ORIGINAL ARTICLE
https://doi.org/10.30773/pi.2022.0211
Print ISSN 1738-3684 / On-line ISSN 1976-3026
OPEN ACCESS

Factors Affecting Stress and Mental Health During the COVID-19 Pandemic

Jinwoo Park, Soyoung Irene Lee, Jeewon Lee, HyunChul Youn✉, and Shin-Gyeom Kim✉

Department of Psychiatry, Soonchunhyang University Bucheon Hospital, Bucheon, Republic of Korea

Objective This study examined the factors influencing the mental health and stress of individuals during the coronavirus disease-2019 (COVID-19) pandemic.

Methods A total of 600 participants were enrolled in this anonymous questionnaire survey that included questions on their demographic profiles and experiences related to the COVID-19 pandemic. The COVID-19 Stress Scale for Korean People (CSSK), Warwick–Edinburgh Mental Wellbeing Scale, Generalized Anxiety Disorder-7, Patient Health Questionnaire-9, Insomnia Severity Index, and Multidimensional Scale of Perceived Social Support were used. Data were analyzed using multiple regression to identify the factors affecting the total CSSK scores and the scores of each of the three CSSK subscales.

Results Multiple regression analyses revealed that the severity of insomnia, sex, degree of income decline, occupation, religion, education level, marital status, residential status, level of social support, and degree of depression and anxiety had significant relationships with COVID-19-related stress.

Conclusion We identified factors affecting stress and mental health in the general population during the COVID-19 pandemic. Our findings may be helpful in providing an individualized approach to managing the mental health of the public. We expect that the results of this study will be used to screen high-risk individuals vulnerable to stress and to establish policies related to the public health crisis.

Psychiatry Investig 2023;20(2):152-161

Keywords COVID-19; Pandemic; Mental health; Stress; Public health crisis.

INTRODUCTION

The novel coronavirus disease-2019 (COVID-19) was first detected in December 2019 and has since become a pandemic. Thereafter, on January 30, 2020, the World Health Organization (WHO) declared COVID-19 a public health emergency of international concern.[1] The virus has a short incubation period, rapid onset of symptoms, rapid change of symptoms, and is highly contagious. Consequently, COVID-19 poses a significant threat to patients as well as healthy individuals.[2] The COVID-19 pandemic is not limited to physical illness or death, but has brought about a period of change, ranging from sudden changes in the daily lives of individuals to global economic crises and socio-cultural changes.[3]

Following the first confirmed case of COVID-19 reported in Korea on January 20, 2020, social distancing was introduced on February 29, 2020. On March 21, 2020, the government announced enhanced social distancing, which restricted the operation of multiuse facilities.[4] Subsequently, the distancing stage was adjusted according to the change in the number of confirmed patients, and all social distancing measures were lifted on April 18, 2022.[5] Vaccinations in Korea started with medical personnel and those vulnerable to infection on February 26, 2021, and were subsequently administered to the whole country. According to the Korea Centers for Disease Control and Prevention (KCDC), 97.4% of adults were vaccinated up to the first shot, 96.6% were vaccinated up to the second shot, and 75.0% received a booster shot by midnight on August 19, 2022.[6]

The COVID-19 pandemic has affected the mental health of the general population. As per a survey conducted by the Korean Society for Traumatic Stress Studies and the Ministry

Received: July 20, 2022 **Revised:** September 7, 2022
Accepted: October 30, 2022

✉ **Correspondence:** HyunChul Youn, MD, PhD
Department of Psychiatry, Soonchunhyang University Bucheon Hospital, 170 Jomaru-ro, Bucheon 14584, Republic of Korea
Tel: +82-32-621-5063, **Fax:** +82-32-621-5018, **E-mail:** dryounh@schmc.ac.kr

✉ **Correspondence:** Shin-Gyeom Kim, MD, PhD
Department of Psychiatry, Soonchunhyang University Bucheon Hospital, 170 Jomaru-ro, Bucheon 14584, Republic of Korea
Tel: +82-32-621-5063, **Fax:** +82-32-621-5018, **E-mail:** redmensch@schmc.ac.kr

of Health and Welfare in March, 2020, the risk groups for anxiety, depression, and suicidal ideation were 19.0%, 17.5%, and 9.7%, respectively. This is relatively high compared to the depression risk (3.79%) and the suicidal ideation rate (4.7%) identified in the 2018 Community Health Survey Report.[7] In a subsequent survey conducted in September 2020, anxiety risk had become 18.9%, which was at the same level as that in the March survey, while the risks for depression and suicidal ideation were 22.1% and 13.8%, respectively, both of which were relatively higher than those identified in the March survey.[8] According to a previous study in Korea, as the damage to society due to COVID-19 continues, accumulated stress on the general population has caused or exacerbated mental health problems.[9] The results of studies conducted in other countries on the mental health of the general population during the COVID-19 pandemic were similar. According to a systematic review, studies in various countries, such as China, Spain, Italy, Iran, the United States, Turkey, Nepal, and Denmark, also showed high anxiety, depression, post-traumatic stress disorder, and psychological stress in the population owing to the COVID-19 pandemic.[10]

However, few studies have investigated how different characteristics of individuals affect their mental health during the pandemic. We attempted to identify the relationships between the stress caused by COVID-19 and various characteristics of individuals. Based on the statistical data and research results mentioned above, we hypothesized that individuals with psychiatric symptoms would be more vulnerable to stress than would individuals without such symptoms during the COVID-19 pandemic.[7-10] Since people suffered from economic problems during the pandemic, we hypothesized that the socioeconomic statuses of individuals would affect their stress.[3] Various experiences related to the COVID-19 pandemic were also expected to affect individuals' stress. Therefore, we investigated demographic factors, psychosocial scales, and experiences related to COVID-19 to identify the factors affecting the stress and mental health of the participants during the pandemic.

