



# Effects of School Closures Resulting From COVID-19 in Autistic and Neurotypical Children

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The purpose of this study was to assess differences in negative consequences resulting from pandemic-related school closures between autistic and neurotypical children. We predicted that more negative consequences overall would be reported for children with autism compared to neurotypical children. We also expected to observe differences in the types of stressors reported between these two groups, with disruptions to daily routines more commonly reported for children with autism and stress due to social isolation more commonly reported for neurotypical children. Participants were parents of school-aged children, ages of 4–15 years old, who responded to an online survey (N = 250). Parental perspectives were collected using the Covid-19 Adolescent Symptom and Psychological Experience Questionnaire (CASPE). Parents in the autism group were additionally asked to respond to a survey about autism-specific stressors which may have increased during the pandemic, such as behavioral concerns, therapy disruptions, and hygiene issues. The majority of the respondents (65%) were parents of children with autism and 35% were parents of neurotypical children. Parents of autistic children were more likely to report that their child was negatively affected by routine changes, whereas parents of neurotypical children were more likely to report that their child was affected by social isolation. Overall, parents of children with autism were more than three times as likely to report negative changes in their child compared to parents of neurotypical children. When asked about autism-specific stressors, parents of autistic children reported concerns related to hygiene, behavioral regression, therapy disruption, meltdowns, and returning to school. The effects of the COVID-19 pandemic and prolonged school closures have disrupted the lives of children. Our results indicate that children with autism are at greater risk for negative outcomes due to emergency-related school disruptions. These findings have implications for educational planning for this vulnerable population for future public health crises.

**Keywords:** autism spectrum disorder (ASD), COVID-19, children with special needs, mental health, school closure, neurotypical children, parents perspective

## OPEN ACCESS

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### Specialty section:

This article was submitted to  
Special Educational Needs,  
a section of the journal  
Frontiers in Education

**Received:** 19 August 2021

**Accepted:** 01 November 2021

**Published:** 23 November 2021

### Citation:

Genova HM, Arora A and Botticello AL  
(2021) Effects of School Closures  
Resulting From COVID-19 in Autistic  
and Neurotypical Children.  
Front. Educ. 6:761485.  
doi: 10.3389/feduc.2021.761485

## INTRODUCTION

In order to curb the spread of coronavirus disease 2019 (COVID-19), schools closed across the United States in the spring of 2020. This large-scale shutdown of in-person school services led to disruptions to the education, socialization, and emotional health for children (Cachón-Zagalaz et al., 2020; Cost et al., 2021), and increased stress among parents and caregivers (Calvano et al., 2021;

Cameron et al., 2020; Thorell et al., 2011). Although most school-aged children were affected by this pandemic, children with autism were likely to have experienced unique challenges and stressors relative to neurotypical peers. Studies from Europe and Chile found that parents of children with autism reported an increase in behavioral problems such as aggression, hyperactivity, oversensitivity, and deteriorated communication skills during the pandemic (Colizzi et al., 2020; Mutluer et al., 2020; Nuñez et al., 2021). Additionally, emerging evidence indicated that there have been disruptions of in-school special education services, speech and language therapy, physical and occupational therapy, and applied behavioral analysis, particularly for younger children, due to the pandemic (White et al., 2021).

To date, few empirical studies have investigated the experiences of children with autism in the United States during the COVID-19 pandemic. The Simons Powering Autism Research for Knowledge (SPARK; a national online autism research cohort) leveraged their large database of children with autism to collect information on COVID-19 experiences from a sample of over 3,500 autistic children (White et al., 2021). The study found that most children experienced disruption to therapies, and their caregivers reported worsening of autism symptoms and moderate family distress. Although the insights from these data are exceptionally valuable, the findings from this investigation were limited by the lack of a comparison group of neurotypical peers. Understanding the unique impact of the school closures pandemic on children with autism in the United States is needed to guide future educational and therapeutic interventions for those who may have been traumatized by the pandemic and/or left with long-lasting negative mental health and education outcomes. The current study attempted to identify stressors unique to school age children with autism compared to neurotypical peers.

