Impact of COVID-19 Pandemic on Mental Health of Children: A Longitudinal Survey in the ABCD Study Cohort

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Abstract

A large longitudinal study on the impact of the COVID-19 pandemic on mental health in children is limited. This large-scale longitudinal observational study examines the pandemic's effects on children's mental health while considering the effects of parental care styles. The Adolescent Brain Cognitive Development study is a large-scale, longitudinal multicenter study in the United States. Of the 11,875 children aged 9–12 years in its database, 4,885 subjects were selected for this study. The child behavior checklist and parental monitoring questionnaire (PMQ) were used to assess children's mental health and parental support styles, respectively. Data collected before and during the pandemic were compared. Withdrawn/depressed and attention problems significantly worsened during compared to before the COVID-19 pandemic ($p < 0.001$, Withdrawn/depressed; 53.4 ± 5.7 to 53.7 ± 5.9, attention problems; 53.4 ± 5.4 to 53.6 ± 5.6). Simple slope analysis found withdrawn/depressed problems worsened when the PMQ was 1 SD below the mean, and rule-breaking behavior was improved when the PMQ was 1 SD above the mean. While the COVID-19 pandemic exacerbated children's depressive symptoms and attention issues, the effects may be minor. Additionally, parental involvement behaviors serve as a protective factor for the child's mental health even during the pandemic.

Introduction

The Coronavirus 2019 (COVID-19) pandemic originated in late 2019.[1] According to the World Health Organization (WHO), as of December 14, 2021, more than 260 million people have been infected and more than 53 million have died due to the virus.[2] The United States accounted for about one in five COVID-19 infections worldwide, and the number of children infected in the United States has climbed to about 7.2 million in December 9 2021.[3] Globally, people have incorporated measures in their daily lives to curb the spread of COVID-19.[4] The situation raises concerns over the virus's impact on mental health.[5] The percentage of children who have visited the emergency department in hospitals due to mental health problems has increased by 31–50% in the United States since the onset of the pandemic.[6,7] School closures to maintain social distancing norms can disrupt children's physical activities and social interactions, and affect their mental health.

A meta-analysis covering 29 studies showed that the percentage of children who experienced high clinical anxiety and depression increased to about 20–25%, doubling from the pre-pandemic numbers.[8] However, most of these studies were cross-sectional; a longitudinal study is required to investigate the COVID-19 pandemic's effects on children's mental health. Indeed, the few longitudinal investigations conducted have reported increased mental health problems such as depression and anxiety.[9–12] Conversely, a longitudinal study in southwest England reported an overall reduced risk of anxiety, no significant changes in the risk of depression, and enhanced wellbeing during the pandemic.[13] Thus, the results of previous longitudinal studies that included pre-pandemic data are inconsistent; it is unclear whether the COVID-19 pandemic has a negative effect on the mental health of children. Hence, it is

necessary to additionally investigate the impact of the pandemic on children's mental health using large longitudinal data.

Additionally, parental involvement affects the overall mental health of the child[14] and even has a lasting effect on the development of the child's personality and other psychological characteristics.[15,16] In particular, perceived family connectedness is likely to have a protective effect on a child's mental health during traumatic events such as disasters.[17] Therefore, in a long-term public health crisis, such as the COVID-19 pandemic, parent-child connections appear to be crucial for children's mental health. Moreover, as quarantine measures continue, children inevitably spend more time at home with their parents and it is worth investigating to what extent parental involvement affects a child's mental health during the pandemic. Although an online cross-sectional study in China has reported that parent-child communication is important for children's mental or behavioral health during the pandemic,[18] there is limited evidence of the impact of the frequency of such communication and parent-child involvement on a child's mental health.

Given this gap, we used samples from the large, longitudinal Adolescent Brain Cognitive Development (ABCD) study to investigate the mental health of children before and during the COVID-19 pandemic. The largest long-term study of brain development and child health in the United States, the ABCD study has targeted more than 10,000 children aged 9–10 since 2015.[19] By using the data from this study, it is possible to infer large-scale longitudinal data, including pre-pandemic data. Therefore, the purpose of this study is two-fold: First, to test the hypothesis that children's mental health has worsened during the COVID-19 pandemic compared to pre-pandemic times; second, to test the hypothesis that parental involvement behavior serves as a protective factor for children's mental health during the pandemic.

