.

## 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 Birmingham Science, Technology, Engineering and Mathematics Ethical Review Committee. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

## AUTHOR CONTRIBUTIONS

All authors contributed to the design of the project, data collection, and wrote the manuscript.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2021.580511/full#supplementary-material>

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# The Use of Online Training Tools in Competition Cyclists During COVID-19 Confinement in Spain

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COVID-19 confinement has supposed a challenge to the whole wide world, especially in athletes that have frustrated their expectations about training programs and competitions. Specifically, competition cyclists during confinement had lot of difficulties to train due to the need to train outside their homes. However, the increase of online training sessions, or virtual training tools could help to overcome training difficulties due to confinement although there are not studies that analyse the effects of using these types of tools in cyclists. This study aims to test how the use of online training tools in competition cyclists during confinement is related to training frequency and duration, and emotions. 329 cyclists filled an online questionnaire about feelings during confinement and the use of online training tools, before and during confinement. Results showed that the use of online training tools was associated with higher frequency and duration of trainings. Moreover, those who used these tools felt more positively about their future and preparation to compete, feeling more energy than those who did not used online tools. In addition, cyclists that started using these online tools (including virtual roller training) during confinement increased the frequency of training. In conclusion the use of online training tools for cycling could be appropriate to maintain training levels and energy and positive feelings about their future.

**Keywords:** COVID-19, online training tools, confinement, emotions, cycling psychology

## INTRODUCTION

The confinement suffered because of the COVID-19 has had a strong impact on people's lives as countless studies show reporting high levels of anxiety, depression, distress, or insomnia (Ammar et al., 2020a; Clemente-Suárez et al., 2020; Fu et al., 2020; Maugeri et al., 2020; Rossi et al., 2020; Trabelsi et al., 2021). In the case of athletes, this impact may have been greater as different expectations of competition and training have been frustrated. This has been even more important for athletes who need to train outdoor in which the greatest mental impairment has been observed (Beas Jiménez et al., 2018; Fu et al., 2020).

Cycling is an endurance sport that needs to train outdoors (mainly on the road). It is estimated that world tour professional male cyclists ride, between training and competitions,

within 25,000 and 35,000 km per year, while world tour female cyclists ride between 13,000 and 18,000 km per year (Sanders et al., 2019). For this reason, cyclists could have been affected highly negatively by the confinement. However, despite the need to train outdoors, as far as we know there are no studies that have tested the effect of confinement on professional cyclists. Thus, from a practical point of view, cyclists, physical trainers, and teams have had to develop useful alternatives to maintain the level of fitness and motivation.

Along with the increase in psychosocial and emotional disorders during confinement, there has also been an increase in the use of technology for training (Ammar et al., 2020b, 2021a). Thus, thanks to the accessibility of training technology, countless mobile and online applications have emerged to allow training at home. Online apps can guide physical exercise and offer reinforcements and contingencies that improve physical fitness (although, these type of publications are scarce and there is excessive fragmentation of them, according to a recent bibliometric study) (Liu and Avello, 2020). In addition, several studies have suggested the efficacy of exergaming applications to increase adherence to exercise and reduce stress, anxiety and mood disorders during confinement (Bentlage et al., 2020; Chtourou et al., 2020). Thus, the use of digital technology has been recommended to improve adherence to exercise due to its social relevance and impact on health in other types of populations, such as the elderly (Ammar et al., 2021b). Apart from applications for training there are numerous applications in the field of psychological or motivational training (Boudreaux et al., 2018; Oh et al., 2020), sleep monitoring for the recovery and improvement of the athlete's performance (Gershkovich et al., 2020), reducing the risk of injuries (Halsen, 2019) or even for the control of intake in obesity (Keogh et al., 2016). There are some studies that show that the use of these apps can be promising to promote physical activity, quality of life, even self-efficacy in sedentary individuals (Gür et al., 2020; Price et al., 2020) although in a recent systematic review (Truelove et al., 2020) it has been indicated that there are some of those studies with methodological deficiencies that compromise the conclusions, suggesting the need for more rigorous and systematic research.

To our knowledge there is little information about the use of these applications in the case of professional or competition athletes despite the large offer and benefits. In the case of cycling, we have not found any studies investigating whether these apps are used, although a study with people who regularly use the bicycle shows that the use of GPS smartphone apps is associated with a higher frequency of cycling and a greater perception of strength (Angosto et al., 2020). Additionally, in recent years the use by competition cyclists of virtual training simulators that improve performance of conventional rollers has increased. These interactive training tools allow cyclists to virtually compete against each other, monitor their workouts, and even schedule team workouts. They also have functionalities that allow quantifying training loads and physiological adaptations, relevant parameters for any training method, incorporating meters and bluetooth or ANT+ connections for different sensors that allow instant information and data on the main physiological parameters (Mujika, 2017). In this way, cyclists training and

performance could be monitored and optimized during indoor training in a similar way to training on the road or in competition (Passfield et al., 2017), with greater efficiency than other instruments such as fitness monitors activity, much cheaper but also much less reliable (Boudreaux et al., 2018). These tools could serve for monitoring the detraining period and quantifying the rate of loss of physical fitness caused by confinement, and planning the lap to normal activity, as it is done in other sports (Eirale et al., 2020). All this could provide an important advantage over non-virtual training (with roller and without interaction), considering the value of social interaction and motivation that they can provide.

In brief, confinement has forced competition cyclists to train indoors and numerous testimonies indicate that many of them have had to start (or use more frequently) to use online training tools (or apps) to maintain training level. However, there is no objective data showing whether this use is effective in improving training frequency or whether it has any effect on the way confinement is experienced. Therefore, the objective of this work is to analyse the use of online training tools and virtual rollers by competition cyclists to confirm the impact of these tools on their perception of confinement, training routines, and mood. This aim has been subdivided into three specific objectives.

First (objective 1) the association between the use of training online tools and the frequency and duration of training during confinement, as well as with mood and to follow training routines will be studied. We expect that the more use of online training tools the higher frequency and duration of training workouts. Moreover, cyclist that employ these online training tools will have better mood and less difficulties following training routines during confinement.

Second (objective 2), those participants who did not use online tools before the confinement will be compared, in the above-mentioned variables, with those who employed them. Complementarily, considering that the use of online training applications may have changed due to confinement, it will be analyzed whether the increase in the use of online training tools during confinement is associated with an increase in frequency and duration of training workouts, mood, and difficulties in following daily routines. In both cases, it is expected that the use of such tools will be associated with the increase the frequency and duration of training, as well with positive mood and less difficulties following routines.

Finally (3rd objective), as virtual rollers suppose greater involvement in training, the use of virtual roller will be studied expecting that cyclists using virtual rollers would train more frequently (and longer training workouts) and will have more positive mood and better competitive perspective during confinement in comparison to those participants not using virtual rollers.

## MATERIALS AND METHODS

### Participants and Procedure

329 competition cyclists (65 women) with a mean age 32.21 (SD = 11.75) participated in this study. Data collection occurred

during the complete confinement (between April 6 and 17, 2020) when there was no information about the possibility of leaving home for training. Participants were assessed by an online questionnaire regarding their week training frequency and duration, mood in relation to the confinement and about the use of online training tools before and during the period of confinement by COVID-19. This study was approved by Ethics Committee of the University of Miguel Hernandez (Elche).

## Measures

*Ad hoc* questionnaire was designed in a Likert response format [from nothing (1) to much (5)] to assess the thoughts and feelings these athletes had about confinement or how they perceived this situation to be affecting them (e.g., “I spend a lot of time each day thinking about negative things about my sporting future or what might happen with this season” or “the confinement situation is affecting my preparation as a cyclist”). In addition, questions about how cyclists were conducting their training, both the frequency of training and the duration of the sessions were asked (including different type of training). Finally, the *ad hoc* questionnaire included questions about the use of online training apps both before and during confinement (e.g., are you connecting to virtual or online training platforms during quarantine?).

The evaluation of emotions was carried out with the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988) in its Spanish adaptation (Sandín et al., 1999). It measures two dimensions: positive affect and negative affect with high reliability indexes ( $\alpha = 0.89$ ). Positive affect reflects the degree to which a person feels activated and pleasantly engaged while negative affect focuses on unpleasant emotional states (Sandín et al., 1999). The scale is composed of a total of 20 items that describe different emotions and is answered in a Likert response format with scores ranging from 1 (none) to 5 (a lot). In our sample we used an adapted short version of the PANAS of 14 items and obtained a  $\alpha = 0.75$  for positive affect and a  $\alpha = 0.076$  for negative affect.

Complementarily, direct Likert questions about mood perception were asked. Specifically, about Irritability, Fatigue, Energy, support by others, tension, and sadness. Moreover, the perception of difficulty to train was asked.

## Grouping Variables

To compare the use of online training tools (objective 2) and virtual rollers (objective 3) participants were grouped depending on the scores in the following yes/not questions:

- During confinement, do you use some of the following online training tools (facebook, Instagram, and youtube, ...)?
- During confinement do you use some of the following virtual training tools (Bkool, Zwift, ...)?

## Statistical Analyses

None of the variables were normally distributed, so non-parametric tests were used to accomplish the aims. Thus, to respond to objective 1 (association between the use of online training tools and training frequency/duration and mood during

confinement), Spearman correlation analyses were carried out between the perceived use of online tools and the variables of frequency and duration of training, as well as in the mood and difficulties to train during the confinement and perception of the future professional.

To address the 2nd objective (comparison depending on the use of online training tools), participants were classified and compared (Mann–Whitney *U*) in two different ways: (1) according to the use of online training tools before to the confinement; (2), according to start using online training tools during the confinement (in this case, participants that started using online training tools were compared in frequency and duration of training before and during confinement using Wilcoxon test).

For the third objective (effects of virtual roller), sample was divided between those that employed and those that not.

All statistical analyses were performed with the package SPSS 24. Level of significance was established at  $p < 0.05$ . Effect size is represented with Cohen *d*.

## RESULTS

First, it is important indicate that all the cyclists in this study had home training tools (mainly rollers) and internet access.

### Relationships Between Online Training Tools Use (Before and During Confinement) and Emotional and Training Variables (Objective 1)

#### Online Training Tools Use Before Confinement

First, cyclists using training apps before confinement continued to use them during confinement ( $r = 0.276$ ,  $p < 0.001$ ).

In addition, the use of online tools before confinement is negatively associated with thinking less negatively about their sporting future during confinement ( $r = -0.116$ ,  $p = 0.036$ ) as well as feeling less irritated ( $r = -0.110$ ,  $p = 0.046$ ). Complementarily, the use of online training tools before confinement is positive and significantly related to positive mood ( $r = 0.146$ ,  $p = 0.008$ ) and negatively to negative mood ( $r = -0.148$ ,  $p = 0.007$ ) during confinement.

#### Online Training Tools Use During Confinement

On the other hand, the use of online training tools during confinement correlates positively with the frequency of training ( $r = 0.119$ ,  $p = 0.001$ ). Regarding the type of training performed, we found that during confinement the higher use of online tools is directly related to the frequency and duration of indoor roller/bike training ( $r = 0.294$ ,  $p = 0.001$  and  $r = 0.322$ ,  $p = 0.001$ , respectively).

In addition, the use of online tools is negatively related to negative thinking about cycling preparation ( $r = -0.113$ ,  $p = 0.042$ ); thus, the more use of online tools during confinement the less the cyclist believes that confinement affects his or her cycling preparedness. Complementarily, the increased use of these tools during confinement correlates negatively with the



effort to train ( $r = -0.253, p = 0.001$ ). Finally, using training tools is positively related to feeling greater energy ( $r = 0.148, p = 0.007$ ).

### Changes in the Use of Online Training Tools During Confinement

When cyclists changed the use of online training tools during confinement (subtracting the frequency of use before confinement to the use during confinement), it was observed that the greater increase using these tools during confinement the more fatigue was perceived by cyclists ( $r = 0.114, p = 0.039$ ). In addition, this increase was associated with a higher frequency of training during confinement ( $r = 0.217, p = 0.001$ ) and to the increased frequency of training compared to training before confinement ( $r = 0.147, p = 0.007$ ). Finally, the increase of using online training tools also correlates positively and significantly with the frequency of functional training ( $r = 0.117, p = 0.034$ ) and roller training ( $r = 0.293, p = 0.001$ ) and with the duration of roller training ( $r = 0.308, p = 0.001$ ).

### Comparison Between the Use of Online Training Tools: Before and During the Confinement (Objective 2)

#### Use of Online Training Tools Use Before the Confinement

When comparing those who used online training tools and those who did not use them before the confinement (**Table 1**), differences in positive PANAS ( $U = 14.317$  ( $Z = 2.725$ ),  $p = 0.006$ ,  $d < 0.1$ ) and negative PANAS [ $U = 9.953$  ( $Z = -2.638$ ),  $p = 0.008$ ,  $d < 0.1$ ] were found. In both cases, those who used online tools had greater positive affect and less negative affect than those who did not use training tools. Furthermore, the training frequency during confinement was also different between groups [ $U = 9,988$  ( $Z = -2,596$ ),  $p = 0.009$ ,  $d < 0.1$ ] having higher scores those who used online tools. Specifically, those who used before confinement, did more functional training [ $U = 9,498$  ( $Z = -3,256$ ),  $p = 0.001$ ,  $d < 0.1$ ] and roller [ $U = 10,329$  ( $Z = -2,204$ ),  $p = 0.028$ ,  $d < 0.1$ ] during quarantine than the other group.

Moreover, those who used online tools before confinement had lower scores in thinking negatively about their sporting/seasoning future [ $U = 10,046$  ( $Z = -2,640$ ),  $p = 0.008$ ,  $d < 0.1$ ] and felt less irritated [ $U = 10,504$  ( $Z = -2,069$ ),  $p = 0.039$ ,  $d < 0.1$ ] than those that did no use online tools.

#### Initiation of the Use of Online Training Tools During Confinement

When comparing cyclists who have initiated the use of online training tools during confinement and those who did not use them (**Table 2**) differences have been found in weekly frequency [ $U = 7,112$  ( $Z = 2,740$ ),  $p = 0.006$ ,  $d < 0.1$ ], and duration of roller use [ $U = 7,348$  ( $Z = 4,371$ ),  $p = 0.000$ ,  $d < 0.1$ ], during confinement. Those who started using online training tools trained more frequently and with longer duration than those who did not use this method.

There were also significant differences in energy [ $U = 6,761$  ( $Z = 2,013$ ),  $p = 0.044$ ,  $d < 0.1$ ], and in training difficulty

**TABLE 1 |** Mean and standard deviation (SD) of cyclists that employed (or not) online training tools before confinement.

	No use of online training tools before confinement		Use of online training tools before confinement	
	Mean	SD	Mean	SD
<b>Emotions and thoughts</b>				
Confinement feelings	1.99	1.08	1.91	1.18
The confinement situation is affecting her preparation as a cyclist.	2.38	1.18	2.17	1.09
He spends a lot of time each day thinking negative thoughts about his sports future/this season.	1.25	1.10	0.95	1.09
Irritability	1.10	0.97	0.91	1.02
Fatigue	0.92	0.94	0.83	0.94
Energy	1.95	1.01	2.14	1.14
Supported by others	2.37	1.15	2.18	1.21
Tension	1.18	1.08	1.02	1.14
Sadness	1.35	1.13	1.25	1.18
Initial Training Difficulty	4.58	3.14	4.40	3.34
Current training difficulty	4.57	2.68	4.10	3.16
Positive Affect	20.36	4.69	21.81	4.88
Negative Affect	14.43	4.43	13.14	4.28
<b>Training variables</b>				
Week training frequency before confinement	7.77	3.32	7.19	3.63
Week training frequency during confinement	9.34	4.27	8.04	3.79
Functional training weekly frequency	3.09	1.89	2.41	1.65
Roller weekly frequency	4.60	2.16	4.05	2.20
Strenght weekly frequency	1.29	1.59	1.23	1.54
Funcional training weekly duration	1.11	0.52	1.07	0.71
Roller training weekly duration	1.75	0.78	1.67	0.97
Strenght weekly duration	0.64	0.69	0.75	0.90

[ $U = 4,252$  ( $Z = -3,531$ ),  $p = 0.001$ ,  $d < 0.1$ ], during confinement. Those who initiated the use of online tools had lower scores in training difficulty and higher energy perception during confinement.

Complementary, frequency and duration of training, pre and during confinement, in participants that started using apps were compared. Results showed a significant increase in the frequency and duration in functional training, roller, and strength training [Frequency:  $Z = -7.483$  ( $p = 0.001$ ),  $Z = -9.028$  ( $p = 0.001$ ) and  $Z = 2.126$  ( $p = 0.034$ ); Duration:  $Z = -3.305$  ( $p = 0.001$ ),  $Z = -8.558$  ( $p = 0.001$ ), respectively (Cohen's  $d < 0.1$ )], showing a general increase in frequency and duration of training workouts in participants that started using online training tools.

### Comparison Between Participants That Used Virtual Roller During Confinement (Objective 3)

Results comparing cyclists that used virtual roller with those that did not used (**Table 3**), revealed that the first group scored lower

**TABLE 2 |** Mean and standard deviation (SD) of cyclists that began to use training apps during the confinement compared to those that did not use (nor begin) online training tools.

	No online training tools use		Initial online training tools use	
	Mean	SD	Mean	SD
<b>Emotions and thoughts</b>				
Confinement feelings	2.10	1.159	1.89	1.016
The confinement situation is affecting her preparation as a cyclist.	2.50	1.225	2.26	1.140
He spends a lot of time each day thinking negative thoughts about his sports future/this season.	1.34	1.176	1.18	1.050
Irritability	1.17	1.089	1.04	0.851
Fatigue	0.86	0.940	0.97	0.945
Energy	1.82	1.027	2.08	0.997
Supported by others	2.25	1.186	2.46	1.122
Tension	1.33	1.124	1.06	1.041
Sadness	1.50	1.212	1.23	1.048
Initial Training Difficulty	4.62	3.178	4.57	3.131
Current training difficulty	5.25	2.656	3.96	2.588
Positive affect	19.76	4.594	20.89	4.764
Negative affect	14.80	4.809	14.14	4.059
<b>Training variables</b>				
Week training frequency before confinement	7.7573	3.57131	7.7632	3.10096
Week training frequency during confinement	8.9320	4.30973	9.6842	4.22239
Functional training weekly frequency	4.15	2.307	4.98	1.951
Roller weekly frequency	4.15	2.307	4.98	1.951
Strenght weekly frequency	1.31	1.810	1.26	1.376
Funcional training weekly duration	1.10	0.515	1.12	0.534
Roller training weekly duration	1.49	0.705	1.96	0.797
Strenght weekly duration	0.59	0.633	0.68	0.744

in the effects of confinement in their perception of preparedness as cyclists [ $U = 10,989$  ( $Z = -2.246$ ),  $p = 0.0025$ ,  $d < 0.1$ ]. Moreover, those cyclists that used virtual roller trained more frequently and with higher duration with roller than those that did not used this tool [ $U = 14.235$  ( $Z = 5.365$ ),  $p = 0.001$ ,  $d < 0.1$  and  $U = 16.539$  ( $Z = -5.820$ ),  $p = 0.001$ ,  $d < 0.1$ , respectively]. In addition, virtual rollers users had less difficulties to train [ $U = 10.627$  ( $Z = -2.663$ ),  $p = 0.008$ ,  $d < 0.1$ ] and to follow training program [ $U = 10.751$  ( $Z = -2.604$ ),  $p = 0.001$ ,  $d < 0.1$ ]. Complementarily, they felt high fatigue [ $U = 14.481$  ( $Z = 2.105$ ),  $p = 0.035$ ,  $d < 0.1$ ] but perceived higher support by others [ $U = 14.574$  ( $Z = 2.152$ ),  $p = 0.031$ ,  $d < 0.1$ ].