One characteristic of autism which may pose unique challenges for these children during the pandemic is a preference for sameness and routines (American Psychiatric Association, 2013). Insistence on sameness may cause stress when demands outside of the “typical” routine are made abruptly (Wigham et al., 2015). Indeed, studies have shown that disruptions to routines and insistence on sameness were associated with a number of down-stream effects including increased behavioral outbursts, generalized anxiety, and aggression in children with autism and increased stress in their parents (Baribeau et al., 2021; Bearss et al., 2016; Bull et al., 2015; Kanne & Mazurek, 2011; Reese et al., 2005). In the case of the pandemic, parents have reported increased stress among their children with autism spectrum disorder (ASD) due to changes in life associated with the pandemic (Amorim et al., 2020; Colizzi et al., 2020; Alhuzimi, 2021). Another characteristic of children with autism that may have been experienced differently compared to neurotypical children is difficulty with socialization (American Psychiatric Association, 2013). Whereas social isolation may increase feelings of loneliness and distress in neurotypical children, fewer daily interactions with peers may have decreased the social-related anxiety that is common among those with autism.

In this investigation, we asked parents of school-aged children—autistic and neurotypical—to report their perceptions of their own and their children’s stress levels related to the COVID-19 pandemic related school closures. We predicted increased negative emotions in the children with autism, as reported by their parents, as well as more negative emotions in the parents of children with autism. We examine how perceptions of stressors may have differed between these two groups. We predicted that parents of children with autism would report that their children were more stressed due to disruptions in daily routines. In comparison, we expected parents of neurotypical peers to report more stress associated with social isolation. As many existing measures of stress due to the COVID-19 pandemic were not designed for parents of children with autism, we also asked parents of autistic children about stressors which may be specific to this population, including disruption to therapy, special education, hygiene, behavioral regression, and meltdowns.

## METHODS

**Data collection:** This cross-sectional investigation collected data using a self-administered survey via Research Electronic Data Capture (REDCap) (Harris et al., 2009). Participants were recruited through outreach to community groups and social media between May and August 2020. The study eligibility criteria included: 1) the respondent was the parent or guardian of a school-age child between the ages of 4–15 years; 2) the respondent was age 18 years or older; 3) the child of the respondent had a diagnosis of autism (for the autism group); 4) the respondent resided with the child; 5) the child was enrolled in formal schooling (i.e. not homeschooled by parent); and 5) the child had no history of a special needs diagnosis other than autism, such as Down Syndrome, Oppositional Defiant Disorder, Schizophrenia, Major Depressive Disorder, Bipolar Disorder, or Traumatic Brain Injury (for either the autism or neurotypical group). Parents with multiple children were asked to choose one child about whom they wanted to answer questions, and were told to focus on only that child during responding. Respondents who successfully screened into the study provided informed consent online. The completion of the survey was incentivized with a chance to win a \$100 gift card. All procedures were approved by the Institutional Review Board (IRB).

**Sample:** The survey received  $n = 346$  initial responses. Cases were excluded if the parent reported on a child outside the age range of 4–15 years ( $n = 32$ ) and if the respondent did not complete the survey or skipped important questions related to their autism diagnosis ( $n = 64$ ). This yielded a final sample of  $n = 250$  for analysis.

## Measures

**Child and parent demographic characteristics** were measured using standard survey measures. Race/ethnicity was measured for

both the parent and the child by six categories: non-Hispanic White, non-Hispanic Black, Hispanic, Asian, Native American, and Other. The majority of the survey respondents identified as non-Hispanic White, with low frequencies of respondents in the other categories. For this reason, this variable was dichotomized as racial/ethnic minority (yes or no) for both the parents and the child measure. Similarly, the current marital status captured parent responses for married/cohabitating, divorced/separated, widowed, and single. The majority of the respondents reported being married with low response frequencies in the other categories. Therefore, parent marital status was dichotomized in all analysis as married/cohabitating with partner versus single parent.

**Psychological Experiences of Pandemic in Children** were measured using *Covid-19 Adolescent Symptom and Psychological Experience Questionnaire (CASPE)* (Ladouceur, 2020), which was developed to examine the psychosocial impact of the COVID-19 Pandemic on children. This questionnaire was selected as it was provided by the NIH-supported survey platform “NIH Public Health Emergency and Disaster Research Response (DR2)”. DR2 was developed specifically to facilitate data integration and collaboration through the use of common data elements. We selected several items from the CASPE related to emotional and social experiences to evaluate the study hypotheses. CASPE questions were modified to assess parent’s during the “peak” pandemic period in their geographic area (as opposed to questions phrased to examine perceptions “in the last week”) to account for differences in the timing of pandemic-related stay-at-home orders and virus hotspots that emerged across the United States in the Spring of 2020.