Method

Participants

Participants selected for the present study were already enrolled in the ongoing Adolescent Brain Cognitive Development (ABCD) study. A sample of 11,875 children aged 9–10 enrolled at 21 study sites across the United States.[19] Of these, 4,885 children contributed three-year follow-up data since the beginning of the COVID-19 pandemic on March 1, 2020. First, of three-year follow-up data in the ABCD study, we extracted data of subjects who contributed data for three-year follow-up data following the onset of the COVID-19 pandemic. Next, we extracted data of these subjects for a two-year follow-up data preceding the pandemic in order to compare with before the COVID-19 pandemic. The present study used two-year and three-year follow-up demographic and mental health data.[20] The data was sourced from the NIMH Data Archive website (https://data-archive.nimh.nih.gov/abcd). The present study mainly used data from the ABCD 4.0 data release (http://dx.doi.org/10.15154/1523041). Full recruitment details of the ABCD study are described in the literature.[21] All parents provided written informed consent and all children provided assent. The research protocol was approved by the Ethics Review Committee of the

University of Fukui (Assurance no. FU-20210067). This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Measures

Demographic Variables and Additional Covariates

The following covariates were dummy coded: race/ethnicity (White, Black, Hispanic, Asian, and other), twin or triplet status, and sex. Annual household income was treated as a 5-level categorical variable. Based on a previous study, [22] the first 5 of the 10 household income levels were collectively assigned a value of 1 (i.e., < $50,000). The subsequent categories used were coded as 2 ($50,000-$74,999), 3 ($75,000-$99,999), 4 ($100,000-$199,999), and 5 ($200,000 or more), respectively (see Table 1). Moreover, parental educational level was included as a continuous covariate in terms of years of study. It was recoded as follows: 12th grade, high school, and general education development = 12 years; some college and associate degree = 14 years; bachelor's degree = 16 years; master's degree = 18 years; professional and doctoral degrees = 20 years.

To assess the mental health of children before and during the pandemic, we used the Child Behavior Checklist (CBCL). Similarly, we used the three-year the Parental Monitoring Questionnaire (PMQ) data to assess parental involvement behavior during the pandemic.

Child Behavior Checklist (CBCL)

The Child Behavior Checklist (CBCL)[23,24] is a questionnaire for parents to assess behavioral and emotional problems of children. The CBCL consists of 113 questions that measure aspects of children's behavior over six months and is scored on a 3-point Likert scale (0 = absent; 1 = occurs sometimes; 2 = occurs often). The CBCL comprises a total score, two broad-band scales (Internalizing and Externalizing Problems), and eight syndrome scales (Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Aggressive Behavior, and Rule-breaking Behavior). The higher the score, the greater the problem. All scores were recorded as *t*-scores and utilized.

Parental Monitoring Questionnaire (PMQ)

The Parental Monitoring Questionnaire (PMQ)[25] is a self-administered, 5-item questionnaire for children to measure parental monitoring and supervision. The PMQ consists of the following categories: parental monitoring of location; parental monitoring of who their children spend time with; parent and child contact; child disclosure; and parental monitoring via family dinner frequency. The range of all items was 1 – 5 (1 = Never; 2 = Almost Never; 3 = Sometimes; 4 = Often; 5 = Always or Almost Always). An average score was calculated based on all five items; the higher the score, the higher the frequency of the parents' monitoring behavior.

Statistical Analyses

All analyses were performed using R version 4.1.1.[26] The effects of the pandemic were analyzed by comparing the data obtained before and during the COVID-19 pandemic. Models for the CBCL outcome were estimated using a linear mixed-effects design using the lmerTest package[27] after centering the independent variable with the average value. Key predictors for each model included PMQ, time, and PMQ × time. Covariates included age, sex, parental education, household income, race, twin, and triplet, while random effect details included individual, sibling, and location information. Furthermore, to understand the characteristics of the interaction, a simple slope analysis was performed on the variables for which interactions showed significant differences pre- and during the pandemic. All *p*-values were from a two-tailed test and results were deemed statistically significant (Bonferroni-corrected $p < .05$).

