



Impact of the Coronavirus Disease Pandemic on Mental Health Among School Students in Korea During the COVID-19 Pandemic

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Objectives: The coronavirus disease (COVID-19) pandemic has had various effects on mankind, especially children and adolescents. Because children and adolescents spend a lot of time at school, COVID-19 has had a great impact on school mental health. In this study, we investigated the effect of prolonged COVID-19 on school mental health.

Methods: We prepared self-report questionnaires for depression (Children's Depression Inventory, CDI), anxiety (Korean version of the Penn State Worry Questionnaire for Children; Generalized Anxiety Disorder-7, GAD-7), and post-traumatic stress (Primary Care Post-traumatic Stress Disorder, PC-PTSD) for administering to students aged between 7 and 18 years, recruited by a COVID-19 psychological prevention support group in the Gwangmyeong Mental Health Welfare Center for 2 years, in 2020 and 2021.

Results: For children aged 7–12 years, there was no significant difference between the years 2020 and 2021 in the assessment of depression, anxiety, and post-traumatic stress. Conversely, for adolescents aged 13–18 years, there was a significant increase in the scale scores (CDI, PC-PTSD, and GAD-7).

Conclusion: Prolonged COVID-19 might have had a significant impact on the mental health of adolescents who spent a lot of time at school. When comparing the years 2020 and 2021, middle and high school students were more affected by COVID-19 than elementary school students.

Keywords: COVID-19; Children and adolescents; School mental health.

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INTRODUCTION

The global spread of the coronavirus disease (COVID-19) pandemic has had various effects on humanity. Children and adolescents gain various social experiences through group interactions, such as school life, which plays an important role in their development. The deprivation of such social experiences during the pandemic has had a significant impact on the development of children and adolescents. Schools teach children and adolescents knowledge and skills, help improve their social and emotional skills, and provide an important environment for children and adolescents' physical activities. Children and adolescents spend most of the day at school, and schools have a great impact on their mental health. However, as schools were closed owing to the pandemic, remote classes

became the new standard for education worldwide. Remote classes require additional involvement from parents, teachers, and schools for a certain period, and the gap between individual students' environments has, thus, widened [1].

The global outbreak of COVID-19 has political, economic, and social impacts, as well as mental/psychological impacts. A newly coined word, "Corona Blue," which is a combination of COVID-19 and "blue" referring to depression, was created and refers to the overall psychological impact caused by infection-related stress and anxiety owing to the global outbreak. This word also refers to stress or depression due to changes in life during the COVID-19 pandemic, such as refraining from going out, banning gatherings, self-quarantine, and social distancing [2,3]. The global spread of the COVID-19 pandemic has had various effects on the mental health of children and adolescents. Exposure to stressful environments caused by COVID-19, prolonged periods of home quarantine, family conflicts and violence, and increased use of the Internet and

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social media are known to be the factors affecting mental health of children and adolescents. The global spread of COVID-19 can cause post-traumatic stress disorder, depression disorder, and anxiety disorder, and children and adolescents may experience more severe symptoms [4]. As they spend a lot of time at schools, children and adolescents' school mental health is directly affected by COVID-19 [5]. It is thought that the prolonged COVID-19 pandemic may have a great impact on the development of children and adolescents, which is directly affected by school life, as it plays an important role in their development. In fact, one-time cross-sectional studies have reported on the short-term effects of COVID-19 on school life and mental health among children and adolescents [6,7].

Studies on the effects of COVID-19 on mental health have been conducted worldwide. However, as the pandemic is prolonging more than expected, it is necessary to conduct long-term studies on changes before and during the COVID-19 pandemic, as well as cross-sectional studies on the effects of COVID-19. One study reported that the prolonged pandemic adversely affected mental health [8], and another study reported a difference in depression and anxiety levels in children and adolescents before and during the COVID-19 pandemic [9].