Parents were asked on a scale of 1–5 (1 = “not at all”, 3 = “somewhat”; and 5 = “a great deal”), how much the COVID-19 outbreak affected their child in a 1) negative way and 2) positive way. Further, parents were asked how involved they were in assisting their child with school work on a scale of 1–5 (1 = “not at all involved”, 3 = “moderately involved”, 5 = “extremely involved”). Due to skewed distributions of these 3 items (negative changes, positive changes, and parents involved in schoolwork), we collapsed the responses to create binary variables where reports of “a great deal/extremely involved” or “a lot/slightly involved” were coded as “1” (a great deal) and the other response options were coded “0” (not at all).

Parents were asked how stressful uncertainty was for their child and how stressful disruptions were for their child on a likert scale of 1–5 (1 = “very slightly or not at all”; 3 = “moderately”; and 5 = “extremely”). Parents were also asked how worried their child was that a family member would become sick using the same rating scale. For these items (stress due to uncertainty, stress due to disruptions and worry due to family sickness), higher scores indicated higher stress.

Parents were asked about emotions and feelings of their children and themselves. Parents were asked to endorse whether they observed a range of emotions in their child on a scale of 1–5 (1 = “very slightly or not at all”, 3 = “moderately”, 5 = “extremely”). Emotions were broken down into 5 positive

emotions (e.g., happy, calm, appreciative) and 14 negative emotions (e.g., anxious, afraid, lonely). Total scores were calculate for all the positive emotions combined and the negative emotions combined for the parent and the child.

*Autism specific stressors* were assessed among the parents of children with autism by a series of questions devised to examine a series of autism-specific behaviors observed by caregivers, such as sensory and stimming issues. To address the rapidly evolving and shifting circumstances of the pandemic in the Spring of 2020, the questionnaire content was devised based on feedback from clinicians, special education teachers and parents of children with autism about their experiences. Parents were asked to rate how much they agreed or disagreed with statements regarding to how the pandemic affected their children on a scale of 1–5 (Strongly Disagree; Disagree; Neither Agree nor Disagree; Agree; Strongly Agree). We asked parents to report the following issues: 1. My child has been having more toileting issues (accidents, bed wetting), 2. My child is having more melt-downs (tantrums) than usual, 3. My child’s therapies have been reduced/disrupted, 4. My child is doing more stimming (repetitive movements or sounds) behaviors, 5. My child is having more sensory issues, 6. My child is more aggressive with family members in the household, 7. My child’s behavior is regressing, 8. My child will be less prepared to return to school in the fall than classmates, 9. My child is falling behind in school work, and 10. My child is left out of virtual social situations. For the current study, we collapsed the responses to create binary variables where reports of either “Agree” or “Strongly Agree” were coded as “1” (parents experienced these concerns) and the other response options were coded “0” (parents did not/slightly experienced these concerns).

## Analysis

The study sample and patterns in COVID-19-related experiences were described using frequencies and percentages for categorical variables and means and standard deviations for continuous variables. Bivariate tests for group differences between autistic and neurotypical children were based on chi-square tests or independent sample t-tests, as appropriate. Logistic regression models with robust standard errors were used to estimate the differences in the odds of reporting negative changes between children with autism compared to neurotypical peers. A multivariate framework was used to adjust the model for key covariates based on a value of  $p$ -value of  $<0.05$  in the bivariate tests. The Bayesian Information Criteria (BIC) was used to assess model fit between the unadjusted and adjusted logistic regression models.

## RESULTS

### Sample Characteristics

The characteristics of this sample and bivariate differences between the autism and neurotypical groups are summarized on **Table 1**. Parents reported on school-age children between 4

**TABLE 1** | ample characteristics by Child Autism Spectrum Disorder (ASD) and Neurotypical status [Mean (SD) or n (%)].

