

The Mental Health of Hospital Workers During the Initial Phase and Third Wave of the COVID-19 Pandemic: Exploring Risk and Protective Factors in the Prolonged Pandemic

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ABSTRACT

Objective : Hospital workers' mental health has deteriorated because of the ongoing COVID-19 pandemic. The purpose of this study was to investigate the impact of the prolonged COVID-19 pandemic on the mental health of hospital workers and its determinants.

Methods : Two surveys were conducted among employees working in a hospital that received COVID-19 patients from the early phase of the pandemic in South Korea. Data on demographics, perceived threat, workplace evaluation, resilience, and mental health status were collected using the Korean General Health Questionnaire-20 in the initial phase (February 2020) and during the third wave of COVID-19 (December 2020) for 467 and 545 workers, respectively. The mental health of hospital workers in the two phases was compared, and the risk and protective factors during the third wave were investigated.

Results : The proportion of patients in the psychiatric high-risk group increased from 2.8% in the initial phase to 11.4% during the third wave. The perceived threat, workplace evaluation, and resilience of respondents deteriorated. Risk factors for mental health during the third wave included the perceived threat items of job stress, loss of control, and considering resignation. Protective factors included presence of children, workplace satisfaction, and hardiness in resilience.

Conclusion : Hospital workers' mental health deteriorated as the pandemic progressed. General stress and tension such as job stress, loss of control, considering resignation rather than COVID-19-specific stress had negative effects on mental health of hospital workers. Therefore, care for work stress itself can be helpful to maintain the mental health of hospital workers. Also, governance to improve workplace satisfaction or hardiness in resilience can be a potential protective factor for hospital workers' mental health during the prolonged pandemic. (Anxiety and Mood 2022;18(2):80-91)

KEYWORDS : COVID-19; Pandemics; Hospital workers; Mental health; Risk factor.

Introduction

In the event of a pandemic, hospitals play an important role in frontline treatment such as the screening, diagnosis, and treatment of critically ill patients. Accordingly, hospital workers experience a rapid increase in their workload. Further-

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more, the nature of infectious diseases causes considerable stress, such as anxiety about self-infection, transmission to family members, and social isolation.¹

Many studies have reported that outbreaks of infectious diseases, such as the severe acute respiratory syndrome (SARS) in 2003, H1N1 influenza in 2009, middle east respiratory syndrome (MERS) in 2015, and the recent coronavirus disease (COVID-19) in 2019, affect the mental health of hospital workers.¹⁻²⁰ According to studies conducted during the SARS outbreak, as the novel virus spread rapidly, hospital workers experienced extreme vulnerability and uncertainty, a fear of mortality, and somatic and cognitive symptoms. Over time, hospital workers gradually began to feel depressed. Additionally, workers in

high-risk areas, such as SARS wards, were found more likely to have higher levels of post-traumatic stress symptoms than their counterparts.² During the H1N1 influenza pandemic, hospital workers working in the intensive care unit experienced fear of disease transmission, vulnerability, and reluctance to care for H1N1 patients.³ General practitioners and practice assistants were at the forefront during the H1N1 pandemic; although their workload increased significantly, they were insufficiently protected.⁴

Similar concerns arose regarding the mental health of hospital workers during the COVID-19 pandemic. Depression, anxiety, insomnia, and distress increased in a significant proportion of hospital workers after the COVID-19 outbreak.^{5,6} There has been extensive discussion on the various factors affecting mental health. Previous studies tried to measure mental health during the infectious disease period with various scales and perspectives. For example, in the previous study, it was attempted to determine the degree of psychological trauma through the Impact of Event Scale (IES), and anxiety, depression, and sleep problem, and family relationship were evaluated through GHQ-12, which was abbreviated from the General Health Questionnaire (GHQ) to 12 items.^{1,5} In other studies, various measures, such as IES, patient health questionnaire (PHQ), 7-item generalized anxiety disorder (GAD-7), insomnia severity index (ISI), and Pittsburgh sleep quality index were used to evaluate depression, anxiety, and insomnia.^{6,7} Some studies have shown that nurses,^{6,8} women,^{6,9} frontline workers,^{6,10} or those who felt isolated and discriminated⁵ were more vulnerable. However, other studies have found that the mental health of non-frontline hospital workers, as measured by the GAD-7, Connor–Davidson Resilience Scale, and trauma related scales, may be associated with high anxiety, resilience, depression, and vicarious traumatization.^{11,12} A previous study has indicated that “living with a family” was significantly associated with the lower scores on IES-R and GHQ-12.⁵ However, others have shown that “living with a family” or having many children led to worse mental health.^{9,13} Hospital workers who perceived that the hospital was safe or possessed persistence or hardiness subtypes of resilience experienced less anxiety and stress.¹⁴