Results

Data of 4,885 children were obtained from before and during the COVID-19 pandemic. Characteristics of these subjects are provided in Table 1. The average values of CBCL and PMQ before and during the COVID-19 pandemic are shown in Table 2.

Table 1
Demographics and Study Sample

Characteristic		
	N	*M* ± *SD*
Child age (month)	4885	119.5 ± 7.5
Education (years)		
mother	4628	15.5 ± 2.5
father	3966	15.3 ± 2.8
		N (%)
Sex	*N* = 4885	
Male		2,576 (53%)
Female		2,309 (47%)
Race	*N* = 4885	
White		2,817 (58%)
Hispanic		947 (19%)
Black		518 (11%)
Asian		117 (2.4%)
Income	*N* = 4555	
< $49,999		1,113 (24%)
$50,000–74,999		613 (13%)
$75,000–99,999		695 (15%)
$100,000-199,999		1523 (33%)
> $200,000		611 (13%)
Note. M, mean; *SD*, standard deviation		

Table 2
Child Behavior Checklist and Parent-Child Relationships Before and During the COVID-19 Pandemic

	Before COVID-19 pandemic	**During COVID-19 pandemic**
	N = 4781	*N* = 4885
CBCL	*Mean* ± *SD*	*Mean* ± *SD*
Total score	44.3 ± 11.0	44.4 ± 11.3
Internalizing problem	47.9 ± 10.4	47.9 ± 10.5
Externalizing problem	44.3 ± 9.6	44.4 ± 9.5
Withdrawn/depressed	53.4 ± 5.7	53.7 ± 5.9
Somatic complaints	54.6 ± 5.8	54.4 ± 5.8
Social problems	52.6 ± 4.7	52.6 ± 4.8
Thought problems	53.6 ± 5.7	53.6 ± 5.7
Attention problems	53.4 ± 5.4	53.6 ± 5.6
Rule-breaking behavior	51.9 ± 3.9	51.9 ± 3.8
Aggressive behavior	52.3 ± 4.8	52.3 ± 4.8
Anxious/depressed	53.2 ± 5.8	53.3 ± 6.0
PMQ	4.50 ± 0.46	4.40 ± 0.49

Note. M, mean; *SD*, standard deviation; CBCL, Child Behavior Checklist; PMQ, Parental Monitoring Questionnaire

Regarding the CBCL, the main effect of time was significant after multiple testing correction: withdrawn/depressed ($p < 0.001$) and attention problems ($p < 0.001$). Except for somatic complaints, the main effect of PMQ was significant after multiple testing correction; anxious/depressed was significant at 0.1% level ($p = 0.001$) and all others (i.e., internalizing problem, externalizing problem, withdrawn/depressed, social problems, thought problems, attention problems, rule-breaking behavior, and aggressive behavior) were significant at below 0.1% levels ($p < 0.001$). In addition, the interactions between parent monitoring behavior and time point of the withdrawn/depressed and rule-breaking behaviors were significant; however, after multiple testing correction, no significant difference was observed (see Table 3).

Table 3
Effects of Parent Monitoring and Time Point on Mental Health in Children

Outcome		Variable	Estimate	R squared	*p* value	Bonferroni corrected *p* value
CBCL	Total score	Time	0.224	0.046	0.045*	0.499
		PMQ	-2.524		< 0.001***	< 0.001***
		Time: PMQ	-0.079		0.737	1.000
	Internalizing problem	Time	0.205	0.037	0.092	1.000
		PMQ	-1.789		< 0.001***	< 0.001***
		Time: PMQ	-0.199		0.437	1.000
	Externalizing problem	Time	0.182	0.036	0.077	0.844
		PMQ	-2.177		< 0.001***	< 0.001***
		Time: PMQ	-0.251		0.247	1.000
	Withdrawn/depressed	Time	0.259	0.041	< 0.001***	0.005**
		PMQ	-1.693		< 0.001***	< 0.001***
		Time: PMQ	-0.387		0.013 *	0.146
	Somatic complaints	Time	-0.049	0.023	0.537	1.000
		PMQ	-0.304		0.045 *	0.498
		Time: PMQ	-0.062		0.709	1.000
	Social problems	Time	0.011	0.022	0.852	1.000
		PMQ	-0.688		< 0.001***	< 0.001***
		Time: PMQ	0.026		0.826	1.000
	Thought problems	Time	0.006	0.024	0.925	1.000
		PMQ	-0.929		< 0.001***	< 0.001***