	Total N = 250	Autism N = 162	Nt N = 88	p
<i>Child Characteristics</i>				
Age (years)	8.73 (3.30)	8.80 (3.37)	8.59 (3.18)	0.629
Male (versus female) (%)	181 (72.4)	123 (75.93)	58 (65.91)	0.091
Racial/ethnic minority (versus non-Hispanic White) (%)‡	60 (24.49)	47 (29.75)	13 (14.94)	0.010
<i>Grade</i>				
Pre-K or Kindergarten	67 (26.91)	46 (28.57)	21 (23.86)	
1st through 8th grade	159 (63.86)	100 (62.11)	59 (67.05)	
High school	23 (9.24)	15 (9.32)	8 (9.09)	0.709
Receiving IEP/504 (%)	163 (65.20)	147 (90.74)	16 (18.18)	0.000
<i>Parent Characteristics</i>				
Age (years)	40.38 (6.98)	39.70 (7.18)	41.64 (6.43)	0.036
Female (%)	229 (91.60)	145 (89.51)	84 (95.45)	0.105
Racial/ethnic minority (%) ‡	46 (18.70)	39 (24.53)	7 (8.05)	0.002
Married (%) ‡	214 (85.60)	138 (85.19)	76 (86.36)	0.800
College degree (%)	167 (66.80)	92 (56.79)	75 (85.23)	0.000
Working (%)	156 (62.40)	90 (55.56)	66 (75.00)	0.002
Parent stress (total)	10.64 (6.14)	12.01 (6.44)	8.11 (4.62)	
<i>Household Characteristics (%)</i>				
Household Income less than \$50,000 per year (%)‡	40 (16.81)	38 (25.00)	2 (2.33)	0.000
<i>Region (%)</i>				
Northeast	151 (60.40)	87 (53.70)	64 (72.73)	
Midwest	32 (12.80)	20 (12.35)	12 (13.64)	
South	26 (10.40)	22 (13.58)	4 (4.55)	
West	41 (16.40)	33 (20.37)	8 (9.09)	0.006
<i>Residential area type (%)</i>				
Large City	38 (15.20)	29 (17.90)	9 (10.23)	
Suburbs of a Large City	92 (36.80)	54 (33.33)	38 (43.18)	
Small City	33 (13.20)	25 (15.43)	8 (9.09)	
Town or Village	70 (28.00)	43 (26.54)	27 (30.68)	
Rural Area	17 (6.80)	11 (6.80)	88 (35.20)	0.215

and 15 years of age, and the average of children represented in this sample was 8.7 years (SD = 3.29 years). The majority of children were male, non-Hispanic White, and attending primary school (i.e., grades pre-K through eight) during the Spring of 2020. Fewer racial and ethnicity minority children were represented in the neurotypical group compared to the autism group (14.94 versus 29.75%,  $X^2 = 6.6496$ ,  $df = 1$ ,  $p = 0.010$ ) and the vast majority of children with autism were receiving special education services through an IEP or 504 plan compared to neurotypical children (90.74 versus 18.18%,  $X^2 = 132.32$ ,  $df = 1$ ,  $p = 0.000$ ).

The parent respondents ranged in age from 22 to 69 years old, with an average age of 40 (SD = 6.98), and were predominantly female, non-Hispanic White, married, college educated, and employed. Parents of children with autism were more likely to be from a racial and ethnic minority group, unemployed, and have less than a college degree compared to parents of the neurotypical children in this sample. Although only a small proportion of the sample were from low-income households (16.81%), people of lower socioeconomic status were disproportionately represented among the autism group compared to the neurotypical group ( $X^2 = 20.20$ ,  $df = 1$ ,  $p = 0.000$ ). An analysis of the autism subgroup only yielded that the majority of these children (78.75%) were attending mainstream public, private, or parochial schools in the Spring of

2020 and a relatively smaller portion were attending special education schools (21.25%).

