High Work-related Stress and Anxiety Response to COVID-19 among Healthcare Workers: A Cross-Sectional Online Survey Study in South Korea

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Abstract

Background: Healthcare workers experienced severe psychological impacts of the COVID-19 outbreak. It is important to establish a process of psychological assessment and interventions for healthcare workers affected by epidemics.

Objective: We investigated the risk factors associated with the psychological impact of each healthcare worker group, to help optimize psychological interventions for healthcare workers in countries affected by COVID-19.

Methods: Participants (N=1,783) from two hospitals in Korea, completed an online survey from 20-30 April 2020, with information on demographics, psychiatric history, Stress and Anxiety to Viral Epidemics - 9 (SAVE-9), Patient Health Questionnaire - 9 (PHQ-9), and Generalized Anxiety Disorder - 7 (GAD-7) scale.

Results: Among the 1,783 healthcare workers, compared to other healthcare workers, nursing professionals had significantly higher levels of depression, general anxiety, and virus-related anxiety symptoms. In the nursing professionals group, single workers reported more severe depressive symptoms than married workers, and junior (< 40 years old) workers reported more anxiety about the viral epidemic. Logistic regression analysis adjusted with age, sex, and work duration identified three factors as significantly associated with healthcare worker's depression (PHQ-9 ? 10): being a nursing professional, single, and higher stress and anxiety to the viral infection (high SAVE-9 score).

Conclusions: Psychological support and interventions for healthcare workers, especially nursing professionals, single, and high SAVE-9 level should be considered.

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Abstract

Background: Healthcare workers experienced severe psychological impacts of the COVID-19 outbreak. It is important to establish a process of psychological assessment and interventions for healthcare workers affected by epidemics.

Objectives: We investigated the risk factors associated with the psychological impact of each healthcare worker group, to help optimize psychological interventions for healthcare workers in countries affected by COVID-19.

Methods: Participants (N = 1,787) from two hospitals in Korea, completed an online survey from April 14 to 30, 2020, by obtaining information on demographics, psychiatric history and the Stress and Anxiety to Viral Epidemics-9 (SAVE-9), Patient Health Questionnaire-9 (PHQ-9), and Generalized Anxiety Disorder-7 (GAD-7) scales. Logistic regression analyses were performed to assess contributing factors as predictor variables and healthcare workers' depression as outcome variables.

Results: Among the 1,783 healthcare workers, compared with other healthcare workers, nursing professionals had significantly higher levels of depression (PHQ-9 score; 5.5 ± 4.6 vs. 3.8 ± 4.2; $P < .01$), general anxiety (GAD-7 score; 4.0 ± 4.1 vs. 2.7 ± 3.6; $P < .01$), and virus-related anxiety symptoms (SAVE-9 score; 21.6 ± 5.9 vs. 18.6 ± 6.3; $P < .01$). In the nursing professionals group, single workers reported more severe depressive symptoms than married workers (PHQ-9 score ≥ 10; 20.3% vs. 14.1%; $P < .01$), and junior (<40 years) workers reported more anxiety about the viral epidemic (SAVE-9 anxiety score; 15.6 ± 4.1 vs. 14.7 ± 4.4; $P < .01$). Logistic regression analysis revealed that the hospital factor (adjusted odds ratio [aOR] = 1.45, 95% confidence interval, CI [1.06–1.99]), nursing professionals (aOR = 1.37, 95% CI [1.02–1.98]), single workers (aOR = 1.51, 95% CI [1.05–2.16]), higher stress and anxiety to the viral infection (high SAVE-9 score, aOR = 1.20, 95% CI [1.17–1.24]), and past psychiatric history (aOR = 3.26, 95% CI [2.15–4.96]) were positively associated with depression.

Conclusions: Psychological support and interventions should be considered for healthcare workers, especially nursing professionals, those who are single, and those with high SAVE-9 level.

Keywords: COVID-19; health personnel; occupational stress; anxiety; depression

Introduction

The coronavirus disease 2019 (COVID-19) is a highly contagious respiratory disease caused by severe acute respiratory syndrome coronavirus 2. It was first reported in December 2019 in Wuhan, Hubei Province, China [1]. In Korea, the first patient was diagnosed on January 20, 2020, and the number of infected persons increased rapidly, exceeding 5,000 within 6 weeks as people who participated in religious events were infected. The Korean government raised the country's infectious disease alert level to the "highest" on February 23, 2020 [2], setting up and operating 638 screening clinics to quickly examine the cases of fever or respiratory symptoms, expanding specialized infectious disease hospitals nationwide for the treatment of severe patients, and allocating 10,000 beds for the treatment of patients with mild disease. People were obligated to undergo strong social distancing measures, such as voluntarily refraining from going out and restricting movement for at least 2 weeks. After 2 months of struggle, the average daily number of new cases gradually decreased and has remained under 20 since April 18, 2020. Over the year, the number of confirmed cases has fluctuated, and in July 2021, the number of confirmed cases increased again, exceeding 1,000 per day. As of July 9, 2021, Korea reported a total of 165,344 confirmed cases, of which 15,462 were quarantined (152,498 completed quarantine; 10,810 quarantined) and 2,036 were deceased [2].