Outcome	Variable	Estimate	R squared	*p* value	Bonferroni corrected *p* value
	Time: PMQ	-0.014		0.921	1.000
Attention problems	Time	0.215	0.031	< 0.001***	0.002**
	PMQ	-1.343		< 0.001***	< 0.001***
	Time: PMQ	-0.107		0.373	1.000
Rule-breaking behavior	Time	-0.068	0.034	0.126	1.000
	PMQ	-0.817		< 0.001***	< 0.001***
	Time: PMQ	-0.247		0.008 **	0.092
Aggressive behavior	Time	0.078	0.026	0.129	1.000
	PMQ	-0.930		< 0.001***	< 0.001***
	Time: PMQ	-0.141		0.204	1.000
Anxious/depressed	Time	0.132	0.018	0.066	0.726
	PMQ	-0.620		< 0.001***	0.001**
	Time: PMQ	-0.185		0.219	1.000

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Note. CBCL, Child Behavior Checklist; PMQ, Parental Monitoring Questionnaire

The withdrawn/depressed of the CBCL showed a significant positive association with time point (i.e., worsened) when parent monitoring behavior was 1 SD below the mean, but there was no significant effect when parent monitoring behavior was 1 SD above the mean (see Table 4 and **Fig. 1**). Additionally, the rule-breaking behavior of the CBCL showed a significant negative association with time point (i.e., reduced) when parent monitoring behavior was 1 SD above the mean, but the change was not significant when it was 1 SD below the mean.

Table 4
Relationship Between Parent Monitoring Behavior Strength and Time Point

Outcome		Variable	Estimate	*R* squared	*p* value
CBCL	Withdrawn/depressed	1 SD above the mean of PMQ: Time	0.084	0.041	0.417
		1 SD below the mean of PMQ: Time	0.467		< 0.001***
	Rule-breaking behavior	1 SD above the mean of PMQ: Time	-0.180	0.034	0.004 **
		1 SD below the mean of PMQ: Time	0.064		0.331

Note. SD, standard deviation; CBCL, Child Behavior Checklist; PMQ, Parental Monitoring Questionnaire

Discussion

The purpose of this study was to investigate the effect of the COVID-19 pandemic on the mental health of children and the effect of parental involvement during the pandemic. We used longitudinal observational data from a large sample of the ABCD study. A total of 4,885 children were analyzed in the study, adjusted for PMQ scores, and then analyzed for changes in CBCL scores before and after the onset of the pandemic. Our findings suggest that the COVID-19 pandemic has a minor adverse effect on children's mental health. We also found that children raised by parents who practice good parenting styles are emotionally calm and adaptive even in the face of the pandemic. Our research presents two important findings that support the study hypotheses. For each, we will interpret the results obtained below.

First, we hypothesized that mental health problems in children would worsen over time due to the COVID-19 pandemic. The study results support our hypothesis. The emotional problem exacerbated by this pandemic was depression. This finding is consistent with previous studies and shows that depressive symptoms in children are exacerbated by the COVID-19 pandemic,[28–33] as is the case in adults.[33–35] However, the withdrawn/depressed behavior went from an average of 53.4 ± 5.7 pre-pandemic to 53.7 ± 5.9 since the onset of the pandemic, which is a change of only 0.3. While the worsening of depressive tendencies for children was statistically significant, the magnitude of deterioration was clinically minor; hence, caution is warranted in the interpretation of these results. Next, this change was similar for attention, which worsened albeit only slightly clinically; the average attention problems went from 53.4 ± 5.4 pre-pandemic to 53.6 ± 5.6 since the onset of the pandemic. Interestingly, the results of our study did not uncover any effects on anxiety or physical complaints. Previous studies have reported that the COVID-19 pandemic does not exacerbate children's emotional problems.[36,37] Rather, emotional problems of children aged 11–16 reportedly diminished in the United Kingdom.[36] A longitudinal study of about 1,000 children in England reported a fair reduction in anxiety overall.[37] These results are consistent with our findings that the COVID-19 pandemic has no effect on children's anxiety. Moreover, our findings