Although the mental health of hospital workers during the pandemic has received continuous attention, most of the preceding studies have been conducted during a specific pandemic period. The COVID-19 pandemic has continued longer than any other recent pandemic, and the resulting changes in the mental health status of hospital workers should be exam-

ined. Furthermore, risk and protective factors affecting mental health of hospital workers during the prolonged pandemic need to be investigated to maintain healthcare system.

This study was conducted at a general hospital in Goyang-si, Gyeonggi-do, South Korea in 2020. This was the only private hospital that ran government-designated negative pressure rooms for the infectious disease, had treated patients with MERS in 2015, and had been receiving infected patients since the early stages of COVID-19.

According to previous studies conducted at this hospital during the 2015 MERS outbreak, hospital workers reported that the workplace had become an unsafe area that stigmatized hospital workers and their families.¹⁴ They had difficulties communicating with the hospital and distrusted the local community. Consequently, workers experienced negative emotions such as anxiety, anger, fear, shame, and stress.¹⁴ Additionally, as the perceived threat of MERS infection increased, the psychological resilience of hospital workers decreased.¹⁵ The hospital realized the need to improve the mental health of hospital workers facing infectious diseases alongside treating patients.

Hence, when the COVID-19 outbreak occurred, the mental health of hospital workers was monitored during the hospitalization of the first COVID-19 patient. In a study conducted during the initial phase of COVID-19 at this hospital, the rate of considering resignation was higher if the workplace evaluation was low, perceived threat of COVID-19 and stress or anxiety were high, or if the respondent’s occupation was nursing.¹⁶ In that study, to evaluate workplace evaluation, three hospital’s actions for COVID-19 (hospital’s actions for COVID-19, hospital’s communication, and hospital’s safety) and overall satisfaction of the hospital were investigated. A study of nurses at this hospital reported that depression and anxiety were higher among nurses in charge of suspected COVID-19 patients than among those in charge of confirmed COVID-19 patients.¹¹ Accordingly, the hospital considered stress management for various duties, and mental health monitoring and supportive counseling were implemented for nurses working in COVID-19-related wards. Afterward, the hospital surveyed all employees during the ongoing COVID-19 pandemic and followed up on their mental health.

Based on previous researches, we hypothesized that as COVID-19 continues for a long time, there would be a deterioration in the mental health of hospital workers. In addition, we predicted that deterioration of hospital workers’ mental health would be related to perceived threat, workplace evaluation, and resilience of hospital workers. Therefore, the purpose and

structure of this study were divided into two main categories. First, this study aimed to investigate the effects of prolonged pandemics on the mental health of hospital workers. The perceived threat, workplace evaluation, resilience, and general mental health of hospital workers were assessed when the first COVID-19 patient was hospitalized and followed up during the third wave. Second, the risk and protective factors affecting the mental health of hospital workers during third wave were investigated to highlight the necessity of regularly monitoring the mental health of hospital workers and suggesting relevant factors to improve their mental health during prolonged pandemics.

Subjects and Methods

Participants

A survey on the recognition of COVID-19 and mental health status was conducted among hospital workers at two points of time in 2020. The first survey was conducted when the first COVID-19 patient was admitted to this hospital; this patient was the third COVID-19 patient in South Korea. The survey period was February 6–12, 2020, and 467 of the 1,336 hospital workers participated (35.0%). The second survey was conducted during December 21–24, 2020, the third wave of the pandemic, which was the largest wave until then with more than 1,000 confirmed cases per day across all country. The hospital had 109 COVID-19 patients at that time; 545 of 1,424 employees participated in the survey (37.5%).

Procedure

An anonymous online questionnaire link was sent to all hospital workers via text message, and the workers participated voluntarily. This self-report questionnaire covered several areas: 1) demographics and job information; 2) the perceived threat of the COVID-19 outbreak; 3) mental health status using the Korean General Health Questionnaire (KGHQ); 4) workplace evaluation; and 5) resilience. The online questionnaire did not proceed to the next page if there was an answer missing, which ensure complete answers without any missing data.