## DISCUSSION

The main aim of this study was to relate, in professional cyclists, the use of online training tools (including virtual rollers) with frequency and duration of training sessions, as well as with mood and maintenance of daily routines during COVID19 confinement. Results confirmed these significant

relationships but with a little effect size and low correlation indexes. Specifically, professional cyclists who use online training tools informed being less pessimistic about their future in comparison with cyclists that do not use these tools. Even using online tools for training before confinement was related to better mood. Therefore, during confinement the use of online training tools would be a recommendable strategy for cyclists to improve mood and their vision of the future. In addition, the increased use of these tools leads to a higher frequency of training, specifically indoor roller and is associated with positive thinking about future preparation. Complementarily, online training tools use was associated with a greater perception of energy. Additionally, an interesting and very useful aspect to highlight is that the use of these online tools was negatively related to the effort that cyclists take to train; so, these methods could be a good instrument to motivate and carry out more effective training routines. In this sense, considering that reduced levels of physical activity have been an issue of concern during COVID-19 confinement (Bentlage et al., 2020) and the effects on mental health as negative affect, well-being and mood, leading to even lower life satisfaction (Ammar et al., 2020a,b,c, 2021a,b), recommending the use of online training tools could solve, partially, some of the confinement issues. In this line, it has been reported a greater acceptance among the population of the use of technologies during this period, so the use of these online resources should be considered as appropriate strategies to maintain physical activity (Ammar et al., 2020c, 2021a).

Our results showed also that the increase in the use of online training was related to the greater frequency and duration of training with the roller. On the other hand, those who used to use these tools before confinement showed a better mood than those who did not use them, as shown by the correlations. Furthermore, that previous use also was related to a more positive thought about their sport future compared to those who do not use them. Finally, those cyclists who started using these training methods in confinement had a higher frequency and duration of weekly training with the roller than those who did not use them. Complementarily, the former perceived more energy and less training difficulty during confinement than the latter. All these results go along the lines of confirming the usefulness of the use of technologies to increase or maintain physical activity at home, although it is important to remember that the effect size is low.

All these results show how specific online cycling trainings can be a very interesting tool in cases of confinement, allowing cyclists to maintain a training routine evaluated by its frequency and weekly duration. Complementarily, the fact that the use of online training tools reduces the difficulty of training and makes it more attractive allow to maintain training routines helping cyclists to maintain their fitness level and competitiveness. In this sense, in other athletes, such as football players, the adaptation of training sessions to the conditions of confinement has already been noted and recommended, stressing that medical and physiological standards should be ensured by adapting training sessions to the new conditions and recommending more research dedicated to the adaptation of safe training sessions during confinement (Eirale et al., 2020). In addition, these instruments are related

**TABLE 3 |** Mean and standard deviation (SD) of cyclists that employed (or not) virtual roller during confinement.

	No virtual roller use		Virtual roller use	
	Mean	S.D.	Mean	S.D.
<b>Emotions and thoughts</b>				
Confinement feelings	1.94	1.13	1.99	1.09
The confinement situation is affecting her preparation as a cyclist...	2.43	1.19	2.16	1.09
He spends a lot of time each day thinking negative thoughts about his sports future/this season.	1.09	1.08	1.26	1.15
Irritability	0.99	1.01	1.12	0.96
Fatigue	0.78	0.86	1.04	1.03
Energy	1.97	1.04	2.08	1.08
Supported by others	2.19	1.20	2.48	1.13
Tension	1.08	1.13	1.21	1.07
Sadness	1.31	1.14	1.36	1.17
Initial training difficulty	4.67	3.21	4.38	3.21
Current training difficulty	4.79	2.82	3.91	2.87
Positive affect	20.57	4.78	21.20	4.88
Negative affect	13.78	4.46	14.39	4.36
<b>Training variables</b>				
Week training frequency before confinement	7.24	3.72	8.02	3.01
Week training frequency after confinement	8.32	4.56	9.74	3.46
Functional training weekly frequency	2.76	1.97	2.99	1.74
Roller weekly frequency	3.88	2.51	5.21	1.38
Strenght weekly frequency	1.29	1.66	1.22	1.45
Funcional training weekly duration	1.09	0.61	1.12	0.56
Roller training weekly duration	1.49	0.78	2.04	0.84
Strenght weekly duration	0.64	0.78	0.72	0.77

to a higher energy and mainly to a more positive vision about their sport future and their preparation, directly influencing the motivation to keep on training. This is very important because following physical activity routines influence positive mood, as has been demonstrated during the pandemic (Clemente-Suárez et al., 2020). We consider this result is also very relevant and reiterates the need to expand the use of the different online training tools in sportsman. Therefore, these tools allow athletes to stay active, which could translate into continued healthy habits such as better sleep quality or a higher level of physical activity (Trabelsi et al., 2021). Research indicates that behavioral changes have occurred in the population during the pandemic lockdown, both in physical activity habits (Leon-Zarceño et al., 2021) and altered eating behaviors (Ammar et al., 2020b), highlighting the importance of safe physical activity in times of pandemic (Chtourou et al., 2020).

Another important result from our study is derived from the analysis of the use of virtual roller. To our knowledge this is the first study that focus on virtual roller. Considering that our results showed a significant increase in the frequency and duration of training bouts and less harmful confinement effects (preparedness and less difficulties to train), we consider that virtual roller could be a ground-breaking in the field of cycling. Thus, the wide training possibilities that provide to cyclists and teams but overall, the possibilities to train without depending on the weather or confinement, could make these virtual training tools a competitive advantage. Among other advantages offered

by this type of rollers is the real-time interaction between geographically distanced cyclists, the possibility of team training with the presence of all the riders, make up for the impossibility of training on the road through indoor training, knowing the real fitness status with relative precision and planning tests remotely, and especially to offer an attractive stimulus to roller training, which facilitates compliance with the routines established by physical trainers or sports directors.

Therefore, as found in other fields of application (Gershkovich et al., 2020; Oh et al., 2020; Price et al., 2020) and in applications more related to physical activity for health purposes (Leahy et al., 2019; Angosto et al., 2020; Gür et al., 2020; Kim et al., 2020), our results also affect the usefulness of the online training tools for a specific field of sport, cycling. Moreover, considering that our sample also includes professional sportsmen, the results can be applied also in the professional world, which could be extrapolated to other fields of professional sport. Complementarily, although this study is focused about confinement by COVID-19, these results could be useful in areas or countries where weather conditions (rain, snow, and wind, . . .) often prevent going out to train.

Limitations and strengths. The main important limitation of this study is that all the measures are subjective (self-reported) and obtained from an online questionnaire directly asking cyclists about their perception of frequency and duration of training and perceived mood and feelings. Moreover, the low effect size and low correlations, even significant, obtained in all

statistical analyses prevent us to made sounding conclusions. Complementarily, this research would have benefited if we had made explicit the specific applications that the cyclists used, mainly in the case of virtual rollers to identify which tools are the most employed and useful. However, the strengths of this study are that it is a specific population that has not been studied during confinement, even though they are eligible for paying attention since they depend on being able to leave home to train. In addition, another strength is that the data were taken at the time of the confinement, two weeks after the start of the confinement when the future was uncertain.

In conclusion, this study shows the benefits of using specific online training tools in competitive cycling. These benefits could be divided in two: training benefits (higher frequency and duration of training with roller) and psychological benefits (positive vision of the future, perception of better preparation, greater perception of energy and less perceived difficulty in training). Future studies should replicate these results and deepen in the type of applications cyclist use.

## 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

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

## AUTHOR CONTRIBUTIONS

AM-T and EL-Z developed the design of the research. All authors participated in the development of the study. MS-R performed the data analyses. All authors contributed in the writing the first draft and reviewing the final draft. The manuscript has been approved by all authors.

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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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# Corrigendum: The Use of Online Training Tools in Competition Cyclists During COVID-19 Confinement in Spain

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## A Corrigendum on

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In the original article, there was a mistake in **Table 3** as published. Some of the means and standard deviations found in **Table 3** were wrong. The corrected **Table 3** appears below.

The authors apologize for this error and state that this does not change the scientific conclusions of the article in any way. The original article has been updated.

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**TABLE 3 |** Mean and standard deviation (SD) of cyclists that employed (or not) virtual roller during confinement.

	No virtual roller use		Virtual roller use	
	Mean	S.D.	Mean	S.D.
<b>Emotions and thoughts</b>				
Confinement feelings	1.94	1.13	1.99	1.09
The confinement situation is affecting her preparation as a cyclist...	2.43	1.19	2.16	1.09
He spends a lot of time each day thinking negative thoughts about his sports future/this season.	1.09	1.08	1.26	1.15
Irritability	0.99	1.01	1.12	0.96
Fatigue	0.78	0.86	1.04	1.03
Energy	1.97	1.04	2.08	1.08
Supported by others	2.19	1.20	2.48	1.13
Tension	1.08	1.13	1.21	1.07
Sadness	1.31	1.14	1.36	1.17
Initial training difficulty	4.67	3.21	4.38	3.21
Current training difficulty	4.79	2.82	3.91	2.87
Positive affect	20.57	4.78	21.20	4.88
Negative affect	13.78	4.46	14.39	4.36
<b>Training variables</b>				
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Funcional training weekly duration	1.09	0.61	1.12	0.56
Roller training weekly duration	1.49	0.78	2.04	0.84
Strenght weekly duration	0.64	0.78	0.72	0.77



# Influence of the COVID-19 Pandemic on Mood and Training in Australian Community Tennis Players

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The COVID-19 outbreak has led to the implementation of strict restrictions in Australia, which have severely impacted sporting activities. Tennis is played by 6.2% of the population within the Oceania region, and is a valuable sport for maintaining social, mental, and physical health. Current literature indicates the COVID-19 pandemic has negatively affected the mental health of Australian residents. The aim of this study was to investigate changes in training and match play due to the outbreak, and its effects on emotional well-being of Australian senior tennis players. Additionally, explore any differences between middle aged (41–60 years) and senior (61 years and over) Australian tennis players. An online survey was used to assess training and match play habits, as well as ascertain the emotional well-being of tennis players. The survey was active from 24th April 2020 until 6th June 2020. Participants were adult (41+ years) tennis players from Australia. Wilcoxon signed rank tests were performed to check for differences in training hours and tennis matches played. Mann–Whitney *U* tests were used to assess the difference in Brief Emotional Experience Scale (BEES) scores, employment status as well as the training hours and tennis matches played between the two age groups. A Kendall's Tau B correlation test was performed to assess the associations of training, match play and demographic characteristics with BEES scores. Kruskal–Wallis tests assessed differences in BEES scores between participants of differing match play formats, tennis experience and cessation of tennis training time periods. There were 245 respondents who met our inclusion criteria. Tennis training hours along with the tennis matches played significantly decreased during COVID-19 compared to pre-COVID-19, 85.09 and 88.48%, respectively. No significant ( $p > 0.05$ ) differences were observed between age groups for any of the training modality hours, nor was there any significant difference in number of tennis matches played. The participants average BEES score was  $0.99 \pm 1.27$ , indicating that respondents had a positive emotional well-being during the COVID-19 pandemic. The emotional well-being of the senior group was significantly ( $P = 0.002$ ) higher than the middle aged group. Together, our results show that training and tennis match play decreased during the COVID-19 pandemic, however the emotional well-being of senior tennis players in Australia appeared to not be negatively affected.

**Keywords:** mental health, mood, training, tennis, community



## INTRODUCTION

The pervasive and deadly nature of severe acute respiratory syndrome coronavirus 2 (COVID-19) has led to implementation of strict restrictions in Australia. On the 20th of March 2020, the Australian government began executing restriction policies, part of which resulted in the closure of all gymnasiums and sporting facilities as well as state borders by the end of March 2020 (Government of Australia, 2020). These restrictions severely impacted sporting activities at elite and community levels. The aforementioned restrictions are expected to have a severe impact on the physical, psychological, and social health of athletes (Eime et al., 2013). This is of concern as sport is a fundamental part of Australian culture, with an estimated 8.4 million adults participating in sporting activities every year (Hughes et al., 2020).

Existing literature shows that COVID-19 has negatively impacted on the mental health of Australians, with studies noting significantly elevated stress, anxiety and depressive symptomology (Newby et al., 2019; Fisher et al., 2020). Whilst informative, these studies have cast a wide net with participants including anyone in Australia of at least 18 years of age. Additionally, physical activity was only measured by Newby, O'Moore (Newby et al., 2019) who found less than half of the respondents met the Australian recommendations of at least 150 min of moderate physical activity per week. To date, no studies have investigated if these negative effects were present in physically active individuals especially seniors who had been regularly participated in community sport, such as tennis before the COVID-19 pandemic.

Tennis is one of the most popular sports in the world, with 1.12% of the world's population participating in tennis. Within Oceania (geographical region that includes Australia) an estimated 6.2% of the population participate in tennis, with a relatively equal distribution of females (47%) and males (Federation IT, 2019). The vast majority individuals engaging in tennis participate at a community level and contrary to many other sports, tennis is played across the entirety of the age spectrum and is therefore considered a valuable sport for maintaining healthy physical activity levels in middle aged and older adults. Individuals who participate in tennis training and match play at a community level, therefore provide an important sample to assess the impact of the COVID-19 pandemic, including the subsequent government restrictions.

Therefore, the aim of this study was twofold; (1) to assess changes in training hours and matches played per week due to the COVID-19 pandemic, and (2) to investigate whether changes in these and other factors (gender, age, income, tennis experience, match play format, or period since training cessation), as a result of the COVID-19 pandemic, influenced the emotional well-being of Australian senior tennis players.

## METHODS

### Study Design

A cross-sectional study was utilized to investigate the impact of the COVID-19 pandemic on senior tennis players across

Australia. An online survey (**Supplementary Material A**) was developed to assess changes in training and match play habits, as well as ascertain the emotional well-being of tennis players. The survey was active from 24th April 2020 until 6th June 2020. During this time, the Australian government enforced its strictest restrictions. This study was reviewed and approved by Edith Cowan University Human Research Ethics Committee (2020-01367).

### Participants

Participants included adult (41+ years of age) tennis players from tennis clubs across Australia. Participants were provided with a link to the survey via social media platforms, their local tennis club or state tennis organization. An information sheet was displayed at the start of the survey and available for download. Participants had to signify consent by ticking a box before continuing on to the survey. General demographic information was first collected, including participants' age range, gender, relationship status, employment, income status, and tennis experience, as well as their thoughts on the COVID-19 pandemic and how it has been handled by their tennis organization.

### Measures

#### Training and Match Play

Training was evaluated using survey questions focused on training modality, hours, location, and equipment. Tennis match play was evaluated using questions querying the number of matches participants played each week. Participants had to report how many hours per week they played tennis and how many tennis matches on average they played per week prior to the COVID-19 pandemic. In order to evaluate a potential change due to the COVID-19 pandemic, the same questions were repeated but in regard to the time point at which they were completing the survey. Because changes in their tennis training and match play volume due to the COVID-19 pandemic could be compensated for by changes in other activities, additional questions focussing on participants' training activities were also included. Participants had to provide information about their weekly training volume of endurance, strength, speed and agility, flexibility, and mobility, coordination (e.g., balance), as well as mental or tactic training prior to the COVID-19 pandemic and at the time point at which they were completing the survey. In order to get a better picture of their training routine and opportunities during COVID-19 pandemic, participants had to report where they were performing the off-court training and what equipment they had access to. For participants who had ceased their tennis training, the time point and reason for this were requested. Those participants who did not perform any form of off-court training during the COVID-19 pandemic were also requested to provide a reason in order to better understand their mindset and motivation.

#### Emotional Well-Being

The Brief Emotional Experience Scale (BEES) is a self-report mood measure, which indicates a participants level of emotional distress (Rogers et al., 2016). It contains positive and negative adjectives, which form complementary pairs covering depression

(happy, sad), anxiety (afraid, confident), and stress (worried, calm). Participants were required to rate these adjectives on a response scale (not at all, a little bit, quite a bit, a lot, extremely) according to their feelings over the past month. The average score of the negative adjectives has then been subtracted from the average score of the positive adjectives. This resulted in an overall score which indicates the participant's mood state. This score can range from  $-3$  to  $+3$ , representing a greater negative emotion or greater positive emotion, respectively. The BEES has been previously used with an adult general population (Rogers et al., 2016), and has good convergent validity with several established questionnaires (Rogers et al., 2016; Skead et al., 2018).

## Statistical Analysis

Participants were stratified into two age categories, middle aged (41–60 years) or senior (61+ years; Liu et al., 2020). The percentage of responses per group were displayed for demographic and training information. The mean and standard deviation of each group was reported for training hours and matches played. The data was checked for normality using a Shapiro-Wilk test, confirming that data was not normally distributed. Wilcoxon signed rank test was performed to check for differences in training hours and tennis matches played per week between pre- and during COVID-19 periods. A Mann-Whitney  $U$  test was performed to assess the difference in BEES scores, employment status as well as the training hours and tennis matches played per week between the two age groups. A Kendall's Tau B correlation test was then performed to evaluate potential associations between training hours and tennis matches played pre- and during COVID-19 and the BEES. Gender, age range, and loss of income were included as covariates in the aforementioned analysis. Kruskal-Wallis tests were performed to determine if the emotional well-being differed in participants as a result of their match play format (singles, doubles, or both), tennis experience or for the time since tennis training ceased (for those who stopped training). Holm-Bonferroni corrections were applied to all  $p$ -values.

## RESULTS

### Participants

There were 245 respondents who met our inclusion criteria, which was a regular tennis player of 41+ years of age in Australia. This included 132 middle aged (41–60 years) participants as well as 113 senior (61+ years) participants. Of the participants who completed the survey, 47% were female which represents the same distribution of females playing tennis internationally (ITF global tennis report 2019), and 82.5% of participants were in a committed relationship and 84.5% had been playing tennis for over 20 years. None of the participants reported testing positive to COVID-19 and 76.5% of participants thought the response of their tennis organization to the COVID-19 pandemic was either good or very good (Table 1). Employment status prior to the COVID-19 pandemic significantly differed ( $p < 0.001$ ) between the two age groups with 60.6% of participants in the middle-aged group working full-time, compared to 16.8% in the senior group (Figure 1).

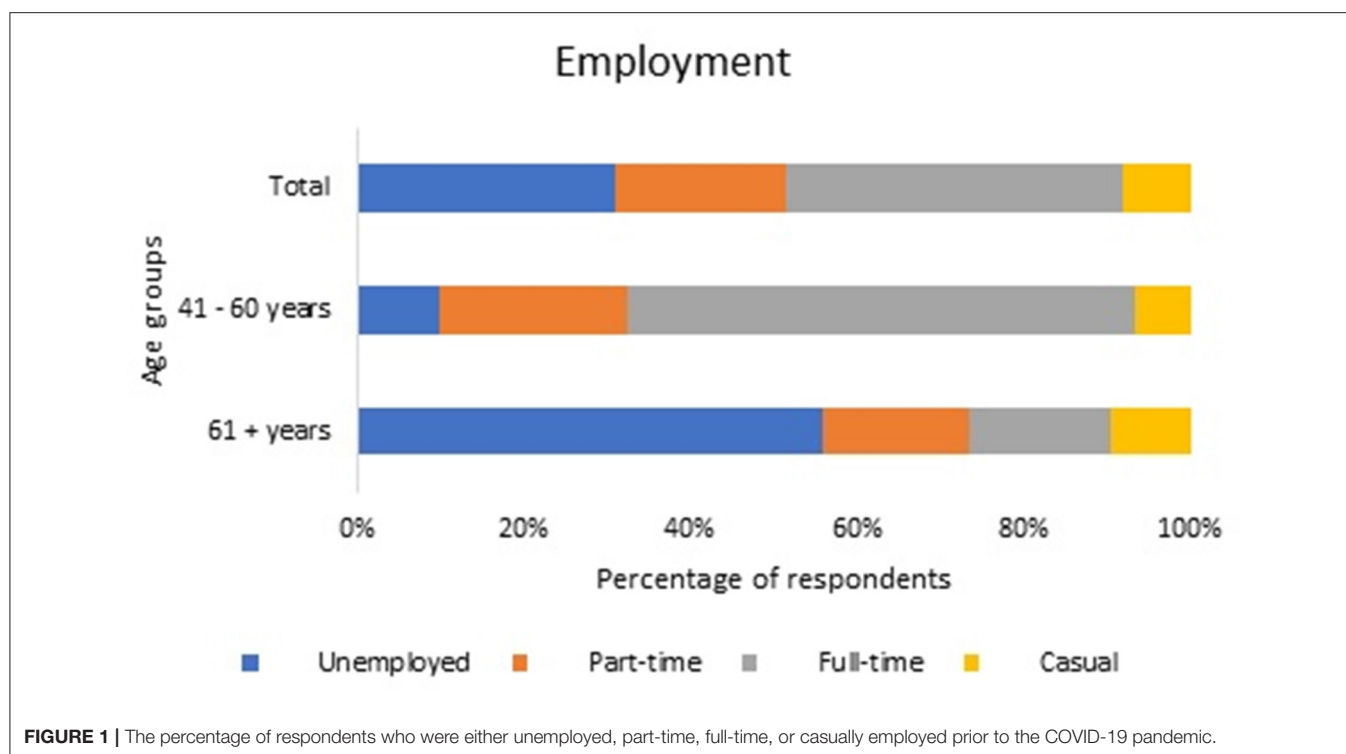
**TABLE 1 |** Participant information displayed as percentage of responses.

