



Factors Associated With Depression and Anxiety in Korean Adolescents During the COVID-19 Pandemic

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Objective This study was performed to identify factors associated with depression and anxiety among Korean adolescents during the coronavirus disease (COVID-19) pandemic.

Methods We conducted a cross-sectional study of 1,898 Korean adolescents (55.2% male, 44.8% female) ranging in age from 12 to 17 years (mean±standard deviation age, 15.4±2.6 years). Depression and anxiety were defined as a Patient Health Questionnaire-9 score ≥10 and Generalized Anxiety Disorder-7 score ≥10, respectively. Other questionnaires included sociodemographic data, psychosocial stresses, and experiences in association with COVID-19. Psychiatric scales included Gratitude Questionnaire-6, Perceived Stress Scale-10, and UCLA Loneliness Scale-3.

Results The prevalence rates of depressive and anxiety symptoms among participants were 13.8% and 21.0%, respectively. Multivariable logistic regression analysis revealed that female sex, fear of COVID-19 infection, low gratitude were risk factors for depression. Fear of COVID-19 infection, increased TV watching time, and academic-related stress were risk factors for anxiety.

Conclusion Depression and anxiety were prevalent during the pandemic in Korean adolescents, and were associated with fear of COVID-19 infection. Providing appropriate information on COVID-19, helping adolescents manage academic-related stress and maintain daily life patterns, and implementing interventions to foster gratitude are important for preventing depression and anxiety in Korean adolescents.

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Keywords COVID-19; Adolescents; Depression; Anxiety; Risk factor; Protective factor.

INTRODUCTION

More than 2 years have passed since the novel coronavirus disease (COVID-19) pandemic began.¹ The effects of the COVID-19 pandemic have not been limited to physical illness or death; massive changes have occurred worldwide, ranging from alterations in individuals' daily lives to a global economic crisis and sociocultural changes.² The COVID-19 pandemic can be thought of as an epidemic disaster. Many studies have

revealed that variable psychological problems, including depression and anxiety, increase in frequency in various populations during epidemics (e.g., severe acute respiratory syndrome, Middle East respiratory syndrome).³⁻⁵ Adolescence is a developmental period characterized by increased vulnerability to the effects of disasters.⁶ Considering the psychosocial characteristics of adolescents, who are not yet capable of fully supporting and caring for themselves or conveying their emotional needs to others (i.e., dependent on families and communities), they are at greater risk than adults during epidemics.⁷ Such disasters can negatively form the biological, psychological, and interpersonal development of adolescents, which is associated with future mental and physical diseases, interpersonal problems, and high-risk behaviors.⁸ Several studies suggest that adolescents subjects to trauma are vulnerable to chronic biopsychosocial impairment.^{9,10} One study reported that adolescents were vulnerable to depression and anxiety during infectious disease outbreaks.^{11,12} Therefore, it is necessary to examine changes in the lifestyle and psychological status of

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adolescents during the current COVID-19 pandemic. Major changes are taking place in the daily lives of adolescents during COVID-19 pandemic, including postponement of school opening, online classes, and restriction to indoor environments, all of which may have a huge psychological and social impact.^{6,13} Around the world, 91% of schools have been closed due to the imposition of social distancing measures in response to the COVID-19 pandemic. In Korea, the opening of schools was postponed to March 23, 2020, and online classes started on March 31, 2020. Since then, face-to-face learning has alternated with online classes depending on the spread of COVID-19 infection. School closures deprives adolescents of school-based peer interactions and regular routines, and can therefore hinder their psychological and physical development.¹⁴ In addition, the shift to an online learning environment revealed inequalities in the distribution of learning resources among adolescents (e.g., internet connection quality, caregivers who can help with learning, and the availability of a space for independent learning). While lifestyle changes due to COVID-19 pandemic likely have a psychological impact on adolescents, few studies have evaluated the impact of epidemics on the mental health of adolescents compared to adults. Moreover, no studies have examined the effects of the COVID-19 pandemic on the mental health of Korean adolescents and associated factors. During the COVID-19 pandemic, many studies focused on mental health, but few evaluated protective factors against mental health problems, especially depression and anxiety.^{15,16} Here, we attempted to identify protective factors to inform future therapeutic interventions. Factors that protect against psychological problems during disasters include gratitude, social support, resilience, and life satisfaction.^{17,18} Therefore, we evaluated gratitude in our participants considering its potential importance for psychiatric interventions. A literature review indicated that gratitude helps to reduce the psychological distress caused by disasters, and is related to fewer symptoms of post-traumatic stress disorder and increased levels of wellbeing, optimism, and happiness.^{19,20} The present study was performed to determine the prevalence rates of depression and anxiety, and to identify risk and protective factors of them, among Korean adolescents during the COVID-19 pandemic. This study provides basic data to facilitate the establishment of programs and systems for psychological support of Korean adolescents during the COVID-19 pandemic.