showed that children's behavioral problems were unaffected by the pandemic. This result is consistent with the findings of an online cross-sectional study of 1,264 children (aged 2–6) and their parents in two primary schools in Hubei, China.[38] Hence, mental health problems, such as anxiety and behavioral issues commonly observed in children, seemed to be largely unaffected by the pandemic.

Subsequently, we verified the hypothesis that parental involvement behavior serves as a protective factor for a child's mental health even during the pandemic. Parental involvement behavior positively affected children's mental health, emotional, and behavioral aspects. In particular, when parents and their children engaged in frequent conversations and parental understanding of their child's condition was high, rule-breaking decreased; when such involvement was weak, the child's depression increased. A cross-sectional study of 1,655 parents and children in China found that parental attitudes and intimacy with children are positively correlated with the child's mental or behavioral health.[18] These results are consistent with those of our study, which shows that parental child-rearing styles have a crucial impact on children's mental health even during the COVID-19 pandemic. Our study is a large longitudinal study of children living in the United States, which has the highest number of COVID-19 infections.[39] As far as we know, it is the first time that parental involvement has been shown to influence the mental health of children in the United States even during this crisis. During home confinement, children generally interact the most with parents and caregivers; so early detection and care of children's mental health problems can prevent deterioration.[40] This finding may demonstrate that parents and caregivers impact their children's mental health.

While our findings bring great benefits to this area of study, our research has a limitation. We set March 1, 2020, as the start date of the COVID-19 pandemic, and analyzed those subjects who consented to provide three-year follow-up data from March 1, 2020, onwards. However, the period from March 1, 2020, to the date of actual data acquisition varies by subject, that is, the impact of the duration of the pandemic at the point of data collection has not been considered. The impact of the pandemic on children's mental health may differ between the early stages of the pandemic and the stages of progress and recovery. In the future, it may be necessary to consider accumulative data across time.

In conclusion, the results of this study indicate that the COVID-19 pandemic may slightly exacerbate depression and attention problems in children. Additionally, even during the global public health crisis caused by COVID-19, positive parent-child relationships have a protective impact on pubescent children's mental health in the United States.Therefore, increasing parent-child involvement is critical to children's overall mental health even during the COVID-19 pandemic.

Declarations

Acknowledgments and Disclosures

Data used in the preparation of this article were obtained from the Adolescent Brain Cognitive Development (ABCD) Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA). This is a

multisite, longitudinal study designed to recruit more than 10,000 children aged 9-10 and follow them over 10 years into early adulthood. The ABCD Study® is supported by the National Institutes of Health and additional federal partners under award numbers U01DA041048, U01DA050989, U01DA051016, U01DA041022, U01DA051018, U01DA051037, U01DA050987, U01DA041174, U01DA041106, U01DA041117, U01DA041028, U01DA041134, U01DA050988, U01DA051039, U01DA041156, U01DA041025, U01DA041120, U01DA051038, U01DA041148, U01DA041093, U01DA041089, U24DA041123, U24DA041147. A full list of supporters is available at https://abcdstudy.org/federal-partners.html. A listing of participating sites and a complete listing of the study investigators can be found at https://abcdstudy.org/consortium_members/. ABCD consortium investigators designed and implemented the study and/or provided data but did not necessarily participate in the analysis or writing of this report. This manuscript reflects the views of the authors and may not reflect the opinions or views of the NIH or ABCD consortium investigators.