Participant demographics			
Parameters	Total ( <i>n</i> = 245)	41–60 years ( <i>n</i> = 132)	61 + years ( <i>n</i> = 113)
<b>Age range (years)</b>			
41–50	20.8	38.6	–
51–60	33.1	61.4	–
61–70	32.2	–	69.9
71 +	13.9	–	30.1
<b>Sex</b>			
Male	51.8	52.3	51.3
Female	47.8	47.0	48.7
Do not want to identify	0.4	0.8	0.0
<b>Relationship status</b>			
Single	15.5	11.4	20.4
In a relationship	82.5	87.1	77.0
Other	2.0	1.5	2.7
<b>Income</b>			
Loss of income	34.3	35.6	32.7
No loss of income	65.7	64.4	67.3
<b>Tennis experience (years)</b>			
1–3	1.2	1.5	0.9
3–5	2.0	3.0	0.9
5–10	2.9	5.3	0.0
10–15	4.9	6.8	2.7
15–20	4.5	5.3	3.5
20 +	84.5	78.0	92.0
<b>Have you contracted COVID-19</b>			
Yes	0.0	0.0	0.0
No	95.1	91.7	99.1
Unsure	4.9	8.3	0.9
<b>Response of tennis organization</b>			
Very good	39.8	36.4	42.5
Good	36.7	34.9	38.9
Uncertain	12.2	14.4	9.7
Poor	7.4	8.3	6.2
Very poor	4.5	6.1	2.7

### On/Off Court Training and Tennis Match Play

The tennis training hours along with the tennis matches played per week significantly decreased when compared to pre COVID-19, 85.1 and 88.5%, respectively (Table 2). Interestingly, endurance as well as flexibility and mobility training hours per week did not differ significantly ( $p = 0.900$  and  $p = 0.730$ , respectively). No significant ( $p > 0.05$ ) differences were observed between age groups for any of the training modality hours, nor was there any significant difference in tennis match play per week.

The majority of participants (76.3%) played only doubles tennis matches as opposed to singles and singles and doubles matches. 70.2% of respondents attributed the inability to perform tennis training during the COVID-19 pandemic to restrictions



to tennis courts. Nearly half (45.3%) of the participants were undertaking some form of exercise training at home during the COVID-19 pandemic. Free weight and bands/tubes represented the most common pieces of equipment used by participants for training (Table 3).

### Emotional Well-Being

The BEES average score was  $0.99 \pm 1.27$ , indicating that respondents had a somewhat positive emotional well-being (greater than 0) during the COVID-19 pandemic (Figure 2). Senior participants had significantly ( $P = 0.002$ ) greater values on the BEES (more positive) compared to middle-aged participants.

Of the selected variables, including tennis training, match play, age group, gender, and employment status only age group ( $r = 0.167$ ,  $p = 0.002$ ) and employment status ( $r = -0.129$ ,  $p = 0.010$ ) were significantly associated with the BEES score. However, after running corrections, there was no significant association between employment status and the BEES.

There was no statistical difference in emotional well-being between participants who participated in singles, doubles or both singles and doubles ( $p = 0.679$ ). Additionally, the emotional well-being did not significantly differ depending on tennis experience ( $p = 0.184$ ). Finally, the time period since tennis training cessation did not significantly influence the emotional well-being ( $p = 0.573$ ) of the participants who had ceased tennis training.

## DISCUSSION

Emerging literature shows that COVID-19 has had a significant and negative impact on the mental health of Australians (Newby

et al., 2019). These findings are, however, non-specific in nature. No studies to date have investigated the impact of COVID-19 on community athletes, particularly with respect to training and match play and emotional well-being. Here, we investigated the impact of COVID-19 on the training status, match play and emotional well-being of community level tennis players. We hypothesized that community tennis players would have a reduction in training hours and number of matches played during the COVID-19 pandemic and this would be associated with lower emotional well-being scores.

Our findings showed a reduction in hours spent training tennis, strength, speed/agility and coordination per week in Australian tennis players during the COVID-19 pandemic. Interestingly, no differences between the middle aged and senior age groups were observed for any of the training modalities. These findings align with previous research reporting a reduction of training load and intensity (75% of respondents) in South African elite and semi-elite athletes across 15 sports (Pillay et al., 2020). Consistent with our expectations, the number of tennis matches played per week was dramatically reduced (88%) during the COVID-19 pandemic. Participants attributed this reduction in match play to restricted access to tennis courts. However, it is noteworthy that the number of matches played prior to and during the COVID-19 pandemic did not significantly differ between the two age groups. Contrary to our assumption, hours training endurance and flexibility/mobility per week did not significantly decrease during the COVID-19 pandemic. This may be due to the limited equipment and facilities needed to successfully undertake these training modalities. This

**TABLE 2 |** Training hours per week for various modalities and tennis matches played per week, before (pre-) and during COVID-19 presented as mean  $\pm$  standard deviation.

Training hours and matches played			
Totals ( <i>n</i> = 245)	Pre-COVID-19	During COVID-19	<i>P</i> -value (corrected)
<b>Training (hours per week)</b>			
Tennis	3.89 $\pm$ 3.01	0.58 $\pm$ 1.40	<0.001*
Strength	1.27 $\pm$ 2.05	0.83 $\pm$ 1.57	<0.001*
Speed and agility	0.77 $\pm$ 1.82	0.49 $\pm$ 1.36	0.002*
Endurance	1.47 $\pm$ 2.36	1.43 $\pm$ 2.31	0.900
Flexibility and mobility	1.28 $\pm$ 2.15	1.13 $\pm$ 1.79	0.730
Coordination	0.89 $\pm$ 2.27	0.62 $\pm$ 1.63	0.004*
Mental/tactics	0.69 $\pm$ 2.19	0.52 $\pm$ 1.73	0.224
<b>Tennis matches</b>	2.43 $\pm$ 1.56	0.28 $\pm$ 0.85	<0.001*
41–60 years ( <i>n</i> = 132)	Pre COVID-19	During COVID-19	<i>P</i> -value (corrected)
<b>Training (hours per week)</b>			
Tennis	3.88 $\pm$ 3.21	0.51 $\pm$ 1.33	<0.001*
Strength	1.15 $\pm$ 1.79	0.80 $\pm$ 1.50	0.008*
Speed and agility	0.55 $\pm$ 1.15	0.41 $\pm$ 1.01	0.207
Endurance	1.27 $\pm$ 1.92	1.50 $\pm$ 2.37	0.469
Flexibility and mobility	1.05 $\pm$ 1.43	1.19 $\pm$ 1.86	0.517
Coordination	0.61 $\pm$ 1.42	0.49 $\pm$ 1.29	0.362
Mental/tactics	0.37 $\pm$ 1.18	0.39 $\pm$ 1.15	0.968
<b>Tennis matches</b>	2.37 $\pm$ 1.37	0.20 $\pm$ 0.75	<0.001*
61 + years ( <i>n</i> = 113)	Pre COVID-19	During COVID-19	<i>P</i> -value (corrected)
<b>Training (hours per week)</b>			
Tennis	3.89 $\pm$ 2.76	0.66 $\pm$ 1.48	<0.001*
Strength	1.40 $\pm$ 2.30	0.87 $\pm$ 1.64	0.003*
Speed and agility	1.03 $\pm$ 2.35	0.59 $\pm$ 1.68	0.022*
Endurance	1.69 $\pm$ 2.77	1.35 $\pm$ 2.23	0.111
Flexibility and mobility	1.55 $\pm$ 2.74	1.05 $\pm$ 1.72	0.034*
Coordination	1.22 $\pm$ 2.94	0.76 $\pm$ 1.95	0.021*
Mental/tactics	1.05 $\pm$ 2.92	0.68 $\pm$ 2.21	0.034*
<b>Tennis matches</b>	2.50 $\pm$ 1.76	0.37 $\pm$ 0.94	<0.001*

No significant differences between age groups were observed for any training modality hours or tennis match play per week.

\*Significant after corrections.

**TABLE 3 |** The percentage of responses regarding the training and tennis match play of participants during the COVID-19 pandemic.

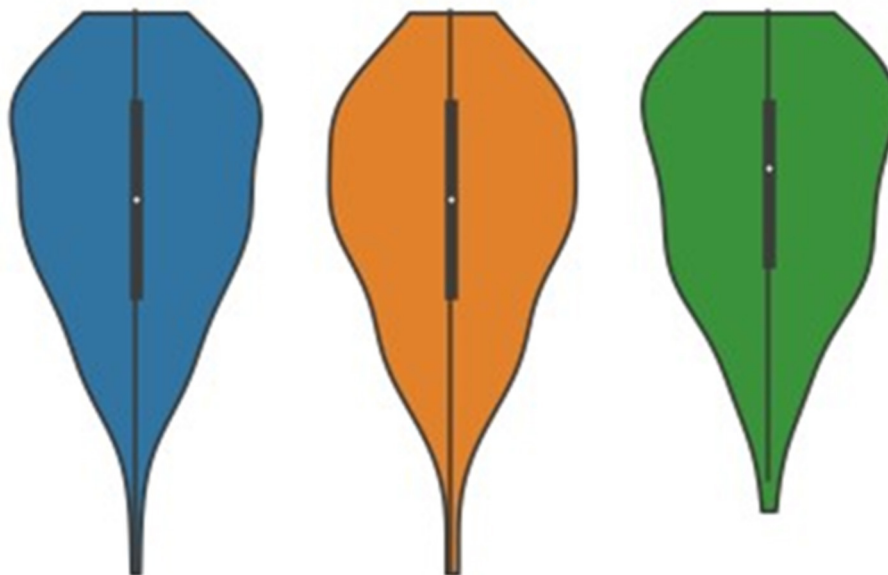
Parameters	Total ( <i>n</i> = 245)	41–60 years ( <i>n</i> = 132)	61 + years ( <i>n</i> = 113)
<b>Format</b>			
Singles	3.7	5.3	1.8
Doubles	76.3	65.9	88.5
Singles and doubles	20.0	28.8	9.7
<b>When tennis training ceased</b>			
	( <i>n</i> = 187)	( <i>n</i> = 104)	( <i>n</i> = 83)
3–4 weeks ago	6.4	4.8	8.4
1–2 months ago	69.0	74.0	62.7
3–4 months ago	20.9	18.3	24.1
More than 5 months ago	3.7	2.9	4.8
<b>Why tennis training ceased</b>			
Not allowed access to a court	70.2	67.1	74.5
Not allowed to train with a partner	15.3	19.9	8.8
Don't want to take the risk	9.3	8.2	10.8
Other	5.2	4.8	5.9
<b>Off-court training location</b>			
Home	45.3	46.8	43.7
Local park	21.7	25.7	17.2
Sporting club	2.5	0.6	4.6
Other	10.3	8.2	12.6
Not training	20.2	18.7	21.9
<b>Equipment access</b>			
None	24.4	24.3	24.6
Bands/tubes	22.6	26.2	18.1
Cardio machines	7.4	6.3	8.8
Cones/ladders/hurdles	3.2	5.8	0.0
Free weights	26.8	26.7	26.9
Resistant machines	5.0	3.9	6.4
Other	10.6	6.8	15.2
<b>Why no off-court training is being conducted during COVID-19</b>			
	( <i>n</i> = 74)	( <i>n</i> = 37)	( <i>n</i> = 37)
Unsure how to train during COVID-19	12.2	11.1	9.1
No equipment or space to train	35.1	26.7	31.8
Don't think off-court training is necessary	28.4	17.8	29.6
Lacking motivation to train	44.6	44.4	29.6

explanation is supported by the finding that 24.4% of participants didn't have access to any exercise equipment during the COVID-19 pandemic. Whilst training modalities such as endurance and flexibility/mobility are sufficient to maintain physical health during the pandemic, the skill demands of tennis require sport-specific training and/or tennis matches to be regularly performed (Fernandez-Fernandez et al., 2017).

Existing studies have noted poor mental health outcomes, including greater emotional distress and concerns in younger adults during the COVID-19 pandemic (Ebrahimi et al., 2020;

Huang and Zhao, 2020; Mazza et al., 2020; Qiu et al., 2020; Wang et al., 2020). These studies have consisted of newly established assessments, including the COVID-19 Peritraumatic Distress Index as well as previously established assessments, including the Depression, Anxiety and Stress Scale, Generalized Anxiety Disorder 7 and Health Anxiety Inventory. Though, it is important to note only two studies from China and Norway, respectively, have included a population group over the age of 60 years (Fernandez-Fernandez et al., 2017; Mazza et al., 2020). The results from our study indicate that although the





**FIGURE 2 |** Mood state of all participants (blue) and those between the ages of 41 and 60 years (orange) and 61 years and over (green), using the Brief Emotional Experience Scale. A significant difference ( $p = 0.002$ ) was found between the two age groups. The median for each group is indicated by the white dot, with the interquartile ranges shown by the thick black line. The remaining distribution, excluding outliers, are shown by the thin black line. Scores greater than 0 indicate a positive mood state, with scores below 0 indicating a negative mood state.

emotional well-being of all participants was positive (score of  $\sim 1$  on a scale ranging from  $-3$  to  $+3$ ), the senior group reported significantly higher ( $p = 0.002$ ) scores in the BEES compared to the middle-aged group. This is in agreement with previous findings from Norway with associations found between higher age and lesser anxiety levels and greater adherence to mitigation strategies (Fernandez-Fernandez et al., 2017). Whilst in our results the training hours and tennis matches played per week did not significantly differ between the age groups, one difference and possible explanation for variations in emotional well-being is the employment status of individuals prior to the COVID-19 pandemic. A significantly greater number of participants were employed on a full-time basis in the middle aged compared to the senior age group prior to the COVID-19 pandemic. It is speculated that the decrease in full-time employment found in the senior group may be attributed to participant retirement. Therefore, it is plausible that the financial impact of the COVID-19 pandemic was not as severe in the senior compared to the middle-aged group, which may explain their significantly more positive emotional well-being.

We expected that reduced training and match play would be associated with lower emotional well-being. Contrary to our expectations, we did not observe any meaningful associations between training hours or match play and emotional well-being. This finding was unexpected given the well-established literature noting a positive impact of physical activities, such as tennis, on mental health (Benedetti et al., 2008; Battaglia et al., 2016; Hekmati Pour and Hojjati, 2016). The lack of association between these outcomes may be explained by the

short duration of the restrictions experienced in Australia at the time of the survey, however, this requires further examination in countries with restrictions over longer durations. Given that we did not examine emotional well-being scores prior to the pandemic, it is not known whether reduced match play and training would have contributed to its decline. Further studies are needed to explore whether COVID-19-related changes in training hours or match play mediate changes in emotional well-being.

While we did not observe significant associations between training and match play and emotional well-being outcomes, we did observe a significant association between employment status and emotional well-being outcomes. However, this weak association did not survive corrections. Furthermore, respondents who had ceased tennis training at various points in time as well as respondents of different tennis experience and match play formats showed no differences in emotional well-being. These findings may be a result of the sample consisting of solely community level tennis players, therefore, the influence of tennis training and match play as well as the other tennis-related variables may not be considerable. Given these findings it is expected other factors (e.g., physical and mental health or lifestyle) had a greater contribution to emotional well-being in Australian tennis players.

A number of limitations need to be considered when interpreting the findings of the present study. Firstly, the cross-sectional study design limits our ability to determine the causes of individuals emotional well-being scores. Secondly, the geographical location within Australia was not collected, therefore, it not known if the sample was biased by a particular

state. Thirdly, the emotional well-being of individuals prior to COVID-19 is unknown and may have been influenced by factors outside of the pandemic (e.g., family background, finances, and health diseases). Fourthly, emotional well-being using as measured by the BEES is only one component of mental health. Finally, several survey questions required participants to respond retrospectively, this along with the self-selected responses of individuals may result in increased variation of scores. However, to ensure the anonymity of participants this was unavoidable.

Despite the aforementioned limitations, this is the first study to assess the impact of COVID-19 on training hours, matches played, and emotional well-being for community tennis players over the age of 40 years in Australia. The results from this study indicate the training hours and matches played per week significantly declined for community tennis players as a result of the COVID-19 pandemic. While not expected, the emotional well-being of community tennis players in Australia was not negatively affected through the COVID-19 pandemic, with the senior age group reporting significantly greater emotional well-being scores compared to the middle-aged group. The results of this study shed light on the impact COVID-19 and the subsequent restrictions have had on community tennis players.

## 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

The studies involving human participants were reviewed and approved by Human Research Ethics Committee, Edith Cowan University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

MT designed the study, collected, analyzed and interpreted the data, and drafted the manuscript. PB collected, analyzed and interpreted the data, and edited the manuscript. KN analyzed the data and edited the manuscript. OG analyzed the data and edited the manuscript. TC designed the study, collected, analyzed and interpreted the data, and edited the manuscript. All authors gave final approval on the accepted manuscript.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fspor.2021.589617/full#supplementary-material>

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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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# A Survey to Evaluate the Association of COVID-19 Restrictions on Perceived Mood and Coping in Australian Community Level Athletes

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## Highlights:

- No differences in coping or well-being in Australian community athletes based on the level of support received during COVID-19 restrictions.
- Community level athletes had better coping when a training program was provided.
- No difference between individual or team community athletes for well-being or coping scores.

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Australian community level athletes faced unprecedented changes to their training and competition options as the global COVID-19 pandemic took a stronghold. This disruption was predicted to have a negative impact on emotional well-being as communities braced through periods of social isolation and physical distancing requirements. This study provides an Australian perspective on the emotional well-being of community level athletes and the extent to which they coped during the COVID-19 pandemic. Emotional well-being and coping were measured using the Brief Emotional Experience Scale and the 28-item Brief Cope Scale. Both instruments were administered along with other questions pertaining to participant demographics and training status via an online survey between April and June 2020. The survey was disseminated to community athletes through word-of-mouth and social media platforms. No significant differences in emotional well-being were observed between athlete groups as a result of COVID-19 and its associated restrictions. Coping scores also appeared to be preserved in Australian community athletes, which contrasts the impact expected as a result of the COVID-19 pandemic. While tentative, the observed preservation in coping may have buffered potential declines in emotional well-being, which has been documented in professional and semi-professional athletes and the general population. These unexpected findings and tentative suppositions warrant further investigation and highlight the importance of conducting a country- or region-specific approach to examining the impact of COVID-19 on community athletes, as responses to COVID-19 are undoubtedly not consistent throughout the world.