METHODS

Study design and participants

This cross-sectional study surveyed 1,898 middle and high school students (55.2% male, 44.8% female) aged 12–17 years

(mean±standard deviation [SD] age, 15.4±2.6 years) living in Gwangju Metropolitan City from April to July 2020, during the opening of schools that had been postponed by the COVID-19 pandemic. After removing the data of participants with incomplete questionnaires, 1,783 participants were included in the analysis. The participants were 1,898 Korean students, including 1,395 middle school (73.5%) middle schools and 503 (26.5%) high school students. Of the participants, 27.3% were religious and 72.7% were not. The academic achievement levels were good, average, and poor for 33.7%, 37.1%, and 29.2% of the participants, respectively. In total, 4.5% of the participants had a physical illness and 0.5% had a mental illness (defined as currently taking medication for a condition). The investigator explained the purpose of the study to the participants, distributed the questionnaires in sealed envelopes to those who consented, and collected them directly after completion. We assured the participants that the collected data would be kept anonymous and used only for research purposes. The study was approved by the Research Ethics Review Committee of Chonnam National University Hospital (approval number CNUH-2020-157). When participants checked consent, this survey was conducted. All methods were performed in accordance with the guidelines and regulations set by the University Institutional Review Board.

Sociodemographic and clinical characteristics

Sociodemographic data included age, sex, school level (middle or high school), religious status (yes or no), academic achievement level (poor/average or good), presence of physical or mental illness (defined as currently taking medication for a condition; yes or no), confirmed COVID-19 experience (yes or no), and quarantine experience (yes or no) of oneself and acquaintances. Participants were clinically assessed in terms of depression, anxiety, and related factors, such as perceived stress, loneliness, gratitude, and psychosocial experiences and stress associated with the COVID-19 pandemic.²¹

Outcome measures

Depression

Depression was assessed using the Korean version of the Patient Health Questionnaire-9 (PHQ-9). PHQ-9 items were scored based on frequency using a 4-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). Higher scores reflect more severe depression.²² A cutoff score ≥ 10 was used as an indicator of clinically relevant symptoms of depression. The PHQ-9 has good internal consistency (Cronbach's $\alpha = 0.80$ – 0.90 ; 0.859 in this study).²³ The Korean version of the PHQ-9 is a reliable and valid tool for screening and assessing

depressive symptoms in Korean populations.²⁴ The PHQ-9 has been used to assess depression in adolescents in many studies.^{23,25}

Anxiety

Anxiety was assessed using the Korean version of the Generalized Anxiety Disorder-7 (GAD-7) scale. The GAD-7 items were scored based on frequency using a 5-point Likert scale ranging from 0 (not at all) to 4 (nearly every day).²⁶ Higher scores indicate more severe anxiety. A cutoff score ≥ 10 was used as an indicator of clinically relevant symptoms of anxiety.²⁷ The GAD-7 has high reliability and validity, with a Cronbach's alpha of 0.90–0.92.^{28,29} In this study, the internal consistency of the GAD-7 was acceptable (Cronbach's $\alpha=0.898$).

Gratitude

Gratitude was measured using the Korean version of the Gratitude Questionnaire-6 (K-GQ-6) adapted by Kwon et al.³⁰ The K-GQ-6 items were scored based on intensity using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating a more grateful attitude and more positive emotions.³¹ We analyzed total scores and the internal consistency was acceptable (Cronbach's $\alpha=0.703$).