METHODS

Participants and procedures

This study was based on an anonymous questionnaire survey administered to 600 adults aged 19 to 65 years living in Bucheon. The instructions, together with a questionnaire, were sent via a uniform resource locator (URL) attached to a mobile phone message through the Bucheon City Mental Health Welfare Center. When participants accessed the provided URL, they checked the consent form before beginning to answer the questionnaire. The survey was conducted for a month in December 2021. It took approximately 30 minutes to complete the questionnaire. Informed consent was obtained from all the participants. Of the 1,000 people who received the message, 701 responded initially. Out of them, excluding those who responded incompletely, 600 were finally enrolled. This study was approved by the Institutional Review Board (IRB) of the Soonchunhyang University Bucheon Hospital (IRB No. 2021-10-026).

Questionnaire

Demographic characteristics and experiences related to COVID-19

All questionnaires were self-reported. The survey included questions regarding basic demographic information, such as sex, age, education level, marital status, residential status, religion, occupation, and average monthly income. Experiences related to COVID-19; history of psychiatric, medical, and surgical diseases; and the psychosocial scales were investigated.

COVID-19 Stress Scale for Korean People

The COVID-19 Stress Scale for Korean People (CSSK) was developed by Kim et al.[11] to measure the stress related to COVID-19 among Korean adults. The CSSK has the advantage of measuring multidimensional aspects of stress, and reflects the situation caused by COVID-19 in Korea, such as self-quarantine. Therefore, we considered it suitable for our study. This scale has 21 questions and consists of three sub-factors (factor 1, fear of infection; factor 2, difficulties of social distancing; and factor 3, anger against others). Factor 1 (fear of infection) comprises questions measuring two types of fear: the fear that one can be infected with COVID-19 and the fear that others may be infected because of oneself. Factor 2 (difficulties of social distancing) comprises questions that measure economic difficulties during the COVID-19 pandemic and negative emotions, such as depression, caused by a decrease in meetings with family and friends. Finally, factor 3 (anger against others) measures anger felt toward other people, including those who cause the infection or violate quarantine rules during the COVID-19 pandemic. Each question is answered on a 5-point scale (1=not at all, 5=very much). Additionally, a higher score indicates greater stress experienced by an individual.[11]

Psychosocial scales

The Warwick–Edinburgh Mental Wellbeing Scale (WEMWBS) consists of 14 questions that aim to build on previous scales and capture a wide conception of well-being, including the affective-emotional aspects, cognitive-evaluative dimensions, and psychological functioning.[12] We used the Korean version of the WEMWBS, which has good content validity

and reliability.[13] To assess participants' degrees of anxiety, depression, and insomnia, we respectively used the Generalized Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9), and Insomnia Severity Index (ISI).[14-16] These scales were translated into Korean and their reliability and validity have been confirmed.[17-19] Finally, to understand the participants' level of social support, the Multidimensional Scale of Perceived Social Support (MSPSS) was used. It assesses an individual's perception of the amount of external social support they receive. It has been tested on individuals of different age groups and from various cultural backgrounds, and is a reliable and valid instrument. The MSPSS consists of three subscales: family, friends, and significant others.[20] We used the Korean version of the MSPSS to confirm its reliability and validity.[21]

Statistical analysis

All statistical analyses were performed using SPSS 26.0 for Windows (IBM Corp., Armonk, NY, USA). The general characteristics and experiences related to the COVID-19 of the study participants and the sums of each scale were determined using descriptive statistics including frequency, percentage, mean, and standard deviation (SD). The differences in the CSSK scores according to the general characteristics and experiences related to COVID-19 in the study participants were analyzed using Student's t-test and one-way ANOVA. Correlations among the study scales were probed using Pearson's correlation coefficients. Finally, stepwise multiple regression analyses were performed to investigate the factors influencing the CSSK scores.

RESULTS

Demographic factors

Table 1 shows the demographic profiles of the study population. The average age of the study participants was 40.80 (SD=10.81) years and 307 (51.2%) were men, the remaining demographic characteristics are listed in Table 1.

Experiences related to the COVID-19 pandemic

The experiences related to COVID-19 and a summary of the scores of the scales used in the study are shown in Table 2. Among the study population, 5 (0.8%) experienced COVID-19 infection, and 78 (13%) experienced self-quarantine at least once. Moreover, 562 (93.7%) received their first or further shots of COVID-19 vaccination, and the participants' average total CSSK score was 74.64 (SD=12.54).

Psychosocial scales

Comparisons of the total CSSK scores and the three par-

Table 1. General characteristics of the study population

Characteristics	Value (N=600)
Age, yr	40.80±10.81
19–29 yr	111 (18.5)
30–39 yr	164 (27.3)
40–49 yr	182 (30.3)
50–59 yr	108 (18.0)
60–65 yr	35 (5.8)
Sex	
Male	307 (51.2)
Female	293 (48.8)
Education level	
Middle school or less	3 (0.5)
High school graduate	105 (17.5)
Current college student	23 (3.8)
College graduate	424 (70.7)
Graduate school or higher	45 (7.5)
Marital status	
Single	271 (45.2)
Married and living with spouse	299 (49.8)
Divorced	24 (4.0)
Separated by death	6 (1.0)
Residence status	
Living alone	57 (9.5)
Living with family members including spouse	287 (47.8)
Living with family members other than spouse	240 (40.0)
Living with a partner other than the family	16 (2.7)
Religion	
Yes	256 (41.0)
No	354 (59.0)
Current occupation	
Health care workers and professionals	54 (9.0)
Office worker	255 (42.5)
Housewife	40 (6.7)
Service/sales	40 (6.7)
Manager	13 (2.2)
Self-employed	37 (6.2)
Freelancer	8 (1.3)
Jobless	53 (8.8)
Student	16 (2.7)
Others	84 (14.0)
Average monthly household income	
Less than 3 million KRW ($2,540)*	158 (26.3)
3 to 7 million KRW ($2,540 to $5,930)*	338 (56.3)
More than 7 million KRW ($5,930)*	104 (17.3)
History of psychiatric disorder	33 (5.5)
History of internal or surgical disease	111 (18.5)