Healthcare workers on the frontline play a major role in preventing the spread of COVID-19 by implementing the government's strong countermeasures. Despite their heroic efforts during the early phase of the pandemic, their mental health faces a considerable threat. In other disasters, healthcare workers take care of patients who have been hurt, but they are not themselves affected by the disaster itself in the hospital. In contrast, healthcare workers are directly affected during epidemics. For healthcare workers who are in close contact with patients with confirmed or suspected COVID-19, lack of personal protective equipment, work overload, poor infection control, and pre-existing medical conditions were identified as risk factors for the disease [3]. Previous studies conducted during the severe acute respiratory syndrome (SARS), influenza A/H1N1, and the Middle East Respiratory Syndrome (MERS) outbreaks showed that healthcare workers face the fear of infecting family, friends, and colleagues [4-6], having increased workload and reluctance to work, perceiving stigmatization, coping by avoiding crowds and colleagues, and feeling scrutinized [6-8]. They experienced severe emotional stress, such as anxiety, worrying, burnout, insomnia, and depressive symptoms, and were diagnosed with acute stress disorder or posttraumatic stress disorder [5, 6, 9-12]. The rate of distress among healthcare workers is known to be higher as compared to the general population [13]. Similarly, recent studies have shown that a significant proportion of healthcare workers experienced psychological impacts of the COVID-19 outbreak, such as depression, anxiety, and stress [14-20]. These studies reported that the psychological impact of COVID-19 on healthcare workers was highly associated with their socio-demographic characteristics, which are important factors related to stress vulnerability or social support. Occupation and workplace differences are also important factors. Females, nurses, and frontline workers

directly engaged in the diagnosis, treatment, and care of patients with COVID-19 are particularly vulnerable to mental health symptoms [14, 19].

As of in July 2021, the COVID-19 pandemic has been prevalent for more than a year and a half. Psychological problems and exhaustion are not only a burden on healthcare workers but could also affect the whole society, threatening essential healthcare services or resulting in severe staff shortages. It is, therefore, important to establish a process of psychological assessment and interventions for healthcare workers affected by epidemics. Studies have assessed psychological symptoms using well-known rating scales such as the 7-item Generalized Anxiety Disorder scale 9 (GAD-7), 9-item Patient Health Questionnaire (PHQ-9) [14, 15, 17], 6-item version of State-Trait Anxiety Inventory (STAI-6), and Center for Epidemiologic Studies Depression Scale (CES-D) [18]. However, these scales are not specific to the viral epidemic but to a general situation. Only a few studies have examined a specialized rating scale for healthcare workers in response to epidemics. One such study developed a questionnaire for healthcare workers during the MERS outbreak [12], in which 150 healthcare workers participated for 6 months after the outbreak ended. However, the questionnaire lacks qualitative validity and comparison with other scales, rendering it impractical for usage. Therefore, a rating scale that is briefly measurable, specific to a viral epidemic, and tailored to healthcare workers is necessary to assess their work-related stress in response to a viral epidemic.

In this study, we aimed to assess the stress and anxiety response of healthcare workers specific to the COVID-19 epidemic. We used the Stress and Anxiety to Viral Epidemics-9 (SAVE-9) scale [21], which we developed to measure specific anxiety responses of healthcare workers to the viral epidemic, along with other well-known scales to assess general anxiety and depression. In addition, we investigated which demographic risk factors of healthcare workers, such as the type of healthcare job, age, sex, and marital status, affected these symptoms during the pandemic. Finally, in this study, we screened healthcare workers who were having an anxiety response to the viral epidemic among those who were not screened as having general anxiety using the pre-existing rating scale that is not specific to the viral epidemic, so that we could underline the need for establishing psychosocial support services for evidence-based rapid evaluations and psychological crisis interventions for vulnerable healthcare workers during any future infectious disease outbreak.