Demographics and job information

The demographic characteristics of the respondents included age, gender (1=men, 2=women), marital status (1=single, 2=living with partner), presence of children (1=no, 2=yes), and religion (1=do not have, 2=have). The respondents' job-related information, such as work period, occupation (1=med-

ical doctor, 2=nurse, 3=other medical professional, 4=non-medical office worker), employment status (1=permanent, 2=temporary), and type of COVID-19 task participation at present (1=frontline worker, 2=second-line worker, 3=no participation), was also collected. Frontline workers were defined as those who were in charge of COVID-19 patients directly. Second-line workers were those who faced potential COVID-19 patients, such as workers in the pneumonia surveillance unit, suspected patients' unit (patients who were admitted before the COVID-19 RT-PCR result could be obtained), emergency room, and COVID-19 screening clinic. This bifurcation was well demonstrated in the dual-track healthcare system at this hospital.²¹

Perceived threat of COVID-19

The questionnaire comprised 10 questions adapted from a previous study that assessed the psychological impact of SARS on hospital workers in Taiwan.¹ Among the perceived threat items, items 1–6 were related to the COVID-19 threat perception, items 7 and 8 to general personal anxiety, and items 9 and 10 to job maintenance. These included perceived job risk (item 1: "I feel that my job is a dangerous one"), perceived stigma (item 2: "I feel that people avoid me because of my job"), fear of infection (item 3: "I am afraid of getting infected by the corona virus"), worry about transmission (item 4: "I am worried I will pass COVID-19 to others"), concern for others (item 5: "My family and friends are worried that they might get infected through me"), fear of possible death (item 6: "I believe that I could die if I get infected with COVID-19"), perceived job stress (item 7: "I feel more stress at work"), loss of control (item 8: "I have little control over whether I get infected or not"), considering resignation (item 9: "I have thought about quitting my job because of COVID-19"), and acceptance of duty (item 10: "I accept the work given to me when infectious diseases, such as COVID-19, break out"), rated on a five-point Likert-type scale ranging from 1 to 5 (1=strongly disagree, 5=strongly agree). The order of questions in the survey was intermixed, as in the Taiwan study,¹ and the order of results was organized by theme. In addition, this questionnaire is not evaluated with a total score, and each item was analyzed as an independent factor in previous studies using this questionnaire.^{1,16}

Workplace evaluation

The workplace evaluation items during the COVID-19 outbreak included "Hospital's action for COVID-19," "Hospital's

communication,” and “Hospital’s safety.” These items were rated on a five-point Likert-type scale ranging from 1 to 5 (1=responded very poorly, 2=did not respond well, 3=ordinary, 4=responded well, 5=responded very well). These items extracted from a qualitative study in the same hospital at the time of MERS,¹⁴ and were made into items through a researcher meeting. “Overall workplace satisfaction” was also rated on a five-point Likert-type scale (1=very unsatisfied, 2=unsatisfied, 3=neither, 4=satisfied, 5=very satisfied). This item is used in the regular survey for hospital staff in Mayo clinic,²² “Considering everything, how would you rate your overall satisfaction with Mayo Clinic as a whole at the present time?” and we translated this question into Korean.

Korean General Health Questionnaire-20 (KGHQ-20)

The General Health Questionnaire (GHQ) developed by Goldberg and Hillier, is a widely used screening tool designed to detect current mental disorders in consulting settings.²³ Validity and reliability studies on several versions of the GHQ have been conducted in Korea (KGHQ-30, KGHQ-20, and KGHQ-12); this study adopted the medium-length KGHQ-20 as a screening tool for workers. The cutoff point for the KGHQ-20 was adopted as 12/13 for cases (high risk for mental disorder, i.e., case/non-case).²⁴

Resilience

Resilience was measured using the Korean version of the Connor–Davidson Resilience Scale (K-CD-RISC).²⁵ The K-CD-RISC is a self-report questionnaire comprising 25 items rated on a five-point Likert-type scale (0–4). This questionnaire measures five aspects of psychological resilience, including “hardiness,” which implies personal competence, high standards, and tenacity of purpose; “persistence,” indicating tolerance to negative emotions, the reinforcing effects of stress and prudent thinking, and decision-making in coping with stress; “optimism,” which means hopes for the future or the likelihood of success of a particular event; “support,” which indicates the ability to get help from others; and “spirituality,” which implies a sense of interconnectedness between the world and living beings.²⁶

Statistical analysis

In this study, two surveys were conducted in the initial phase (February 2020) and the third wave of the pandemic (December 2020). Demographic data, perceived threat, workplace evaluation, mental health status by KGHQ-20, and resili-

ence were compared between the two phases using a Mann-Whitney U test or chi-square test. Mann-Whitney U test was performed to investigate the differences in demographics, perceived threat, workplace evaluation, and resilience factors between the case (high-risk) group and the non-case group based on the KGHQ-20 during the third wave because variables did not assume the normality. Finally, multivariate backward logistic regression analyses applying likelihood ratio estimation were performed to investigate the factors affecting mental health during the third wave, and outcomes were presented as odds ratios (ORs) and 95% confidence intervals (CIs). All analyses were conducted using the SPSS Statistics version 26 program (IBM Corp., Armonk, NY, USA).