Owing to the prolonged COVID-19 pandemic, there may be a difference in the aspects of the impact of COVID-19 on children and adolescents' mental health between 2020, at the beginning of the COVID-19 outbreak, and 2021, when the changes in individuals' daily lives due to the COVID-19 pandemic became routine. We repeatedly conducted surveys in 2020 and 2021 through a regional mental health welfare center using the same instruments for children and adolescents living in an urban area. The present study aimed to compare the survey results between 2020 and 2021 and investigate the changes in the mental health of children and adolescents over time.

METHODS

Participants

We conducted a self-report questionnaire survey of students living in a city as a project organized by a mental health welfare center located in the Gwangmeong city capital regions. The participants in this study were children and adolescents aged 7–18 years. In principle, children were encouraged to complete the self-report questionnaire by themselves, and those who found it difficult were asked to complete it with their guardians' help.

This study was conducted as a basic research project, which is a part of the disaster psychological support services for the increasing psychological anxiety and depression in citizens due to the prolonged COVID-19 pandemic.

The survey was conducted by the Gwangmyeong Mental

Health Welfare Center using an online system and was administered to children and adolescents recruited by the executive committee organizations (such as local welfare centers, youth counseling institutions, and suicide prevention centers) of the COVID-19 psychological support group in the center. The online survey content included self-report assessment scales such as depression, anxiety, and post-traumatic stress symptom scales. This study was approved by the Institutional Review Board of Korea University Guro Hospital and was conducted after obtaining informed consent from the participants (IRB No. 2020GR0593).

Measurements

Assessment of depression

The Children's Depression Inventory (CDI), developed by Kovacs and Beck (1977), is a self-report scale that assesses the severity of cognitive, emotional, and behavioral symptoms of depression in children [10,11]. The CDI consists of 27 items grouped into 5-factor areas: depressive mood, behavior disorders, anhedonia, negative self-esteem, and physiological symptoms. Respondents need to select the one that best characterizes their symptoms during the past 2 weeks. Each item is scored on a scale ranging from 0 to 2. The total score ranges from 0 to 54, with a higher score indicating more severe depression and various depressive symptoms. CDI has been proven to be a valid and useful scale for evaluating depression in children and adolescents [10-12].

Assessment of anxiety

The Korean version of the Penn State Worry Questionnaire for Children (PSWQ-CK) is a tool used to measure the degree of anxiety in children. This tool was modified for children from the Penn State Worry Questionnaire (PSWQ). PSWQ consists of 16 items, and PSWQ-CK consists of 14 items. The items measure the general characteristics, severity, duration of worry, and controllable worry in individuals. Each item is scored on a scale of 0 (not at all), 1 (sometimes), 2 (often), and 3 (always). The total score ranges from 0 to 42 points, with a higher score indicating a higher anxiety tendency. The PSWQ-CK was found to be a useful scale for measuring anxiety in children aged 8–12 years [13-15].

The Generalized Anxiety Disorder-7 (GAD-7) questionnaire is a self-report anxiety scale used to measure the anxiety status. GAD-7 consists of seven items inquiring about the degree of anxiety symptoms that a patient has felt in the past 2 weeks and the degree to which the patient's daily life has been bothered by such anxiety symptoms. Each item is scored as 0 (not bothered at all), 1 (bothered for several days), 2 (bothered for more than seven days), and 3 (bothered nearly every day). The

total score ranges from 0 to 21, and a GAD-7 scale score of ≥ 15 is considered severe GAD, a score of 10–14 as moderate GAD, and a score of < 10 as mild GAD. The GAD-7 questionnaire has proven to be a useful and effective scale for assessing the severity of anxiety, including GAD, in participants [16–18].

In this study, children aged 7–8 years were assessed for their degree of anxiety using PSWQ-CK, while adolescents aged 9 years or older were assessed using the GAD-7 questionnaire.

Post-traumatic stress symptoms

Primary Care Post-traumatic Stress Disorder (PC-PTSD) is a self-report scale developed by Prins in 2003 that is designed to screen for post-traumatic stress disorder. Using PC-PTSD, individuals are instructed to answer “yes” or “no” to five items regarding re-experiencing, avoidance, numbing, hyperarousal, and negative changes in the past month. A score of 1 for “yes” and 0 for “no” is assigned, and a total score of ≥ 4 is suggestive of potential PTSD. PC-PTSD has been proven to be effective in primary care practice because its items are simple and it has a high sensitivity and specificity [19–21].

