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Hoo-yeon Lee¹, Dongwoo Choi², Jung Jae Lee^{3,4,5}

1 Department of Preventive Medicine, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea

2 Data Link & Operation Team, Cancer Data Center, National Cancer Control Institute, National Cancer Center, Goyang-si, Republic of Korea

3 Department of Psychiatry, College of Medicine, Dankook University, Chungnam, Republic of Korea

4 Department of Psychiatry, Dankook University Hospital, Chungnam, Republic of Korea

5 Chungcheongnam-do Mental Health and Welfare Center, Chungnam, Republic of Korea

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(5) Corresponding author's name, address, and e-mail address:

Jung Jae Lee, D Department of Psychiatry, College of Medicine, Dankook University, Chungnam, Republic of Korea, E-mail: mdjjlee@dankook.ac.kr

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1 **Depression, anxiety, and stress in South Korea general population**
2 **during the COVID-19 pandemic**

3

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ABSTRACT

Objective

To investigate the prevalence and risk factors of poor mental health in the general South Korean population during the COVID-19 pandemic

Methods

This cross-sectional, population-based, online survey study was conducted from November 5, 2020 to November 20, 2020 and included adults aged 20–49 years in Chungnam Province, South Korea. A total of 549 adults were included.

Results

A total of 18.8% of the participants had symptoms of depression, 10.6% had symptoms of anxiety, and 5.1% had a high level of perceived stress during the COVID-19 pandemic. Higher levels of stress (OR, 3.13 [95% CI, 1.13-8.67]), anxiety (OR, 2.23 [95% CI, 1.09-4.49]), and depression (OR, 3.00 [95% CI, 1.64-5.50]) were found among never married, widowed, divorced, and separated people compared to married/cohabiting/partnered subjects. Subjects who felt increased stress at home during the COVID-19 outbreak reported more depression (OR, 2.45 [95% CI, 1.49-4.05]) and anxiety (OR, 2.42 [95% CI, 1.31-4.50]). Females had increased risk of anxiety (OR, 1.97 [95% CI, 1.09-3.58]) and stress (OR, 6.40 [95% CI, 2.30-17.85]) level than males. Subjects with the highest household income reported fewer symptoms of stress than subjects with the lowest household income (OR, 0.24 [95% CI, 0.06-0.96]).

Conclusions

The participants in this study exhibited poor mental health index scores, suggesting that some people are at risk for mental health problems during the COVID-19 pandemic. Being married was independently and significantly associated with a lower likelihood of depression, anxiety, and stress.

Key words: COVID-19, pandemic, depression, anxiety, stress, marital status

INTRODUCTION

The coronavirus disease 2019 (COVID-19) outbreak began in December 2019 and aroused global attention. In contrast to previous epidemics and pandemics, such as severe acute respiratory syndrome and Middle East respiratory syndrome, the pathogen that causes COVID-19 is more contagious and spreads more rapidly [1]. The extent and timeliness of public health measures and COVID-19 containment efforts have differed among countries. Efforts have included closing international borders, restricting domestic travel, introducing mandatory self-isolation for at-risk and symptomatic individuals, social distancing, and wearing face masks in public areas [2]. Compulsory measures, such as containment, quarantine, community control, and business and school closures, have been implemented in South Korea [3].

In the face of this large-scale infectious public health event and the enormous disruptions to daily life, many people are under unprecedented pressure and experiencing severe psychological distress due to persistent fear, social isolation, and economic hardships [4]. The wearing of face masks, disruption of interpersonal interactions due to social distancing, and loss of income have also been reported to affect mental health [2]. Action by public health bodies is necessary to reduce the spread of COVID-19, but can lead to isolation, loneliness and increased stress and anxiety.

A growing body of evidence has demonstrated the clinical effects of the COVID-19 pandemic on mental health, including higher rates of depression (14.6–48.3%), anxiety (6.33–50.9%), and stress (8.1–81.9%) [2, 5, 6]. The prevalence of depressive symptoms in the US was more than three-fold higher during compared to before the COVID-19 pandemic [7]. Risk factors for mental distress during the COVID-19 pandemic include female gender, younger age, and the presence of chronic/psychiatric illnesses [5]. Other factors predicting mental distress included loneliness, divorced/widowed or single status, and lower household income.

People without family have a special risk of health problems and experience deteriorated mental health due to COVID-19 [8, 9]. However, the family situation, particularly parental burden, is difficult for families, with home schooling, social isolation and lockdown situations. family stress is also associated with pandemic-related stress, anxiety and depression [8]. COVID-19 has widened gaps between the married and the single and people living with others and people in isolation [10]. Marital status is a predictor of health outcomes in Western populations. However, data from Asian cultures is still limited [11].