## Bivariate Differences in COVID-19-Related Stressors

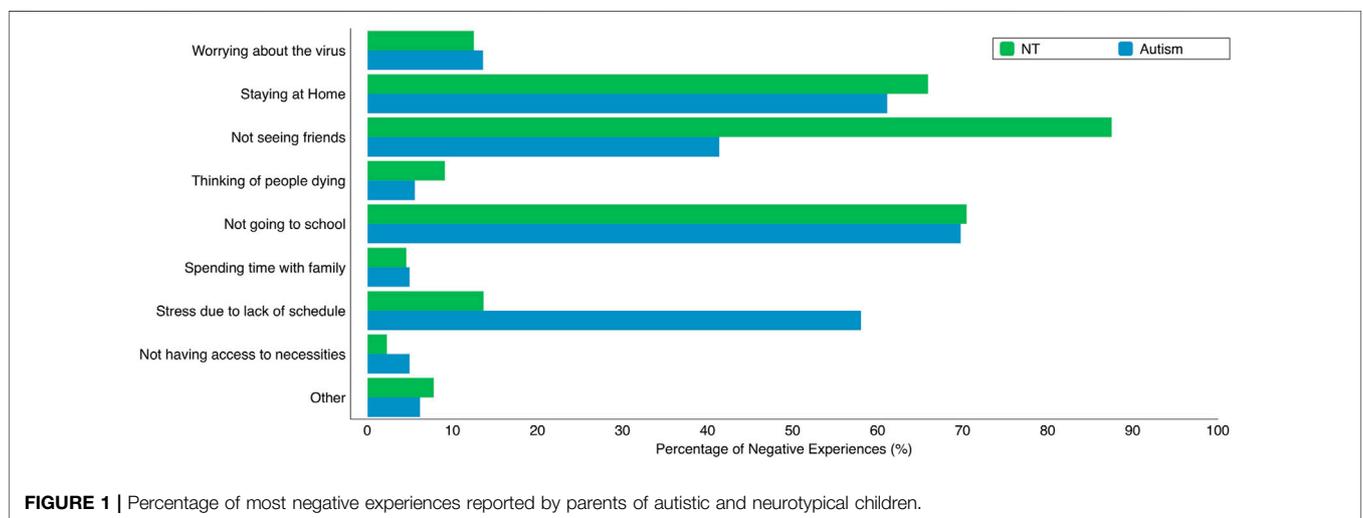
The CASPE assessed overall parental observations related to the COVID-19 pandemic and its impact on the day-to-day life of their child (see **Table 2**). The parents of autistic children reported greater negative changes in their child compared to the parents of neurotypical peers (50 vs 23.86%,  $X^2 = 16.13$ ,  $p < 0.001$ ). Parents of children with autism also reported more positive changes in their children compared to the parents of neurotypical (18.52 vs 9.09%,  $X^2 = 3.93$ ,  $p = 0.047$ ). Overall, parents of autistic children reported that they were more involved with their children's schoolwork compared to neurotypical peers (79.63 versus 60.23%,  $X^2 = 10.84$ ,  $p < 0.001$ ).

CASPE also assessed parents' perceptions of their children's emotional impact caused by the uncertainty and disruption due to the pandemic (**Table 2**). Parents of autistic children perceived that uncertainty ( $3.18 \pm 1.31$  versus  $2.78 \pm 1.12$ ,  $p < 0.01$ ) and disruption ( $3.41 \pm 1.21$  versus  $2.93 \pm 1.01$ ,  $p = 0.002$ ) due to pandemic were more stressful for their child compared to the neurotypical children. When directly asked about the perception of their child and their concern regarding someone in the

**TABLE 2** | Consequence of pandemic reported by parents of autistic and neurotypical children [Mean (SD) or n (%)].

	Total N = 250	Autism N = 162	Nt N = 88	p
A great deal of negative changes (vs not at all) (%)	102 (40.80)	81 (50.00)	21 (23.86)	0.000
A great deal of positive changes (vs not at all) (%)	38 (15.20)	30 (18.52)	8 (9.09)	0.047
Parents involved a great deal in schoolwork (vs not at all) (%)	182 (72.80)	129 (79.63)	53 (60.23)	0.001
How stressful was uncertainty for your child?	3.04 (1.27)	3.18 (1.31)	2.78 (1.12)	0.018
How stressful were disruptions for your child?	3.24 (1.17)	3.41 (1.21)	2.93 (1.01)	0.002
How worried was your child someone would become sick?	2.32 (1.30)	2.33 (1.41)	2.32 (1.07)	0.959
Child's negative emotions	35.27 (11.90)	37.33 (12.07)	31.48 (10.63)	0.002
Child's positive emotions	17.29 (3.75)	17.65 (3.71)	16.64 (3.76)	0.040
Parent's negative emotions	40.76 (11.11)	41.73 (11.52)	38.97 (10.14)	0.060
Parent's positive emotions	17.32 (3.60)	17.57 (3.59)	16.86 (3.60)	0.137

Bivariate group differences were tested using Pearson's  $\chi^2$ -test for categorical data and independent samples t-tests for continuous measures. †N varies slightly due to missing data; ‡parents responded their child was not in school.