Data analyses

All statistical analyses in this study were performed using the SPSS 25.0 software (IBM Corp., Armonk, NY, USA). Statistical significance was set at $p < 0.05$. The demographic and clinical characteristics of the participants were compared using mean and standard deviation. The differences in clinical characteristics of the participants or each scale score (CDI, GAD-7, PC-PTSD) between those in the years 2020 and 2021 were analyzed using an independent sample t-test.

RESULTS

Demographic variables

This study included 453 children and adolescents aged 7–18 years who were enrolled in primary, middle, or high schools. There were 172 and 281 participants in 2020 and 2021, respectively. In the case of the participants in 2020, the mean age was 12.55 ± 2.87 years, and there were 76 primary (aged 7–12 years),

72 middle (aged 13–15 years), and 24 high (aged 16–18 years) school students, of whom 84 (48.8%) were male and 88 (51.1%) were female. When considering the participants in 2021, the mean age was 12.96 ± 3.28 years, and there were 131 primary, 73 middle, and 77 high school students, of whom 140 (49.8%) were male and 141 (50.1%) were female. The demographic data of the participants are shown in Table 1.

Depression, anxiety, and post-traumatic stress symptom assessment results

In terms of depression in children (aged 7–12 years), there was no significant difference in depression between 2020 (mean score: 7.37 ± 6.92) and 2021 (mean score: 8.27 ± 7.15) ($p = 0.38$). When considering the anxiety in children aged 7–8 years as measured by PSWQ-CK, there was no significant difference in anxiety between 2020 (mean score: 10.05 ± 8.22) and 2021 (mean score: 9.77 ± 7.53) ($p = 0.91$). In anxiety in children aged 9–12 years as measured by GAD-7, there was no significant difference between 2020 (mean score: 2.76 ± 4.78) and 2021 (mean score: 3.51 ± 4.97) ($p = 0.44$). Moreover, there was no significant difference in post-traumatic stress symptoms in children between 2020 (mean score: 0.86 ± 1.30) and 2021 (mean score: 1.05 ± 1.33) ($p = 0.30$).

In terms of depression in adolescents (aged 13–18 years), there was a significant difference in depression between 2020 (mean score: 9.52 ± 8.94) and 2021 (mean score: 13.10 ± 10.53) ($p = 0.01$). When considering anxiety in adolescents, there was a significant difference between 2020 (mean score: 2.83 ± 4.03) and 2021 (mean score: 4.28 ± 4.83) ($p = 0.02$). Lastly, there was a difference in post-traumatic stress symptoms between 2020 (mean score: 1.06 ± 1.39) and 2021 (mean score: 1.43 ± 1.54) ($p = 0.06$). The results of the analysis are presented in Table 2.

Correlation between depression, anxiety, and post-traumatic stress symptom scale scores

Correlation analysis (Pearson’s correlation analysis) between the CDI, PC-PTSD, and anxiety scale (either PSWQ-CK or GAD-7, depending on age) scores was performed. In 2020, there was a significant correlation between all scale scores,

Table 1. Demographic data of the participants

Clinical characteristics	2020 (n=172)	2021 (n=281)	Total (n=453)
Age (yr)	12.55 ± 2.87	12.96 ± 3.28	
Elementary school student (age 7 to 12 yr)	76 (44.2)	131 (46.6)	207
Middle school student (age 13 to 15 yr)	72 (41.9)	73 (26.0)	145
High school student (age 16 to 18 yr)	24 (13.9)	77 (27.4)	101
Sex			
Male	84 (48.8)	140 (49.8)	224
Female	88 (51.1)	141 (50.1)	229

Values are presented as mean \pm standard deviation or number (%)