Methods

Study Site

This study was conducted among healthcare workers at the ASAN Medical Center (AMC), a tertiary hospital (2,705 beds; 7,970 healthcare workers) in Seoul and the Uijeongbu St. Mary's Hospital (USMH), a secondary hospital (716 beds; 1,800 healthcare workers) in Uijeongbu, Gyeonggi province, South Korea. During the outbreak, due to the rapid increase in the number of COVID-19 confirmed cases in USMH, the entire hospital was in cohort isolation for 3 weeks starting from March 1, 2020. During the cohort isolation, the outpatient departments were closed, and the discharge of in-patients was withheld. Wards exposed to the COVID-19 confirmed patients were quarantined and only essential medical staff were allowed to enter the wards. The quarantined people were regularly tested for COVID-19, and those who were negative remained, whereas those who were positive were transferred to a designated COVID-19 treatment institution. On May 11, 2020, the hospital was restored to full functionality.

A patient who had visited USMH on March 25, 2020, was admitted to the emergency room of AMC on March 26, 2020 and was confirmed to have COVID-19 on March 31, 2020. Since then, four wards were in cohort isolation and 57 healthcare workers were quarantined in AMC. Cohort isolation in the wards was lifted on April 15, 2020, and AMC was released from the COVID-19 intensive care medical institution status on April 19, 2020.

Participants and Procedure

The survey was conducted during the 14th to 18th of April 2020 at USMH and the 20th to 30th of April 2020 at AMC. We adopted a cross-sectional, anonymous online survey design to assess the psychological impact on healthcare workers without face-to-face contact during the COVID-19 epidemic. We publicized this study through notice boards at the two hospitals, and 1,787 healthcare workers responded voluntarily. To minimize contact, they completed the questionnaires through an online survey platform. The subjects were not compensated for their participation. This study was approved by the Institutional Review Board (AMC No. 2020-0580, UC20RADI0090). Written informed consent was waived, as the participants could declare, while answering through the web, whether or not they agreed to the use of their information for the study.

Healthcare workers were classified into five groups based on the International Standard Classification of Occupations (ISCO, 2008 revision) [22]: medical doctors (ISCO code 2211, 2212); nursing professionals (ISCO code 2221); health associate professionals (ISCO code 2240, 2261, 2262, 2264, 2265, 2266, 2267, 3211, 3212, 3213, 3214, 3221, 3252, 3253); health management and support personnel (ISCO code; 1342, 2131, 2133, 3141, 3344); and clerical support workers, service and sales workers, trade workers, and plant and machine operators; and health service provided not classified elsewhere.

Assessment Measures

SAVE-9 scale

The SAVE-9 scale (provided as supplementary material) was developed to assess work-related stress and anxiety response of healthcare workers to the COVID-19 pandemic [21]. Respondents rated their agreement with each item on a 5-point scale ranging from 0 (never) to 4 (always). In the previous validation study [21], satisfactory internal consistency (Cronbach's $\alpha = 0.795$) was observed, and a two-factor structure was adopted: (1) anxiety about viral epidemics and (2) work-related stress associated with viral epidemics. The total SAVE-9 score (22 points) and total anxiety subcategory score (15 points) were explored comparable with at least mild degree of Generalized Anxiety Disorder-7 scale. We used the Korean version of the SAVE-9 scale, since it was developed originally in Korean language (www.save-viralepidemic.net).

Patient Health Questionnaire-9 (PHQ-9)

PHQ-9 is a self-administered, nine-item questionnaire for assessing depression. Each item is scored on a three-point scale ranging from 0 (not at all) to 3 (nearly every day). Scores can range from 0 to 27, with higher scores reflecting a greater symptom severity. A score of 10 is the cut-off score to evaluate the depression status [23]. In this study, we used the Korean version of the PHQ-9 scale (www.phqscreeners.com).

Generalized Anxiety Disorder-7 (GAD-7)

GAD-7 is a self-administered, seven-item questionnaire specific to general anxiety. Each item is scored on a three-point scale ranging from 0 (not at all) to 3 (nearly every day). Scores can range from 0 to 21, with higher scores reflecting a greater symptom severity. In this study, 5 was used as the cut-off score for mild anxiety [24], as we wished to screen healthcare workers with at least mild degree of anxiety response. In this study, we used the Korean version of the GAD-7 scale (www.phqscreeners.com).

Socio-demographic data

Information on sex, age, marital status, type of healthcare job, and years of employment were collected. Additionally, the participants were asked whether they had a current or previous diagnosis of depression, anxiety, or insomnia.

Analysis

Statistical analyses were performed using SPSS Version 21.0 for Windows (IBM Corp., Armonk, NY). The clinical characteristics were summarized as means ± standard deviations. To calculate frequency, the number of each sample was divided by the total number of samples in each healthcare worker group. Student's t-test

for continuous variables and Chi-square test for categorical variables were used for between-group analyses. The level of significance for all analyses was defined as two-tailed $P < .01$. Logistic regression analysis was conducted to explore the risk factors for healthcare workers' depression. Finally, the additional value (i.e., detection of those who were not screened through GAD-7) of the SAVE-9 was estimated using a McNemar test. To obtain robust odds ratios of considering the previously (or clinically) important factors, variables with $P < .1$ in univariate analysis were included.