Values are presented as mean±standard deviation, number (%). Percentages may not total 100% due to rounding. *dollar denomination is based on the prevailing exchange rate in December 2021

Table 2. Participants' experiences related to the COVID-19 pandemic and summary of scores of the scales

	Value (N=600)
Experience of COVID-19 infection	5 (0.8)
Types of treatment in case of COVID-19 infection	
Community treatment center	4 (80.0)
Self-quarantine at home	1 (20.0)
Hospitalization in the general ward	0 (0)
Hospitalized in the intensive care unit	0 (0)
Experience of spreading infection to others	
Spreading within your family	2 (40.0)
Spreading in the workplace	1 (20.0)
None	2 (40.0)
Number of times of self-quarantine	
None	522 (87.0)
One-time	56 (9.3)
Twice	20 (3.3)
Three times	1 (0.2)
Four times	1 (0.2)
COVID-19 Vaccination experience	
Not vaccinated	38 (6.3)
Done with the first vaccination	562 (93.7)
Done with the second vaccination	551 (91.8)
Done with booster shots	119 (19.8)
Whether there are quarantine rules implemented by the workplace itself	
Yes	137 (22.8)
No	463 (77.2)
Changes in income during the COVID-19 pandemic	
Increase in income or no change	369 (61.5)
Less than 25% reduction	98 (16.3)
25%–50% reduction	61 (10.2)
50% or more reduction	39 (6.5)
Unemployed or out of business	33 (5.5)
CSSK total	74.64±12.54
CSSK factor 1 (fear of infection)	32.49±6.89
CSSK factor 2 (difficulty due to social distancing)	18.13±4.32
CSSK factor 3 (anger toward others)	24.02±4.41
WEMWBS	46.94±9.51
GAD-7	3.80±4.28
PHQ-9	5.10±5.26
ISI	9.11±4.53
MSPSS	58.07±13.65

Values are presented as mean±standard deviation, number (%). COVID-19, coronavirus disease-2019; CSSK, COVID-19 Stress Scale for Korean People; WEMWBS, Warwick-Edinburg Mental Well-being Scale; GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9; ISI, Insomnia Severity Index; MSPSS, Multidimensional Scale of Perceived Social Support

ticipant factors, according to their characteristics, are presented in Tables 3 and 4 presents the correlation analysis results between the total scales, along with each coefficient of the correlation. Table 5 depicts the results of the multiple regression analyses and the factors exhibiting significant relationships with CSSK and the three factors (factor 1, fear of infection; factor 2, difficulties of social distancing; and factor 3, anger against others). Multiple regression analyses of the participants' sum of scales (WEMWBS, GAD-7, PHQ-9, ISI, and MSPSS), general characteristics, and COVID-19 pandemic-related experiences, such as vaccination, self-quarantine, and changes in income or occupation during the pandemic, were conducted. Factors significantly related to the total CSSK scores were ISI (β=0.227), sex (β=0.168), GAD-7 (β=0.141), MSPSS (β=0.122), level of education (β=-0.098), occupation before the COVID-19 pandemic (β=-0.084), and changes in income during the COVID-19 pandemic (β=0.080). CSSK factor 1 scores were significantly influenced by sex (β=0.211), ISI (β=0.183), GAD-7 (β=0.121), MSPSS (β=0.097), occupation after the COVID-19 pandemic (β=-0.092), and residence status (β=0.068). Multiple regression analyses on the CSSK factor 2 scores revealed that it was significantly affected by ISI (β=0.196), changes in income during the COVID-19 pandemic (β=0.173), PHQ-9 (β=0.134), educational level (β=-0.099), and marital status (β=-0.090). Lastly, the factors significantly associated with CSSK factor 3 were sex (β=0.213), ISI (β=0.203), religion (β=0.103), MSPSS (β=0.100), occupation before the COVID-19 pandemic (β=-0.099), and education level (β=-0.080).

DISCUSSION

This study attempted to identify the factors affecting the mental health and stress caused by COVID-19 among the public. According to the KCDC, 93.6% of adults were vaccinated up to the first shot, 91.6% were vaccinated up to the second shot, and 8.1% had received a booster shot by midnight on December 3, 2021, when this study was conducted.[22] Regarding the results of COVID-19-related experiences in the study, the vaccination rates of the participants in this study were similar to the total vaccination rate in Korea.[22] Further, 0.8% of the participants in this study responded that they had experienced COVID-19, and this figure is also similar considering the cumulative number of confirmed cases announced by the KCDC at the same time.[22]

Insomnia severity exhibits a positive relationship with the degree of stress caused by COVID-19. These results are consistent with those of previous studies showing that elevated stress increases awareness of the surrounding environment and lowers the quality of sleep.[23] In terms of sleep physiology,