**Keywords:** 2019-nCoV (2019 novel coronavirus), Australia, athlete, survey, coping



## INTRODUCTION

COVID-19 has caused significant emotional distress worldwide (Montemurro, 2020; Pfefferbaum and North, 2020; Shanahan et al., 2020). Fear of infection (Lazzerini et al., 2020) and implementation of preventative health measures, including social and physical distancing (Galea et al., 2020) by governments to reduce COVID-19 transmission has seen a dramatic increase in global mood disorders (Kumari and Mahla, 2020; Van Rheeën et al., 2020). Populous level studies conducted in Italy, Spain, USA, and Australia have noted a significant increase in stress, anxiety and depressive symptomology (Fitzpatrick et al., 2020; Ozamiz-Etxebarria et al., 2020; Rossi et al., 2020; Staples et al., 2020). Together, these studies highlight the significant impact of COVID-19 on the general population, however, provide little insight into the consequences of this pandemic on specific societal populations, including the sporting community.

Many studies examining the sporting community have investigated the impact of COVID-19 on adolescent mental health (McGuine et al., 2020a,b), large sporting events (Adami et al., 2020; Mann et al., 2020), as well as professional and semi-professional athletes (Hughes et al., 2020; Ludvigsen and Hayton, 2020; Murray et al., 2020). These studies have noted elevated anxiety, depression, and greater perceived stress in South African (Pillay et al., 2020) and Italian athletes (di Fronso et al., 2020), respectively. These adverse changes in mood state were attributed to a disruption to sporting events (e.g., cancellation of competitions), which negatively impacts professional standing (e.g., ranking) and salary (e.g., loss of income). While important, it is noteworthy that semi-professional and professional athletes only represent a small percentage of the sporting community, with community athletes representing a significantly larger population (May, 2020). Although research has confirmed that community level athletes account for 90% of the entire Australian athletic population per the Clearinghouse for Sport 2019 data, there is a paucity of research which has specifically examined the impact of COVID-19 on community level Australian athletes.

In one of the few available studies, di Fronso et al. (2020) explored the impact of COVID-19 on perceived stress and emotional well-being in professional and community level Italian athletes. Greater stress and poorer emotional well-being were noted in community level athletes when compared to elite/expert athletes, which authors attributed to a reduced ability to deal with adversity and effectively regulate emotions (Anshel and Kaissidis, 1997; Anshel et al., 2009). Makarowski et al. (2020) reported no changes in perceived stress in a large sample of athletes from eastern and western Europe as well as parts of Asia. Authors attributed this unexpected finding to greater utilization of avoidant (i.e., maladaptive) coping strategies, including denial, substance use and venting. Although a form of coping, maladaptive strategies will not facilitate long-term relief from the perceived difficult situation (Brown et al., 2005; Cheng et al., 2020; Rettie and Daniels, 2020). As such, the type of coping strategy being utilized is an important differentiating factor to encourage long term coping relief. Together, these findings suggest that COVID-19 differentially impacts the mood state of community athletes, which may be explained, at least in part,

by employed coping strategies, sport and country of residence. The preliminary nature of these findings necessitates further investigation and comparison throughout other countries.

The purpose of this study was to examine emotional well-being and coping strategy utilization in Australian community level athletes during the COVID-19 pandemic. It was hypothesized that emotional well-being would be negatively impacted when a lower level of support was received during the COVID-19 pandemic and associated with a diminished coping capacity in Australian community level athletes. Exploring potential effect on Australian community level athletes provides a unique insight into the importance of community level sport.

## MATERIALS AND METHODS

### Ethics Approval

This study was approved by the Edith Cowan University Human Resource Ethics Committee (HREC: 2020-01315).

### Study Design/Participants/Setting

This is a cross-sectional descriptive study. The questionnaire was electronically distributed throughout Australia during April-June 2020 via word-of-mouth and social media platforms including Twitter, Facebook and LinkedIn. Participants were required to compete at a community level, have engaged or intended to engage in a formalized sporting competition or training prior to the COVID-19 restrictions (March 2020), reside in Australia and be aged 18 years and over to participate. Due to the unprecedented and unpredictable nature of COVID-19, a sample size estimation was not completed.

For the purpose of this study, “lock down” was defined as the closure of Australian international and interstate borders. All Australian states and territories allowed individuals to exercise outdoors but recommended they stay home unless absolutely necessary. Restrictions varied from state to state, organized sport ceased, and gym facilities were indefinitely closed with the eastern seaboard being affected the most. Australian athletes were able to continue training throughout the nation with modified (e.g., home-based) activity and maintain a sense of connectedness using electronic means.

### Measures

An online survey was administered using Qualtrics software (**Appendix 1**). Within the survey, participants were asked to report on their current demographics (nine-items), COVID-19 sporting relationship (20-items), perceived emotional well-being (six-items), and coping (28-items).

Coping was assessed using the 28-item Brief COPE Scale (Carver, 1997). Items were scored using a four-point Likert Scale, 1 (I haven't been doing this at all) to 4 (I've been doing this a lot). Possible total scores ranged from 28 to 112 with a lower score indicating poorer coping strategies. In addition, 12 of the 14 subscale scores can be grouped to reflect two key domains of Avoidant Coping (sum of 12-items, items: 1, 3, 4, 6, 8, 9, 11, 13, 16, 19, 21, 26) or Adaptive Coping (sum of 12-items, items: 2, 5, 7, 10, 12, 14, 15, 17, 20, 23, 24, 25) (Carver, 1997; Mahmoud et al., 2012).

Perceived emotional well-being was assessed using the Brief Emotional Experience Scale (Rogers et al., 2016; Skead and Rogers, 2016; Skead et al., 2018, 2020; Rogers and Cruickshank, 2020; BEES). Participants reflected on how they have felt emotionally over the previous month across six-domains (three positive—happy, calm, confident; and three negative—worried, safe, afraid). The six emotional items were scored using a four-point Likert Scale, one (Not at all), two (a little bit), three (quite a bit), four (a lot or extremely). To calculate the total score, the mean of three negative items is subtracted from the mean of three positive items. Total possible score ranged from  $-3$  to  $+3$ , with a higher score indicating “higher emotional well-being.” Additionally, a cut off score of  $>0$  indicates “positive emotion is greater than negative emotion.”

Both scales are self-reported by the participant and have established validity and reliability within the general population (Carver, 1997; Rogers and Cruickshank, 2020).

## Data Analysis

Descriptive statistics [Sample Size (N), Mean (M), Standard Deviation (SD), Median (Mdn)] for emotional well-being (BEES) and coping (Coping) scores were calculated based on participant demographics (e.g., Age, State) and sporting details (e.g., team or individual). Individual univariate generalized linear models explored the association between each outcome variable (BEES, Total Coping, Avoidant Coping, Adaptive Coping) and each independent variable (demographic and sporting variables). Sub-categories were excluded if the cell count was  $<3$ .

Four generalized linear models explored if the level of support provided to the athlete was associated with a community level athlete's ability to cope during COVID-19, while adjusting for other extraneous factors. If any sub-categories of the five key independent variables of interest (Club Support) had a cell count of  $<3$ , they were excluded from all four models. Details of each model set up within SPSS included: A generalized linear model, with a linear scale response (with identity link function). Club support, demographic and sport-related variables (factors) were assessed with category order per factor specified in descending order. Model effects were specified as main effects and Type III model effect, with the intercept included in the model and 95% confidence intervals. The scale parameter was set to Maximum likelihood estimate and the log-likelihood function set to full, with model based exponential parameter estimates included. Standardized residuals were saved for visual assessment.

Ability to cope was explored across four separate models (one dependent variable per model) including emotional well-being (Total BEES score), Total Coping (sum score), Avoidant Coping (sum score), and Adaptive Coping (sum score). Club support was explored by five independent variables. These variables included contact by the national sporting organization (No, Yes), contact by the state sporting organization (No, Yes), contact by the club-level sporting organization (No, Yes), ability to continue training (No, Yes), and provided with a training program (No, Yes). Each model was also adjusted for five demographics factors—state or territory, sex, age, change in employment due to COVID-19, and medical condition. Additionally, the models were adjusted for two sport-related fixed factors including team or individual sport

and position security within the sport. For each model (1–4), residuals were visually inspected for normality.

Data analysis was completed in Microsoft Excel and IBM SPSS Statistics Version 25. Significance was set at  $p < 0.05$  for all analyses. There was no missing data due to the parameters of the Qualtrics study set to require all survey items to be completed.

## RESULTS

### Participants

A total of 151 participants completed the questionnaire responding across all eight states or territories of Australia, with Western Australia accounting for 64% of responses (Table 1). There was no significant difference in emotional well-being (BEES), Total Coping, Avoidant Coping or Adaptive Coping between states or territories. While not significant, participants from Northern Territory and Tasmania had the greatest coping scores (although the lowest respondent rate,  $n = 2$ ), with participants from New South Wales and Victoria displaying lower coping scores. The majority of participants identified as female ( $N = 89$ , 59%) and were in a relationship ( $N = 111$ , 74%). Initial univariate analysis indicated a significant difference in emotional well-being (BEES) for sex ( $p = 0.003$ ), with females reporting lower mean scores ( $M = 0.30$ ,  $SD = 1.27$ ) compared to males ( $M = 0.92$ ,  $SD = 0.92$ ) (i.e., females had a lower emotional well-being than males). Total coping scores were significantly greater in females ( $M = 57.16$ ,  $SD = 9.97$ ,  $p = 0.026$ ), in comparison to males ( $M = 53.33$ ,  $SD = 10.85$ ). There was a significant difference in Adaptive Coping scores for sex ( $p = 0.019$ ), with females reporting higher mean scores ( $M = 30.15$ ,  $SD = 6.87$ ) compared to males ( $M = 27.48$ ,  $SD = 6.87$ ) (i.e., females had greater adaptive coping than males). There was no significant difference in Avoidant Coping scores based on sex ( $p = 0.082$ ), although descriptively females had a greater mean Avoidant Coping score ( $M = 20.02$ ,  $SD = 4.30$ ) than males ( $M = 18.73$ ,  $SD = 4.72$ ). A fifth of participants were aged between 26 and 30 years ( $N = 30$ , 20%), whilst the age ranged from 18 years to over 71 years. Avoidant coping scores were significantly greater ( $p = 0.009$ ) for 18–21 years ( $p = 0.008$ ), 22–25 years ( $p = 0.003$ ), 26–30 years ( $p = 0.025$ ), 31–35 years ( $p = 0.017$ ), 36–40 ( $p = 0.029$ ), and 51–60 ( $p = 0.016$ ) in comparison to participants aged 71 years and over. Although not significant, older respondents had greater emotional well-being scores ( $p = 0.144$ ) and lower total coping scores ( $p = 0.376$ ) (poorer ability to cope) than younger participants.

### Employment and Medical Conditions

During the study period, no participants were diagnosed with COVID-19 while two participants stated they were unsure (Table 2). Almost a fifth of participants lost their employment due to COVID-19 (19%), with an additional fifth of participants experiencing a reduction in employment (20%). Of the 30 participants with reduced employment, 61% ( $N = 17$ ) saw their employment decrease by at least 50%.

The mean coping score was greater for participants who lost all employment (i.e., coping better), than participant's whose

**TABLE 1** | Participant demographics ( $N = 151$ ).

	<i>N</i>	<i>%</i>	<b>BEES</b>			<b>Coping</b>			<b>Coping avoidant</b>			<b>Coping adaptive</b>		
			<b>M</b>	<b>SD</b>	<b>Mdn</b>	<b>M</b>	<b>SD</b>	<b>Mdn</b>	<b>M</b>	<b>SD</b>	<b>Mdn</b>	<b>M</b>	<b>SD</b>	<b>Mdn</b>
<b>Total responses</b>	151	100.00	0.58	1.32	0.67	55.65	10.43	56.00	19.48	4.48	19.00	29.13	6.96	29.00
<b>Location</b>														
ACT	4	2.65	0.67	2.16	1.17	52.75	4.99	52.50	18.75	4.50	17.50	27.75	3.59	26.50
NSW	15	9.93	1.33	1.08	1.33	51.33	11.65	48.00	17.13	3.96	16.00	26.67	6.87	28.00
NT <sup>b</sup>	2	1.32	−0.33	0.94	−0.33	68.50	3.54	68.50	21.00	2.83	21.00	39.50	0.71	39.50
QLD	10	6.62	0.30	1.54	0.67	59.30	12.18	60.50	20.20	4.42	20.50	31.30	8.30	33.50
SA	5	3.31	0.87	1.04	0.33	59.00	4.95	59.00	22.40	5.55	20.00	29.60	3.29	29.00
TAS <sup>b</sup>	2	1.32	−0.33	2.36	−0.33	62.00	14.14	62.00	24.00	8.49	24.00	31.50	2.12	31.50
VIC	17	11.26	0.63	1.26	0.33	53.12	9.12	52.00	18.82	3.28	19.00	28.12	6.94	25.00
WA	96	63.58	0.51	1.29	0.67	55.94	10.44	56.50	19.64	4.58	19.00	29.24	7.06	29.00
<b>Sex</b>														
Male	60	39.74	0.92	1.26	0.67	53.33	10.85	52.50	18.73	4.72	17.50	27.48	6.85	28.00
Female	89	58.94	<b>0.30<sup>a</sup></b>	1.27	0.33	<b>57.16<sup>a</sup></b>	9.97	58.00	20.02	4.30	19.00	<b>30.15<sup>a</sup></b>	6.87	30.00
Other/ Prefer not to say <sup>b</sup>	2	1.32	3.00	0.00	3.00	58.00	9.90	58.00	17.50	2.12	17.50	33.50	6.36	33.50
<b>Age</b>														
18–21 years	17	11.26	0.51	1.02	0.67	56.76	12.32	56.00	<b>20.59<sup>a</sup></b>	4.96	19.00	28.94	6.91	28.00
22–25 years	24	15.89	0.14	1.18	0.17	58.96	9.92	58.50	<b>21.42<sup>a</sup></b>	4.80	20.00	30.08	6.16	29.00
26–30 years	30	19.87	0.54	1.37	0.67	56.40	8.78	57.50	<b>19.37<sup>a</sup></b>	3.90	19.00	29.93	6.47	29.50
31–35 years	13	8.61	0.41	1.56	0.33	55.77	11.71	56.00	<b>20.08<sup>a</sup></b>	3.30	20.00	28.00	8.76	26.00
36–40 years	9	5.96	0.67	1.37	1.00	53.89	8.74	54.00	<b>19.78<sup>a</sup></b>	4.82	19.00	26.89	6.81	28.00
41–50 years	24	15.89	0.89	1.34	1.00	53.46	11.15	53.50	17.67	3.86	17.00	28.92	7.41	29.50
51–60 years	24	15.89	0.61	1.34	0.50	56.04	10.97	57.50	<b>19.83<sup>a</sup></b>	4.81	19.50	29.33	7.72	27.50
61–70 years	7	4.64	0.71	1.28	0.33	50.43	9.54	49.00	16.57	3.82	16.00	28.86	7.15	30.00
71 years +	3	1.99	2.56	0.19	2.67	46.67	6.66	45.00	13.67	2.08	13.00	27.00	5.57	26.00

*M*, Mean; *SD*, Standard Deviation; *Mdn*, Median.

The reference categories are set to Location (WA); Sex (Male); Age (71 Years +).

BEES: Brief Emotional Experience Scale. Lower score indicates lower emotional well-being. Possible score −3 to +3.

Coping: Brief COPE Scale. Lower score indicates a poorer ability to cope. Possible score 28–112.

Coping Avoidant: Brief COPE Domain Scale. Higher score indicates stronger Avoidant coping traits.

Coping Adaptive: Brief COPE Domain Scale. Higher score indicates stronger Adaptive coping traits.

<sup>a</sup> Significant difference to reference category at  $p < 0.05$ .

<sup>b</sup> Sub-category excluded from analysis due to low cell count.

Bolded is to emphasize the “a” which denotes: Significant difference to reference category at  $p < 0.05$ .

employment was not affected. Comparatively, emotional well-being was greater in participants whose employment was not affected, in comparison to those who partially or completely lost employment (Table 2).

Emotional well-being scores appeared poorer for participants with respiratory and other illnesses compared to other medical conditions, or no medical conditions (Table 2). By contrast, coping appeared similar across all medical illnesses. Respondents with immune related medical conditions had the lowest avoidant coping scores, while participants with respiratory or immune and other medical conditions reported lower adaptive coping domains. Employment and Medical Conditions were not significantly associated with BEES, Coping, or Adaptive and Avoidant Coping.

## Sporting Profile and Effect of COVID-19

Participants responded across a plethora of team and individual sports (Supplementary Table 1), including Triathlon, Ten Pin

Bowling, Running, Hockey, Fencing, Lawn Bowls, Cycling, and Australian Football. Three quarters of the participants were classified as participating in an individual sport (Table 3). Comparing team and individual athletes, team athletes had marginally greater emotional well-being scores, while individual athletes had slightly greater mean total coping score and adaptive coping scores. However, emotional wellbeing ( $p = 0.173$ ), total coping ( $p = 0.135$ ), avoidant coping ( $p = 0.108$ ) and adaptive coping ( $p = 0.412$ ) scores did not differ between sporting type (team or individual).

The occurrence of COVID-19 negatively affected over a third of participant's position security within their sport (position in the sport deteriorated a lot or somewhat) ( $N = 59$ , 39%) (Table 3). This was similar for individual ( $n = 45$ , 40% of individual athletes) and team-sport athletes ( $n = 14$ , 38% of team athletes). Position in sport was not significantly associated with emotional well-being ( $p = 0.206$ ), total coping ( $p = 0.691$ ), avoidant ( $p = 0.247$ ), or adaptive coping ( $p = 0.758$ ) scores,

**TABLE 2** | Comparison of emotional well-being and coping scores based on loss of employment due to COVID-19 and pre-existing medical conditions ( $N = 151$ ).

	N	%	BEES			Coping			Coping avoidant			Coping adaptive		
			M	SD	Mdn	M	SD	Mdn	M	SD	Mdn	M	SD	Mdn
<b>Total responses</b>	151	100.00	0.58	1.32	0.67	55.65	10.43	56.00	19.48	4.48	19.00	29.13	6.96	29.00
<b>Employment loss due to COVID-19</b>														
Yes	28	18.54	0.28	1.32	0.17	58.73	10.35	59.50	20.40	4.41	19.50	30.87	6.65	31.50
Reduced employment	30	19.87	0.40	1.38	0.50	55.36	8.67	54.00	19.50	3.93	18.00	28.96	5.77	28.00
No effect	93	61.59	0.74	1.28	0.67	54.74	10.85	55.00	19.17	4.66	19.00	28.62	7.35	29.00
<b>Medical condition</b>														
None	115	76.16	0.66	1.23	0.67	55.28	10.69	55.00	19.52	4.58	19.00	28.83	6.84	29.00
Immune System <sup>b</sup>	1	0.66	2.33	0.00	2.33	61.00	0.00	61.00	16.00	0.00	16.00	38.00	0.00	38.00
Immune System and Other <sup>b</sup>	2	1.32	-0.83	0.71	-0.83	59.50	0.71	59.50	24.00	1.41	24.00	29.00	1.41	29.00
Respiratory	10	6.62	0.17	1.60	0.17	54.80	11.37	53.50	19.30	4.72	18.00	27.50	7.86	25.50
Respiratory and Other	3	1.99	-0.89	0.51	-1.00	63.00	7.55	62.00	24.67	0.58	25.00	31.00	7.21	29.00
Immune and Respiratory <sup>b</sup>	0	0.00	-	-	-	-	-	-	-	-	-	-	-	-
Other	20	13.25	0.62	1.58	0.33	56.45	9.65	55.00	18.25	3.63	18.50	30.95	7.54	29.50

M, Mean; SD, Standard Deviation; Mdn, Median.

The reference category is set to "no effect" or "none."

BEES, Brief Emotional Experience Scale. Lower score indicates lower emotional well-being. Possible score -3 to +3.

Coping: Brief COPE Scale. Lower score indicates a poorer ability to cope. Possible score 28-112.

Coping avoidant: Brief COPE Domain Scale. Higher score indicates stronger Avoidant coping traits—Non-parametric alternative used.