Ethics statement

This study’s protocol was reviewed and approved by the institutional review board (IRB) of Myongji Hospital (IRB No. 2020-02-011-001). The IRB waived the requirement for informed consent because this study used only anonymous data collected from workplace mental health screenings with voluntary participation, and informed consent could disrupt the anonymity of the employees.

Results

Demographics

The mean age of the respondents was 34.3 years (standard deviation [SD]=9.4); 23% of the total respondents were men and 77% were women. Most respondents were nurses (50.5%), doctors (10.5%), other medical professionals (26.8%), and office workers (12.3%). 9.3% of the respondents had direct contact with COVID-19 patients (i.e., frontline workers), whereas 29.6% had possible contact (i.e., second-line workers) and 61.6% of respondents had no contact. The length of work experience varied from less than 2 years to over 10 years, and 76.9% were regular workers. Over half of the respondents were single (57.6%) and approximately half were not religious (56.4%) (Table 1).

Perceived threat

Table 2 shows the percentage of affirmations for each item (agree or strongly agree). There was a significant difference in the perceived threat of COVID-19 between the two phases. The threat perceived by hospital workers during the third wave was generally worse than that in the initial phase. During the third wave, hospital workers reported a statistically signifi-

cant increase in the perceived threat items 1, 3, 4, 5, and 6, which were related to their sense of COVID-19 threat (perceived job risk, fear of infection, worry about transmission,

concern for others, and the possibility of death), items 7 and 8, which were related to higher general anxiety (perceived job stress, loss of control), and item 9, which was related to resig-

Table 1. Demographic characteristics of the two COVID-19 phases

	Initial phase (n=467)	Third wave (n=545)	Total
Age (Mean [SD])	35.3 (10.2)	33.6 (8.5)	34.3 (9.4)
Gender (%)			
Men	23.3	22.8	23.0
Women	76.7	77.2	77.0
Occupation (%)			
Medical doctor	10.3	10.6	10.5
Nurse	50.3	50.6	50.5
Other medical professionals	29.3	24.6	26.8
Office workers	10.1	14.1	12.3
Contact with COVID-19 patients (%)			
Frontline (direct contact)	7.7	10.6	9.3
Second line (possible contact)	24.6	33.9	29.6
No contact	67.7	55.4	61.1
Work years in the current hospital, years (%)			
< 2	21.2	35.2	28.8
2-3	19.1	21.7	20.5
4-6	17.6	16.0	16.7
7-10	15.8	11.4	13.4
> 10	26.3	15.8	20.7
Form of employment (%)			
Regular	80.3	73.9	76.9
Temporary	19.7	26.1	23.1
Marriage (%)			
Single	55.7	59.8	57.9
Married	44.3	40.2	42.1
Presence of children (%)			
No	60.3	65.7	63.2
Yes	39.6	34.3	36.8
Religion (%)			
No religion	55.9	56.9	56.4
Have a religion	44.1	43.1	43.6

Table 2. Comparison of threat perception between the two COVID-19 phases

	Initial phase (n=467) (%)	Third wave (n=545) (%)	χ^2	p
I feel that my job is a dangerous one (PT1)	53.5	67.3	20.15	<0.001
I feel that people avoid me because of my job (PT2)	34.5	29.2	3.27	0.078
I am afraid of getting infected by the corona virus (PT3)	38.5	68.8	93.01	<0.001
I am worried that I will pass COVID-19 to others (PT4)	34.9	64.8	89.77	<0.001
My family and friends are worried that they may get infected through me (PT5)	37.3	49.4	14.96	<0.001
I believe that I could die if I get infected with the COVID-19 (PT6)	13.3	28.4	34.33	<0.001
I feel more stressed at work (PT7)	33.8	52.5	35.50	<0.001
I have little control over whether I get infected or not (PT8)	9.2	19.1	19.75	<0.001
I have thought about quitting my job because of COVID-19 (PT9)	8.1	18.7	23.61	<0.001
I accept the work given to me when infectious disease, such as COVID-19, break out (PT10)	58.9	54.3	2.14	0.144

PT, perceived threat item

nation. However, acceptance of duty (item 10) and perceived stigma (item 2) did not differ significantly between the initial phase and the third wave (Table 2).