Table 3. Comparison of CSSK scores according to participant characteristics

Factor	CSSK total		CSSK factor 1 (Fear of infection)		CSSK factor 2 (Difficulty due to social distancing)		CSSK factor 3 (Anger toward others)	
	Mean	p	Mean	p	Mean	p	Mean	p
Age		0.988		0.977		0.710		0.424
20s	74.33		32.34		18.17		23.82	
30s	75.09		32.75		18.04		24.30	
40s	74.50		32.28		17.91		24.31	
50s	74.46		32.56		18.30		23.61	
60s	74.74		32.57		19.00		23.17	
Sex		<0.001**		0.663		<0.001**		<0.001**
Male	72.29		30.99		18.20		23.10	
Female	77.09		34.06		18.05		24.99	
Education level		0.077		0.258		0.182		0.089
Middle school or less	70.67		31.00		16.67		23.00	
High school graduate	76.69		33.35		18.65		24.69	
Current college student	71.65		30.78		18.57		22.30	
College graduate	74.89		32.58		18.17		24.14	
Graduate school or higher	69.24		30.58		16.36		22.31	
Marital status		0.388		0.481		0.222		0.935
Single	73.83		32.04		17.85		23.95	
Married and living with spouse	75.49		32.92		18.45		24.13	
Divorced	72.83		32.00		17.08		23.75	
Separated by death	75.67		33.17		19.00		23.50	
Residence status		0.025*		0.043*		0.123		0.072
Living alone	71.49		30.70		17.54		23.25	
Living with family members including spouse	75.54		32.84		18.55		24.15	
Living with family members other than spouse	73.92		32.28		17.74		23.90	
Living with a partner other than the family	80.44		35.63		18.38		26.44	
Religion		0.249		0.065		0.036*		0.099
Yes	75.35		33.11		18.57		23.67	
No	74.14		32.05		17.82		24.27	
Average monthly household income		0.329		0.223		0.144		0.328
Less than 3 million KRW ($2,540)†	74.30		31.85		18.61		23.84	
3 to 7 million KRW ($2,540 to $5,930)†	75.23		32.91		18.07		24.25	
More than 7 million KRW ($5,930)†	73.21		32.08		17.56		23.58	
Changes in income during the COVID-19 pandemic		0.001*		0.389		<0.001*		0.197
Increase in income or no change	72.90		32.07		17.10		23.74	
Less than 25% reduction	76.67		32.86		19.56		24.26	
25%–50% reduction	77.51		33.26		20.12		24.13	
50% or more reduction	78.28		33.10		20.15		25.03	
Unemployed or out of business	78.39		33.91		19.33		25.15	
COVID-19 vaccination experience		0.357		0.369		0.052		0.909
Done with the first vaccination	79.36		34.73		20.55		24.09	
Done with the second vaccination	74.21		32.30		17.87		24.04	
Done with booster shots	75.87		33.19		18.56		24.12	
Not vaccinated	74.29		31.76		19.00		23.53	
Number of times of self-quarantine		0.585		0.563		0.958		0.476
None	74.47		32.37		18.12		23.98	
One-time	76.82		33.82		18.36		24.64	
Twice	73.45		32.00		17.60		23.85	
Three times	63.00		27.00		18.00		18.00	
Four times	73.00		32.00		20.00		21.00	

Table 3. Comparison of CSSK scores according to participant characteristics (continued)

Factor	CSSK total		CSSK factor 1 (Fear of infection)		CSSK factor 2 (Difficulty due to social distancing)		CSSK factor 3 (Anger toward others)	
	Mean	p	Mean	p	Mean	p	Mean	p
Occupation before COVID-19 pandemic		<0.001**		<0.001**		<0.001**		0.207
Self-employed	72.31		31.30		17.26		23.75	
Others	76.32		33.35		18.75		24.22	
Current occupation		0.010*		0.121		0.201		0.083
Self-employed	78.16		34.19		18.73		25.24	
Others	74.41		32.38		18.09		23.94	
Change of occupation during COVID-19 pandemic		0.147		0.683		0.149		0.066
None	74.29		32.42		18.00		23.87	
Yes	76.21		32.77		18.72		24.73	
History of psychiatric disorder		0.809		0.939		0.907		0.649
None	74.61		32.48		18.12		24.00	
Yes	75.15		32.58		18.21		24.36	
History of medical and surgical disease		0.806		0.542		0.941		0.857
None	74.58		32.41		18.13		24.04	
Yes	74.90		32.85		18.10		23.96	

*p<0.05; **p<0.01; †dollar denomination is based on the prevailing exchange rate in December 2021. COVID-19, coronavirus disease-2019; CSSK, COVID-19 Stress Scale for Korean People

Table 4. Correlations among variables (N=600)

	WEMWBS	CSSK total	CSSK factor 1	CSSK factor 2	CSSK factor 3	GAD-7	PHQ-9	ISI
	r(p)	r(p)	r(p)	r(p)	r(p)	r(p)	r(p)	r(p)
CSSK total	-0.049 (0.232)							
CSSK factor 1	-0.019 (0.641)	0.910** (<0.001)						
CSSK factor 2	-0.106* (0.010)	0.646** (<0.001)	0.392** (<0.001)					
CSSK factor 3	-0.006 (0.891)	0.788** (<0.001)	0.640** (<0.001)	0.245** (<0.001)				
GAD-7	-0.440** (<0.001)	0.245** (<0.001)	0.197** (<0.001)	0.249** (<0.001)	0.144** (<0.001)			
PHQ-9	-0.479** (<0.001)	0.230** (<0.001)	0.172** (<0.001)	0.256** (<0.001)	0.134** (0.001)	0.870** (<0.001)		
ISI	-0.243** (<0.001)	0.297** (<0.001)	0.230** (<0.001)	0.299** (<0.001)	0.191** (<0.001)	0.525** (<0.001)	0.547** (<0.001)	
MSPSS	0.579** (<0.001)	0.038 (0.355)	0.049 (0.233)	-0.022 (0.595)	0.053 (0.198)	-0.280** (<0.001)	-0.354** (<0.001)	-0.191** (<0.001)