**FIGURE 1** | Percentage of most negative experiences reported by parents of autistic and neurotypical children.

household or extended family might become sick, the worries of both the autistic and neurotypical peers were comparable ( $p = 0.959$ ).

The parents of children with autism reported a higher total of negative emotions for their child on average compared to parents of neurotypical children ( $37.33 \pm 12.07$  vs  $31.48 \pm 10.63$ ,  $p = 0.002$ ). The parents of autistic children also reported marginally more positive emotions (e.g., feeling relaxed, hopeful, confident about the future) compared to the neurotypical children ( $17.65 \pm 3.71$  vs  $16.64 \pm 3.76$ ,  $p = 0.04$ ). There were no differences between the two groups in terms of the negative emotions ( $41.73 \pm 11.52$  vs  $38.97 \pm 10.14$ ,  $p = 0.06$ ) or positive emotions ( $17.57 \pm 3.59$  vs  $16.86 \pm 3.60$ ,  $p = 0.137$ ) reported for the parents themselves.

### Most Frequent Stressors Reported in Each Group

Parents were asked to select the top three most negative experiences of the pandemic from a list of nine choices (see **Figure 1**). Consistent with our hypotheses, results indicated that not seeing friends was the most frequently selected concern for the parents of neurotypical children, but stress related to schedule

disruption was the most significant concern for children with autism. We observed comparable distributions across the other stressors (worrying about the virus, access to necessities).

### Autism-specific Behavioral Concerns

Autism-specific behavioral concerns were assessed based on the series of questions answered by the parents of children with autism. In this group, 25.98% of parents reported experiencing concerns about toileting issues, as well as “meltdowns” (61.59%) and therapies having been disrupted (78.63%). Parents reported an increase in stimming behavior (65.65%), sensory issues (65.67%), and being aggressive with the family members (46.32%). They showed concern that their autistic children were regressing behaviorally (62.77%). They expressed that their children are less prepared to return to school (57.35%), falling behind in school (48.53%), and experienced being left out of virtual social situation (54.33%).

### Differences in Overall Negative Changes

**Table 3** presents the results of the logistic regression models estimating the differences between children with autism and

**TABLE 3** | Logistic regression predicting differences in parent report of overall negative changes between autistic and neurotypical children.

	Model 1			
	OR	95% CI	OR	95% CI
Child characteristics				
Autism (versus neurotypical)	3.19	[1.79–5.69]	3.60	[1.32–9.83]
Minority (versus non-Hispanic white)			0.78	[0.37–1.63]
Receiving IEP or 504 plan (versus none)			0.37	[0.14–1.00]
Number of behavioral concerns			1.16	[1.09–1.22]
Parent Characteristics				
Age (years)			1.05	[1.00–1.11]
College graduate (versus not)			0.69	[0.32–1.50]
Employed (versus not)			0.35	[0.18–0.66]
Household income <\$50,000 (versus \$50,000 or more)			1.31	[0.54–3.19]
Model Statistics				
Bayesian Information Criterion	–11.25		–20.1	
$\Delta$ in BIC compared to Model 1			–8.86	

neurotypical peers in the odds of parent reported of negative changes during the initial peak of the COVID-19 related school closures net of key covariates. Model 1 indicates that parents of children with autism were more than three times as likely to report that their child experienced negative changes compared to the parents of neurotypical children. The estimate of this gap increased slightly (OR = 3.6, 95% CI [1.32–9.83]) after adjusting for differences in the children’s racial and ethnic minority backgrounds, receipt of special education services, the number of behavioral concerns noted by parents, and parent age and socioeconomic status (Model 2).