Perceived stress

The Perceived Stress Scale-10 (PSS-10) evaluates perceived stress over the past month using a 5-point Likert scale ranging from 0 (never) to 4 (very often), with higher scores indicating greater perceived stress.³² Cohen et al.³³ developed the PSS-10 and demonstrated its reliability and validity. Questions 1–3, 6, 9, and 10 of the PSS-10 are scored conventionally; questions 4, 5, 7, and 8 are reversely scored. We used the Korean version of the PSS-10, which has good reliability and validity.³² The internal consistency of the PSS-10 was high (Cronbach's $\alpha=0.767$).

Loneliness

Loneliness was assessed using UCLA Loneliness Scale developed by Russell et al.³⁴ We used the Korean version of UCLA Loneliness Scale adapted by Kim.³⁵ The scale was adapted to assess perceived isolation, with higher scores indicating greater loneliness.³⁵ The Cronbach's α of UCLA Loneliness Scale-3 was 0.756, indicating acceptable internal consistency.

Psychosocial experiences and stress

To assess psychosocial experiences and stress associated with the COVID-19 pandemic, we developed a questionnaire based on a literature review^{36,37} and our clinical opinions (Supplementary Table 1 in the online-only Data Supplement). Ten

questions were used to assess psychosocial experiences and 15 were used to assess psychosocial stress related to the COVID-19 pandemic. Four of the 10 psychosocial experience questions were related to COVID-19 infection and quarantine experience, while the remaining six were related to changes in daily life patterns during the pandemic. The 15 psychosocial stress questions were distributed over four factors: fear of COVID-19 infection (7 items), academic-related stress (3 items), stress caused by changes in eating and sleeping patterns (3 items), and stress caused by changes in daily activities (2 items). The items were scored based on intensity using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scores for each factor were calculated by dividing the summed score for the items by the number of items. Higher scores indicate more severe psychosocial stress in relation to the COVID-19 pandemic.

Statistical analysis

The analysis was conducted by dividing the subjects into groups according to the presence or absence of depression and anxiety. The chi-square test was performed to compare sociodemographic factors between the groups. Reliability was verified by calculating Cronbach's α coefficient, which reflects internal consistency. Binary logistic regression analysis was used to identify factors affecting depression and anxiety in the study participants; those factors were then subjected to univariate analysis. Variables that were significant in the univariate analyses were adjusted for in multivariate analysis, and the adjusted odds ratio (OR) and confidence intervals (CIs) were calculated. SPSS for Windows ver. 21.0 (IBM Corp., Armonk, NY, USA) was used to perform the statistical tests. All statistical tests were two-tailed, and $p < 0.05$ was taken to indicate statistical significance.

RESULTS

The 1,783 participants included in this study consisted of 979 male (54.9%) and 804 female (45.1%) adolescents ranging in age from 12 to 17 years (mean \pm SD age, 15.4 \pm 1.7 years). The overall prevalence rates of depression and anxiety were 13.8% and 21.0%, respectively.

Table 1 shows the sociodemographic characteristics of the cohort and their associations with depression and anxiety. The depression and anxiety rates were higher among female than male adolescents (17.0% vs. 11.3%, respectively, $\chi^2=11.578$, $p < 0.001$; 24.2% vs. 18.3%, respectively, $\chi^2=8.967$, $p=0.003$). There were no significant differences in depression or anxiety according to school level, religious status, academic achievement level, presence of mental illness, or presence of a physical illness (Table 1).

Table 1. Sociodemographic characteristics of Korean adolescents according to the presence of depression and anxiety during the COVID-19 pandemic

Variables	N (%)	Depression (+)			Anxiety (+)		
		N (%)	χ^2	p	N (%)	χ^2	p
Sex (N=1,732)			11.578	<0.001***		8.967	0.003**
Male	955 (55.1)	108 (11.3)			175 (18.3)		
Female	777 (44.9)	132 (17.0)			189 (24.3)		
School level (N=1,732)			1.512	0.219		0.162	0.687
Middle school	1,279 (73.8)	185 (14.5)			264 (20.6)		
High school	453 (26.2)	55 (12.1)			100 (22.1)		
Religious (N=1,711)			0.661	0.416		0.339	0.560
Yes	473 (27.6)	71 (15.0)			105 (22.2)		
No	1,238 (72.4)	167 (13.5)			257 (20.8)		
Academic achievement level (N=1,677)			1.042	0.594		5.435	0.066
Good	567 (33.8)	72 (12.7)			101 (17.8)		
Average	622 (37.1)	91 (14.6)			139 (22.3)		
Poor	488 (29.1)	70 (13.9)			112 (23.0)		
Underlying mental illness (N=1,725)			0.531	0.466		0.355	0.551
Yes	9 (0.5)	2 (22.2)			1 (11.1)		
No	1,716 (99.5)	237 (13.8)			363 (21.2)		
Underlying physical illness (N=1,726)			1.936	0.164		0.632	0.427
Yes	78 (4.5)	15 (19.2)			19 (24.4)		
No	1,648 (95.5)	225 (13.7)			345 (20.9)		