The prevalence of mental health symptoms and associated factors during the COVID-19 outbreak need to be determined so that appropriate priorities for public health policies can be set, and effective health care interventions in South Korea implemented. Thus, we investigated the prevalence and risk factors of mental health symptoms in the general population in South Korea during the COVID-19 pandemic.

MATERIALS AND METHODS

Data and study population

In a web-based cross-sectional survey targeting adults aged 20–49 years in Chungnam Province, South Korea, we investigated mental health, experience and perceptions of the COVID-19 pandemic, and the psychosocial effects of COVID-19.

Conventional face-to-face interview was not feasible during the pandemic. We collected data from an online survey panel, Embrain Public® recruited through random sampling of residential addresses throughout Korea at the end of October 2020. Participants answered the questionnaires anonymously online from November 5, 2020 to November 20, 2020.

Participants were people who decided to enter studies they were eligible for themselves by signing up to a panel platform. A total of 5182 were invited to participate via the Internet. 993(19.2%)

have agreed to participate. A total of 549 adults aged 20–49 years were the final study population after exclusion of participants with a missing variable. All participants provided informed consent prior to completing the survey

Dependent variables: depression, anxiety, and perceived stress

The primary outcomes were depression, anxiety, and perceived stress. We used the Korean version of the Patient Health Questionnaire-9 (PHQ-9) to determine whether participants had depressive symptoms [12]. The nine items assess the frequency of depressive symptoms over the past 2 weeks on a 4-point Likert scale ranging from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). The PHQ-9 score ranges from 0–27 points, and higher scores indicate more severe depressive symptoms. In our study, a PHQ-9 score ≥ 10 indicated the presence of depression [13–15].

We used the Korean version of the Generalized Anxiety Disorder-7 (GAD-7) scale to assess anxiety symptoms [16]. The seven items assess the frequency of anxiety symptoms over the past 2 weeks on a 4-point Likert scale ranging from 0 (*never*) to 3 (*nearly every day*). The total GAD-7 score ranges from 0–21, with higher scores indicating more severe functional impairment due to anxiety. A total GAD score ≥ 10 points was taken to indicate the presence of anxiety symptoms [17].

The Perceived Stress Scale (PSS) is a self-report instrument consisting of 10 items that assess “how unpredictable, uncontrollable, and overloaded respondents find their lives”. Each of the items on the PSS-10 is rated on a 5-point Likert scale, ranging from 0 (*never*) to 4 (*very often*). The PSS-10 consists of six positively (items 1, 2, 3, 6, 9, and 10) and four negatively (items 4, 5, 7, and 8) worded items. The negatively worded items were re-coded during the analysis. Total scores range from 0–40, with higher scores indicating higher levels of perceived stress. A high level of perceived stress was defined as a PSS-10 score ≥ 27 [18]. We used the Korean version of the PSS-10 [19].

Independent variables

The mental health-related impact of COVID-19 was measured by four items, including support from friends, support from family members, financial stress, and stress at home. Scores were compared between the COVID-19 period and pre-COVID-19 period (much increased, increased, same as before, decreased and much decreased).

The sociodemographic variables included gender, age, marital status, education level, and household income level. Marital status was classified as married/cohabiting/partnered or unmarried/widowed/divorced/separated. Age was categorized into 20–29, 30–39, and 40–49 years groups. We categorized education level as high school graduate or less, or college or more. Household income was categorized as < \$2,000/month, \$2,000–4,999/month, or ≥ \$5,000/month.

Statistical analysis

First, we investigated the general characteristics of the study population, the prevalence rates of depression, anxiety, and stress, and the psychological impact of COVID-19. Second, we analyzed the prevalence of depression, stress, and anxiety during COVID-19 according to the sociodemographic characteristics and negative psychosocial changes using the chi-square test. Third, the bivariate associations between the independent variables and the mental health variables were calculated using logistic regression, and the associations were reported as odds ratios (ORs) with 95 % confidence intervals. Fourth, all independent variables were entered simultaneously into multivariate logistic regression models and the associations were reported as adjusted ORs (aORs). All statistical analyses were performed using SAS software (version 9.4; SAS Institute, Cary, NC, USA). A p-value < 0.05 was considered significant.