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Data availability

The ABCD Study anonymized data, including all assessment domains, are released annually to the research community. Information on how to access ABCD data through the NDA is available on the ABCD Study data-sharing webpage: https://abcdstudy.org/scientists_data_sharing.html. Instructions on how to create an NDA study are available at https://nda.nih.gov/training/modules/study.html. The ABCD data repository grows and changes over time. The ABCD data used in this report came from the ABCD 4.0 data release (http://dx.doi.org/10.15154/1523041).

References

1. Zhu, N. et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med*. **382**, 727-733. doi: 10.1056/NEJMoa2001017 (2020).
2. World Health Organization. https://covid19.who.int/ Accessed on: December14, 2021.
3. American Academy of Pediatrics. *Children and COVID-19:State data report*. Updated September 12, 2021. Accessed on: December 9, 2021. https://downloads.aap.org/AAP/PDF/AAP%20and%20CHA%20-%20Children%20and%20COVID-19%20State%20Data%20Report%2012.9%20FINAL.pdf
4. Lee, J. Mental health effects of school closures during COVID-19. *Lancet Child Adolesc Health*. **4**, 421. doi: 10.1016/S2352-4642(20)30109-7 (2020).
5. Xiang, Y. T. et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*. **7**, 228-229. doi: 10.1016/S2215-0366(20)30046-8 (2020).
6. Leeb, R. T. et al. Mental health-related emergency department visits among children aged <18 years during the COVID-19 pandemic – United States, January 1-October 17, 2020. *MMWR Morb Mortal Wkly Rep*. **69**, 1675-1680. Doi: 10.15585/mmwr.mm6945a3 (2020).
7. Yard, E. et al. Emergency Department visits for suspected suicide attempts among persons aged 12-25 years before and during the COVID-19 pandemic—United States, January 2019-May 2021. *MMWR Morb Mortal Wkly Rep*. **70**, 888-894. doi: 10.15585/mmwr.mm7024e1 (2021).
8. Racine, N., McArthur, B. A., Cooke, J. E., Eirich, R., Zhu, J., Madigan, S. Global prevalence of depressive and anxiety symptoms in children and adolescents during COVID-19: A meta-analysis. *JAMA Pediatr*. **175**, 1142-1150. doi: 10.1001/jamapediatrics.2021.2482 (2021)
9. Zhang, L., Zhang, D., Fang, J., Wan, Y., Tao, F., Sun, Y. Assessment of mental health of Chinese Primary School Students before and after School Closing and Opening during the COVID-19 pandemic. *JAMA Netw Open*. **3**, e2021482. doi: 10.1001/jamanetworkopen.2020.21482 (2020).
10. Vizard, T. et al. *Mental Health of Children and Young People in England 2020, Wave 1 Follow-Up to the 2017 Survey*. Health and Social Care Information Centre. (2020).
11. Thorisdottir, I. E. et al. Depressive symptoms, mental wellbeing, and substance use among adolescents before and during the COVID-19 pandemic in Iceland: A longitudinal, population-based study. *Lancet Psychiatry*. **8**, 663-672. Doi: 10.1016/S2215-0366(21)00156-5 (2021).
12. Widnall, E. et al. *Young People's mental health during the COVID-19 Pandemic 2020.* https://research-information.bris.ac.uk/ws/portalfiles/portal/248631996/Covid_Analysis_Report_24_08_2020.pdf. Accessed on: December 26, 2021.
13. Bignardi, G. et al. Longitudinal increases in childhood depression symptoms during the COVID-19 lockdown. *Archives of Dis. in Child*. **106**, 791-797. doi: 10.1136/archdischild-2020-320372 (2021).
14. Davids, E. L., Roman, N. V., Leach, L. The link between parenting approaches and health behavior: A systematic review. *J Hum Behav Soc Environ*. **27**, 589-608. doi: 10.1080/10911359.2017.1311816 (2017).