Table 2. Comparisons of scale scores between 2020 and 2021

Scale	2020	2021	p
CDI			
Child (7–12 yr)	76 7.37±6.92	131 8.27±7.15	0.38
Adolescent (13–18 yr)	96 9.52±8.94	150 13.10±10.53	0.01
PC-PTSD			
Child (7–12 yr)	76 0.86±1.30	131 1.05±1.33	0.30
Adolescent (13–18 yr)	96 1.06±1.39	150 1.43±1.54	0.06
Anxiety scale score (PSWQ-CK & GAD-7)			
Child (7–8 yr) PSWQ-CK	19 10.05±8.22	26 9.77±7.53	0.91
Child (9–12 yr) GAD-7	38 2.76±4.78	78 3.51±4.97	0.44
Adolescent (13–18 yr) GAD-7	94 2.83±4.03	149 4.28±4.83	0.02

Values are presented as number or mean ± standard deviation. CDI, Children's Depression Inventory; PC-PTSD, Primary Care Post Traumatic Stress Disorder; PSWQ-CK, Korean version of the Penn State Worry Questionnaire for Children; GAD-7, Generalized Anxiety Disorder-7

Table 3. Correlations of scale scores in year 2020 and 2021

	2020		2021	
	CDI	PC-PTSD	CDI	PC-PTSD
PC-PTSD	0.36*		0.55*	
Anxiety scale				
PSWQ-CK (7–8 yr)	0.72*	0.45*	0.54*	0.68*
GAD-7 (9–18 yr)	0.53*	0.47*	0.69*	0.56*

*p<0.01. CDI, Children's Depression Inventory; PC-PTSD, Primary Care Post Traumatic Stress Disorder; PSWQ-CK, Korean version of the Penn State Worry Questionnaire for Children; GAD-7, Generalized Anxiety Disorder-7

that is, between the CDI and PC-PTSD scores ($r=0.36, p<0.01$), the CDI and PSWQ-CK scores ($r=0.72, p<0.01$), the CDI and GAD-7 scores ($r=0.53, p<0.01$), the PC-PTSD and PSWQ-CK scores ($r=0.45, p<0.01$), and the PC-PTSD and GAD-7 scores ($r=0.47, p<0.01$). In 2021, significant correlations were observed between all scale scores, that is, between the CDI and PC-PTSD scores ($r=0.55, p<0.01$), the CDI and PSWQ-CK scores ($r=0.54, p<0.01$), the CDI and GAD-7 scores ($r=0.69, p<0.01$), the PC-PTSD and PSWQ-CK scores ($r=0.68, p<0.01$), and the PC-PTSD and GAD-7 scores ($r=0.56, p<0.01$). The results of the analysis are presented in Table 3.

DISCUSSION

This study aimed to investigate the effects of the prolonged COVID-19 pandemic on the mental health of children and adolescents and determine the correlations between the scale scores. The results of this study revealed that depression and anxiety levels and post-traumatic stress symptoms in adolescents were exacerbated by the prolonged pandemic compared to the symptoms in children.

When depression scale scores were divided by age and compared between the years 2020 and 2021, for children (aged 7–12 years), there was no significant difference in depression

scale scores between the years (mean score: 7.37 ± 6.92 in 2020, mean score: 8.27 ± 7.15 in 2021; $p=0.38$), whereas for adolescents (aged 13–18 years), there was a significant difference in depression scale score (mean score: 9.52 ± 8.94 in 2020, mean score: 13.10 ± 10.53 in 2021; $p=0.01$). In other words, there was an increase in depression scale scores in adolescents in 2021 compared to 2020. Additionally, for children, there was no significant difference in post-traumatic stress symptom scores between 2020 and 2021 (mean scores: 0.86 ± 1.30 and 1.05 ± 1.33 , respectively; $p=0.30$). For adolescents, no statistically significant difference was observed ($p<0.05$), but there was a significant difference in post-traumatic stress symptom score (mean score: 1.06 ± 1.39 in 2020 and 1.43 ± 1.54 in 2021; $p=0.06$).