Ethics statement

This study was approved by the Institutional Review Board of Dankook University (DKU 2021-05-038)

RESULTS

Table 1 describes the sociodemographic characteristics and mental health status of the 549 participants aged 20–49-years. A total of 74.9% of the participants had a university level of education or above and 50.3% were married. Among all study participants, 18.8% had depression (PHQ-9 score ≥ 10). Anxiety symptoms (GAD-7 ≥ 10) were reported by 10.6% of the respondents. A total of 5.1% of the participants reported high perceived stress (PSS-10 score ≥ 27). Comparing the COVID-19 period to the pre-COVID-19 period, 21.5% and 9.7% of the respondents felt that support from their friends and family members had decreased when they were in need. Financial stress and stress at home increased by 48.6% and 30.4% during the COVID-19 pandemic.

Table 2 summarizes the prevalence of depression, anxiety, and stress by the sociodemographic characteristics and negative psychosocial changes. Females were more likely to have anxiety and high perceived stress than males. Age was negatively associated with depression. Married people had lower levels of depression, anxiety, and stress than those who were never married or whose marriages ended in divorce or widowhood. Anxiety symptoms were more severe in people with less education and a lower household income than those with higher education and income levels. Depression and anxiety was associated with negative psychosocial changes such as decrease of support from friends or family members and increase of financial stress or stress at home.

Table 3 shows the results from multivariate logistic regression analysis, performed to identify risk factors for poor mental health. Females had odds ratios for anxiety and stress of 1.97 and 6.40, respectively. Subjects aged 30–39 years had 2.96 times higher perceived stress levels than those aged 20–29 years. Married people had significantly lower rates of depression, anxiety, and stress. People in

the highest income group had lower perceived stress levels. Stress at home during the COVID-19 pandemic was positively associated with depression and anxiety. No significant relationships were detected between mental health and support from friends or family members.

DISCUSSION

This study revealed high prevalence rates of depression, anxiety, and stress in the general population of South Korea aged 20–49 years. A total of 10.6% of the participants with generalized anxiety disorder scored 10 or higher on the GAD-7, which was much higher than the proportion of 2.4% reported in a previous national survey based on lifetime prevalence [20]. The prevalence rate of depressive symptoms (PHQ-9 score ≥ 10) was much higher than the rates of 6.1–6.7% reported in previous studies analyzing population-based data [21, 22]. Compared to previous reports conducted before the Covid-19 in South Korea, our data suggest increased rates of depression and anxiety symptoms, although this conclusion should be drawn cautiously because of the inherently different assessment methods and sampling strategies.

Females were more likely to have anxiety and high perceived stress than males. Although not significant, this study showed that females had a 1.23-fold higher likelihood of depression than males. Males and females exhibited different mental health outcomes. Females were more likely to have high anxiety and perceived stress levels than males [5, 22–24].

Married people are the less likely group to suffer from poor mental health. In our study, being married was significantly associated with a lower likelihood of depression, anxiety, and stress. A considerable amount of evidence indicates that married individuals enjoy better mental health than single individuals [25, 26]. A study assessing psychosocial distress, conducted in the USA, South Korea, France, and Hong Kong, suggested that being married is associated with better well-being than being single [27].

Single subjects are certainly more likely to feel the effects of loneliness and isolation than married couples, which may explain their consistently higher levels of stress, anxiety, and depression [5, 27]. Loneliness has been amplified during the COVID-19 crisis, which is characterized by social distancing [28]. Such social distancing, in association with limited social support and interpersonal communication, has worsened depression, fear, insomnia, and anxiety symptoms [20]. Married participants had 40% lower odds of developing anxiety during the COVID-19 lockdown than unmarried participants [29]. Our study showed the mental health benefits of marriage in an Asian population. Being married per se is not universally beneficial, but the satisfaction and support associated with such a relationship tend to be important [30]. The importance of the quality of the interaction with a spouse or partner should be investigated.

Our study population reported stress at home has been increased by 30.4% since the COVID-19 pandemic. Increased stress at home after the pandemic was positively associated with depression and anxiety after controlling for sociodemographic variables and marital status. Previous studies showed that parents with children at home reported unique pressures, including worrying about their children's physical and mental health, education, and the stress of looking after their children while continuing to work [29, 31]. Actions such as social distancing, sheltering in place, restricted travel, and closures of key community resources are likely to dramatically increase the risk of family violence [32].

Poor economic status is a significant risk factor for developing symptoms of mental disorders, especially depressive symptoms during the pandemic period [5]. However, our study showed household income was not significantly associated with depression and anxiety during the COVID-19 pandemic. It could be that government intervention to support financial hardship might mitigate poor mental health during the pandemic [33]. We need further evaluation to investigate association between mental health and social support or government financial aid program.