Results

A total of 1,023 AMC healthcare workers and 764 USMH healthcare workers participated in the online survey. We analyzed data of 1,783 healthcare workers after excluding four responses of healthcare workers who did not agree for the use of their responses in this study. Table 1 shows the demographic characteristics of the participants. In total, 76.1% workers were female, 52.7% were single. The proportion of participants in their 20s, 30s, and over 40s was similar. Compared to USMH healthcare workers, AMC healthcare workers reported more participation of nursing professionals, more past psychiatric history, and higher levels of PHQ-9, GAD-7, and work-related stress subcategory of SAVE-9.

Table 1. Demographic characteristics of the participants (N = 1,783)

Variables	ASAN medical center (N = 1,019)	Uijeongbu St. Mary's Hospital (N = 764)	*P-value*	Total (N = 1,783)
Gender (female)	808 (79.3%)	548 (71.7%)	< .01	1,356 (76.1%)
Age				
20–29	309 (30.3%)	287 (38.5%)	< .01	596 (33.4%)
30–39	387 (38.0%)	222 (29.8%)		609 (34.2%)
40–49	253 (24.8%)	161 (21.6%)		414 (23.2%)
50–59	70 (6.9%)	74 (9.9%)		144 (8.1%)
60–65	0 (0.0%)	1 (0.1%)		1 (0.1%)
Marital status				
Single	529 (52.3%)	410 (53.7%)	0.30	939 (52.7%)
Married	482 (47.7%)	354 (46.3%)		836 (46.9%)
Categories of healthcare worker				
Medical doctors	192 (18.8%)	100 (13.1%)	< .01	292 (16.4%)
Nursing professionals	596 (58.7%)	369 (48.3%)		967 (54.2%)
Health associate professionals	126 (12.4%)	120 (15.7%)		246 (13.8%)
Health management and support personnel	83 (8.1%)	85 (11.1%)		168 (9.4%)
Health service provided not elsewhere classified	20 (2.0%)	90 (11.8%)		110 (6.2%)
Past psychiatric history (yes)	129 (12.7%)	49 (6.4%)	< .01	178 (10.0%)
Years of employment (year)	9.9 ± 9.0	9.5 ± 9.3	0.37	9.7 ± 9.1
Assessment measures				
Patient Health Questionnaire-9 (PHQ-9)	4.9 ± 4.6	4.4 ± 4.4	< .01	4.7 ± 4.5
Generalized Anxiety Disorder-7 (GAD-7)	3.7 ± 4.0	3.0 ± 3.7	< .01	3.4 ± 3.9
Stress and Anxiety to Viral Epidemic-9 (SAVE-9)	20.3 ± 5.7	20.2 ± 7.0	0.64	20.3 ± 6.3
Anxiety subcategory of SAVE-9	14.2 ± 4.2	14.7 ± 4.9	0.06	14.4 ± 4.5
Work-related stress subcategory of SAVE-9	6.1 ± 2.3	5.5 ± 2.7	< .01	5.8 ± 2.5

Among the five categories of healthcare workers, workers in the nursing professionals group were younger, more depressed, and more anxious compared to workers in all other groups (Table 2 and 3). The SAVE-9 scale score was significantly correlated with PHQ-9 score in all healthcare worker groups (all, $P < .01$). In the nursing professionals group, single workers reported more depressive symptoms (higher proportion of workers whose PHQ-9 ≥ 10) compared with married workers. Excluding the nursing professionals, other

groups did not differ significantly in PHQ-9 scores with respect to sex, age, or marital status. However, in non-nursing professionals group, female workers reported higher anxiety (higher proportion of GAD-7 ≥ 5) compared with males, and married workers reported more anxiety compared with singles. Especially among all married workers, nursing professionals had significantly higher scores on SAVE-9, GAD-7, and PHQ-9 (P < .001) compared with all other healthcare workers. The SAVE-9 score was higher in the nursing professionals group than in other groups, except nursing professionals. In the nursing professionals group, junior workers (<40 years) were more anxious about the viral epidemic situation; junior and single workers stressed more about their work. Female workers in all groups, except nursing professionals, were more anxious about the viral epidemic and felt more stressed.