Coping adaptive: Brief COPE Domain Scale. Higher score indicates stronger Adaptive coping traits.

<sup>a</sup> Significant difference to reference category at  $p < 0.05$ .

<sup>b</sup> Sub-category excluded from analysis due to low cell count.

however participants whose position improved somewhat had marginally greater coping, adaptive and avoidant coping scores.

Over half of all participants ( $N = 77$ , 51%) were formally contacted at least once by all three levels of their sporting organization (National, State, Club) (Table 3). Comparatively, 9% of participants were not formally contacted by anyone from their sporting organization across any level ( $N = 14$ ). Participants not contacted by their national organization had significantly greater mean BEES score ( $p = 0.012$ ) (greater emotional well-being) than participants who were contacted (Table 3). All coping, adaptive and avoidant coping scores were similar between participants contacted by national and participants who were not contacted.

There was no significant difference in emotional well-being, coping, avoidant or adaptive coping scores between participants contacted at a state or club level. However, coping, adaptive and avoidant coping scores were marginally greater for participants contacted by their respective state or club organization.

The majority of participants continued some form of training ( $n = 138$ , 91%). While total coping scores were greater for participants who continued training, there was no significant difference in total coping scores. Adaptive coping scores were significantly greater for participants able to continue training in comparison to those who were not (0.025).

The majority of participants were not provided by with a training program ( $n = 47$ , 69%) (Table 3). Overall, whilst not significant, community level athletes had greater coping scores when a training program was provided, compared to when one was not provided. There was no significant difference in

emotional well-being, or avoidant coping scores. Participants had a significantly a greater mean adaptive coping score when they had a training program provided ( $p = 0.038$ ) in comparison to those who did not (Table 3).

## Association of Organizational Support on Community Level Athlete's Emotional Well-Being and Coping Ability During COVID-19

Four generalized linear models explored if the level of support provided by a club was associated with a community level athlete's emotional well-being, and ability to cope during COVID-19, while adjusting for other extraneous factors (Table 4).

Model 1 indicated contact from national sporting body was significantly associated with poorer emotional well-being ( $B = -0.63$ , 95% CI: -1.14, -0.13;  $p = 0.014$ ) when adjusting for demographic and other sporting factors. No other level of support was associated with emotional well-being.

In Model 2, when adjusting for demographic and other sporting factors, the level of support provided was not associated with a community level athlete's ability to cope during COVID-19. Similarly, in Model 3, the level of support provided to an athlete was not associated with avoidant coping, when adjusting for demographic and other sporting factors. Model 4 indicated the ability to continue training was significantly associated with greater adaptive coping scores ( $B = 4.27$ , 95% CI: 0.41, 8.13;  $p = 0.033$ ) when adjusting for demographic and other sporting factors. However, the wide confidence intervals need to be acknowledged, meaning a large plausible range in adaptive



**TABLE 3 |** Participant sporting details cross referenced with BEES, Coping and Coping Domain scores ( $N = 151$ ).

	<i>N</i>	%	BEES			Coping			Coping avoidant			Coping adaptive		
			<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>
<b>Total Responses</b>	151	100.00	0.58	1.32	0.67	55.65	10.43	56.00	19.48	4.48	19.00	29.13	6.96	29.00
<b>Type of sport*</b>														
Team	113	74.83	0.68	1.31	0.67	54.82	10.39	55.00	19.08	4.26	19.00	28.84	7.11	29.00
Individual	37	24.50	0.35	1.27	0.33	57.73	10.17	57.00	20.41	4.76	20.00	29.92	6.55	29.00
Other <sup>b</sup>	1	0.66	-2.00	-	-2.00	72.00	-	72.00	30.00	-	30.00	33.00	-	33.00
<b>Eligible to play in 2020</b>														
Yes	141	93.38	0.58	1.31	0.67	55.32	10.44	56.00	19.33	4.39	19.00	28.97	7.05	29.00
No	10	6.62	0.67	1.45	0.33	60.30	9.73	65.50	21.60	5.46	21.00	31.40	5.30	29.00
<b>Position in team*</b>														
Deteriorated a lot	29	19.21	0.43	1.07	0.33	53.86	12.17	50.00	19.00	4.46	19.00	28.24	8.12	28.00
Deteriorated somewhat	30	19.87	0.42	1.28	0.67	56.00	9.57	55.50	20.53	4.61	19.50	28.60	7.43	28.00
No change	88	58.28	0.74	1.39	0.67	55.95	10.21	56.00	19.15	4.44	18.00	29.53	6.51	29.00
Improved somewhat	4	2.65	-0.42	1.26	-0.83	59.25	9.91	56.00	22.25	3.86	22.50	30.75	4.99	29.00
Improved a lot <sup>b</sup>	0	0.00	-	-	-	-	-	-	-	-	-	-	-	-
<b>Contact from sports organization</b>														
National level														
Yes	107	70.86	<b>0.42<sup>a</sup></b>	1.24	0.33	55.73	10.54	56.00	19.46	4.44	19.00	29.18	6.78	29.00
No	44	29.14	0.99	1.42	1.00	55.45	10.29	56.00	19.52	4.62	19.00	29.02	7.45	29.00
State level														
Yes	107	70.86	0.53	1.23	0.67	56.06	10.63	56.00	19.50	4.48	19.00	29.38	7.00	29.00
No	44	29.14	0.71	1.51	0.83	54.66	9.99	54.50	19.41	4.55	19.00	28.52	6.90	28.00
Club level														
Yes	115	76.16	0.58	1.28	0.67	56.17	10.86	57.00	19.46	4.57	19.00	29.57	7.10	29.00
No	36	23.84	0.61	1.44	0.67	53.97	8.86	53.50	19.53	4.25	19.00	27.75	6.37	28.00
<b>Continue training</b>														
Yes	138	91.39	0.58	1.32	0.67	56.00	10.53	56.00	19.39	4.39	19.00	<b>29.51<sup>a</sup></b>	6.95	29.00
No	13	8.61	0.59	1.38	0.67	51.92	8.81	51.00	20.38	5.52	18.00	25.08	5.88	26.00
<b>Training program provided</b>														
Yes	47	31.13	0.57	1.12	0.67	57.32	10.89	58.00	19.34	3.70	19.00	<b>30.85<sup>a</sup></b>	7.59	30.00
No	104	68.87	0.59	1.40	0.67	54.89	10.19	55.00	19.54	4.81	19.00	28.36	6.54	28.00

*M*, Mean; *SD*, Standard Deviation; *Mdn*, Median.

The reference category for each dichotomous independent categorical variable is set to "No."

\* The reference categories are set to Sport Type (Team); Position in Team (Deteriorated a lot).

BEES: Brief Emotional Experience Scale. Lower score indicates lower emotional well-being. Possible score -3 to +3.

Coping: Brief COPE Scale. Lower score indicates a poorer ability to cope. Possible score 28-112.

Coping avoidant: Brief COPE Domain Scale. Higher score indicates stronger Avoidant coping traits.

Coping adaptive: Brief COPE Domain Scale. Higher score indicates stronger Adaptive coping traits.

<sup>a</sup> Significant difference to reference category at  $p < 0.05$ .

<sup>b</sup> Sub-category excluded from analysis due to low cell count.

Bolded is to emphasize the "a" which denotes: Significant difference to reference category at  $p < 0.05$ .

coping scores. Other variables reflecting level of support were not significantly associated with adaptive coping score outcomes.

## DISCUSSION

COVID-19 has impacted the way of life of individuals worldwide, leading to a deterioration in emotional well-being, with several studies, including those in athletic populations, reporting an increase in stress, anxiety and depressive symptomology (Cullen et al., 2020; Holmes et al., 2020; Pierce et al., 2020; Reardon et al., 2020). Few studies have investigated the implications of COVID-19 on community level athletes (Asif et al., 2020; Mann et al.,

2020) and the ability of athletes to cope during the pandemic (Makarowski et al., 2020). Given earlier findings (Adami et al., 2020; di Fronso et al., 2020; Mann et al., 2020; Pillay et al., 2020), the protective role of sport engagement on mental health (Vella et al., 2019), and the imposed restrictions on sport engagement, researchers anticipated that Australian community level athletes would experience a deterioration in emotional well-being, which would be related to a diminished capacity to employ protective coping strategies. In contrast to our expectations, we found no evidence of a decrease in emotional well-being or poorer use of coping strategies between Australian community athletes during the COVID-19 pandemic.

**TABLE 4 |** Association between the level of support provided by a sport on a community level athletes' emotion and ability to cope during COVID-19 ( $N = 151$ )\*.

	<b>B</b>	<b>B 95% CI</b>	<b>Sig (p-value)</b>
<b>MODEL 1. BEES</b>			
Contacted by club	0.09	−0.43, 0.61	0.738
Contacted by state sporting body	0.05	−0.47, 0.57	0.857
Contacted by national sporting body	−0.63	−1.14, −0.13	<b>0.014<sup>a</sup></b>
Able to continue training	0.10	−0.64, 0.84	0.787
Provided with a training program	0.06	−0.39, 0.52	0.793
	0.09	−0.43, 0.61	0.738
<b>MODEL 2. TOTAL COPING</b>			
Contacted by Club	2.11	−2.07, 6.28	0.322
Contacted by State Sporting Body	1.17	−3.02, 5.37	0.584
Contacted by National Sporting Body	−1.18	−5.30, 2.93	0.573
Able to continue training	3.91	−2.00, 9.83	0.195
Provided with a training program	1.99	−1.65, 5.63	0.283
<b>MODEL 3. COPING—AVOIDANT</b>			
Contacted by Club	−0.11	−1.91, 1.69	0.906
Contacted by State Sporting Body	0.17	−1.65, 1.98	0.856
Contacted by National Sporting Body	−0.02	−1.77, 1.74	0.984
Able to continue training	−0.97	−3.53, 1.60	0.459
Provided with a training program	−0.14	−1.72, 1.43	0.858
<b>MODEL 4. COPING—ADAPTIVE</b>			
Contacted by club	1.59	−1.12, 4.30	0.249
Contacted by state sporting body	0.41	−2.31, 3.14	0.766
Contacted by national sporting body	−1.05	−3.69, 1.59	0.437
Able to continue training	4.27	0.41, 8.13	<b>0.030<sup>a</sup></b>
Provided with a training program	2.14	−0.23, 4.52	0.077

The reference category for each independent categorical variable is set to "No."

No subgroup in the five key independent variables of interest (Level of Support) had a low cell count.

Model effect size (R-Squared) is unable to be computed in GenLM using SPSS software.

Model 1. Outcome: BEES: Brief Emotional Experience Scale. Lower score indicates lower emotional well-being. Possible score −3 to +3.

Model 2. Outcome: Brief COPE Total Scale. Lower score indicates a poorer ability to cope. Possible score 28–112.

Model 3. Outcome: Coping Avoidant. Brief COPE Domain Scale. Higher score indicates stronger Avoidant coping traits.

Model 4. Outcome: Coping Adaptive. Brief COPE Domain Scale. Higher score indicates stronger Adaptive coping traits.

<sup>a</sup>Significant difference at  $p < 0.05$ \* Each model is adjusted for state or territory, sex, age, change in employment status due to COVID-19, and medical condition (respiratory, immune compromised, other), team or individual sport and position security within the sport.

Bolded is to emphasize the "a" which denotes: Significant difference to reference category at  $p < 0.05$ .

While the coping capacity of community athletes in Australia was found to be similar in community athletes irrespective of demographics or level of sporting support received, this finding could be related to the fewer positive COVID-19 cases and associated deaths compared with many other countries worldwide (Communicable Diseases Intelligence: COVID-19 National Incident Room Surveillance Team, 2020). Additionally, Australia had shorter lockdown periods, therefore limiting in-person physical distancing and social isolation, which are known to adversely impact on mental health and coping mechanisms (Smith and Victor, 2019; Usher et al., 2020). However, with the cross-sectional study design, further research would be required to ascertain if these coping scores are unique to the Australian COVID-19 setting, lower infection and mortality rates, or impacted directly by the pandemic. Other Australian-centric factors were likely to have contributed to the outcomes of this study. For instance, while coping was seemingly greater for participants who lost employment, it is noted that the

Australian Federal Government swiftly provided more robust and pandemic-specific national support to anyone that lost employment (via *Job Seeker*) or was temporarily displaced (for businesses via *Job Keeper*) as a result of COVID-19 to ensure temporary financial stability. Additionally, Australian athletes were able to continue training throughout the nation under varied circumstances (e.g., decreased numbers, non-contact, web-based) and maintained a sense of community throughout the lockdown process as a result.

Adaptive Coping scores were higher for females compared to males, which may be aligned with women being more likely to engage in help-seeking behaviors (Liddon et al., 2018; Volk et al., 2020). Further analysis of coping scores across states and between individual and team sports, revealed that participation in any community level sporting type or location yielded positive coping results. These findings were unexpected given early reports of greater anxiety and depressive symptomology in athletes who had trained in a club facility (Makarowski et al., 2020; McGee and

Sanders, 2020). This was presumed to be due to, at least in part, an inability to cope with the indirect impacts of COVID-19 on employment, training and participating in competitive matches.

There is a well-documented relationship between utilizing better coping strategies/mechanisms and experiencing improved emotional well-being (Berto, 2014; Tremolada et al., 2016; Marroquín et al., 2017). Both adaptive (e.g., seeking social support, acceptance) and maladaptive (e.g., rumination, avoidance) coping strategies are part of the human reaction to adverse experiences and are affiliated with greater emotional well-being (Marroquín et al., 2017). Despite higher coping scores being reported by female athletes in the present study, they contrastingly reported lower emotional well-being scores than their male counterparts. This phenomenon can be attributed to female athletes tending to ruminate more (di Fronso et al., 2020), report less access to training equipment during the lockdown (Bowes et al., 2020), as well as being more likely to perceive the pandemic as a serious health problem thereby potentially being more compliant with physical distancing and social isolation measures (Galasso et al., 2020; Liu et al., 2020). Women continue to be disproportionately affected by the COVID-19 pandemic—they are more susceptible to increased rates of intimate partner violence (Connor et al., 2020; Mazza et al., 2020), have seen an increase in burden of care (e.g., household responsibilities Fodor et al., 2020; Kibbe, 2020), and have a higher presence on the frontlines (e.g., nurses Bahri, 2020; McLaren et al., 2020).

Although not significant, emotional well-being was greater in participants whose employment was not affected, as job instability is associated with worse mental health outcomes (Moen et al., 2020; Wilson et al., 2020). Similarly, not significant but of note, respondents that identified as being part of a team sport had marginally greater emotional well-being scores. This is likely attributed to the emphasis on staying connected with teammates (Jukic et al., 2020) and the call-to-action to make a concerted effort to reintroduce group activities for emotional well-being (Denay et al., 2020; Hughes et al., 2020).

The longer-term psychological impact of COVID-19 is widely speculated (Butler and Barrientos, 2020; Sher, 2020; Talevi et al., 2020) as Australia and countries around the world continue to endure subsequent COVID-19 outbreaks and affiliated implications (i.e., extended regulations to maintain physical distancing and social isolation). Ensuring training opportunities are available and modifiable for community level athletes will preserve coping capacity and further strengthen their emotional well-being (Strohle, 2019; Teychenne et al., 2020). Therefore, additional research will assist with the potential lasting effects of the global pandemic (Kathirvel, 2020; Moreno et al., 2020) as the world of returning to community sport hangs in the balance (Ranasinghe et al., 2020).

## Limitations

A number of limitations need to be considered when interpreting the study findings. First, the study only included individuals within Australia, where the transmission of COVID-19 has been comparably lower than the vast majority of other countries and individuals were still allowed to exercise, provided they adhered

to physical distancing. Additionally, prospective pre-COVID coping and emotional well-being scores were not available, therefore conclusions cannot be drawn about changes in these outcomes, and a causal link to COVID-19 cannot be established with the current study design.

Furthermore, the findings may not be generalisable to all community athletes due to the low sample size, however, these findings offer an initial insight to coping and emotional well-being in athletes within Australia. Australian states and territories were disproportionately impacted by COVID-19, with varying lock down requirements and durations. The final models attempted to control for this by adjusting based on state with low cell counts and wide beta confidence intervals, however residuals were normal. Next, the results may have been influenced by sampling (e.g., responder) bias, with more mentally fit participants more likely to complete the survey. In addition, the large number of Western Australian and female participants could also skew results, while increased alcohol use throughout Australia (Neill et al., 2020) may be confounding factors. Finally, this study did not exclude or control for people with pre-existing mental health conditions. Given the nature of the survey and speed of COVID-19 transmission this was not feasible.

## CONCLUSION

It was anticipated that the implications of COVID-19 (e.g., uncertainty on return to sport conditions, athlete safety) would have significant detrimental effects on community-level athlete well-being and their ability to cope. Here we report no differences in coping or emotional well-being between demographic factors, or based on the level of support received in an Australian cohort of community athletes. While these findings are undoubtedly of interest, there is a fundamental need for researchers to investigate the longer-term ramifications of COVID-19 on community level athletes in Australia and worldwide.

## 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 Edith Cowan University Human Research Ethics Committee HREC: 2020-01315. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

CF-H: investigation and writing—original draft. SH: formal analysis and writing—original draft. SR: conceptualization, methodology, and validation. SV and PB: conceptualization, methodology, investigation, and validation. MT:

conceptualization, methodology, investigation, data curation, and writing—original draft. TC: conceptualization, methodology, investigation, data curation, and writing—original draft. 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/fspor.2021.624267/full#supplementary-material>



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# “A Labour of Love”: Active Lifestyle Entrepreneurship (Occupational Devotion) During a Time of COVID-19

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The Novel Coronavirus (COVID-19) crisis management strategies adopted by world leaders across the globe in 2020 impacted the work-life balance of billions of people. Entire populations were forced to stay at home and maintain a safe distance from family members, friends, colleagues, and customers. Occupational devotion is defined as a feeling of strong, positive attachment to a form of self-enhancing employment, where achievement and fulfillment are high, and the core activity has such intense appeal that the line between this work and leisure is virtually erased. Although it is not a new concept, this area of the serious leisure perspective has been largely overlooked by scholars observing the world of sport events and entrepreneurship. Using Creative Analytical Practice (CAP), a post-qualitative methodology, we present the personal narrative of a New Zealand-based active lifestyle entrepreneur who, as a result of a nationwide COVID19 lockdown, was forced to re-assess his long-established occupational devotion. Our co-constructed story offers an emotive insight into the personal cost and consequences of finding yourself living in a lockdown.

**Keywords:** occupational devotion, active lifestyle entrepreneurship, creative analytical practice, COVID-19, personal narrative, serious leisure

## EPISODE ONE: A TEAM OF FIVE MILLION

“The coronavirus COVID-19 pandemic is the defining global health crisis of our time and the greatest challenge we have faced since World War Two... But the pandemic is much more than a health crisis, it’s also an unprecedented socio-economic crisis. Stressing every one of the countries it touches, it has the potential to create devastating social, economic and political effects that will leave deep and longstanding scars... The International Labor Organization estimates that 400 million jobs could be lost... Every country needs to act immediately to prepare, respond, and recover” (United Nations Development Programme, 2020).

In March 2020, the International Monetary Fund’s (IMF’s) chief economist referred to the highly infectious respiratory disease as “a crisis like no other” (Chan, 2020). The Novel Coronavirus (COVID-19) crisis management strategies adopted by world leaders across the globe has directly impacted the work-life balance of billions of people with millions forced to stay at home and maintain a safe distance from family members, friends, colleagues and customers. The social lockdowns and strict restrictions to human movement, witnessed on all seven continents, ruthlessly exposed the socially-constructed boundaries that separate what is and what is not an essential part of twenty-first century society. In an attempt to save lives and reduce the spread of COVID-19, all large social gatherings were canceled or postponed, including some of the world’s most iconic

sports events. There was no Wimbledon (for the first time since 1945). There was no Monaco Formula One Grand Prix (for the first time since 1954). Likewise, the British (Golf) Open, the European Football Championships, and the Games of the XXXII Olympiad (aka Tokyo 2020) were all unceremoniously removed from the 2020 sporting calendar.