p<0.01; *p<0.001

Table 2 shows the results of the univariate logistic regression analysis performed to detect factors associated with depression and anxiety. Female sex, longer TV watching time, and a higher PSS-10 score were associated with a significantly increased risk of depression. Higher scores on questions about COVID-19-related psychosocial stress, including fear of COVID-19 infection, and academic-related stress, were positively associated with depression. However, the GQ-6 score was significantly negatively associated with depression. Female sex, poor/average academic achievement (compared to good), and longer TV watching time were associated with a significantly increased risk of anxiety. Higher scores on questions about COVID-19-related psychosocial stress, including fear of COVID-19 infection, and academic-related stress were associated with an increased risk of anxiety (Table 2).

In logistic regression analyses, dependent variables are categorical data divided according to the presence or absence of depression and anxiety based on using PHQ-9 and GAD-7, respectively. In both Tables 3 and 4, the chosen independent variables significant at $p<0.05$ (sex, academic achievement level, TV watching time, fear of COVID-19 infection, academic related stress, perceived stress, and gratitude) were included as covariates in multivariable logistic regression analysis. The

results of multivariable logistic regression analysis of depression and anxiety are shown in Tables 3 and 4. Female sex, high level of fear regarding COVID-19 infection, and low gratitude were risk factors for Depression (Table 3). A change in daily life patterns during the COVID-19 pandemic, especially watching more TV, was a risk factor for anxiety. Psychosocial stress related to COVID-19, such as a high level of fear regarding COVID-19 infection and academic-related stress, were risk factors for anxiety (Table 4).

Exploratory factor analysis was conducted to verify the validity of the 15 psychosocial stress questions, grouped according to the four factors described above. The Kaiser-Meyer-Olkin was high (0.874), and the result of Bartlett's test of sphericity indicated the suitability of exploratory factor analysis ($\chi^2=11,967.27$, $p<0.001$). The commonality value of all questions exceeded 0.4. Varimax rotation was performed and four subfactors had initial eigenvalues of ≥ 1 ; the cumulative amount of variance explained was 68.05%. Supplementary Table 1 (in the online-only Data Supplement) gives the eigenvalue and variance values for each factor.

We conducted supplementary analyses for subjects with both depression and anxiety symptoms. We performed the chi-square test to compare sociodemographic factors between

Table 2. Results of univariate logistic regression analysis to detect risk factors for depression and anxiety during the COVID-19 pandemic