Table 2. Clinical characteristics of the participants by category of healthcare worker (N = 1,783)

	Nursing professionals (n = 967)	Medical doctors (n = 292)	Health associate professionals (n = 246)	Health management and support personnel (n = 168)	Health service provided not elsewhere classified (n = 110)	All workers excluding nursing professionals (n = 816)
Age (junior – 20s and 30s senior – 40s, 50s, and 60s)	718 (75.1%) / 238 (24.9%)	215 (73.9%) / 76 (26.1%)	152 (62.3%) / 92 (37.7%)*	77 (46.7%) / 88 (53.4%)*	43 (39.8%) / 65 (60.2%)*	487 (60.2%) / 321 (31.8%)*
Sex (female)	933 (96.5%)	122 (41.8%)*	114 (46.3%)*	103 (61.3)*	84 (76.4%)*	423 (51.8%)*
Past psychiatric history	90 (9.3%)	33 (11.3%)	18 (7.3%)	27 (16.2%)*	10 (9.2%)	88 (10.8%)
Marital status (married)	396 (41.1%)	140 (48.1%)*	143 (58.6%)*	94 (56.3%)*	63 (57.3%)*	440 (54.2%)*
Years of employment	10.1 ± 8.6	6.6 ± 7.4*	10.3 ± 11.0	11.5 ± 10.4	10.4 ± 9.4	9.2 ± 9.7

* P <.01 compared to nursing professionals group

Table 3. Clinical symptom assessment of the participants by category of healthcare worker (N = 1,783)

	Nursing professionals (n = 967)	Medical doctors (n = 292)	Health associate professionals (n = 246)	Health management and support personnel (n = 168)	Health service provided not elsewhere classified (n = 110)	All workers excluding nursing professionals (n = 816)
PHQ-9	5.5 ± 4.6	2.9 ± 3.4*	3.8 ± 4.2*	4.6 ± 4.7	4.4 ± 4.5	3.8 ± 4.2*
PHQ-9 ≥ 10 (junior / senior), %	19.2 / 13.9	5.1 / 5.3	9.8 / 10.9	14.3 / 9.1	11.6 / 13.8	8.6 / 9.7
PHQ-9 ≥ 10 (male / female), %	11.8 / 18.0	5.3 / 4.9	6.8 / 14.0	13.8 / 9.7	0 / 16.7†	6.9 / 10.9
PHQ-9 ≥ 10 (married / single), %	14.1 / 20.3†	5.0 / 5.3	9.8 / 9.9	9.6 / 13.7	13.8 / 10.6	8.9 / 8.9
GAD-7	4.0 ± 4.1	2.0 ± 3.0*	3.0 ± 3.9*	3.4 ± 4.0	2.7 ± 3.1*	2.7 ± 3.6*
GAD-7 ≥ 5 (junior / senior), %	35.8 / 35.7	16.3 / 14.5	24.3 / 25.0	39.0 / 30.2	18.6 / 27.7	22.7 / 24.5
GAD-7 ≥ 5 (male / female), %	35.3 / 35.7	14.1 / 18.0	18.9 / 31.6	27.7 / 38.6	3.8 / 29.8†	17.4 / 29.0†
GAD-7 ≥ 5 (married / single), %	35.9 / 35.6	19.3 / 12.5	27.3 / 21.8	35.1 / 33.8	27.0 / 19.1	26.4 / 20.1†
SAVE-9	21.6 ± 5.9	17.2 ± 6.1*	20.2 ± 5.9*	18.9 ± 6.3*	18.2 ± 6.8*	18.6 ± 6.3*
Anxiety subcategory	15.4 ± 4.2	12.0 ± 4.6*	14.7 ± 4.3	13.4 ± 4.5*	13.3 ± 4.8*	13.3 ± 4.6*
Junior (J) / senior (S)	J: 15.6 ± 4.1 S: 14.7 ± 4.4†	J: 11.6 ± 4.7 S: 13.0 ± 4.3	J: 14.8 ± 4.1 S: 14.5 ± 4.7	J: 13.8 ± 4.9 S: 13.1 ± 4.0	J: 13.6 ± 5.2 S: 12.9 ± 4.6	J: 13.1 ± 4.8 S: 13.5 ± 4.5