Comparison of workplace evaluation between the two COVID-19 phases

Third wave hospital workers rated the hospital's response lower compared to the workers in the initial phase. The mean score of the hospital's actions against COVID-19 was 4.3 (range 1–5) in the initial phase and 3.7 during the third wave. The means of hospital's communication, hospital's safety, and overall workplace satisfaction decreased from 4.1 to 3.3, 3.8 to 3.2, and 3.1 to 3.0, respectively (Table 3).

Comparison of mental health factors between the two COVID-19 phases (KGHQ-20, resilience)

The KGHQ-20 survey was conducted in both phases; the psychiatric high-risk group with a score of 13 or higher comprised 2.8% of the total in the initial phase but increased significantly to 11.4% during the third wave. The additional logistic regression was performed with the KGHQ caseness as a dependent variable, and demographic factors (age, gender, occupation, contact with COVID-19 patients, years of service, employment regularity, marriage, presence of child, religion) and the 'phase' as independent variables, and the only significant factor was the 'phase' ($\text{Exp}(B)=2.140$, $p<0.001$). Therefore, the increase of frequency of psychiatric high risk by K-GHQ between the phase was significant after controlling for demographic factors. Resilience decreased from 66.6 to 59.4 out of a total of 100 and showed a statistically significant decrease for

all sub-items: hardiness, persistence, optimism, support, and spirituality (Table 4).

Comparison of factors by psychiatric morbidity during the third wave

The proportion of patients in the high-risk group for psychiatric morbidity increased sharply during the third wave (Table 4). Therefore, this study compared the difference between demographic factors, perceived threat, workplace evaluation, and resilience between the psychiatric high-risk group, called the case group, and the non-case group during the third wave. The hospital workers in the case group were younger than those in the non-case group, and the proportion of women was higher. Furthermore, in the case group, the proportions of nurses, single workers by marital status, and workers without children were higher than that in the non-case group. Additionally, the case group perceived a more severe threat in terms of all items except one (PT10: acceptance of duty) compared to the non-case group. Similarly, high-risk workers attached lower scores to all items of workplace evaluation compared to the non-case group and showed lower total scores and sub-scores for resilience except the spirituality sub-score. Contact with COVID-19 patients, years of service, employment regularity, and religion were not significantly different between the case and non-case groups (Table 5).

Risk factors of psychiatric morbidity:

Logistic regression analysis

Multivariate backward logistic regression analysis was performed, focusing on the significant factors identified in Table

Table 3. Comparison of workplace evaluation between the two COVID-19 phases

Mean (SD)	Initial phase (n=467)	Third wave (n=545)	Z	p
Hospital's actions against COVID-19	4.3 (0.8)	3.7 (0.8)	-12.28	<0.001
Hospital's communication	4.1 (0.8)	3.3 (0.9)	-13.75	<0.001
Hospital's safety	3.8 (1.0)	3.2 (1.0)	-9.37	<0.001
Workplace satisfaction	3.1 (0.9)	3.0 (0.9)	-3.00	0.003

Table 4. Comparison of mental health factors between the two COVID-19 phases

Mean (SD)	Initial phase (n=467)	Third wave phase (n=545)	Z/ χ^2	p
KGHQ-20	4.1 (3.7)	6.5 (4.5)	-9.41	<0.001
KGHQ-20 \geq 13: % of high risk	2.8%	11.4%	27.06	<0.001
Resilience (total)	66.6 (16.0)	59.4 (16.4)	-7.00	<0.001
Hardiness	23.2 (6.4)	20.5 (6.3)	-6.41	<0.001
Persistence	21.9 (5.4)	19.6 (5.6)	-6.82	<0.001
Optimism	10.7 (2.9)	9.5 (3.1)	-5.71	<0.001
Support	6.0 (1.4)	5.4 (1.65)	-6.16	<0.001
Spirituality	4.8 (1.6)	4.4 (1.68)	-4.36	<0.001

KGHQ-20, Korean General Health Questionnaire; K-CD-RISC, Korean version of the Connor–Davidson Resilience Scale