Variables	Depression			Anxiety		
	OR	95% CI	p	OR	95% CI	p
Sociodemographic characteristics						
Sex, female	1.605	1.120–2.111	<0.001***	1.424	1.129–1.795	0.003**
School level, middle school	1.224	0.887–1.689	0.219	0.948	0.731–1.229	0.687
Religious, yes	1.133	0.839–1.530	0.416	1.079	0.835–1.395	0.560
Academic achievement level, poor	1.151	0.808–1.640	0.435	1.373	1.016–1.855	0.039*
Academic achievement level, average	1.178	0.845–1.643	0.334	1.342	1.008–1.786	0.044*
Underlying mental illness, yes	1.783	0.368–8.634	0.472	0.065	4.351–0.534	0.557
Underlying physical illness, yes	1.506	0.843–2.690	0.167	0.729	2.110–1.240	0.427
COVID-19 infection and quarantine experience						
Personal infection experience, yes	1.241	0.144–10.67	0.844	0.754	0.088–6.472	0.797
Experience of infected acquaintances, yes	1.355	0.510–3.600	0.542	1.198	0.508–2.826	0.680
Personal quarantine experience, yes	1.134	0.631–2.039	0.674	1.328	0.814–2.165	0.256
Experience of quarantine of acquaintances, yes	1.034	0.747–1.431	0.839	1.194	0.911–1.563	0.199
Questionnaire items related to changes in daily life patterns during the COVID-19 pandemic						
Convenience food intake, increased	1.125	0.846–1.496	0.419	1.104	0.866–1.407	0.424
Sleeping time, increased	0.975	0.723–1.316	0.869	1.106	0.861–1.420	0.431
TV watching time, increased	1.365	1.011–1.841	0.042*	1.411	1.093–1.821	0.008**
Internet usage, increased	1.226	0.931–1.615	0.146	0.981	0.775–1.242	0.874
PC or smartphone usage, increased	1.143	0.868–1.506	0.341	1.065	0.842–1.134	0.600
Exercise, increased	0.844	0.585–1.217	0.363	1.141	0.852–1.526	0.376
Questionnaire items related to psychosocial stress associated with COVID-19						
Fear of COVID-19 infection, score	1.736	1.485–2.028	<0.001***	1.786	1.563–2.040	<0.001***
Academic-related stress, score	1.157	1.030–1.300	0.014*	1.167	1.057–1.289	0.002**
Stress caused by changes in eating and sleeping patterns, score	1.112	0.982–1.259	0.094	1.055	0.949–1.172	0.324
Stress caused by changes in daily activities, score	1.117	0.986–1.265	0.083	1.091	0.983–1.121	0.102
Psychiatric scales						
UCLA Loneliness Scale-3, score	1.041	0.953–1.138	0.369	0.996	0.992–1.075	0.909
Perceived Stress Scale-10, score	1.031	1.007–1.056	0.011*	1.009	0.989–1.029	0.396
Korean version of the Gratitude Questionnaire-6, score	0.967	0.944–0.991	0.006**	0.997	0.977–1.018	0.776

*p<0.05; **p<0.01; ***p<0.001. OR, odds ratio; CI, confidence interval

groups (subjects with both depression and anxiety vs. other subjects). In this subgroup analysis, only sex factor showed significant difference ($\chi^2=10.85$, $p<0.001$). And we performed multivariable logistic regression analysis to detect risk factors for comorbid depression and anxiety symptoms. In this subgroup analysis, female sex (OR=1.666; 95% CI, 1.186–2.340; $p=0.003$), high level of fear of COVID-19 infection (OR=1.787; 95% CI, 1.485–2.149; $p<0.001$) and academic-related stress (OR=1.164; 95% CI, 1.007–1.344; $p=0.040$) were risk factors for comorbid depression and anxiety symptoms.

DISCUSSION

This study was performed to investigate the prevalence

rates of depression and anxiety (and the risk and protective factors therefor) during the COVID-19 pandemic in Korean adolescents. This study investigated the prevalence rates of depression and anxiety and psychosocial experiences during the COVID-19 pandemic in Korean adolescents. In addition, the effects of sociodemographic and psychosocial experience variables of the subjects on depression and anxiety during the COVID-19 pandemic were investigated. The main results and clinical and policy implications of this study are as follows.

The results showed that depression and anxiety had prevalence rates of 13.8% and 21.0%, respectively. These incidences of depression and anxiety among Korean adolescents were similar to or higher than those in previous studies conducted in China during the COVID-19 pandemic.^{25,38} As both depres-

Table 3. Results of multiple logistic regression analysis to detect risk factors for depression during the COVID-19 pandemic

Variables	OR	95% CI	p
Sociodemographic characteristics			
Sex, female	1.386	1.012–1.897	0.042*
Questionnaire items related to changes in daily life patterns during the COVID-19 pandemic			
Increase in TV watching time, yes	1.331	0.951–1.864	0.095
Questionnaire items related to psychosocial stress associated with COVID-19			
Fear of COVID-19 infection, score	1.799	1.515–2.136	<0.001***
Academic-related stress, score	1.134	0.992–1.297	0.066
Psychiatric scale			
Perceived Stress Scale-10, score	1.003	0.971–1.036	0.844
Korean version of the Gratitude Questionnaire-6, score	0.962	0.936–0.989	0.005**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. OR, odds ratio; CI, confidence interval