Male (M) / female (F)	M: 14.1 ± 5.8 F: 15.4 ± 4.1	M: 11·3 ± 4·6 F: 12.9 ± 4.4†	M: 14.2 ± 4.4 F: 15.3 ± 4.1	M: 12.8 ± 4.8 F: 13.7 ± 4.2	M: 11.1 ± 3.9 F: 13.9 ± 4.9†	M: 12.5 ± 4.7 F: 13.9 ± 4.5†
Married (M) / single (S)	M: 15.4 ± 4.0 S: 15.4 ± 4.3	M: 12.8 ± 4.4 S: 11.3 ± 4.6	M: 14.6 ± 4.6 S: 14.9 ± 3.9	M: 13.7 ± 4.2 S: 13.0 ± 4.7	M: 13.9 ± 4.5 S: 12.3 ± 5.2	M: 13.7 ± 4.5 S: 12.7 ± 4.7†
Work-related stress subcategory	6.3 ± 2.5	5.3 ± 2.2*	5.5 ± 2.4*	5.5 ± 2.4*	5.0 ± 2.6*	5.4 ± 2.4*
Junior (J) / senior (S)	J: 6.4 ± 2.5 S: 5.7 ± 2.4†	J: 5.4 ± 2.2 S: 5.0 ± 2.3	J: 5.5 ± 2.4 S: 5.5 ± 2.5	J: 5.7 ± 2.6 S: 5.4 ± 2.3	J: 5.0 ± 2.7 S: 4.9 ± 2.6	J: 5.4 ± 2.4 S: 5.2 ± 2.4
Male (M) / female (F)	M: 5.8 ± 3.0 F: 6.3 ± 2.5	M: 4.9 ± 2.4 F: 5.8 ± 1.9†	M: 5.2 ± 2.3 F: 5.9 ± 2.5	M: 5.1 ± 2.7 F: 5.8 ± 2.2	M: 3.5 ± 2.0 F: 5.4 ± 2.7†	M: 4.9 ± 2.4 F: 5.8 ± 2.3†
Married (M) / single (S)	M: 5.9 ± 2.4 S: 6.5 ± 2.6†	M: 5.3 ± 2.2 S: 5.3 ± 2.3	M: 5.8 ± 2.4 S: 5.2 ± 2.4	M: 5.5 ± 2.7 S: 4.3 ± 2.4	M: 5·4 ± 2·7 S: 4·2 ± 2·4	M: 5.5 ± 2.4 S: 5.2 ± 2.4

***** *P* <.01 compared to nursing professionals group
† *P* <.01 among each healthcare worker group

Compared with that of medical doctors and other groups, the SAVE-9 score of nursing professionals was higher (Figure 1).

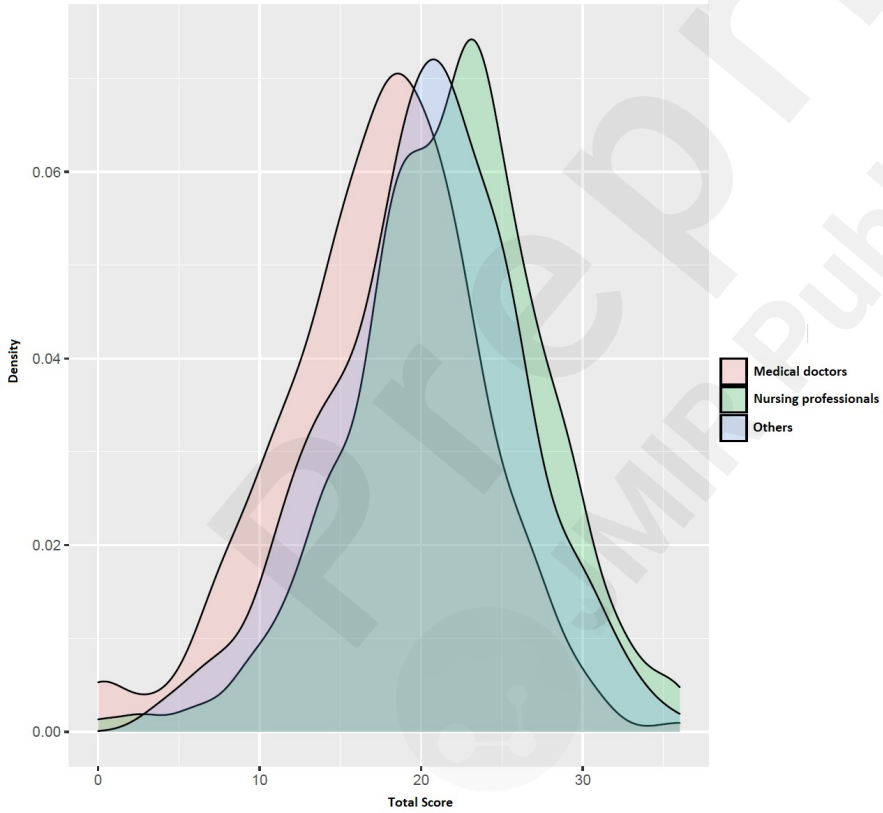

Figure 1. The distribution of the SAVE-9 score among healthcare workers group

The results of logistic regression analysis are presented in Table 4. The hospital factor (AMC, adjusted odds ratio [aOR] = 1.45, 95% confidence interval, CI [1.06–1.99], nursing professionals (aOR = 1.37, 95% CI [1.02–1.98]), single workers (aOR = 1.51, 95% CI [1.05–2.16]), higher stress and anxiety to the viral infection (high SAVE-9 score, aOR = 1.20, 95% CI [1.17–1.24]), and past psychiatric history (aOR = 3.26, 95% CI [2.15–4.96]) were positively associated with depression.