*p<0.05; **p<0.01. CSSK, COVID-19 Stress Scale for Korean People; CSSK factor 1, fear of infection; CSSK factor 2, difficulty due to social distancing; CSSK factor 3, anger toward others; WEMWBS, Warwick-Edinburg Mental Well-Being Scale; GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9; ISI, Insomnia Severity Index; MSPSS, Multidimensional Scale of Perceived Social Support

the set point of the hypothalamic-pituitary-adrenal axis, which plays an important role in regulating the sleep-wake cycle, can be modulated and reset to other levels by stressful experiences, and this process may affect the quality of sleep.[24] Additionally, it can be assumed that sleep hygiene has become poorer as participants spend more time at home during the COVID-19 pandemic.

The study revealed that female sex had a positive relationship with the degree of stress caused by COVID-19, especially in terms of fear of infection and anger towards others. This is consistent with previous studies showing that women are more likely to experience psychological distress during the

Table 5. Multiple regression analyses on the CSSK total scores and each of the three factors

	B	SE	β	t	p
CSSK total					
ISI	0.630	0.123	0.227	5.124	<0.001
Sex	4.202	0.948	0.168	4.433	<0.001
Changes in income during the COVID-19 pandemic	2.413	1.172	0.080	2.058	0.040
Level of education	-4.658	1.792	-0.098	-2.599	0.010
GAD-7	0.413	0.133	0.141	3.111	0.002
MSPSS	0.112	0.036	0.122	3.113	0.002
Occupation before COVID-19 pandemic	-4.399	2.002	-0.084	-2.198	0.028
CSSK factor 1 (Fear of infection)					
ISI	0.279	0.069	0.183	4.063	<0.001
Sex	2.906	0.533	0.211	5.458	<0.001
Residence status	1.593	0.925	0.068	1.722	0.086
Occupation after COVID-19 pandemic	-2.629	1.106	-0.092	-2.378	0.018
GAD-7	0.194	0.075	0.121	2.610	0.009
MSPSS	0.049	0.021	0.097	2.364	0.018
CSSK factor 2 (Difficulty due to social distancing)					
ISI	0.187	0.043	0.196	4.299	<0.001
Changes in income during the COVID-19 pandemic	1.798	0.398	0.173	4.516	<0.001
PHQ-9	0.110	0.038	0.134	2.926	0.004
Level of education	-1.613	0.621	-0.099	-2.596	0.010
Marital status	-0.777	0.330	-0.090	-2.357	0.019
CSSK factor 3 (Anger toward others)					
Sex	1.877	0.346	0.213	5.422	<0.001
ISI	0.198	0.039	0.203	5.135	<0.001
Religion	0.920	0.354	0.103	2.598	0.010
Before COVID-19 pandemic Occupation	-1.816	0.712	-0.099	-2.549	0.011
MSPSS	0.032	0.013	0.100	2.504	0.013
Level of education	-1.340	0.653	-0.080	-2.051	0.041

CSSK total: Adj. R^2=0.158, F(p)=17.082 (<0.001). CSSK factor 1: Adj. R^2=0.120, F(p)=14.617 (<0.001). CSSK factor 2: Adj. R^2=0.143, F(p)=20.948 (<0.001). CSSK factor 3: Adj. R^2=0.103, F(p)=12.492 (<0.001). B, beta coefficient; SE, standard error; β, standardized beta coefficient; COVID-19, coronavirus disease-2019; CSSK, COVID-19 Stress Scale for Korean People; ISI, Insomnia Severity Index; GAD-7, Generalized Anxiety Disorder-7; MSPSS, Multidimensional Scale of Perceived Social Support; PHQ-9, Patient Health Questionnaire-9

COVID-19 pandemic.[25,26] Best et al.[25] estimated that women are generally more likely to experience parenting stress and parenting responsibilities, and that their work responsibilities may worsen psychological distress during the pandemic.[25,27] Rodriguez-Besteiro et al.[26] reported that women presented relatively higher levels of perceived risk of COVID-19 than that presented by men owing to their emotional vulnerability. These interpretations may explain the results of women experiencing greater stress in this study.

The degree of income decline and the level of COVID-19 stress exhibited a positive relationship, especially in terms of difficulties due to social distancing. Furthermore, being self-employed had a positive relationship with COVID-19 stress; in this case, it was prominent in terms of the fear of infection and anger towards others. Since the beginning of the COVID-19 pandemic, Korea has implemented social distancing measures, such as restrictions on the number of private gatherings and limitations in multiuse facilities.[28] According to a survey conducted by the Seoul Metropolitan Government on 526 self-employed individuals from November 20 to December 10, 2021, 93.7% of the participants reported suffering from COVID-19 and 93.7% reported that sales had declined.[29] In 2021, according to data from the Small Enterprise and Market Service, an average of 20,000 individuals had closed their shops or kiosks every month.[30] An August 2021 research by the Korea Development Institute revealed that the total

debt within the self-employed sector increased by 21% year-on-year.[31] In this context, it is believed that the extent of the decrease in income and whether they were engaged in self-employment affected individuals' level of COVID-19-related stress. The results of our study were consistent with those of previous studies. According to Rodríguez et al.,[32] low income or economic instability is associated with stress during the COVID-19 pandemic. Shevlin et al.[33] found that low income or a decrease in income was related to depression and anxiety during the COVID-19 pandemic, which can lead to stress caused by COVID-19.