The Mental Health of Hospital Workers During the COVID-19 Pandemic

Table 5. Comparison of factors by psychiatric morbidity during the third wave

	Non case group (n=483, 88.6)	Case group [†] (n=62, 11.4)	Z/ χ^2
Age (Mean [SD])	34.0 (8.7)	30.6 (6.1)	-2.64**
Gender			9.73**
Men	118 (24.4)	6 (9.7)	
Women	365 (75.6)	56 (90.3)	
Occupation			18.77*
Medical doctor	53 (11.0)	5 (8.1)	
Nurse	229 (47.4)	47 (75.8)	
Other medical professionals	129 (26.7)	5 (8.1)	
Non-medical office workers	72 (14.9)	5 (8.1)	
Contact with COVID-19 patient			0.40
Frontline (direct contact)	50 (10.4)	8 (12.9)	
Second line (possible contact)	165 (34.2)	20 (32.3)	
No contact	268 (55.5)	34 (54.8)	
Work experience, years			9.36
<2	168 (34.8)	24 (38.7)	
2-3	108 (22.4)	10 (16.1)	
4-6	70 (14.5)	17 (27.4)	
7-10	58 (12.0)	4 (6.5)	
>10	79 (16.4)	7 (11.3)	
Form of employment			2.51
Regular	352 (72.9)	51 (82.3)	
Temporary	131 (27.1)	11 (17.7)	
Marriage			10.75**
Single	277 (57.3)	49 (79.0)	
Living with partner	206 (42.7)	13 (21.0)	
Presence of children			12.16***
No	305 (63.1)	53 (85.5)	
Yes	178 (36.9)	9 (14.5)	
Religion			1.66
No religion	270 (55.9)	40 (64.5)	
Have a religion	213 (44.1)	22 (35.5)	
Perceived threat (PT) [‡] (n [%])			
PT1 (perceived job risk)	314 (65.0)	53 (85.5)	10.47**
PT2 (perceived stigma)	133 (27.5)	26 (41.9)	5.51*
PT3 (fear of infection)	320 (66.3)	55 (88.7)	12.91***
PT4 (worry about transmission)	303 (62.7)	50 (80.6)	7.73**
PT5 (concern for others)	227 (47.0)	42 (67.7)	9.46**
PT6 (thought of possible death)	125 (25.9)	30 (48.4)	13.68***
PT7 (perceived job stress)	234 (48.4)	52 (83.9)	27.65***
PT8 (loss of control)	78 (16.1)	26 (41.9)	23.66***
PT9 (considering resignation)	72 (14.9)	30 (48.4)	40.49***
PT10 (acceptance of duty)	267 (55.3)	29 (46.8)	1.60
Workplace evaluation (Mean [SD])			
Hospital's actions against COVID-19	3.73 (0.76)	3.26 (0.92)	-4.31***
Hospital's communication	3.34 (0.91)	2.81 (1.05)	-3.85***
Hospital's safety	3.31 (0.95)	2.65 (1.07)	-4.83***
Overall workplace satisfaction	3.05 (0.87)	2.24 (0.95)	-6.20***

Table 5. Comparison of factors by psychiatric morbidity during the third wave (continued)

	Non case group (n=483, 88.6)	Case group [†] (n=62, 11.4)	Z/ χ^2
Resilience (Mean [SD])			
Resilience (total)	60.8 (16.0)	48.2 (15.1)	-5.91***
Hardiness	21.2 (5.8)	15.8 (6.0)	-6.14***
Persistence	20.0 (5.5)	16.0 (5.2)	-5.49***
Optimism	9.8 (3.0)	7.7 (3.2)	-4.70***
Support	5.5 (1.5)	4.8 (1.7)	-3.28***
Spirituality	4.4 (1.6)	4.0 (1.7)	-1.57

*p<0.05; **p<0.01; ***p<0.001; [†]Korean General Health Questionnaire-20 (KGHQ-20) score \geq 13; [‡]PT1–PT10 are mentioned in Table 2

Table 6. Risk of psychiatric morbidity: logistic backward regression analysis

Variable	β^*	s.e.	Wals	d.f.	p-value	OR(95% CI)
Constant	0.318	0.724	0.193	1		
Presence of children	-0.801	0.410	3.809	1	0.051	0.449
Workplace satisfaction	-0.448	0.195	5.266	1	0.022	0.639
Resilience: Hardiness	-0.120	0.028	18.908	1	<0.001	0.887
PT7 (perceived job stress)	1.134	0.392	8.351	1	0.004	3.108
PT8 (loss of control)	0.779	0.352	4.907	1	0.027	2.179
PT9 (considering resignation)	0.747	0.345	4.687	1	0.030	2.111