Table 4. Logistic regression analysis to explore predictor variables for depression*

Explanatory variables	Crude OR	95% CI	*P*-value	Adjusted OR	95% CI	*P* -value
AMC (vs. USMH)	1.43	1.08–1.89	0.04	1.45	1.06–1.99	**0.02**
Junior (vs. senior)	1.36	1.01–1.84	0.049	1.20	0.81–1.79	0.36
Female (vs. male)	2.39	1.62–3.55	< .01	1.11	0.68–1.80	0.68
Single (vs. married)	1.46	1.11–1.92	< .01	1.51	1.05–2.16	**0.03**
Nursing professionals (vs. others)	2.20	1.65–2.95	< .01	1.37	1.02–1.98	**0.04**
SAVE-9 score	1.19	1.16–1.23	< .01	1.20	1.17–1.24	**< .01**
Past psychiatric history	2.47	1.71–3.56	< .01	3.26	2.15–4.96	**< .01**

OR, odds ratio; CI, confidence interval; AMC, ASAN Medical Center; USMH, Uijeongbu St. Mary's Hospital
* Depression was defined as PHQ-9 score ≥10

Among participants, 534 (29.9%) workers were classified as having "high anxiety" using the GAD-7 total score (GAD-7>5). Among workers who were not classified as having "high anxiety" (N = 1,240), an additional 400 (400/1,783, 22.4%) workers were newly screened as having stress and anxiety due to the viral epidemic based on the SAVE-9 score ≥ 22 (kappa = 0.351, P < 0.001).

Discussion

The results demonstrated that nursing professionals were more depressed, anxious, and stressed by the viral epidemic than other healthcare workers during the first phase of the COVID-19 pandemic. Marital status (being single) as well as anxiety and work-related stress associated with the viral epidemic were risk factors for depression among healthcare workers. The average SAVE-9 score among healthcare workers was 20.3 points. Considering that previous validation study of SAVE-9 [21] defined mild degree symptoms of virus-related stress and anxiety more than 22 points, this study showed similar results to previous studies [14, 19, 25, 26] in that a high proportion of healthcare workers experience psychological impacts of COVID-19. To better fight the COVID-19 outbreak, all healthcare workers are being employed in activities related to epidemiological investigations and contact isolation. Along with the existing healthcare workers at the infectious diseases departments, all workers have been recruited at screening clinics. Nursing professionals directly provide care to all confirmed/suspected patients and their caregivers. The others measure the temperature and sanitize the hands of all incoming people at the hospital entrance, explaining that hospital access and medical treatment are restricted to the contacts identified through epidemiological correlation. All healthcare workers must wear personal protective equipment at screening clinics and cohort isolation wards.

Consistent with previous studies, we also found that nursing professionals were more likely to feel stress or anxiety than other healthcare workers [14, 15, 19, 27, 28]. Nursing professionals are in crisis as they care for infected patients but experience fear of infectious diseases, insufficient isolation-patient-care-systems, and ethical dilemmas [29]. In addition, nurses may experience risk in situations where it is difficult to remove and re-wear a gown in-between treatment due to lack of time as well as face distressing situations where uncooperative patients may be exposed to direct infection [30]. As nurses interact most closely with infected patients and face long-term exposure, they reported experiencing physical and emotional difficulties. This may have influenced the high level of stress nurses report experiencing due to feeling burdened by work changes and reacting sensitively to lack of resources. Therefore, it has been suggested that mental health and stress management programs are needed for nurses who take care of infected patients [30, 31]. Through continuous infection prevention training and protective equipment training, nurses' ability to cope with crises and ethical dilemmas must be improved [32].

Compared with healthcare workers who were single, all married workers, excluding nursing professionals, scored higher on GAD-7. Owing to high medical knowledge regarding the high infectivity of the virus and the relatively insufficient medical supplies at the beginning, healthcare workers had high safety concerns. Married workers may worry not only about their own protection but also about the safety of their family members, including children. This finding is consistent with previous studies, which noted that the concern for the health of oneself and one's family was significantly higher among married workers [5, 33].

However, among the nursing professionals group, there was no difference in GAD-7 scores according to marital status (single: 35.6%, married: 35.9%; GAD-7 ≥5 points), compared to 26.4% of married workers and 20.1% of single workers in all other healthcare worker groups. The group of nursing professionals had higher overall depression, anxiety, and virus-related stress and anxiety than other healthcare workers. The Korean government's emphasis on social distancing made it necessary for participants to submit daily results of viral symptoms monitoring and to be only at home or the hospital. Being a healthcare worker may have exerted a lot of pressure on them to make things better. Among single workers, this semi-compulsory sequestration was compelled, and they experienced a greater change in life than married workers. As they could not perform daily activities to reduce their stress, their perceived negative emotions increased, and positive emotions remained relatively low. In such unforeseen situations, family support is important to motivate people to continue working [12, 34]. Married workers can connect more closely with their families, share things beyond work, and vent emotions better. This finding indicates that single nursing professionals may need more psychological support. We also found that the hospital factor was significantly associated with depression. AMC is one of the biggest hospitals in Korea and there are many patients with high severity of illness compared to other hospitals. Compared to USMH, AMC has a higher proportion of nursing professionals, past psychiatric history, and a higher SAVE-9 score, and these factors may have influenced the association of hospital factors with depression.