## DISCUSSION

While the COVID-19 pandemic has affected school children world-wide, in the current investigation we examined the unique experience of children with autism in the United States. During this ongoing and evolving public health crisis, several studies and commentaries have suggested that the long-term school closures and abrupt transition to virtual learning may have had disproportionate, adverse effects on children with special needs (Bellomo et al., 2020; Lim et al., 2020; White et al., 2021). To date, few empirical studies in the United States have quantified the adverse effects of educational disruptive and to our knowledge, few have compared the experiences of autistic children relative neurotypical peers. The findings from this investigation are aligned with reports from other countries (Colizzi et al., 2020; Mutluer et al., 2020; Nuñez et al., 2021) that have suggested that the overall negative experiences were high across all participants, parents of children with autism reported more overall negative consequences among their children relative to the parents of their neurotypical peers.

Routine disruption appeared to be among the biggest stressors of the children of autism, compared to neurotypical peers. It is possible that this stress led to other challenges during the pandemic. In addition, we found that certain behaviors which are often observed in autism (“meltdowns”, sensory issues,

stimming behaviors) were reported to increase during the pandemic. These behaviors may have represented coping mechanisms to deal with the anxiety produced by the disruption change. Follow-up research is needed to track these behavioral changes and increased anxiety in children with autism to see whether they will disappear with time, or whether intervention is needed to reduce anxiety.

We predicted that children with autism were going to experience less stress associated with social isolation from friends compared to neurotypical peers. This prediction was supported by our data. While the greatest stressor in the neurotypical group was isolation from friends, it was much less of a stressor for children with autism. Interestingly, parents of autistic children reported that their children were being left out of virtual social experiences. That is, while neurotypical children may have been compensating lack of socialization in school with virtual experiences, autistic children may have experienced this coping strategy less. What needs to be examined in the future is whether the “break” from socialization may have long-term detrimental effects on mental health and social functioning in autistic children (as has been the case for neurotypical children (Loades et al., 2020)), or whether this is less of a concern for autistic youth as they were less distressed by social isolation.

One accommodation made during the pandemic was on-line delivery of education, medical treatment and therapy. Telemedicine and tele-education delivery that was used out of necessity may continue to be used beyond the pandemic as many have found it to be a suitable and highly accepted replacement for in-person services (Holtz, 2021; Tenforde et al., 2020). While some have argued that virtual services are appropriate for those with autism (Ameis et al., 2020; Lindgren et al., 2016), our findings suggest that this may not be the case. Our studies indicated that parents of children with autism felt that therapeutic and educational goals were not being met in a virtual setting, and a concern that their children would have difficulty in keeping up with schoolwork once schools reopened. Research is emerging about the negative impact of school closures on children in general (Tomasik et al., 2020); that it may have led

to significant learning loss and later on in life may have several cascading effects such as lower academic attainment, lower rates of employment, lower earnings and higher crime rates. Children with autism who participated less in virtual schooling may be at even greater risk of these negative outcomes. Future mitigation of the long-term effects of this pandemic for this population is essential.

We examined the factors that predict the negative experiences in the children with autism and neurotypical peers during the initial phase of the COVID-19 related school closures. Parents of children with autism reported more than three times that their children were likely to experience negative changes compared to their neurotypical peers. When adjusted for the differences in children's race and ethnic background, special education services, behavioral concerns, and parents' socioeconomic status the predictive gap for negative changes slightly increased. There is evidence to suggest that parents' own traumatic experiences appear to influence the assessment of their autistic child's negative experience (Kassam-Adams et al., 2006).

One unexpected finding was that parents of children on the autism spectrum reported greater positive emotions in their children during the pandemic compared to parents of neurotypical children. This finding was interesting in light of findings that indicated greater negative changes. The greater positive emotions may be explained by greater heterogeneity of emotions in the autism children. It may also be explained by the findings that the social isolation represented a welcome respite from social demands placed on children with autism during the pandemic, as well as the opportunity to stay home with family members. However, it is unclear why greater positive emotions were experienced by the autism group, but that may be an interesting avenue of research in the future.