The prevalence rates of mental health symptoms have been reported to be different among studies, which could be due to the use of different measurement scales, patterns of reporting, or cultural

factors [5]. Regional differences in the psychological health of the general public during major disease outbreaks exist according to outbreak severity, the economy, government preparedness, the availability of medical supplies/facilities, and the effectiveness of dissemination of COVID-related information. The stage of the outbreak in a given region also affects the psychological responses of the public.

The COVID-19 pandemic has been a traumatic event. In addition, the policies created to prevent its spread have introduced new stressors and disrupted daily living for infected patients and the general population [7]. Studies regarding the psychological implications of the COVID-19 pandemic are being published in various countries and indicate moderate-to-high levels of distress [28]. Our study does not suggest a long-term effect of the COVID-19 pandemic on mental health. However, the prevalence of moderate to severe depressive and anxiety symptoms was higher compared to several previous studies conducted before the COVID-19 pandemic [21, 34]. Follow-up studies may be needed to assess the long-term psychological impacts of the COVID-19 pandemic [5].

This study had several limitations. First, although the number of active internet users grows, the online modality has a risk of selection bias. Nevertheless, online surveys have become an important tool for COVID-19 research when conventional survey methods are not feasible [35]. Second, the survey also used self-reported questionnaires to measure psychiatric symptoms and did not make clinical diagnoses. Response bias may also have been present, where anxious individuals stressed by the pandemic may have been more likely to participate [2]. This could have resulted in worse mental well-being outcomes compared to the actual situation. Third, as the study participants were residents of a province, it was not possible to analyze regional differences, which makes it hard to generalize our results to the entire population of South Korea. Finally, as it was cross-sectional, the ability to make causal inferences regarding the associations between perceptions of COVID-19 and the prevalence of mental health symptoms is limited. The possibility of residual confounding remains, as not all potential confounders were controlled for in the model.

Despite these limitations, our findings have implications for psychological interventions aimed at

reducing psychological distress, and improving mental health and psychological resilience, during public health emergencies. The COVID-19 pandemic has been controlled in South Korea without a nationwide lockdown or drastic social distancing policies, compared to Europe and the USA [36]. Population-based studies on mental health and COVID-19 should be established to provide evidence-based guidance on responding to future pandemic in South Korea.

The participants in this study exhibited relatively poor mental health index scores during the COVID-19 outbreak. Implementing community-based strategies to promote resilience and support psychologically vulnerable individuals during the COVID-19 crisis is of fundamental importance. More assistance should be provided to vulnerable groups in society, in accordance with age, gender, and marital status.

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TABLE 1. Sociodemographic and mental health (N = 549)

Variables		N	%
Gender	Male	286	52.1
	Female	263	47.9
Age(years)	20-29	148	27.0
	30-39	188	34.2
	40-49	213	38.8
Marital status	Married/cohabiting/partnered	276	50.3
	Unmarried, separated, divorced, and widowed	273	49.7
Education	High school or less	138	25.1
	University or more	411	74.9
Household income (\$/month)	< 2000	62	11.3
	2000–4999	376	68.5
	≥ 5000	173	31.5
Depressive symptom (0-27)	No	446	81.2
	Yes (PHQ-9≥10)	103	18.8
	Median(Q1-Q3)	4.0	2.0- 8.0
Anxiety symptom (0-21)	No	491	89.4
	Yes (GAD-7≥10)	58	10.6
	Median(Q1-Q3)	3	1.0- 6.0
Perceived Stress (0-40)	No	521	94.9
	Yes (PSS-10≥27)	28	5.1
	Median(Q1-Q3)	17	14.0- 21.0
Support from friends during COVID-19	Decreased	118	21.5
	Same as before	375	68.3
	Increased	56	10.2
Support from family members during COVID-19	Decreased	53	9.7
	Same as before	383	69.8
	Increased	113	20.6
Financial stress during COVID-19	Decreased	17	3.1
	Same as before	265	48.3
	Increased	267	48.6
Stress at home during COVID-19	Decreased	39	7.1
	Same as before	343	62.5
	Increased	167	30.4