Further, we found that having religion was associated with reduced COVID-19 stress, especially in terms of anger towards others. Ellison and George[34] reported that enhancing emotional and tangible support during a stressful event through religious activities helps buffer the effects of stress. Religious commitment purportedly helps control stress or plays an immunomodulatory role in regulating hormones such as cortisol, which is associated with stress and depression.[35,36] The influence of religious factors on COVID-19 stress in this study can be considered in the same context.

We found that having a graduate degree or higher education was associated with a reduction in COVID-19 stress, especially in terms of the difficulties of social distancing and anger towards others. According to a study that analyzed the differences in risk perception, knowledge, and protective behavior regarding COVID-19 by educational level, high levels of education and knowledge correlated with good adherence to protective behaviors such as hand hygiene and social distancing.[37,38] A low level of education was associated with a greater perceived severity of COVID-19, which can lead to COVID-19-related stress during the pandemic.[37] Considering the results of these preceding studies, participants with a high level of education in this study might have experienced relatively less stress based on up-to-date and more accurate health information, and good adherence to precautionary measures.

Among the four types of marital status ("single," "married and living with spouse," "divorced," and "separated by death"), living with one's spouse after marriage exhibited a positive correlation with stress caused by COVID-19, especially in terms of the difficulties associated with social distancing. Living alone (among the residence status options) was related to less stress from COVID-19, especially with respect to the fear of infection. The perceived social support of the participants had a positive relationship with COVID-19 stress, especially in terms of fear of infection and anger towards others. Previous studies have shown that the physical illness of one's spouse can act as a stressor to oneself.[39] These stressors are estimated to increase the stress of participants living with their spouses during the COVID-19 pandemic. Due to social distancing, facilities such as schools and daycare centers for children or the elderly were closed, which increased the burden of supporting their families.[40] It can be assumed that people living with others experience greater COVID-19-related stress owing to the fear of infection from their roommates. In this context, living alone may be associated with a relatively low level of stress during the pandemic. The perceived social support surveyed in this study consisted of three areas, including friends and significant others, in addition to family members. As face-to-face contact with people other than family members has been restricted during the COVID-19 pandemic, those who perceive high social support from friends and meaningful others may have experienced relatively higher stress.

Finally, the degree of depression and anxiety showed a positive relationship with the stress experienced during the COVID-19 pandemic. These results are consistent with those of previous studies showing that COVID-19 results in stress and various psychological symptoms, including anxiety and depression.[33,41,42] According to a systematic review and meta-analysis conducted by Cénat et al.,[43] the pooled prevalence of depression, anxiety, and psychological distress were 15.97%, 15.15%, and 13.29%, respectively. Compared to the WHO study on mental health disorders in the general population, the prevalence of depression in populations affected by COVID-19 is more than three times higher than that in the general population, while it is four times higher for anxiety.[43] Esterwood and Saeed[44] found that emotional responses such as extreme fear and uncertainty became more evident during the pandemic. These responses contributed to increased stress responses, which are particularly pronounced in people with pre-existing mental health problems such as depression and anxiety.

Per our expectations, psychiatric symptoms such as depression, anxiety, insomnia, and socioeconomic profiles, including occupations or changes in income, affected stress during the COVID-19 pandemic. The strength of this study is that we investigated and analyzed various individual factors that are expected to influence the stress and mental health of the public during the COVID-19 pandemic, not limited to examining statistical figures. By investigating experiences related to COVID-19, such as of infection, transmission, self-quarantine, and changes in income during the pandemic, we attempted to identify the impact of this special situation on the public. We highlighted the differences between groups with different characteristics and identified both protective and risk factors by analyzing various sociodemographic characteristics and psychosocial scales. We expect the results of this study to be used for screening high-risk groups that are expected to be more susceptible to stress from public health

crises. Moreover, it may be helpful to relieve stress and improve people's mental health by providing individualized psychological interventions and determining appropriate psychiatric services according to their own characteristics, rather than a one-size-fits-all approach. By appropriately allocating limited resources, it will be possible to effectively manage the mental health problems in the general population, which can continue even after the COVID-19 pandemic. Furthermore, the design and results of our study can be used to plan and conduct new research in the event of a public health crisis. We also expect that the results of this study can be used to establish policies related to public health crises.

Nevertheless, our study had several limitations. Although the Bucheon City Mental Health Welfare Center randomly sent the message containing the survey to people, there is possibility that the enrolled subjects may not fully represent the entire population. Therefore, these points should be considered when generalizing our research results and applying them to the entire population of Bucheon or Korea. Among our study participants, the number of those who experienced COVID-19 infection and transmission to others was low. It can be estimated that those who have experienced these experiences might have experienced relatively greater stress; however, we have not sufficiently enrolled these people. As we targeted participants who were able to respond voluntarily due to the study design, people with serious health problems were not included. Regarding the age of the participants, the participants were limited to those in their 20s and 60s, excluding children and the elderly. Lastly, since this study had a cross-sectional design and was conducted for one month, changes in participants' stress and mental health over time were not reflected. Therefore, if a similar study is conducted, a longitudinal study involving a wider variety of participants is recommended.

In conclusion, suffering from insomnia, female sex, experiencing a large decline in income during the pandemic, being self-employed, and having high levels of depression and anxiety are likely to heighten stress from COVID-19. Being married and living with a spouse, having roommates, and high levels of perceived social support were also associated with higher levels of stress. As we identified various factors that affect the stress and mental health of the general population during the COVID-19 pandemic, we expect that our findings will help improve the mental health of the public during the pandemic.