New Zealand's Director-General of Health, Dr Ashley Bloomfield, publicly reported the country's first case of COVID-19 in an announcement made on Friday February 28th, 2020. The following week, Prime Minister Jacinda Ardern revealed her government's COVID19 crisis management strategy. The goal was to go hard, act fast and completely eliminate/eradicate all communal transmission as quickly as possible. It was a strategy based on the recommendations of scientists from within the field of public health and epidemiology. For the aggressive strategy to work, the government needed everyone to follow the new rules of social engagement.

Four COVID-19 Alert Levels (C-19 AL) were presented to the public via a nationwide address on March 21st March. They were labeled; Prepare (Level 1), Reduce (Level 2), Restrict (Level 3) and Lockdown (Level 4). Each CL-19 AL came with their own range of strict conditions and control measures and the nation was immediately placed into CL-19 AL3. This was changed to C-19 AL4 2 days later, as the Prime Minister declared a State of National Emergency starting at 12:21 p.m. on 25 March 2020. The nationwide lockdown lasted for 49 days. All social gatherings were outlawed, with only essential workers allowed to leave their place of residence (referred to as "a bubble"). The only businesses that were allowed to remain open were those deemed "essential" services (e.g., supermarkets, pharmacies, petrol stations etc.). Gyms and sports fields/facilities were closed and all events were either canceled or postponed. The New Zealand border was closed to all foreign nationals and those who were eligible to enter on "mercy" or "repatriation" flights were required to self-isolate for 2 weeks. Light/low intensity physical activity such as walking, jogging or cycling within one's local neighborhood was permitted, but only with the members of your bubble.

Whilst some non-essential businesses were allowed to reopen in late April, as the country moved into C-19 AL3, it wasn't until the nation moved into CP-19 AL2 on the 13th of May that schools and other childcare facilities were allowed to reopen. All bars and restaurants were also allowed to reopen at this point, but under strict conditions that limited numbers and enforced social distancing. New Zealand entered C-19 AL1 at 11:59 p.m. on Monday 8 June, 2020, following 2 weeks of no community cases being recorded. No sport fixtures or events were permitted until New Zealand had been in C-19 AL1 for a couple of weeks. By the end of June, life in New Zealand had essentially returned to "normal." Events hosting over 100 people were once again permitted and the domestic winter sports leagues, both amateur and professional, were able to commence.

Our paper shares the personal narrative of an active lifestyle entrepreneur living in New Zealand. Having set the scene within the opening paragraphs, the rest of the paper has been split up onto a trilogy of overlapping episodes. Episode two introduces the concepts of active lifestyle entrepreneurship and occupational devotion. Episode three is split into two halves. The

first focuses on the philosophies, principles and practices of post-qualitative narrative inquiry, more specifically the employment of Creative Analytical Practice (CAP). The second presents a personal narrative entitled "*THE* event of our lifetime (got to run)." Finally, the fourth episode offers our socially constructed interpretations of the method(s) employed and the meaning(s) extracted. Our aim is to establish a meaningful and memorable connection between the reader and the subject of an evocative personal narrative.

## EPISODE TWO; ACTIVE LIFESTYLE ENTREPRENEURSHIP

The globalization, commercialization and commodification of sport has led to a noticeable increase in the number of entrepreneurs looking to establish their own space in a heavily congested and highly competitive active economy (Jones et al., 2020; Ratten, 2020). According to Finch et al. (2019, p.4), an "active economy" "incorporates all organizations who participate in, or contribute to, improving individual and/or community level well-being through the development and delivery of sport, physical activity and active recreation experiences". They identify ten interdependent sectors that co-exist within an active economic ecosystem, including organized sport and active recreation (Finch et al., 2019). Organized sport is characterized as structured and competitive physical exertion requiring skills and rules, whereas active recreation incorporates more relaxed, sociable leisure experiences primarily encountered for health and well-being, as well as entertainment and enjoyment.

In 2019, Scott Jones, the creator of a social enterprise called "Athletes On Fire," defined the active entrepreneur as "someone who pursues an entrepreneurial endeavor in a field that inspires, teaches, motivates, or trains people to move, or, an entrepreneur that lives an active and adventurous lifestyle while maintaining an entrepreneurial endeavor" (Jones, 2019). Paula Gregorowicz, founder of "The Paula G Company, differentiates the active entrepreneur from the athletic entrepreneur, placing a greater emphasis on an individual's passion for "something... anything that makes your heart sing", whether it be gardening, singing, cooking or running" (Gregorowicz, 2015). Similarly, the term "lifestyle entrepreneurship" was first coined to describe local artisan or craft-based business owners looking to establish a better work-life balance (Bredvold and Skalen, 2016).

Burns (2001) defines lifestyle enterprises as businesses that not only provide adequate income, but also allows the owner-manager to engage in an area of activity that brings them personal pleasure. A lifestyle entrepreneur is therefore someone who creates a new business venture that aligns with their personal values, interests and identities (Wright and Wiersma, 2019; Jones et al., 2020). According to Shaw and Williams (2004), lifestyle entrepreneurs are typically older male adults who enjoy being their own boss. Furthermore, research suggests that many have retired or resigned from former better paid professions, and/or moved to a new areas with the intention of generating enough income to sustain their lifestyle (Peters et al., 2009). They are typically experienced consumers (hobbyists) and product



innovators who share a number of personal characteristics, including a strong desire to enhance their quality of life and that of their family (Peters et al., 2009). Their goal isn't to establish a business that they can grow and/or harvest, but one that will be low maintenance and enjoyable to own/operate.

Marchant and Mottiar (2011) divided the lifestyle entrepreneurship market into those "constrained" and those "non-constrained." Drawing on occupational socialization theory, Kim and Longest (2014) determined that there was a direct correlation between an entrepreneur's past professional background and the number of people they were willing to involve in their new business idea. Those coming from venture-specific profit-driven industries were found to be more likely to opt for solo ventures or small collaborations, whilst those coming from more interactive people-driven occupations were more likely to seek and recruit a number of new business partners. Although the success and sustainability of new ventures are typically assessed by the speed in which they are progressing, if not growing, Kim et al.'s (2015) study into the viability of American leisure-based entrepreneurship found that social lifestyle entrepreneurs were content to play the long game. Lifestyle entrepreneurs situated in New Zealand's tourism sector, for example, were found to specifically market their product toward consumers who shared their socio-cultural values (Ateljevic and Doorne, 2000).

## Occupational Devotion: the Sleeping Giant of the Serious Leisure Perspective

Serious leisure is defined as the "systematic pursuit of an amateur, hobbyist or volunteer activity sufficiently substantial and interesting in nature" (Stebbins, 1992, p.3).

The consumers of serious leisure typically navigate their way through four or five overlapping "career" phases (Stebbins, 2014). The resources invested in the beginning, development, establishment, maintenance and decline stages can vary, however, with one's progression being driven by a range of social, cultural, and historical factors (Stebbins, 2014). Serious leisure consumers have also been found to share a number of personal traits, many of which are also shared by active lifestyle entrepreneurs (Jones et al., 2020). These including the drive to persevere, the desire to pursue a career, the willingness to put in effort in order to gain skill and knowledge, the ability to realize the special benefits attached to self-fulfillment, self-expression and group accomplishment, the ability to create/cultivate of an attractive personal and social identity and, lastly, the ability to maintain a unique ethos through active involvement within your social world (e.g., an internally recognizable group of likeminded people) (Stebbins, 2014a).

Although the concept of serious leisure has been explored on numerous occasions over the last 30 years, surprisingly little attention has been paid to the subset of "devotee work," defined as "an activity in which participants feel a powerful devotion... to an occupation that they are proud to be in" (Stebbins, 2014a, p. 4). Stebbins (2014b) justifies the inclusion of occupational devotion within the broader serious leisure perspective (SLP), arguing that those who experience such an intense positive attachment

and a sense of high-level achievement (on a day-to-day basis) can effectively remove the boundary between work and leisure. Occupational devotion is defined as a feeling of strong, positive attachment to a form of self-enhancing employment where the core activity has such intense appeal that the line between this work and leisure is virtually erased (Stebbins, 2004).

Stebbins (2004) split the work devotees from the non-devotees, using the following seven criteria; skill, knowledge/experience, variety, creativity/innovativeness, control, aptitude/taste, social/physical milieu and the ability to work in a team. In terms of personal characteristics, the occupational devotee was identified as someone with the following five strongly seated socio-cultural values; success, achievement, freedom of action, individual personality and activity (being involved in something) (Stebbins, 2009). Their devotion is evident in their everyday actions, lifestyle, motivation, and social relations. More so, it helps to define their personal and social identities (i.e., who they are and how they are seen by others) (Stebbins, 2009). According to Stebbins (2009), occupational devotees acquire a combination of skills, knowledge and experiences that offers ample opportunity for creativity or innovation. The concepts of occupational devotion and devotee work were framed within the four broad social contexts of history, religion, work, and leisure (Stebbins, 2004). Gender, social class, and social character have also been used to help researchers explore the antecedents of occupational devotion (Stebbins, 2004).

On the subject of remuneration, Stebbins (2004) proposes that there are three critical orientations present within the concept of occupational devotion. The first exists when an work devotee is primarily seeking payment that allows them to continue pursuing the core activity (i.e., they seek to be paid so that they may continue working). Stebbins (2004) suggests that the true value for those who fall within this cohort comes from being in a position to routinely carry out their fulfilling work. Money is not the supreme value to principles-led devotees, who search for little more than the minimum needed to sustain their preferred lifestyle. The second orientation is that of acquisition. This covers the work devotees who seek an occupation that allows them to live comfortably as opposed to passably (i.e., they seek extrinsic rewards and future wealth and are happy to relocate or reinvent themselves to get it). The third group represent a combination of the first two orientations. Those deemed to adhere to "Principled-acquisitive orientation" seek to be paid so they may continue working in an role that gives them pleasure, but see no reason why they cannot sooner or later generate enough profit to sustain a comfortable living (i.e., they seek a healthy but profitable work-life balance).

Although occupational devotees are not immune to feelings of work-based frustration, anger and (self)doubt, the strong emotional connections felt toward the thing they do for a living (their livelihood) ensures that the positive aspects soon negate any such negativity (Stebbins, 2009). Four somewhat broad and non-exclusive types of devotee work are identified within under the banner of occupational devotee within the SLP framework, these being; liberal professions, consulting/counseling occupations, some skilled trades, some

small businesses (Stebbins, 2014a). Stebbins acknowledged the difficulty in studying occupational devotion from an entrepreneurial perspective from the outset, blaming the scarcity of data available on small business entrepreneurs (Stebbins, 2004). He also noted the lack of research in which occupational devotees have claimed to have achieved something important or that they have been successful in life, concluding that, “compared with others in their reference groups, they [occupational devotees] have developed considerable knowledge and skill and acquired considerable experience, all of which they have applied with a certain level of creativity or innovation. But many devotees, unlike some other kinds of workers, cannot measure their achievement and success in remunerative terms for high pay by no means always flows from occupational devotion” (2004, p. 18).

Durieux and Stebbins (2010) suggest that, “to find serious leisure through social entrepreneurship, you must have a sense of commitment and a moral obligation to your enterprise and its target of benefits. These two attributes are key in motivating you to serve as a volunteer in your own social enterprise... Commitment and leisure may sound like an odd couple, but in serious leisure, commitment is a central condition” (pp. 47-48). In Hjorth (2007) proposed that those who study entrepreneurship needed to broaden their resource-based focus to include the time of opportunity creation as well-opportunity recognition, evaluation and exploitation. His recommendation was for the adoption of more humanistic narrative-based methods that allow researchers to look at entrepreneurship from personal perspective.

The aim of this episode was to introduce you to the concepts of active lifestyle entrepreneurship and occupational devotion, the latter of which remains an area of the serious leisure perspective worthy of further exploration, especially within the field of sport-based entrepreneurship. As noted within the introduction, the next episode is split into a couple of parts/halves. The first half provides an overview of the paradigms and principles behind post-qualitative narrative inquiry. The second half offers our attempt at employing creative analytical practice within a post-qualitative piece of narrative inquiry.

### EPISODE THREE; CREATIVE ANALYTICAL PRACTICE (THE SOCIAL SCIENCE OF STORYTELLING)

Coffey (1999, p. 11) claims that the search for new knowledge is always “situated, partial, local, temporal and historically specific.” Narrative inquiry is the study of how human’s construct and consume the world through the creation and subsequent sharing of stories (Bruner, 1990). Narrative accounting (or storytelling) allows a series of individual stories to be structured in a manner and direction that demonstrate a sense of movement through time and space (Gergen and Gergen, 1986; Polkinghorne, 1997). Put another way, narratives provides the map that can save people from getting lost in a sea of nostalgia (Ricoeur, 1991). A narrative can also shape our social identity and allow us to make sense of our present day priorities (Clandinin and Connelly, 2000).

Narrative-based inquiry not only showcases, but also situates the complexity and messiness of the lived experience (Wright, 2017).

A narrative is broadly defined as “the ordering and connecting of particular subjects, events, actions, and experiences in a causally or temporally meaningful sequence or whole” (Wright and Blair, 2016, p.219). A narrative is not only an essential structure in human meaning-making, but also the discourse form which can express the diachronic perspective of human actions (Smith and Sparkes, 2009, Wright, 2017). It is widely considered to be the heart, the soul and the structure of any fictional or non-fictional story (Papathomas, 2016). Personal narratives are typically produced to inspire reflection and a period of critical self-examination (Richardson, 1999). They can appear as a single thread or as a collection of numerous threads (plots) that have been weaved together to form a multi-layered account a past lived experience (Polkinghorne, 1997). The process of extracting, removing and combining multiple memories into a single narrative is commonly referred to as emplotment (Polkinghorne, 1997). According to Papathomas (2016, p.39), narrative analysis represents “the cardinal approach to making sense of our worlds.”

Narrative researchers only plot the particular, as opposed to the general, seeking to showcase the inherent complexities that accompany individuality as opposed to summarizing the broader patterns that exist within a community (Bruner, 1990; Clandinin and Connelly, 2000). Creative Analytical Practice (CAP) is a form of contemporary ethnography that invites the reader into the research, allowing them to unearth new learnings from/through the consumption of personal narratives and other types of emotive, socially-constructed, conversational representations (Richardson, 1999; Parry and Johnson, 2007; Berbary, 2015; Wright, 2019). CAP ethnographers package and present stories of lived experiences, both their own and those of others (Richardson, 1999). These stories are typically shared in the form of evocative autoethnography or creative non-fiction, with the emphasis placed on the “believability” and “trustworthiness” of the content (as opposed to its generalisability) (Smith, 2016; Wright, 2019).

CAP “brings to the consciousness some of the complex political/ideological agendas hidden in our writing” (Richardson, 2000, p.254). CAP was born in the 1990s, inspired by a crisis of representation that spread across the humanities and social sciences and effectively challenged the way things had traditionally been done. It offers interpretivists, humanists and social constructionists a literary-inspired means of sharing personal stories, including their own (Richardson, 1999). CAP ethnographers are storytellers who relate to a host of critical “post-” paradigms, including poststructuralism, posthumanism and postmodernism (Berbary, 2015). Berbary (2015) suggests that CAP ethnographers can benefit from more unstructured guides used for more narrative-style semi-structured interviews. She also notes the possibilities attached to moving from specific stories to broader concepts, focusing on the combination of existing themes/ideas and the creation of poly-voiced, dialogic, juxtaposed narratives, composites, or visual forms. She concludes that CAP can be applied to post-qualitative studies that elicit thick, rich, contextualized stories, but also warns that it is

“almost impossible to move in the opposite direction from broad information to in-depth stories” (p.37).

The epistemology behind CAP is based on the concept of nascency (Saldaña, 2005). In essence, the judgement of value and validity is not for the author to dictate, but for each individual audience member to determine in their own time (Saldaña, 2005). The goal of the storyteller is to temporarily transport his/her audience into a place that they are able to recognize, if not a place that they have previously visited (Wright, 2019). Wright (2019) adds that one of the benefits of employing CAP is its proven ability to provoke a reaction and strike a chord with a global audience, including those who would not normally consume academic discourse. The most appropriate assessment criteria are transferability, dependability and confirmability (Parry and Johnson, 2007, Smith, 2016; Wright, 2019). The narrative should also be relevant (topical) and something to which you (the reader) can directly relate (Mieniczakowski and Morgan, 2001; Smith, 2016). The evocative language that you are about to encounter has been taken directly from the mouth/mind of an active lifestyle entrepreneur during a nationwide lockdown. The story was co-constructed during an unprecedented period of unrest and uncertainty. It includes extracts from two social media posts shared during and after a couple of COVID-19 lockdowns, the first of which lasted from March to May, 2020. The second lockdown lasted a month, but only applied to people living in the region of Auckland (home to over a quarter of New Zealand's resident population). Passages from the transcript of an in-depth interview conducted prior to the pandemic have been embedded and interwoven into the personal narrative.

The one-on-one interview focused largely on the origins of his lifestyle enterprise and his active entrepreneurial mindset. When answering questions about his background, he was happy to reveal and reflect upon his past experiences and his future aspirations (both professional and personal). It was during that first hour-long conversation where we were able to recognize many of the characteristics and traits associated to active lifestyle entrepreneurship and occupational devotion. Within the interview, he spoke passionately about the company's past, present and prospects for the future. He spoke pleasantly about his employees/colleagues and his clients/customers (with whom he clearly had a lot in common). It was clear that he was doing something that he genuinely loved and that he was loving every minute of what he did. On the subject of work-life balance, he revealed that he had decided to relocate his family out of New Zealand's largest urban center and into one of the nation's most active, yet remote, regional economies. Having worked hard to establish his business, he was looking forward to stepping back a little and spending more time with his family.

The content of the two social media posts add another layer to study that we were in the process of creating from a series of the in-depth interviews. They reveal a side to the individual that wasn't evident during our first meeting. It wasn't hidden (it just wasn't present). The posts were not written by a professional event manager or an experienced business owner-operated trying to impress his audience. They were not written to promote his business venture (or himself). They were, however, full of emotion. They were evocative, provocative and deeply personal.

They were raw, real, relevant, most of all, easily relatable. The combined number of positive comments from his colleagues, customers and competitors (n.131), plus the large number of “likes” generated (n.304), tells a story in itself. It told us that he had shared something that other people understood and a story that others had accepted as being both genuine and truthful. It told us that he had written something that other people wanted, perhaps even needed, to see. Collectively, the three narratives allowed us to tell a COVID-19 story yet to be told by our peers within the field of sport events and entrepreneurship. It offered us the chance to illustrate the personal impact of COVID-19 on an active lifestyle entrepreneur who, once upon a time, was looking forward to 2020's arrival for a number of reasons. It was going to be the year his business (referred to as TS) launched two new events and celebrated their 20th anniversary.

Only a small amount of emplotment and editing was applied to the personal narrative that you are about consume. The majority is presented exactly how it was created, including the punctuation, spelling and syntax. For ethical reasons, we have removed all specific references to people and places, including the name of the participant's businesses (referred to as TS). Our narrative was sent back to our entrepreneur on several occasions for feedback and as a form of triangulation. We provided him with plenty of opportunities to critically assess the authenticity and accuracy of our interpretations of his lived experience. A second/follow up interview was deemed unnecessary once we discovered how much quality material he had already provided. Arguably, what makes his personal narrative so powerful and provocative is the fact that it was produced in the moment itself (Smith, 2016). It reveals the fear, anguish and optimism that he was feeling at a time when no one had any real idea how long New Zealand's C-19AL4 lockdown was going to last or, crucially, whether or not it was going to work. If we were to interview him again today, and ask him to reflect upon how he felt during the first lockdown, his answer would inevitably be influenced by everything that has happened since.