Table 4. Multiple logistic regression analysis to detect risk factors for anxiety during the COVID-19 pandemic

Variables	OR	95% CI	p
Sociodemographic characteristics			
Sex, female	1.286	0.997–1.659	0.053
Academic achievement level, poor	1.362	0.994–1.865	0.054
Academic achievement level, average	1.273	0.945–1.715	0.112
Questionnaire items related to changes in daily life pattern during COVID-19 pandemic			
Increase in TV watching time, yes	1.394	1.059–1.836	0.018*
Questionnaire items related to psychosocial stress associated with COVID-19			
Fear of COVID-19 infection, score	1.829	1.595–2.098	<0.001***
Academic-related stress, score	1.135	1.019–1.265	0.022**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. OR, odds ratio; CI, confidence interval

sion and anxiety are significantly affected by environmental factors, including the sociocultural and economic context, we compared the results of the present study with those of a previous survey of Korean adolescents conducted before the COVID-19 pandemic; depression and anxiety were more prevalent in our survey.³⁹ Although it did not use the same scale as this study, the prevalence of depression from August 2014 to January 2015 was 13.6% in a cross-sectional study of 1,991 students from 30 middle and high schools in Korea.³⁹ In addition, a survey of children and adolescents conducted in four regions of Korea from September 2016 to December 2017 showed a prevalence rate of anxiety of 15.7% among middle and high school students.⁴⁰ Insufficient statistical data are available regarding the mental health status of Korean adolescents, and the diagnostic test tools used differ between studies; nevertheless, the above results suggest that the prevalence of depression and anxiety among Korean adolescents has increased since the beginning of the COVID-19 pandemic.

The present study showed that fear of COVID-19 infection was a risk factor for depression and anxiety in Korean adolescents. Fear of infection associated with new infectious diseases,

such as COVID-19, tends to be exacerbated by the fear of infecting others, fear of being quarantined, and social stigma, in addition to uncertainty caused by a lack of information.^{41,42} In this study, these fears were grouped into one factor (fear of COVID-19 infection) and then analyzed. Consistent with several previous studies, fear of infection, fear of spreading disease to others, and social stigma related to infectious disease strongly influenced the likelihood of depression and anxiety in this study.^{43–45} Excessive fear of infection or disease transmission and social stigma were associated with a lack of knowledge and exposure to misinformation regarding COVID-19.^{46,47} The latest and most accurate information on diseases, and appropriate countermeasures for prevention (e.g., mask wearing and hand washing), can reduce the severity of depression and anxiety.^{1,48–51} Taken together, the results of the present and previous studies suggest that it is necessary for the government and health authorities to provide accurate, up-to-date information and education on preventive methods for new infectious diseases.^{1,23}

Anxiety was significantly associated with increased TV watching time in this study. According to previous studies

conducted in adult populations, during the COVID-19 pandemic, the prevalence rate of anxiety was high in those with longer TV watching times.^{52,53} In addition, increased TV watching time may be associated with increased exposure to COVID-19-related news, decreased physical activity, and fewer social interactions.⁵⁴⁻⁵⁶ Previous studies have shown that increased exposure to COVID-19-related news was associated with depression and anxiety.⁵⁷⁻⁵⁹ Disaster-related TV exposure was associated with post-traumatic stress syndrome (PTSS) in teenagers not directly exposed to the disasters.⁶⁰⁻⁶² In addition, there was a positive relation between the total amount of news consumed and the level of psychological trauma in the disaster context.⁶³ In epidemic disasters, an appropriate level of media consumption reduces anxiety and promotes behavior that can prevent disease, whereas excessive media use can increase anxiety.⁶⁴ Detailed descriptions of the COVID-19 pandemic, such as the numbers of confirmed COVID-19 cases and deaths, have been reported on TV every day. This study showed that increased time watching TV was a risk factor for anxiety, possibly because of exposure to large amounts of detailed information on the pandemic.^{65,66} Previous studies showed that sedentary behavior, such as watching TV, is positively correlated with anxiety, while physical activity protects against anxiety.⁶⁷ Several physiological mechanisms can explain the negative correlation between physical activity and anxiety.⁶⁷ The group with increased TV watching time in this study may have had fewer social interactions, which can lead to a sense of social isolation and loneliness, both of which are risk factors for anxiety.^{21,68,69} Therefore, it is necessary to be aware of increases in passive sedentary behavior, such as TV watching, among adolescents during the COVID-19 pandemic. In addition, adults should encourage adolescents to engage in physical activity at home or outdoors, and to avoid excessive media consumption.