15. Rohner, R. P, Britner, P. A. Worldwide mental health correlates of parental acceptance–rejection: Review of cross-cultural and intracultural evidence. *Cross-Cultural Res.: The J. of Comparative Soc. Sci*. **36**, 15-47. doi: 10.1177/106939710203600102 (2002).
16. Rohner, R. P., Khaleque, A., Cournoyer, D. E. Parental acceptance-rejection: Theory, methods, cross-cultural evidence, and implications. *Ethos*. **33**, 299-334. Doi: 10.1525/eth.2005.33.3.299 (2005).
17. Cobham, V. E., McDermott, B., Haslam, D., Sanders, M. R. The role of parents, parenting and the family environment in children's post-disaster mental health. *Curr Psychiatry Rep*. **18**, 53. Doi: 10.1007/s11920-016-0691-4 (2016).
18. Du, F. et al. Associations between parent–child relationship, and children's externalizing and internalizing symptoms, and lifestyle behaviors in China during the COVID-19 epidemic. *Sci Rep.* **11**, 23375. Doi: 10.1038/s41598-021-02672-7 (2021).
19. Jernigan, T. L., Brown, S. A., ABCD Consortium Coordinators, ABCD Consortium Coordinators [introduction]. Introduction. *Dev Cogn Neurosci*. **32**, 1-3 (2018).
20. Barch, D.M. et al. Demographic, physical and mental health assessments in the adolescent brain and cognitive development study: Rationale and description. *Dev Cogn Neurosci*. **32**, 55-66. doi: 10.1016/j.dcn.2017.10.010 (2018).
21. Garavan, H. et al. Recruiting the ABCD sample: Design considerations and procedures. *Dev Cogn Neurosci*. **32**,16-22. doi: 10.1016/j.dcn.2018.04.004 (2018).
22. Paul, S. E. et al. Associations between prenatal cannabis exposure and childhood outcomes: Results from the ABCD study. *JAMA Psychiatry*. **78**, 64-76. Doi: 10.1001/jamapsychiatry.**2020**. 2902 (2021).
23. Achenbach, T. M. *The Achenbach System of Empirically Based Assessment (ASEBA): Development, Findings, Theory and Applications.* University of Vermong Research Center for Children, Youth, and Families (2009).
24. Achenbach, T. M., Rescorla, L. A., University of Vermont, Research Center for Children Youth & Families. Manual for the ASEBA school-age forms and profiles: Child Behavior Checklist for ages:6-18. *Teacher's Report Form, Youth Self-Report: An Integrated System of Multi-Informant Assessment*. ASEBA (2001).
25. Zucker, R. A. et al. Assessment of culture and environment in the Adolescent Brain and Cognitive Development Study: Rationale, description of measures, and early data. *Dev Cogn Neurosci*. **32**,107-120. doi: 10.1016/j.dcn.2018.03.004 (2018).
26. R Development Core Team., R Foundation for Statistical Computing, Vienna., Austria (2020).
27. Kuznetsova. A., Brockhoff, P.B., Christensen, R. H. B. lmerTest package: Tests in linear mixed effects models. *J Stat Soft*. **82**,1-26. doi: 10.18637/jss.v082.i13 (2017).
28. Xie, X. et al. Mental health status among children in home confinement during the Coronavirus disease 2019 outbreak in Hubei Province, China. *JAMA Pediatr*. **174**, 898-900. Doi:10.1001/jamapediatrics.2020.1619 (2020).
29. Chen, F. et al. Depression and anxiety among adolescents during COVID-19: A cross-sectional study. *Brain Behav Immun*. **88**, 36-38. Doi: 10.1016/j.bbi.2020.05.061 (2020).