## THE Event of Our Lifetime (Got to Run)

Today (the day before my 48th birthday) I am grateful for quite a few things. My body, at the moment it's in OK shape. I'm fit enough to run for 1.5–2 h pretty comfortably. On today's run I thought a lot, I thought about what the fuck has been going on the past 2 weeks. I run trails for a lot of reasons, and one of those reasons is to make sense of the “things” that are going on in my world. I was able to process a lot (well, some) of what this past 2 weeks has done, been, and what it all means.

I really didn't like running when I was at school, so it's kind of bizarre that I started forming this company. I remember it [the start] pretty vividly. Once I made the decision, I went into my bosses office and I suggested that he make my position redundant. I was really fortunate to get that job [as an event manager for the council]. I didn't deserve to get it. I had no experience. But the CEO was a family friend and he decided to take a bit of a shot with me.

I spent two and a half years delivering a portfolio of events, all connected to sport, but not the kind of events that TS does. I went and pitched to him that I would take a number of the events

that I knew they wanted to retain, but they didn't really want to organize themselves. I said, "You make my position redundant, I'll organize these events for you, and you can save some money". I left that meeting with a contract worth twenty grand, which seemed like quite a lot, even though it was a big reduction in my salary.

At that point, I didn't really know how TS was going to look or what we were going to do. I guess for those first few years I kind of just messed around, just trying to make ends up. I just kind of chucked a few things together. I did no planning around preparing a business case or anything mapping out how it might look. If there was a book to be written, it could be around how not to start a business. There wasn't a whole lot of product testing; it was basically just very informal, asking friends "How do you think this could work?" I only just hung in there. I had no responsibilities so I didn't have to pay myself a salary.

I created a concept, and secured the local council as a major funder. That was the start of TS. In the first year, and we're going back 20 years, we got something like 550 people. From there, the portfolio just started to grow and the "Off-road Series" was born with two or three events. I made the decision to stop playing cricket and then replaced that with a little bit of running, a little bit of mountain biking, a little bit more of the endurance kind of stuff. I was always drawn to the off-road stuff or the trail stuff, as opposed to the pounding the pavement kind of stuff. I thought; "Hey, this stuff is kind of fun. Is there an opportunity and would other people kind of buy into this?" A lot of conversations happened with mates over a beer.

I didn't have much support back in those days. All of the events, I've pretty much created by myself in some form. I would map the courses and do the websites and organize the registration; kind of all of it. I would drag people in. It took a couple of years before I had any staff. I'm amazed that some of these events even happened. A lot of it was about instinct, trusting my gut and going, "Hey this is cool, this is a good spot. The people are out there running and they like this kind of stuff; then surely they're going to like this?" I think the key challenge has probably been that a lot of this business has been created and grown pretty organically. I'm always researching what is happening overseas, what's trending.

The biggest challenge for me has been around trying to map out the future of the business; trying to stay ahead of the game a little bit. We were pretty much market leaders for a while, but it's probably fair to say that we've been caught over the years. We were the main people out there offering these sorts of events, but now, oh man, look at all the stuff that's going on there. So, keeping it fresh and innovative has been a massive challenge. We're now a business of ten employees across two offices. Back then the market was pretty uncluttered so we got dibs on putting events on in places before most people.

I think in many ways we popularized trail running in New Zealand. If you were running trails back in those early days, you were kind of a weirdo orienteering guy or girl, or a multi-sporter. Those are small markets and people didn't really get that; so, we were more trying to kind of create something that was a bit more mainstream but still really cool. There was an element of people that were doing it, but they were pretty hardy and they were pretty

experienced. Back in those days, you didn't get mothers of three running trails. To create a sanitized safe environment for people to go and do these things was probably the real recipe for success I think.

People that do our events generally have a pretty good time. So, we try to promote the TS part of the business too, as opposed to the events. That's a kind of a romantic view; the view is people will actually potentially make their decision to do an event because they've had a good experience with TS, or one of their friends has and has told them. We do have some very adoring fans, I have no doubt about that, but it's a relatively small percentage. What's actually happens in reality, is loyalty is waning and people identify with the event and if it works for them then they'll do it. So, they will make their decisions based around the event concept, the date and the location and if it fits in with their very busy and full life then they will do it. So, for us, it's constantly about trying to present these events to people. Every event's got a story.

The favorite thing about the business is the people; and the most challenging thing about the business is the people. My role now is to kind of map the future of the business and steer it in the direction it's going to keep it going and hopefully keep it going strongly; which involves being across what's next. We can't continue to run the same events all the time, and if we are then why are we doing what we're doing, how are we keeping them fresh and innovating all the time; so that people actually still consider spending their time and money with us, as opposed to the competition—and there's a lot of that now. There's not a lot of originality left. We are all out there stealing each other's ideas, right? We are continually inspired by the people who do our events and we get their stories from time to time, around what they've been through to get to the start lines and the adversity and the challenge that they've faced.

We like to think that we create inspiring locations and experiences for people. It's about the accessibility too and making it easy. You get a lot of insight around how much people hate their jobs in doing what we do, because they come to us to remove themselves from that stuff that they go through. You hear the stories. I've had a lot of "successful" people come to me who would happily slice their income in half to come and work for something, somewhere like TS. Why? Because they believe in what we do and what we're about. There's this real essence around the people that work here. ...you walk upstairs and everyone's kind of got this thing; they all believe and they all know this is a hard business to make money in. It's not a well-paid industry. I'm pretty upfront with these guys that this is not an easy business and we are not smashing it. We're doing okay, but it's a fine line.

I think most of us would agree that 2020 in many ways has been the craziest, hardest and saddest of years. Of course out of adversity comes opportunity and potential, however, all in all it's been tough and it's OK to acknowledge that. I've struggled, my work-mates have struggled, and I've spoken with a lot of people over the last few months that are exhausted, anxious, and just completely over it. I'm not sure about others, but when I start the downward spiral (that's a whole different story!), I let slip a bunch of things that I know 100% are good for me, for both my mental and physical condition. One of those things for me is running,



but not just running anywhere—for me to get the full benefits package, I need to get into nature and hit some trails.

I have not been good company lately, not good company at all. Fortunately my wife is “personally developed” to a point where she can let my solemn grumpiness go, she knows it’s not about her, and she gets that when things aren’t going well, that I become reclusive, non-communicative and extremely dis-engaged, which does not make me a very good person to be around. Luckily our house is pretty big with lots of space and a huge reserve out the front. This means we’ve got access to space, and that’s very, very important right now. My mountain bike has been recently serviced and it’s going to get plenty of use over the next month, or more. . . I’m also very lucky to have a good stock of shoes, I think (hope) I’m going to get through some. I’m sure they’re designed to last less time than the olden days. I’m sure the pair I discovered today, that have two big rips in them, have only been in the game for 3–4 months.

Trails are like, so damn important to me, so important. They have been a critical part of my life for the last 20+ years, since TS began. Those trails became the place where we were able to meet, to connect and challenge ourselves in nature, together. So what about my head? Bloody hell. My head has been in some places these last 2 weeks (mostly up my own ass!). I thought I’d try and capture my mental journey to date (and it has felt very MENTAL alright!). Below is my own alert level system 1–4, explained as it has affected and occurred to me and my company.

### **Alert Level 1 – Is this Really Happening?**

This phase started on Sunday 14th March, 6-days out from our biggest event of the year. The phone started ringing that morning, and it didn’t really stop. In my heart I knew that we were very likely going to have to cancel. Those of you that know this event will understand the complexity and challenging nature of delivering an event on the islands. There’s something about that wee stretch of water between the mainland and these islands which creates that challenge to produce. . . ! An event for 2000+ outdoor and nature-loving runners, walkers, mountain-bikers and triathletes.

### **Alert Level 2 –How the F% and K Do We Deal With This? This Wasn’t Meant to Happen to LIL’ Old NZ – We’re All Good Down This End of the World... Aren’t We?**

There’s a few parts to this phase. . .

Part one; This bit started on Monday 15th March, when the TS team decided we had no possible way of being able to deliver the event. We made the call to cancel. Well, a week out from an event of this nature, a LOT has been done, and a LOT of \$ has been spent (around 70% of the revenue we discovered). We were in the shit. What were we going to do (a) to communicate this cancellation message effectively and authentically to the participants, our sponsors, stakeholders, suppliers, volunteers etc., and (b) to not become bankrupt in the process of canceling this event, the biggest in every sense, in our schedule of 20 events?!

Part two (a); This one started later that same day, when we went into fight-or-flight mode, and scrambled like an egg to work out what our exact, present financial position was. Were we going to be able to claw any \$ back from any of our suppliers, and what were we going to offer the many, many disappointed people who’d trusted us, spent their hard-earned money with us, and expected a bloody good show on Sat?

Part two (b); This one started somewhere around Tue 17th or Wed 18th March when it became clear that we weren’t going to be putting on our next event, and then very likely the next one after that. The penny started to drop that being in the business of putting on events was perhaps not one of the best businesses to be in right now! During this time my mind went from the micro level (What about that event?, and that event?, and. . . it’s okay. . . the TS team can deal with that, they’re good, like real good!) to the macro level (What does this Covid-19 thing mean for TS?). Very quickly we assessed the financial situation. We came up with our action plan and it was real simple; get every available \$ into our bank account that we can, and stop spending any unnecessary \$ - immediately. Back onto the phone I went, pleading our case to both our landlords, insurers, and anyone else that we felt we might be able to get some financial respite from. This bit was 100% about survival.

Somewhere in this phase the economic support package was announced and outlined by the government. We were able to tick the wage subsidy bit. There was going to be no problem showing a minimum 30% reduction in income. This is our good time of the year. Financially, times are good, and we’re generating an average of \$40k+ per week in entry revenue. Since Monday 16th March, we’ve generated \$0. This isn’t going to change for a while, so we went from bingo to bummer in a day.

We’re not budgeting any revenue for the next 3 months, which is almost exactly how long this business will survive if nothing changes. For now though, we have 12 staff/team members who are working from home (we’re not sure on exactly what) and are on 80% of their salary—that’s something we can be proud of. We submitted our application on the day that the wage subsidy grants were open (along with thousands of other affected businesses), I got a call within 24-h to check the authenticity of our application, and then the one-off lump sum appeared in our account less than a day later. Less than two days and we at least had a tincy, wincy bit of breathing space.

### **Alert Level 3 –I am Feeling Very, Very Sorry for Myself, My World Is in Ruins – Why Isn’t Everyone Feeling Sorry for Me?**

I’m not exactly sure when this phase started, in all honesty maybe it was on day one (right back at the start). I was just too caught up in trying to deliver positive messages to the team and our community, along with finding a way to keep this company going, to feel it then. But then it kicked in. Once we’d dealt with the messaging, and had an idea of how our next 2-3 months might look, as well as getting just enough \$ into our bank account to pay the team, along with a few unavoidable bills, I then got right into the phase of feeling fucking sorry for myself.

I would categorize myself in my “normal” state as an empathetic and a very positive person. Over the past 20 years in business (this business) we’d got through some pretty flipping big stuff. I’d definitely learnt something about resilience. But this time I just jumped straight into a pretty deep pit of self-pity, and I’ve been here for a while. Why the f%&k did this have to happen?, to the world yeah sure, but to me?, and my company? – this company that does so much good for people, and is turning 20-years old in August! This was the year for celebration, not survival! I’ve paid my dues, blah blah blah... And all that stuff...

I don’t know, some of you might’ve been here (and maybe still are here) too? And you know what dawned on me somewhere between a hazy IPA and a glass of Shiraz last night?... it’s Okay... it’s normal to feel this way, and we should give ourselves permission to feel this way. But we can’t stay forever in this place of helplessness and deep sympathy for ourselves, because in this place there is zero chance of (a) survival, and (b) future success, once the storm passes. And it will pass.

### **Alert Level 4 – Acceptance and Empathy, We Will Get Through this, and Out the Other Side Good Things Will Come**

The last phase of my small business owners alert level system started nearly 2 weeks after the shit hit the fan. I woke up feeling good, not just “oh god, can this day just get done so I can go back to bed, to sleep and just escape again for a bit.”<sup>1</sup> The feelings of depression and self-pity lifted somewhat, and I felt a whole lot lighter. I felt more present with my wife and my kids. I got to a point where I stopped trying to control this thing, which again can be pretty hard for a person of my nature. People like me like to think we can make things happen when and where the way we want to see them happen. Well, this Covid-19 thing is going to do its thing, and we aren’t going to make it go away by telling ourselves that we usually get what we want in this life.

We need to find a way to step back, breathe, do what we can do and roll with these regular punches being dished out. And on the other side... well... I for one really do believe that we’ll get back to work at some stage. Someone told me that they thought that we were “in THE event of our lifetimes”, and I believe that. Business, but not just business, all things will be different when C-19 isn’t such a thing anymore. Out of adversity and challenge can come opportunity and success and many other good things. I believe that. We’ll get back into doing what we love the most, which is getting like-minded people into nature, connecting and challenging themselves together.

Like the rest of the nation (and the world), my time and energy went elsewhere as we attempted to navigate Covid, and it’s many, far-reaching impacts. I spent my time trying to fix stuff, and forgot about myself. I don’t know much, but I know a few things... especially in times of high anxiety and stress, we NEED this shit, we MUST take the time to stop, to get out into nature and do our thing, whatever that thing might be. I also love mountain-biking and golf, but without

a doubt I get the most from running trails. It’s so, so good for me.

I enjoy being by myself (I’m a classic introvert), and trails are the place I go to get my solitude fix, to just be me on the trails, with no agenda except to run. I take my issues onto the trail, and it’s rare that they come back with me. I can also feel my mind de-fragging while I’m out there, bits get filed into the places where they should be, and create space for me to think more effectively when I head back into the world. At the end of the day, for me it’s very basic—I’m a better person when I run regularly. My world becomes balanced and my existence becomes simplified, and I like that!

## **EPISODE FOUR: A LABOR OF LOVE**

“The more frequently CAP ethnographies are published, presented, performed, or installed, the more legitimate they become... CAP ethnographies may indeed be the most valid and desirable representation, for they invite people in and open spaces for thinking about the social that elude us now” (Richardson, 1999, p.661).

Atkinson (2002) refers to the healing nature of sharing personal stories as a form of narrative therapy. The principles of Creative Analytical Practice (CAP) are rooted firmly within an interpretivist paradigm built upon the belief that stories play a fundamental role in shaping the personal and the social (Berbary, 2015; Smith, 2016). Critics highlight the lack of generalisability and the lack of familiarity with the phenomenon/phenomena under investigation (Allen-Collinson, 2016). Allen-Collinson, 2016 challenges these criticisms, noting the manner in which personal narratives can fully capture the richness, vitality, evocativeness and grounded “bodyfulness” of the participant’s story in a way like no other form of qualitative research. The storyteller, as opposed to the storyanalyst, offers an alternative means of extracting the deeper meanings located within all personal narratives (Smith, 2016).

To conclude, CAP ethnography is a post-qualitative methodology for interpretivists and phenomenologists who accept that no individual method, theory, discourse, genre or tradition can ever be presented as being the best way of capturing the lived experience (Richardson and St. Pierre, 2005). Whilst Laurel Richardson is widely credited as being the mother of CAP ethnography, (Connelly and Clandinin, 1990, p.5) were one of the earliest advocates and adopters of the storytelling approach to narrative analysis, suggesting that “the two narratives of participant and researcher become, in part, a shared narrative construction and reconstruction through the inquiry’. Rather than produce an abstract interpretation of the meanings found within our personal narrative, we propose that the story is both analytical and theoretical in its own right (Smith, 2016; Wright, 2019). As a result, we have chosen to take a back seat and let the voice of our entrepreneurial occupational devotee be the first and focal point of the narrative analysis process (Smith, 2016). The more we signpost our own “answers/conclusions”, and/or justify the method adopted to

share this story, the more we risk taking your (the readers) focus away from our active lifestyle entrepreneurs personal experience of COVID-19 (which is the primary focus of the article).

According to Willig Willig (Willig, 2001, p.53), “phenomenological contemplation” focuses on an object or event observed/encountered by the researcher whereas “phenomenological analysis” is solely reliant upon research participant’s description of a past lived experience. Whilst the former requires an element of introspection, the latter requires the researcher to temporarily get inside someone else’s experience (Willig, 2007). CAP effectively allows the researcher to meet both of these requirements at the same time. This final episode focuses upon the lessons learned and the meaning(s) that we have extracted from what has become a true labor of love. The occupational devotee identifies and immerses themselves within the things they desire and the things that they do to make their existence attractive (worth living) (Stebbins, 2009). In other words, devotee work is a form of serious leisure “from which a full or partial livelihood is possible” (Stebbins, 2014a, p.4).

It is during times of fear and failure that individuals are often forced to temporarily down tools and take stock of their past experiences and present-day priorities. Many people use times of crisis and unexpected change to mentally revisit and emotionally reflect upon where they’ve been, where they currently find themselves and, perhaps more importantly, where they’re heading (Gardner, 2009; Rodham et al., 2020). We have employed CAP in an attempt to inspire other (i.e., you, the reader) to establish your own emotional connection with the evocative content provided (Berbary, 2015; Wright, 2019). Ultimately, we choose to focus on one person’s lived experience and utilize a couple of short posts that were also shared via social media. Our findings were never going to be generalisable because that was never our intention. We never started out on this journey with the intention of having to explain/justify or argue the merits and messiness of employing CAP. Our goal was simply to share the story of an active lifestyle entrepreneur caught up in a COVID-19 lockdown. The more we engaged with the serious leisure enthusiast and the method of CAP, however, the more we began to truly love what we were doing. The boundaries between work and play became blurred and we became devoted to sharing this story.

The story that we have shared is expected to resonate with those who found themselves engaging in serious leisure pursuits during a COVID-19 lockdown. We expect it to resonate with small business owners who found themselves feeling lost, angry, alone and/or a little confused by the speed in which their professional world changed (possibly forever). It should strike a chord with those who found themselves having to navigate the practicalities of working from home, whilst also babysitting and/or home schooling their equally lost, angry, frustrated, scared and/or confused children. Finally, we expect that our story will resonate with those who, unlike our active lifestyle entrepreneur, were unable to engage in any serious leisure activities. Moreover, we hope to have targeted your

sociological imagination through a personal narrative that illustrates the impact of unexpectedly finding oneself in a COVID-19 lockdown. We hope to have captured your interest in a subject area that we believe deserves more attention within the sport, leisure and tourism academy. We hope to leave you thinking about more than just how the lockdown affected the individual in our story. We hope that you find yourself thinking about your life in lockdown and how it affected your own levels of occupational devotion.

COVID-19 has provided us all with an opportunity to assess our many socially constructed identities, including those related to our professional roles and responsibilities. Although the full impact of the community lockdowns will not be known, or fully understood, for many years to come, we are all in a position to able to critically assess the immediate impact of the social distancing that was forced upon us in 2020. New Zealand’s response was, when compared to other nations, highly effective. The number of people who died in New Zealand from COVID-19 in 2020 was recorded by the Ministry of Health as being twenty-five (25) (Ministry of Health, 2021). The focus on stopping the spread, however, came at a significant socio-economic cost. Supply chains were broken. Thousands of jobs were lost. Lives and livelihoods were ruined. Non-essential businesses of all sizes were denied the ability to operate for several months and, once open, they were then forced to operate to a restricted capacity. Even after the lockdowns, the closed borders resulted in businesses only being able to target local customers and domestic tourists.

The New Zealand sport, events, tourism/travel and hospitality sectors were amongst the worst hit, despite the financial support packages provided by the government. Award-winning businesses were left searching for innovative ways of generating new revenue streams. Many were forced to target the local community and domestic tourism market for the very first time. Many more were forced to assess the extent to which they are rooted, if not devoted, to their pre-COVID-19 professional identity. In terms of recommendations, our only one relates to the lack of post-qualitative literature looking at occupational devotion within the sport, leisure and tourism sectors. This would appear to be a missed opportunity, considering the large number of owner-operated (family-run) enterprises found within the service sector, not to mention the large number of lifestyle entrepreneurs choosing to blur the boundaries between work and play (Wright and Wiersma, 2019; Jones et al., 2020). With this in mind, we would like to see more occupational devotion-inspired research being undertaken within the fields of sport, leisure and tourism, including the creation of personal narratives and CAP ethnographies (e.g., autoethnographies and ethnodramas).

## DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the authors are not permitted to share

the recordings of the interview conducted with the participant or the transcripts produced. Requests to access the datasets should be directed to richard.wright@aut.ac.nz.

## ETHICS STATEMENT

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

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## AUTHOR CONTRIBUTIONS

RW has overseen the production of this manuscript, which was inspired by the initial findings of a case study and interview conducted by CW. RW has written the majority of it (80%), but RA was brought in to help strengthen Episodes 2 and 4, following the questions and criticisms of one of the reviewers. He has contributed (20%) to the manuscript. Without CW, however, there would be no story. it was her initial engagement with the participant that gave us access and, ultimately, the authority to tell his story.



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# What Will We Do? The Action Plan From a Brazilian Professional Football Club Youth Academy Facing the COVID-19 Pandemic

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In 2020, the world was affected by the COVID-19 pandemic, which remains a major challenge for most countries today. In Brazil, football clubs' youth academies have faced a disruption of their regular activities. In order to study how the learning cultures of a Brazilian professional football club youth academy have been changed, and the alternatives created by the club's staff within this context, this perspective article aims to analyze how they have structured the Under-15 (U15) team learning culture during social isolation due to the COVID-19 pandemic. Through document and thematic analysis on a Brazilian professional football club's youth academy program, we promoted a dialogue between the process of adaptation to remote theoretical-tactical teaching with the learning theory proposed by Hodgkinson and collaborators. The main theme of analysis of this study was the remote structure of the theoretical-tactical learning and physical training. Challenged with the need to transpose face-to-face activities into a learning culture based on remote communication, the U15 team coaching staff created a process to prescribe physical training, and to teach and discuss football tactical issues with young players during the period of social isolation. This perspective article shows that it is possible for sports institutions to create programs for the development of young athletes within the social isolation/distancing context, considering both theoretical-tactical learning and physical training processes. The adaptation to remote environments as structures for the learning culture seems a challenge, but is also a good alternative for young players to develop their interpretation and perception of football theoretical-tactical issues.

**Keywords:** football, COVID-19, action plan, youth academy, sport career, learning cultures, social inclusion

## INTRODUCTION

Since the beginning of 2020, the world has been facing a pandemic caused by COVID-19 (Del Rio and Malani, 2020). In April, 19, 2021, 140.8 million cases and 3 million virus-related deaths have been reported globally (WHO, 2021). As COVID-19 has caused impacts in various fields of society such as health, economics, education, and sport, it can be said that this pandemic represents an

intersection between the natural and social dimensions that surround human life (Badiou, 2020). To face this scenario, quarantine and social distancing have been adopted as strategies to prevent the spread of the virus in several countries (Frahsa et al., 2020; Wilder-Smith and Freedman, 2020), as any meetings, festivals, professional, or youth football games offer a genuine contamination risk (McCloskey et al., 2020).

Worldwide, several sport activities have been impacted due to measures aimed at preventing people agglomerations. Major sports leagues have been disrupted and the Tokyo Olympics have been postponed to 2021 (IOC, 2020), as countries around the world are implementing measures to contain the virus spreading (McCloskey et al., 2020; Pons et al., 2020). Evans et al. (2020) proposed questions about the impact of the pandemic in the sports context, in order to reflect on how the lives of institutions, athletes and other sport participants will be transformed and what new considerations may guide the practice of teaching and training in the future. In addition, the authors sought to elucidate how the pandemic revealed the inequalities of access to and consumption of sport in society, bringing to light the need for social sciences studies on the sport world facing COVID-19, considering cultural, social, and political contexts.

Within the sports scenario, football youth academies consist in very relevant social spaces where young players commonly migrate to invest in a sport career, being away from their families and homes. The joining of a football club youth academy allows young athletes to be immersed in a very specific football culture (Darby et al., 2007; Esson, 2015), reinforcing their dream of developing an elite football career (Bourke, 2003; Agergaard and Ungruhe, 2016; van der Meij and Darby, 2017). A better understanding on how football youth academies work can offer information about the management processes of these institutions, and how they provide protection and guarantee the rights of young players (Yilmaz et al., 2020).

In Brazil, football is a relevant sport, interesting to young players for several reasons, including the belief about the possibility of social mobility (Rial, 2008; Damo, 2014; Marques et al., 2020). Because of this, Brazilian laws regulate the football clubs' youth academies system (Brazil, 2011), which encourage these institutions to be certified by the Brazilian Football Confederation (CBF) when they meet the minimum requirements to offer adequate care to young players. Some of the conditions for obtaining this certification are (a) to ensure that young players are registered for and attending school, and (b) to guarantee health and psychological care for players and their families. When the clubs are certified, they legally acquire the right of priority when signing the first professional contract with the young players.

In Brazilian youth football, competitions are organized according to a state/regional sport federations' management system. These events are divided into several age groups: Under-11 (U11), U13, U15, U17, and U20. In the state of São Paulo, the Paulista Football Federation (FPF) approved the return of professional competitions in July, 2020 (FPF, 2020a). However, most of their youth competitions remained suspended with no date for return, except for the São Paulo Championship U20, which restarted at the end of October, 2020 (FPF, 2020b). Within

this context, the eventual return of activities depends on the epidemiological situation in the region in which the competitions take place (São Paulo, 2020). Consequently, efforts to better understand the effects of the COVID-19 pandemic in the sports field (Giulianotti and Collison, 2020; Mateu and Marques, 2020; Bandyopadhyay, 2021), and especially in grassroots sport (Frahsa et al., 2020; Kelly et al., 2020; Pons et al., 2020) are very relevant.

In the specific case of Brazil, even before the pandemic, the country was already facing political and economic crises that mainly affected the poorest socioeconomic groups. As little is known about the characteristics of COVID-19 transmission in a context of great social inequality (Barreto et al., 2020), the conditions of social vulnerability of a significant part of Brazilian population (Graeff et al., 2019) suggest that dealing with this new disease is a highly complex challenge (Buheji et al., 2020; Mateu and Marques, 2020). In this context, Brazilian federal and state governments have adopted several measures to reduce the spread of COVID-19, which include restrictions on the functioning of schools, universities, places of coexistence, public transportation, and other venues that facilitate the agglomeration of people, such as related to social and sporting events (Oliveira et al., 2020). As a result, the suspension of the in-person activities in youth football academies obligated Brazilian clubs to adapt the ways of training, teaching and learning to remote communication alternatives. Considering that young football players' learning and career development are long term processes, consisting mainly of practical experiences (Barker et al., 2014; Barker-Ruchti and Schubring, 2016), the social isolation related to the COVID-19 pandemic led to structural and relevant modifications on football youth academies' learning cultures.

The concept of learning cultures does not address geographical places (related only to concrete sites), but social and symbolic spaces with imprecise and overlapping boundaries, where people interact, constructing learning processes through interpersonal relations (Hodkinson et al., 2007b, 2008). Although this concept was created based on in-person learning relations, it is also applicable to the remote learning condition, because it also involves similar structures of social relationships among participants. Besides that, learning cultures are constituted by power relations within the culture of a given institution (in this case, a Brazilian professional football club youth academy), its ways of organization, social interaction among club staff and young players, and their dispositions for action (Lee and Price, 2016).

In order to explore and discuss how the learning cultures of a Brazilian professional football club youth academy have been changed and the alternatives created by the club's staff within this context, this perspective article aims to analyze how they have structured the U15 team's learning culture during social isolation due to the COVID-19 pandemic.

To justify this analysis, we believe that a better understanding of a Brazilian professional football club youth academy's remote learning culture, created during social isolation because of the COVID-19 pandemic, can contribute to the body of knowledge and practical actions on several areas, such as sport management, sport pedagogy, sociology of education, sociology of sport, among others, both for immediate and for future interventions.

## METHODS

The investigated Brazilian professional football club youth academy participates in state level championships and has the 'Formative Club Certificate', a quality seal endorsed by the CBF for clubs that offer good conditions for developing young players. The club consists of 125 players aged between 13 and 20 years old, distributed among groups ranging from the U15 to U20. The investigated group (U15) consists of 27 players. In addition, there is a Department of Human Development (DHD) in this institution that offers psychological and social care for players.

After the interruption of training and competitions due to the COVID-19 pandemic, and the returning of young athletes to their family homes (around 50% of players' families live in different towns than the club's headquarters), the club adjusted its procedures and ways of interaction with athletes to remote communication alternatives. At that time, several activities of psychological support from the DHD were proposed for athletes and their families, considering the new social context. In addition to this, the club's coaching staff, together with the head manager of the youth academy, proposed diversified physical and game activities for players training at home.

Within the scenario of sports activities interruption, in the following we present and analyze the learning culture structure of this Brazilian professional football club youth academy U15 team, located in a countryside city in the state of São Paulo. For this, we took as main sources of data the action plan for remote activities created by the club's coaching staff (details about this document are presented in the **Supplementary Material**). To accomplish this task, a documentary analysis method was initially performed (Bowen, 2009; Smith and Sparkes, 2014). Then, data analysis was performed based on the Thematic Analysis method (Braun and Clarke, 2006, 2012, 2019), adopting the following interactive and dynamic procedures (Braun and Clarke, 2019): (a) the researchers became familiar with the data, reading and rereading the plans and reports provided by the club; (b) a first coding proposal based on learning cultures was created from a sociocultural perspective (Hodkinson et al., 2007a, 2008); (c) the data were reviewed and grouped into three main themes; (d) production of results' report.

The article's themes were composed by some analytical categories, such as: (a) remote tactical learning activities; (b) physical conditioning exercises; (c) retrospective analysis on the players' trajectories before joining the club. The three major themes are: (1) Awareness and care; (2) Theoretical-tactical learning and physical training; (3) Career counseling and psychological support (**Figure 1**). Although the construction of the thematic map addresses the three themes, the authors' option for this article was to discuss and present the analysis only from the theme "Theoretical-tactical learning and physical training" and its sub-themes "Pedagogical and contextual adaptations for remote learning on theoretical-tactical aspects of football" and "Physical conditioning exercises." The choice to name it as "theoretical-tactical" is because the situation of teaching and learning was based on a remote interaction, in which it was not possible for young players to practice football, causing

those contents to be approached only on a conceptual and theoretical dimension.

## RESULTS AND DISCUSSION

As the purpose of this article is to analyze how a Brazilian professional football club youth academy staff have structured its U15 team's learning culture during social isolation due to the COVID-19 pandemic, the authors' choice was to present and discuss the action plan related to the Theoretical-tactical learning and physical training.

The U15's action plan and reports provided by the club's coach staff concerns ways to enable the continuity of the teaching specific football topics during COVID-19 pandemic. This document is part of the Training Curriculum of the youth academy, and aims to structure a remote learning culture considering both the social isolation conditions and the young players' sociocultural background, creating specific and particular horizons for learning (Peim and Hodkinson, 2007; Hodkinson et al., 2008) in the pandemic context. Considering that the learning of young players is structured by a dialectical relation between social context and the individual disposition to learn (Hodkinson et al., 2008; Barker-Ruchti et al., 2016), the learning cultures based on the collective construction of knowledge and the sharing of personal perceptions can create an important sense of coexistence and favorable conditions for learning (Hodkinson et al., 2007b), especially during a period of social distancing/isolation (Kelly et al., 2020).

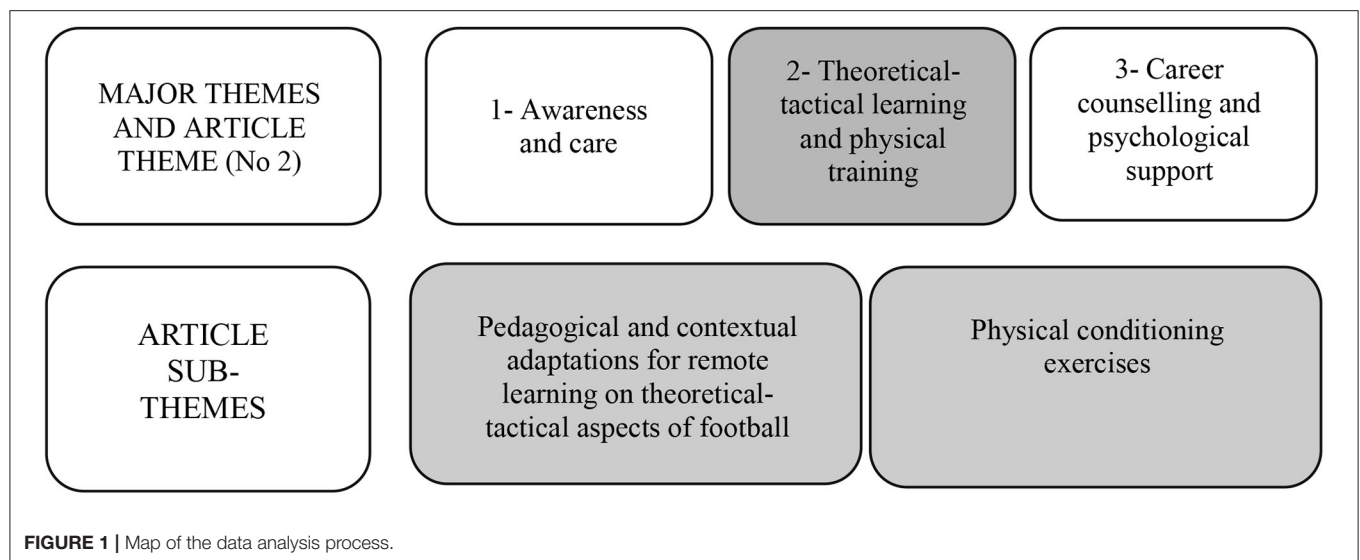
### Pedagogical and Contextual Adaptations for Remote Learning on

#### Theoretical-Tactical Aspects of Football

One of the actions of the analyzed professional football club youth academy was to provide access to digital means for remote communication between young players and the club's coach staff. As a first step, a group was created on an instant messaging platform, whereby young players could interact with their teammates, coach staff, and the DHD. This creation of a remote space altered the learning culture shared by these social agents. Therefore, one aspect highlighted in the club's "Training Curriculum" is to enable an environment in which young players can express their own understandings about theoretical-tactical issues. Although in-person and face-to-face training sessions are not possible during the pandemic social isolation, the remote learning culture contributed to young players present and discuss their ideas about football theoretical-tactical issues with teammates and coaching staff. Furthermore, considering that each interaction among agents provides transformations on the learning cultures (Hodkinson et al., 2008; Barker-Ruchti et al., 2016), it is also possible that the learning processes have changed and became different during the young players interactions with digital media.

Adding to this, before the U15 coach staff started the remote activities with young players, the DHD did adjustments on the activities to be proposed, according to the socioeconomic and sociocultural conditions that young players have had





in their homes. In line with concerns regarding not only football development, but also the athletes' living conditions and guarantee of basic rights, the club supported athletes who were in a situation of social vulnerability. This work involved the specialized attention of psychological and social service cares from the DHD, being close to the young athletes that demanded special attention (such as anxiety situations and financial or social distresses due to the context of pandemic and its limitations on conviviality). In this sense, multidisciplinary work among educators, managers, coaches, physiotherapists, psychologists, and social assistants was fundamental for the creation of a remote learning culture that could offer institutional support and suitable remote learning conditions.

The support from the DHD was decisive for the coach staff planning the theoretical-tactical learning activities. Not all young players have had good access to the internet and to technological devices. Therefore, activities that depended on the players watching long lasting football game videos for theoretical-tactical reflection and collective discussion were not easily available for every player. Taking this information into account, some activities were adapted by the coach staff. As an example, young players had to read the information in the text messages shared into the group, and based on this they should draw, explain, and produce texts about the theoretical-tactical issues that have been trained before the pandemic. The main concern on this activities' adaptation was to vary the teaching and learning methods, in addition to diversifying the materials for the fulfillment of tasks, seeking to reduce the inequality of internet access among young players.

Within this process, activities proposed for the theoretical-tactical learning were based on pre-pandemic lived situations during training and matches sessions. Based on videos and literature sent by coach staff, players studied and answered questionnaires related to tactical issues. Then, in remote meetings among players and coaches, theoretical tactical topics were

discussed and analyzed in-depth (the **Supplementary Material** presents examples of activities and their aims).

### Physical Conditioning Exercises

Brazil is a country in a socioeconomic development process with a high level of social inequality (Graeff et al., 2019). It produces a scenario where several young players have difficulties of access to means of remote communication, creating some barriers for the engagement with physical exercise and maintenance of fitness in social isolation/distancing situation. While some social groups may devote more time to maintaining their physical fitness and conditioning, using better materials, exercises, and nutrition, others do not have the same opportunities (Mateu and Marques, 2020). For those young players who did not have the structural or contextual conditions to perform the planned training at home, as the difficulty of accessing information through technological devices because of social vulnerability and specific familial dynamics, there was an alternative plan which was based on exercises that could be done in a more limited space and with a lack of material resources (such as squats, push-ups, burpees, and resisted exercises utilizing body weight).

### PREPARING FOR THE FUTURE: CONCLUSIONS, LEARNING CULTURE PRACTICAL IMPLICATIONS, AND THE YOUTH ACADEMY FUTURE IN THE POST-PANDEMIC SCENARIO

The aim of this article was to analyze how a Brazilian professional football club youth academy staff have structured the U15 team learning culture during social isolation due to the COVID-19 pandemic. According to this, we presented how interventions and interactions between the club's staff and young players were planned and adapted into a specific learning culture during the

social distancing period.

Faced with the need to transpose in-person activities into remote communication, the club's coaching staff involved with the U15 team was obligated to plan and create a favorable environment to social interaction among all athletes. The work developed with the U15 football players through interactive meetings with coaches, and also the DHD interventions, offered an in-depth understanding about what were the conditions that each player was living at their homes during pandemic social isolation. In parallel to the perspective of learning as a cultural practice in the sports context, it is evident that the social structure offered by the club was strongly related to the practices performed before the pandemic. The remote activities sought to reconstruct the club's learning culture, but still shared a very close interaction among players and coach staff.

Important problems caused by the COVID-19 pandemic are related to the social isolation, and consequently the transformation of the learning culture of this club from in-person relations to a remote environment. This seems to be one of the biggest challenges imposed over sports institutions during the pandemic context. However, such factors may present themselves as an opportunity for clubs to reflect on their teaching/training practices and investigate socioeconomic and sociocultural conditions lived by young players. A better understanding of contextual factors can help with the adaptation of teaching/training and support the expansion of the remote learning cultures possibilities by sport institutions.

This perspective article shows that it is possible for sports clubs to create programs for the development of young athletes within the social isolation/distancing context, considering both theoretical-tactical learning and physical training processes. The adaptation to remote environments as structures for the learning culture seems a challenge, but is also a good alternative for young players developing their interpretation and perception of football theoretical-tactical issues. The possibility of creating a remote environment meets the need for social distancing imposed by the COVID-19, besides favoring new

technologies that can be used as a teaching tool even in a post-pandemic world.

The contribution of this work is specially related to the presentation of an adaptation process from a Brazilian professional football club youth academy to the conditions imposed by social distancing due the COVID-19 pandemic. However, it can also be considered as a first step for future studies on applications of remote activities to young players' training programs. It seems relevant that future research should focus on exploring the perspective of the social agents involved in sport programs, with special attention to young players.

## 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.

## AUTHOR CONTRIBUTIONS

MM, AK, and RM: study design. BG and PM: critical friend. MM, AK, PM, BG, and RM: manuscript preparation. 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/fspor.2021.589459/full#supplementary-material>

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**Conflict of Interest:** MM and AK are staff members of the club that was analysed in this case report. MM is coach of U15 team and AK is chief psychologist of the Department of Human Development.

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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