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

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: HyunChul Youn, Shin-Gyeom Kim. Data curation: Jinwoo Park, HyunChul Youn. Formal analysis: Jinwoo Park, Shin-Gyeom Kim. Funding acquisition: HyunChul Youn, Shin-Gyeom Kim. Investigation: Jinwoo Park, Jeewon Lee. Methodology: Jinwoo Park, Jeewon Lee. Project administration: Soyoung Irene Lee, HyunChul Youn, Shin-Gyeom Kim. Supervision: HyunChul Youn, Shin-Gyeom Kim. Validation: Soyoung Irene Lee, Jeewon Lee. Visualization: Jinwoo Park, Soyoung Irene Lee. Writing—original draft: Jinwoo Park. Writing—review & editing: all authors.

ORCID iDs

Jinwoo Park	https://orcid.org/0000-0002-2100-3716
Soyoung Irene Lee	https://orcid.org/0000-0003-2473-2954
Jeewon Lee	https://orcid.org/0000-0001-5930-1834
HyunChul Youn	https://orcid.org/0000-0002-6557-5628
Shin-Gyeom Kim	https://orcid.org/0000-0001-8196-655X

Funding Statement

This study was supported by the Soonchunhyang University Research Fund.

REFERENCES

1. World Health Organization. Novel coronavirus (2019-nCoV). Situation report - 11 [Internet]. Available at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200131-sitrep-11-ncov.pdf?sfvrsn=de7c0f7_4. Accessed May 10, 2022.
2. Wang J, Wang JX, Yang GS. The psychological impact of COVID-19 on Chinese individuals. Yonsei Med J 2020;61:438-440.
3. Choi J. The effects of COVID-19 pandemic on the mental health of the general public and children and adolescents and supporting measures. J Korean Neuropsychiatr Assoc 2021;60:2-10.
4. Ministry of Foreign Affairs, Republic of Korea. All about Korea's response to COVID-19 [Internet]. Available at: https://www.mofa.go.kr/eng/brd/m_22591/view.do?seq=35&srchFr=&srchTo=&srchWord=&srchTp=&multi_itm_seq=0&itm_seq_1=0&itm_seq_2=0&company_cd=&company_nm=&page=1&titleNm=. Accessed May 10, 2022.
5. Korean Ministry of Health and Welfare. The lifting of social distancing rules [Internet]. Available at: https://www.mohw.go.kr/react/al/sal0301vw.jsp?PAR_MENU_ID=04&MENU_ID=0403&page=1&CONT_SEQ=371078. Accessed May 10, 2022.
6. Korean Ministry of Health and Welfare. COVID-19 outbreak and vaccination status in Korea [Internet]. Available at: https://ncov.kdca.go.kr/tcmBoardView.do?brdId=3&brdGubun=31&dataGubun=&ncvContSeq=6827&contSeq=6827&board_id=312&gubun=ALL. Accessed September 7, 2022.
7. Korean Ministry of Health and Welfare, Korea Suicide Prevention Center. 2020 white book [Internet]. Available at: https://www.043w.or.kr/www/downloadBbsFile.do?atchmnflNo=27765. Accessed March 29, 2020.
8. Korean Society for Traumatic Stress Studies. The third survey on the mental health of the people in COVID-19 [Internet]. Available at: http://kstss.kr/?p=1873. Accessed May 10, 2022.
9. Ryu S, Park IH, Kim M, Lee YR, Lee J, Kim H, et al. Network study of responses to unusualness and psychological stress during the COVID-19 outbreak in Korea. PLoS One 2021;16:e0246894.
10. Xiong J, Lipsitz O, Nasri F, Lui LMW, Gill H, Phan L, et al. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. J Affect Disord 2020;277:55-64.
11. Kim E, Park S, Lee Y, Park H. Development and initial validation of the COVID stress scale for Korean people. Korean J Counsel 2021;22:141-