The results of the present study showed that the risk of anxiety was increased in participants with higher levels of academic-related stress. This study included questionnaire items regarding academic stressors. A previous online survey of American high school students conducted during the COVID-19 pandemic showed that the most salient stressors were academic (e.g., excessive homework, lack of motivation to learn, and time management).⁷⁰ A study of 5,175 Chinese children and adolescents conducted during the lockdown period for COVID-19 showed that difficulties related to online classes caused depression and anxiety.⁷¹ Various facets of online learning (e.g., reduced opportunity for interaction, imbalance in the distribution of learning resources, and concerns about poor academic achievement) may promote psychological distress in children and adolescents.³ It is thus necessary to determine whether adolescents are experiencing academ-

ic-related stress, especially difficulties related to online classes, and to help them accordingly.

Female sex was a risk factor for depression in this study. In a meta-analysis examining the prevalence of depression and anxiety symptoms in children and adolescents during the COVID-19 pandemic, females experienced higher levels of both in relation to the disease than males.⁷² Other studies reported higher rates of depression, anxiety, sleep problems, and PTSS in women than men during infectious disease outbreaks.^{6,23,25,73,74} These findings suggest that girls may be more vulnerable to psychological distress than boys during infectious disease outbreaks. The government and health authorities should identify high-risk groups and provide early interventions.

This study showed that gratitude can protect against depression. In previous studies, gratitude had a negative correlation with depressive and posttraumatic stress disorder symptoms.^{75,76} Other studies showed that gratitude was associated with many positive factors, including positive reframing, social support, self-esteem, life satisfaction, and sense of control, all of which are associated with reductions in depression.^{18,77} In particular, our previous study of the general adult population showed that gratitude significantly protected against depression during the pandemic.³¹ Gratitude might enhance people's coping resources and emotional well-being in the face of negative events.^{78,79} In a study of American adolescents conducted during school closures due to the COVID-19 pandemic, "secondary engagement" coping mechanisms, such as gratitude, were associated with persistent positive emotions.^{80,81} Taken together, the results of this and previous studies suggest that gratitude employed during the COVID-19 pandemic can buffer the negative effects of disasters, improving adolescents' mood and restoring a sense of control.⁸² Encouraging adolescents to use gratitude during the pandemic may help prevent psychological conditions such as depression.^{83,84} In addition, interventions fostering gratitude are needed to improve the mental health of adolescents.

In addition, we conducted supplementary analyses for participants with both depression and anxiety symptoms as it is likely that adolescents show both symptoms. The study showed that the risk factors for comorbid depression and anxiety symptoms were increased in participants with higher levels of fear of COVID-19 infection and academic-related stress, and female. Each of these factors was described above as a risk factor for depression and anxiety, and also acted as a risk factor in the group with comorbid depression and anxiety. Depression and anxiety frequently coexist and share a general etiological process.⁸⁵ Previous studies suggest neuro-biologic similarities between depressive and anxiety disorders (serotonergic and noradrenergic dysfunction has been identified in depressive and anxiety disorders).^{86,87} In a national

survey of United States, 58% of respondents with depression also had an anxiety disorder.⁸⁸ Also comorbid depression occurs in 90% of participants with anxiety disorders.⁸⁶ As such, depression and anxiety commonly coexist and have biological similarities, so it seems that risk factors are also shared as shown in the results of this study.

This study had several limitations. First, as it was conducted on a population of teenagers in one city, the results may not be generalizable to other populations. Second, the cross-sectional design precludes inferences regarding causality. Finally, this study enrolled only adolescents who volunteered to participate. Some adolescents with depression and anxiety may have been unable to participate due to the severity of their psychological symptoms. Despite these limitations, this study provides data that could help predict and prevent negative psychological problems in Korean adolescents during the COVID-19 pandemic, by shedding light on risk and protective factors for depression and anxiety. Further research is needed to determine the psychological effects of this prolonged pandemic on Korean adolescents.