-2LL=287.913, Nagelkerke's $R^2=0.325$; Hosmer–Lemeshow test: $\chi^2=7.088$ (p=0.527)

Independent variables included in this regression: age, gender, occupation, marriage, presence of children, perceived threat(PT) item 1-9, workplace evaluation (hospital act, communication, safety, overall satisfaction), resilience (hardiness, persistence, optimism, support). Variables that showed significant results (p < 0.05) are presented in the table, as predictor. *log odds (β). s.e. stadard error; Wals, wald statistics; DF, degrees of freedom; OR, odd ratio; CI, confidence interval

5. That is, age, gender, occupation, marriage, presence of children, perceived threat(PT) item 1-9, workplace evaluation (hospital act, communication, safety, overall satisfaction), resilience (hardiness, persistence, optimism, support) were included as independent variables. During the prolonged COVID-19 situation (third wave), the presence of children, higher workplace satisfaction, and higher hardiness in resilience were protective factors for mental health. However, perceived job stress (PT7), loss of control (PT8), and considering resignation (PT9) led to deterioration in mental health. During the third wave, items 7–8, which were related to personal stress and tension, and considering resignation (PT9) had a greater effect on psychiatric morbidity than items 1–6, which corresponded to the sense of COVID-19 threat (Table 6).

Discussion

The outbreak of a novel infectious disease causes physical overwork and mental overload in hospital workers. However, previously studied epidemics or pandemics, such as SARS, H1N1 influenza, or MERS, were not as extensive and prolonged as COVID-19 has been, necessitating that the changes in hospital workers' mental health and risk factors during the pro-

longed pandemic period be investigated.

This study was a cross-sectional study performed at two separate periods of COVID-19 pandemic. The proportion of the psychiatric high-risk group increased from 2.8% of the total in the initial phase to 11.4% of the total during the third wave. The high-risk group during the third wave was younger and showed higher proportions of women, nurses, workers living without a partner, and workers without a child. In addition, the high-risk group showed a higher perceived threat of COVID-19, lower workplace evaluation scores, and lower resilience. The logistic regression showed that the protective factors included presence of children, higher workplace satisfaction, and higher hardiness in resilience, whereas risk factors included the perceived threat items of perceived job stress (PT7), loss of control (PT8), and considering resignation (PT9).

The present findings are consistent with those of another study dealing with longitudinal trends during the COVID-19 pandemic, which showed that the mental health of hospital workers deteriorated over time (from March 2020 to November 2020).¹⁷ Previous studies found that women,^{6,9,27} nurses,⁶⁻⁸ and frontline workers^{6,10} tended to have worse mental health during the COVID-19 pandemic. In this study, the proportions of women and nurses in the case group were consistently

higher than those in the non-case group despite no difference in the degree of contact with COVID-19 patients. In previous studies, mental health was found to be relatively poor because frontline workers had close and frequent contact with patients and experienced a rapidly increasing workload.^{6,10} Another study showed that the mental health of non-frontline nurses was worse than that of frontline nurses, possibly because of insufficient personal protective equipment, unknown conditions of patients, and weak recognition of their contribution.^{11,12} In this study, direct contact was not significantly related to mental health during prolonged pandemics. Considering the lessons learned during the 2015 MERS outbreak, the hospital organization paid attention to frontline workers, reduced frequency of contact by telemedicine and the overall workload, provided incentives, and often expressed gratitude. To an extent, these actions may have prevented deterioration in the frontline workers' mental health.

Considering the risk factors in the prolonged phase of the pandemic, personal stress and tension (PT7–8), and considering resignation (PT9) seemed to be more related to psychiatric morbidity than the sense of threat from COVID-19 (PT1–6). In a study performed in the initial phase of the COVID-19 pandemic in Japan, “the feeling of being isolated and being discriminated against” was an independent risk factor.⁵ In a study conducted in China, stigmatization, distancing, and perceived high job risk, and not the fear of the COVID-19 infection, increased depression, anxiety, and stress.⁸ The stigmatization of hospital workers was also a recurring theme of stress in the current study's hospital during the 2015 MERS outbreak.¹⁴ However, during the COVID-19 pandemic, stigmatization was not the main theme in the initial phase (34.5%) and was even lower during the third wave (29.2%) (Table 2). In 2015, there were only 186 confirmed cases of MERS in South Korea, and hospital workers were perceived as potential carriers. Similarly, COVID-19 was first reported on a specific cruise ship in Japan and specific provinces in China, and the earlier studies were performed by the treatment team of that cruise or province. Over time, COVID-19 was acknowledged as a virus with high infectivity and lower fatality than MERS in Korea, and its rampancy may have prevented the stigmatization of hospital workers. Moreover, as a lesson from the MERS outbreak, the hospital distributed press releases about hospital workers' stress in the initial phase to arouse public opinion, and a nationwide thank-you campaign for medical staff was also conducted (#thanks-to challenge).