30. Zhou, S.J. et al. Prevalence and socio-demographic correlates of psychological health problems in Chinese adolescents during the outbreak of COVID-19. *Eur. Child. Adolesc. Psychiatry*. **29**, 749-758. Doi: 10.1007/s00787-020-01541-4 (2020).
31. Liu, X. et al. Psychological status and behavior changes of the public during the COVID-19 epidemic in China. *Infect Dis Poverty*. **9**, 58. Doi: 10.1186/s40249-020-00678-3 (2020).
32. Duan, L. et al. An investigation of mental health status of children and adolescents in China during the outbreak of COVID-19. *J Affect Disord*. **275**,112-118. Doi: 10.1016/j.jad.2020.06.029 (2020).
33. COVID-19 Mental Disorders Collaborators. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *Lancet*. **398**, 1700-1712. doi: 10.1016/S0140-6736(21)02143-7 (2021).
34. Salari, N. et al. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. *Glob. Health*. **16**, 57. doi: 10.1186/s12992-020-00589-w (2020).
35. Matsumoto, K., Hamatani, S., Shimizu, E., Käll, A., Andersson, G. Impact of post-COVID conditions on mental health: a cross-sectional study in Japan and Sweden. DOI : 10.1186/s12888-022-03874-7 (2022).
36. Waite, P. D., Pearcey, S., Shum, A., Raw, J., Patalay, P., Creswell, C. How did the mental health of children and adolescents change during early lockdown during the COVID-19 pandemic in the UK? *Psychiatry*. Preprint at ArXiv. doi: 10.31234/osf.io/t8rfx (2020).
37. Wang, G., Zhang, Y., Zhao, J., Zhang, J., Jiang, F. Mitigate the effects of home confinement on children during the COVID-19 outbreak. *Lancet*. **395**, 945-947. doi: 10.1016/S0140-6736(20)30547-X (2020).
38. Liu, Q. et al. The prevalence of behavioral problems among school-aged children in home quarantine during the COVID-19 pandemic in China. *J Affect Disord*. **279**, 412-416. doi: 10.1016/j.jad.2020.10.008 (2021).
39. Worldmeter. https://www.worldometers.info/coronavirus/countries-where-coronavirus-has-spread/ Accessed on: November 3, 2022.
40. Zwi, M., Jones, H., Thorgaard, C., York, A., Dennis, J. A. Parent training interventions for Attention Deficit Hyperactivity Disorder (ADHD) in children aged 5 to 18 years. *Cochrane Database Syst Rev*. **2011**, CD003018. doi: 10.1002/14651858.CD003018.pub3 (2011).

Figures

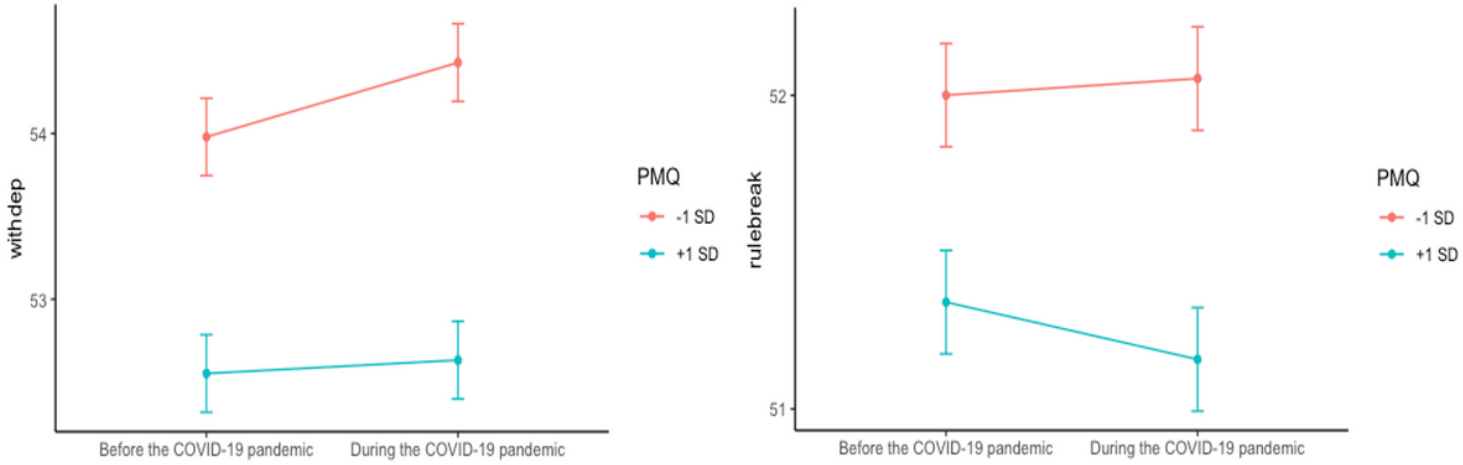

Figure 1

Legend not included with this version.