Conclusions

This study revealed the prevalence of depression and anxiety among Korean adolescents increased during the COVID-19 pandemic. The fear of COVID-19 infection was significantly associated with the prevalence of depression and anxiety. The risk of anxiety was increased in participants with longer TV watching times and higher levels of academic-related stress. The results suggest that it is necessary to reassure adolescents through the provision of accurate and up-to-date information on methods for preventing COVID-19 infection. In addition, efforts are needed to reduce the social stigma associated with the disease, and attention should be paid to adolescents exhibiting increased passive sedentary behavior, such as watching TV. It is necessary to check for academic-related stress and provide help as appropriate. This study showed that a gratitude disposition has a protective effect against depression. As gratitude is helpful in relieving psychological distress during a disaster, and promotes feelings of well-being, optimism, and happiness, strategies to foster gratitude are needed to improve the mental health of adolescents. Efforts are also needed to determine other risk factors for depression and anxiety, and to provide appropriate interventions for adolescents during prolonged infectious disease disasters. The results of this study will contribute to the development of interventions and policies to prevent psychological problems among Korean adolescents caused by societal changes associated with the COVID-19 pandemic.

Supplementary Materials

The online-only Data Supplement is available with this article at <https://doi.org/10.30773/pi.2021.0365>.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

Jae-Min Kim and Sung-Wan Kim, contributing editors of the *Psychiatry Investigation*, were not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

Author Contributions

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Supplementary Table 1. Factor analysis of the questionnaire on psychosocial stress associated with COVID-19

Item of questionnaire	Mean	Standard deviation	Factor loading				
			1	2	3	4	
Fear of COVID-19 infection							
I am afraid I will get COVID-19.	3.07	1.22	0.821*	0.107	0.034	0.136	
I am afraid my family will get COVID-19.	3.64	1.20	0.813*	0.042	0.055	0.103	
I am afraid my family or I will die from COVID-19.	3.26	1.32	0.804*	0.061	0.053	0.027	
I am afraid that there will be asymptomatic infected people around me.	2.95	1.28	0.801*	0.140	0.096	0.065	
I am afraid that I will be quarantined for 2 weeks on contact with an infected person.	2.68	1.25	0.758*	0.138	0.068	0.008	
I am afraid that I will harm those around me if I am confirmed to have COVID-19.	3.71	1.17	0.743*	0.155	0.116	0.103	
I am afraid that I will be blamed by others if I am infected.	3.12	1.33	0.687*	0.224	0.158	0.046	
Academic-related stress							
I feel stressed about managing study time on my own after the spread of COVID-19.	2.76	1.35	0.192	0.840*	0.155	0.142	
I feel stressed academically after the spread of COVID-19.	2.92	1.40	0.216	0.799*	0.175	0.066	
I feel stressed about online classes after the spread of COVID-19.	2.85	1.41	0.106	0.771*	0.155	0.135	
Stress caused by changes in eating and sleeping patterns							
My diet has become irregular after the spread of COVID-19.	2.69	1.33	0.113	0.179	0.804*	0.154	
I eat convenience food more often after the spread of COVID-19.	2.82	1.27	0.102	0.091	0.797*	0.088	
My sleep schedule has become irregular after the spread of COVID-19.	2.81	1.40	0.094	0.188	0.785*	0.018	
Stress caused by changes in daily activities							
COVID-19 interferes with my personal leisure.	3.90	1.23	0.104	0.069	0.113	0.906*	
I feel stressed by changes in my daily activities after the spread of COVID-19	3.15	1.36	0.180	0.418	0.160	0.690*	
Eigenvalue			4.392	2.325	2.073	1.418	
Variance explained (%)			29.27	15.50	13.81	9.45	
Cumulative variance explained (%)			29.27	44.78	58.59	68.05	
Number of items			7	3	3	2	
Kaiser-Meyer-Olkin statistic			0.874				
Bartlett's test of sphericity			$\chi^2=11,967.27$, $df=105$, $p<0.001$				
Reliability (Cronbach's α)			Total=0.87	0.901	0.807	0.756	0.660

All questionnaire items were rated using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). *highest factor loading values