This study has several acknowledged limitations. For one, we asked parents of children, but we did not collect the children's perspectives themselves. Studies where autistic adults were asked to report on their own perspective suggested that autistic adults reported lower stress levels during the pandemic (Lugo-Marín et al., 2021) whereas parents and caregivers have reported an increase in stress levels in comparison to pre lockdown. Again, this reduction in stress levels may be due to lower social interaction demands due to social distancing. It is difficult to extrapolate the experience of autistic adults to autistic children as their life demands can greatly differ, but future research tracking changes post-pandemic would benefit from collecting perspectives of children themselves. An obvious advantage to this would be that the data would not be influenced by parental bias, as parents and caregivers were experiencing their own unique stressors (social isolation, lack of respite care, fear of COVID-19 infection, employment changes) that may have influenced their perspectives. Second, the representative sample has population bias due to online recruitment during the lockdown. The sample represents the people with access to the internet and social media and may underrepresent the people with lower socioeconomic status. This bias may have resulted in an underestimation of effects. Further, because we recruited participants online, we were not able to verify their diagnosis with medical records, or standardized measures such as the

Autism Diagnostic Observation Schedule. However, we eliminated anyone who failed to complete the survey, or skipped important questions related to their diagnosis. Finally, while we chose a measure promoted by the NIH (CASPE) to examine the effects of the pandemic, the CASPE does not yet have psychometric data available for our population. Additionally, we created a measure to examine autism-specific stressors, and thus no psychometric data exist for that either. However, while a limitation, these measures were the best tools available to us to examine an ongoing and constantly evolving public health care crisis. Further, the insights from our findings are relevant for supporting potential intervention criteria for individuals with autism. The findings will be relevant to focus on the needs of autistic children and future research since we have to bear the long terms ramification of the pandemic and the probability of other public health crises.

## Recommendations for the Future

The results collected in the current study, combined with existing literature allow for the creation of recommendations for clinicians and service-providers. First, on-line delivery of services appears to be less appropriate for children with autism, especially younger children. While providers may find that tele-medicine is more convenient, and may reduce financial resources for their practice, children with autism may benefit less from these services than what would be expected from neurotypical peers. Similarly, many education systems are now considering that virtual school may represent a way for schools to remain open in the case of future health emergencies or even in situations such as inclement weather (i.e. snow-days; hurricanes). While tele-education is a convenient way to reduce lost school days, those school days may be lost to autistic children who cannot attend in an online format. If tele-education becomes the norm in the future, this represents an unfair and inappropriate learning environment for children with autism. One potential is offering children with autism additional time to "make-up" what they lose during an online school day once they are physically in school again.

While returning to school and socialization may represent a panacea for neurotypical children, it is possible that children with autism may have significant needs resulting from the pandemic that must be examined. For example, educational losses (due to inability to attend to an online format), must be directly addressed in order for children with autism to "catch-up" to their peers. It would be unacceptable for an entire generation of autistic children to continue to struggle with educational goals compared to their peers. Therapeutic goals should also be adjusted where appropriate to address long-lasting negative impact of the pandemic in terms of physical and mental concerns.

Finally, special consideration should be made to the parents and caregivers of autistic children as well. While the parents of children with autism did not differ from the parents of neurotypical children in negative emotions, there were considerable autism-specific concerns in the parents of autistic children due to the nature of their diagnosis. As has been shown, stress levels in parents influence stress in autistic children (Rezendes & Scarpa, 2011; Rodriguez et al., 2019; Lin et al., 2021). Thus, addressing mental

health concerns in parents of children with autism is critical to improve mental health outcomes in the children as well.

## CONCLUSION

In conclusion, our study indicates that parents of children with autism were more likely to observe and report negative effects of the pandemic compared to parents of neurotypical peers. Consistent with what has been reported in other countries and one large scale study in the United States, therapy and education were disrupted for children with autism, and significant stress was experienced with routine disruption. It is essential that educators, clinicians, and service-providers meet the needs of the autistic population post the pandemic, as it would be unacceptable to have large groups of children with autism left behind.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Kessler Foundation IRB board at 120 Eagle Rock

Ave, Suite 100, East Hanover, New Jersey. The patients/participants provided their written informed consent to participate in this study.

## AUTHORS CONTRIBUTION

HG conceptualized the idea, devised the autism specific stressors questionnaire, and wrote the manuscript. AA helped in formulating the ideas and direction of the manuscript, conducted literature review and wrote sections of the manuscript. AB conducted the data analysis and helped in manuscript writing.

## ACKNOWLEDGMENTS

The authors would like to thank the families who provided us with their valuable perspectives of how this global crisis affected them.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2021.761485/full#supplementary-material>

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