TABLE 2. Mental health and psychosocial characteristics associated with COVID-19

Variables	Depressive symptom		Anxiety symptom		Perceived Stress	
	Yes(%)	<i>p value</i>	Yes(%)	<i>p value</i>	Yes(%)	<i>p value</i>
Gender						
Male	17.8	0.561	7.7	0.022	1.8	0.0002
Female	19.8		13.7		8.8	
Age						
20-29	26.4	0.021	14.9	0.138	5.4	0.0372
30-39	16.5		9.0		8.0	
40-49	15.5		8.9		2.4	
Marital status						
Married	11.7		7.0		2.9	
Unmarried, separated, divorced, and widowed	25.7	<.0001	14.1	<.0001	7.3	0.0215
Education						
High school or less	26.8	0.005	15.9	0.018	5.1	0.9864
University or more	16.1		8.8		5.1	
Household income (\$/month)						
< 2000	25.8	0.051	21.0	0.017	11.3	0.0207
2000–4999	20.4		9.6		5.4	
≥ 5000	13.3		8.7		2.3	
Support from friends during Covid-19						
Same as before/Increased	16.5	0.009	9.5	0.125	4.6	0.3493
Decreased	27.1		14.4		6.8	
Support from family members during Covid-19						
Same as before/Increased	16.9	0.001	9.7	0.039	5.0	0.8454
Decreased	35.9		18.9		5.7	
Financial stress during Covid-19						
Same as before/Decreased	13.8	0.002	7.8	0.030	3.9	0.1892
Increased	24.0		13.5		6.4	
Stress at home during Covid-19						
Same as before/Decreased	13.9	<.0001	7.6	0.001	4.5	0.2952
Increased	29.9		17.4		6.6	

TABLE 3. The association between mental health and sociodemographic and psychosocial characteristics associated with COVID-19

Variables		Depressive symptom						Anxiety symptom						Perceived Stress					
		OR	95% CI		aOR	95% CI		OR	95% CI		aOR	95% CI		OR	95% CI		aOR	95% CI	
Gender																			
	Male	1.00			1.00			1.00			1.00			1.00			1.00		
	Female	1.14	0.74	1.74	1.23	0.77	1.96	1.90	1.09	3.33	1.97	1.09	3.58	5.39	2.02	14.38	6.40	2.30	17.85
Age																			
	20-29	1.00			1.00			1.00			1.00			1.00			1.00		
	30-39	0.55	0.32	0.94	0.93	0.50	1.70	0.57	0.29	1.12	0.98	0.45	2.10	1.52	0.63	3.68	2.96	1.08	8.14
	40-49	0.51	0.30	0.86	1.07	0.55	2.08	0.56	0.29	1.08	1.05	0.46	2.39	0.42	0.14	1.31	0.89	0.25	3.21
Marital status																			
	Married	1.00			1.00			1.00			1.00			1.00			1.00		
	Unmarried, separated, divorced, and widowed	2.61	1.65	4.12	3.00	1.64	5.50	2.20	1.24	3.91	2.33	1.09	4.99	2.59	1.12	5.98	3.13	1.13	8.67
Education																			
	High school or less	1.92	1.21	3.03	1.54	0.93	2.54	1.98	1.12	3.49	1.64	0.89	3.03	0.99	0.41	2.39	0.87	0.34	2.26
	University or more	1.00			1.00			1.00			1.00			1.00			1.00		
Household income (\$/month)																			
	< 2000	1.00			1.00			1.00			1.00			1.00			1.00		
	2000–4999	0.74	0.39	1.38	0.98	0.49	1.97	0.40	0.19	0.82	0.49	0.22	1.11	0.45	0.18	1.14	0.53	0.18	1.53
	≥ 5000	0.44	0.22	0.90	0.76	0.34	1.71	0.36	0.16	0.80	0.57	0.23	1.43	0.19	0.05	0.66	0.24	0.06	0.96
Getting support from friends during Covid-19																			
	Same as before/Increased	1.00			1.00			1.00			1.00			1.00			1.00		
	Decreased	1.89	1.17	3.05	1.38	0.76	2.49	1.60	0.87	2.94	1.20	0.58	2.51	1.50	0.64	3.48	1.32	0.50	3.48
Getting support from family members during Covid-19																			
	Same as before/Increased	1.00			1.00			1.00			1.00			1.00			1.00		
	Decreased	2.74	1.49	5.04	1.74	0.81	3.71	2.17	1.03	4.59	1.53	0.61	3.85	1.13	0.33	3.88	0.83	0.21	3.38
Financial stress during Covid-19																			
	Same as before/Decreased	1.00			1.00			1.00			1.00			1.00			1.00		
	Increased	1.96	1.27	3.05	1.46	0.90	2.37	1.84	1.05	3.22	1.36	0.73	2.50	1.68	0.77	3.65	1.30	0.55	3.05
Stress at home during Covid-19																			
	Same as before/Decreased	1.00			1.00			1.00			1.00			1.00			1.00		
	Increased	2.65	1.71	4.12	2.45	1.49	4.05	2.56	1.47	4.44	2.42	1.31	4.50	1.51	0.69	3.31	1.50	0.61	3.67