In this study, we measured anxiety symptoms among healthcare workers using the SAVE-9 scale, which is used for assessing anxiety measures specific to the viral epidemic, and GAD-7 scale, which is used for measuring non-specific anxiety. In previous SARS and MERS outbreaks, healthcare workers were exposed to protracted epidemics, and the unfavorable conditions presented as a high prevalence rate of burnout and depression [35]. The COVID-19 pandemic has been persistent for more than a year; thus, the impact of long-term mental health of healthcare workers should be considered carefully. There have been studies that have reported severe psychological impacts on healthcare workers during various phases of COVID-19 [14, 36]. However, the rating scales used in the previous studies were not specific to the viral epidemic, and those results did not reflect psychological stress specifically in relation to the viral epidemic. Therefore we developed a new brief measure, SAVE-9 [21] to assess anxiety and stress of healthcare workers specifically in response to the COVID-19. During a pandemic, a larger number of healthcare workers need attention and care for maintaining essential care services. SAVE-9 would be a more useful measure of the level of stress in healthcare workers during a viral epidemic than tools designed for specific pathologies.

In addition, we could screen an additional 400 (22.4%) healthcare workers as having significant stress and anxiety response to the viral epidemic even after screening 534 (29.9%) workers who were classified as having "high anxiety" using the GAD-7 scale. The GAD-7 is widely used to assess participants' generalized anxiety, but it does not reflect the psychological stress specifically in response to viral epidemics. Therefore,

we consider that the viral epidemic-specific rating scale can assess the psychological state of healthcare workers that is specific to a situation such as the COVID-19 pandemic.

This study has some limitations. First, this was a cross-sectional study. Therefore, we can suggest only associations between mental problems and COVID-19 in healthcare workers but not causal relationship or underlying mechanism. Second, the survey was conducted only in one hospital in Seoul and one in Uijeongbu. Thus, the sample may have been biased. In addition, the responses might be biased, as this study utilized a self-report online questionnaire. Nevertheless, as the job type distribution of the sample mirrored that of the healthcare workers at study sites, it can be considered as substantially representative in these hospitals. Third, the questionnaire was conducted in mid-April 2020, immediately after the end of the cohort isolation. The psychological status of healthcare workers at the onset or peak of Korea's COVID-19 crisis was therefore not assessed. Future research should focus on specific groups, incorporating more inception points in local epidemics. We will have to collect more comprehensive data on the psychological status of healthcare workers in other infectious disease outbreaks. Fourth, we were unable to classify workers as parent-facing, contact, frontline healthcare workers, or those with a history of COVID-19 positivity or quarantine. As noted above, Lai et al [14] revealed that being directly engaged in clinical activities was an independent risk factor of psychiatric symptoms. Workers with COVID-19 exposure or positivity had a two-fold to four-fold increased risk of being anxious and depressed compared with controls [37]. Moreover, quarantine activity has been shown to adversely affect mental health both during and after quarantine. Finally, the coarse categorization of healthcare jobs may lead to biased findings. Since one of the objectives in this study was to explore which workers among the category of healthcare jobs suffered the severest stress in this pandemic, we categorized them into two (nursing professionals vs. other healthcare workers) groups.

Despite these limitations, our study indicates that all healthcare workers were at risk of COVID-19 and that they worried about health problems for themselves, their family, and their colleagues. Especially nursing professionals, who are the major healthcare workers in the medical system and heroes on the frontline, can easily be depressed and frustrated. In addition, their marital status (being single), past psychiatric history, and higher level of anxiety specifically in response to the viral epidemic also influence their depressive symptoms. We could measure anxiety response and work-related stress among healthcare workers during this pandemic using the rating scale, which is more specific to the viral epidemic.

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Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Abbreviations

AMC: ASAN Medical Center
USMH: Uijeongbu St. Mary's Hospital
ISCO: International Standard Classification of Occupations
SAVE-9: Stress and Anxiety to Viral Epidemics-9
PHQ-9: Patient Health Questionnaire-9
GAD-7: Generalized Anxiety Disorder-7

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Supplementary Files

Figures

The distribution of the SAVE-9 score among healthcare workers group.