163.
12. Tennant R, Hiller L, Fishwick R, Platt S, Joseph S, Weich S, et al. The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): development and UK validation. Health Qual Life Outcomes 2007;5:63.
13. Kim S, Jung HY, Na KS, Lee SI, Kim SG, Lee AR, et al. A validation study of the Korean version of Warwick-Edinburgh Mental Well-being Scale. J Korean Neuropsychiatr Assoc 2014;53:237-245.
14. Williams N. The GAD-7 questionnaire. Occup Med 2014;64:224.
15. Arroll B, Goodyear-Smith F, Crengle S, Gunn J, Kerse N, Fishman T, et al. Validation of PHQ-2 and PHQ-9 to screen for major depression in the primary care population. Ann Fam Med 2010;8:348-353.
16. Bastien CH, Vallières A, Morin CM. Validation of the insomnia severity index as an outcome measure for insomnia research. Sleep Med 2001;2:297-307.
17. Choi HS, Choi JH, Park KH, Joo KJ, Ga H, Ko HJ, et al. Standardization of the Korean version of patient health questionnaire-9 as a screening instrument for major depressive disorder. J Korean Acad Fam Med 2007;28:114-119.
18. Seo JG, Cho YW, Lee SJ, Lee JJ, Kim JE, Moon HJ, et al. Validation of the generalized anxiety disorder-7 in people with epilepsy: a MEPSY study. Epilepsy Behav 2014;35:59-63.
19. Cho YW, Song ML, Morin CM. Validation of a Korean version of the insomnia severity index. J Clin Neurol 2014;10:210-215.
20. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. J Pers Assess 1988;52:30-41.
21. Park H, Nguyen T, Park H. Validation of multidimensional scale of perceived social support in middle-aged Korean women with diabetes. Asia Pac J Soc Work Dev 2012;22:202-213.
22. Korean Ministry of Health and Welfare. COVID-19 outbreak and vaccination status in Korea [Internet]. Available at: https://ncov.kdca.go.kr/tcmBoardView.do?brdId=3&brdGubun=31&dataGubun=&ncvContSeq=6827&contSeq=6827&board_id=312&gubun=ALL. Accessed May 10, 2022.
23. Xiao H, Zhang Y, Kong D, Li S, Yang N. The effects of social support on sleep quality of medical staff treating patients with coronavirus disease 2019 (COVID-19) in January and February 2020 in China. Med Sci Monit 2020;26:e923549.
24. Van Reeth O, Weibel L, Spiegel K, Leproult R, Dugovic C, Maccari S. Physiology of sleep (review)–interactions between stress and sleep: from basic research to clinical situations. Sleep Med Rev 2000;4:201-219.
25. Best LA, Law MA, Roach S, Wilbiks JM. The psychological impact of COVID-19 in Canada: effects of social isolation during the initial response. Can Psychol 2021;62:143.
26. Rodriguez-Besteiro S, Tornero-Aguilera JF, Fernández-Lucas J, Clemente-Suárez VJ. Gender differences in the COVID-19 pandemic risk perception, psychology, and behaviors of Spanish university students. Int J Environ Res Public Health 2021;18:3908.
27. Minello A. The pandemic and the female academic. Nature 2020 Apr 17. [Epub]. Available at: https://doi.org/10.1038/d41586-020-01135-9.
28. Korean Ministry of Health and Welfare. COVID-19 'social distancing' [Internet]. Available at: https://ncov.kdca.go.kr/tcmBoardView.do?brdId=&brdGubun=&dataGubun=&ncvContSeq=353917&contSeq=353917&board_id=&gubun=ALL. Accessed May 10, 2022.
29. Lee JH. 94% of self-employed people in Seoul "hit by COVID-19"… Sales fell 42%. Chosun Biz [Internet]. 2022 Jan 5 [cited 2022 May 10]. Available at: https://biz.chosun.com/topics/topics_social/2022/01/05/K4GMOXN44ZBKLDMU6ZQ42ICIAY/.
30. Choi YJ. 20,000 stores closed every month, confirmed by numbers. Chosun Biz [Internet]. 2022 Jan 11 [cited 2022 May 10]. Available at: https://www.chosun.com/economy/economy_general/2022/01/11/3FVENEPS4ZFBFDKA7HHN7BN5QI/.
31. Oh YH. Debt burden of the self-employed: risk diagnosis and policy direction (2021) [Preprint]. Available at: https://ssrn.com/abstract=3994726. Accessed May 10, 2022.
32. Rodríguez S, Valle A, Piñeiro I, González-Suárez R, Díaz FM, Vieites T. COVID-19 lockdown: key factors in citizens' stress. Front Psychol 2021;12:666891.
33. Shevlin M, McBride O, Murphy J, Miller JG, Hartman TK, Levita L, et al. Anxiety, depression, traumatic stress and COVID-19-related anxiety in the UK general population during the COVID-19 pandemic. BJPsych Open 2020;6:e125.
34. Ellison CG, George LK. Religious involvement, social ties, and social support in a southeastern community. J Sci Study Relig 1994;33:46-61.
35. Aukst-Margetić B, Margetić B. Religiosity and health outcomes: review of literature. Coll Antropol 2005;29:365-371.
36. Lissoni P, Cangemi P, Pirato D, Roselli MG, Rovelli F, Brivio F, et al. A review on cancer--psychospiritual status interactions. Neuro Endocrinol Lett 2001;22:175-180.
37. Rattay P, Michalski N, Domanska OM, Kaltwasser A, De Bock F, Wieler LH, et al. Differences in risk perception, knowledge and protective behaviour regarding COVID-19 by education level among women and men in Germany. Results from the COVID-19 snapshot monitoring (COSMO) study. PLoS One 2021;16:e0251694.
38. Mustafa N. Psychological stress and associated factors during the coronavirus disease (COVID-19). Int J Sci Res 2020;10:12-18.
39. Daniel K, Wolfe CD, Busch MA, McKevitt C. What are the social consequences of stroke for working-aged adults? A systematic review. Stroke 2009;40:e431-e440.
40. Prime H, Wade M, Browne DT. Risk and resilience in family well-being during the COVID-19 pandemic. Am Psychol 2020;75:631-643.
41. Salari N, Hosseinian-Far A, Jalali R, Vaisi-Raygani A, Rasoulpoor S, Mohammadi M, et al. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. Global Health 2020;16:57.
42. Lakhan R, Agrawal A, Sharma M. Prevalence of depression, anxiety, and stress during COVID-19 pandemic. J Neurosci Rural Pract 2020;11:519-525.
43. Cénat JM, Blais-Rochette C, Kokou-Kpolou CK, Noorishad PG, Mukunzi JN, McIntee SE, et al. Prevalence of symptoms of depression, anxiety, insomnia, posttraumatic stress disorder, and psychological distress among populations affected by the COVID-19 pandemic: a systematic review and meta-analysis. Psychiatry Res 2021;295:113599.
44. Esterwood E, Saeed SA. Past epidemics, natural disasters, COVID19, and mental health: learning from history as we deal with the present and prepare for the future. Psychiatr Q 2020;91:1121-1133.