In terms of anxiety scale scores, there was no significant difference in anxiety scores by year in primary school children, whereas there were significantly higher levels of anxiety in middle and high school adolescents in 2021 than in 2020 due to the prolonged COVID-19 pandemic. A previous study analyzing factors affecting interpersonal relationships in children and adolescents reported that regardless of sex, children and adolescents' relations with their parents gradually decreased, and their relations with peers gradually increased as they grew from childhood to adolescence [22]. For children up to primary school students, their families becomes the main part of their interpersonal relations, and their interpersonal relations at schools do not constitute a large part. However, for adolescents, their interpersonal relations gradually expand, and interpersonal relations at schools beyond their families become increasingly important. Therefore, adolescents' interpersonal relations and social activities at schools are being damaged intensively and directly by the COVID-19 outbreak, which might be more greatly impacted by COVID-19 [23]. Children begin to make friends at school and start to feel the need for peer relationships outside of their families. However, adolescents rely even more heavily on peer relationships, which

are extremely important in their school lives. Therefore, the decrease in opportunities for interpersonal relationships in schools due to COVID-19 is expected to have a particularly significant impact on adolescents [24]. According to statistics comparing the average school attendance rates for the first semesters of 2020 and 2021, the primary school attendance rates were 48.6% and 74.6%, respectively; the middle school attendance rates were 46.3% and 63.8%, respectively; and the high school attendance rates were 54.8% and 72.0%, respectively. In other words, the average school attendance rates in all primary, middle, and high schools increased over time from the first semester of 2020 to the first semester of 2021 [25]. As the average school attendance rate in primary school students increased, there was no significant difference in depression and anxiety scale scores among these students. However, as the rate increased in middle and high school students, there was a significant increase in depression and anxiety scale scores. This is thought to be due to the negative impact of prolonged COVID-19 rather than environmental changes that were caused by the increased average school attendance rates of middle and high school students.

The results of the correlation analysis between depression, anxiety, and post-traumatic stress symptom scale scores showed a significant positive correlation between the scale scores in both 2020 and 2021. It is known that childhood and adolescence are a period when emotion regulation skills develop, and disruptions in emotion regulation during this period increase the risk of developing depressive disorders in the future [26]. In addition, the results of this study indicate that there is a positive correlation between depression and anxiety scale scores, supporting that both depression and anxiety symptoms are associated with the problem of emotion regulation.

Studies regarding the effects of the COVID-19 outbreak on anxiety, depression, and post-traumatic stress symptoms in school students have been conducted in foreign countries and have confirmed that COVID-19 has a significant correlation with anxiety, depression, and post-traumatic stress symptoms. In addition, it has been reported that a lack of family and social support is associated with negative mental health [27]. As such, the COVID-19 pandemic seems to affect a broad range of mental health areas rather than a specific one. In addition, despite the fact that school closures due to the COVID-19 pandemic have not been fully enforced in South Korea, the impact of COVID-19 on mental health in Korean students has been observed, similar to students other countries that experienced full-scale school closures [1].

The limitations of this study were as follows. First, the depression, anxiety, and post-traumatic stress disorder assessment scales used in this study were self-reported scales, and

more accurate assessments by clinicians were not conducted separately. Therefore, because children and adolescents as respondents might rate the scales according to their own criteria, there may be limitations in objectively comparing the results. Second, although this study compared the mean scale scores between 2020 and 2021, not all children and adolescents who participated in the survey in 2020 were followed up in 2021; a longitudinal follow-up over a long period was not fully conducted due to the prolonged COVID-19 pandemic. In fact, only seven children and adolescents were followed up consecutively in 2021.

Nevertheless, the results of this study are significant. Adolescents aged 13 years or older showed a difference in overall mental health, such as depressive symptoms, anxiety symptoms, and post-traumatic stress symptoms between 2020 and 2021, indicating that the prolonged COVID-19 pandemic had a significant impact on mental health in adolescents who usually spend most of their time at school.

Availability of Data and Material

The datasets generated or analyzed during the study are not publicly available as the IRB approved the data to be used by the research team only, but it could be available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Moon-Soo Lee. Data curation: Hye-mi Cho. Formal analysis: Hye-mi Cho, Young-Eun Mok, Su-hyuk Chi, Changsu Han. Funding acquisition: Hyun-suk Yi. Methodology: Hye-mi Cho, Moon-Soo Lee. Writing—original draft: Youngsoo Jang, Moon-Soo Lee.

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