Fortunately, a previous study conducted during the initial

phase of COVID-19 showed that hospital workers believed that their current frontline jobs resulted from social and moral responsibility¹⁸; in this study, over half of the workers indicated “acceptance of duty” (PT10) and this continued into the third wave. However, the percentage of affirmative answers for PT10 decreased: “A long stay wears out one's welcome.”

The average age of study participants was 34.3, which was similar to average age of all hospital workers (35.0) in this hospital during the same period. When comparing cases and non-cases according to KGHQ-20 at the third wave, the age of the case group was younger than that of the non-case group. Therefore, the younger the hospital worker's age, the more likely the worker was to be more vulnerable to mental health as a hospital worker during the COVID-19 period, but the age did not appear as a significant predictor in the regression analysis.

The reason why age did not survive in the regression analysis in this study could be considered as follows. First, the severity of individual mental stress and pressure (PT 7, 8, 9), or the presence of protective factors such as having a child might have a greater effect on mental health than age itself during the COVID-19 pandemic. Second, the overall younger age of hospital workers might dilute the influence of age. Third, it was possible that the age was a continuous variable, so the influence was less reflected than that of the nominal variable. Hereupon, an additional analysis was done by dividing the third wave participants into under 30 and over, there was no significant difference in age between the case and the non-case group ($\chi^2=1.23$, $p=0.267$).

The protective factors for hospital workers in the prolonged pandemic phase included presence of children, workplace satisfaction, and hardiness in resilience. In previous studies, “not living with a partner” was considered a risk factor,⁵ which was consistent with the results of the t-test (Table 5). In contrast, in a study conducted during the initial phase of the COVID-19 pandemic, “living with a family” was a predictor of depression in non-medical hospital workers.⁹ Additionally, a previous study found that “having two or more children” was a risk factor for depression among women hospital workers.¹³ This may be because, in the early stages of COVID-19, women workers experienced a significant dilemma between increased workload and family care and between family care and avoiding contact with family members. However, the logistic regression results during the third wave showed that “presence of children” was a significant protective factor (Table 6). A study conducted with the general public found that family

support buffered loneliness, making it easier to tolerate social distancing during the COVID-19 pandemic and contributing directly or indirectly to positive mental health.²⁸ During the prolonged pandemic, family members also played a positive role among hospital workers, accompanied by gradual adjustments to work and family care dilemmas. In South Korea, family life tends to revolve around children; thus, presence of children may emerge as a significant factor compared to living with a partner.

Workplace evaluation was also an important factor in other studies. According to a study of the Chinese workforce conducted during the initial phase of COVID-19, hospital workers experienced less stress when they felt that the workplace was sanitary and preventive, and returning to work was perceived as a risk factor.²⁹ The hospital's actions against COVID-19 were significantly associated with workers' acceptance of duty in the initial phase study for this hospital.¹⁶ In the current study, workplace evaluation in the initial phase was satisfactory. The means of hospital's actions, hospital's communication, and hospital's safety were 4.3/5, 4.1/5, and 3.8/5, respectively (Table 3). The hospital sent real-time notification texts and mobile newsletters about the COVID-19 situation to all hospital workers (admission of the first COVID-19 patient, infection control plan, etc.) from the initial phase, based on the MERS lesson that opacity of information makes workers anxious and distrustful.¹⁴ However, workplace evaluation scores deteriorated as the pandemic progressed. In response to the open question, workers indicated that they wanted proper rewards or rest for the overload and were disappointed with the long suspension of hospital welfare benefits such as fitness centers and relaxation areas because of quarantine guidelines. Workplace satisfaction was an important factor in this hospital throughout the pandemic. Recognizing the decline in workers' workplace satisfaction, the hospital launched a resilience program for hospital workers in early 2021, the outcome of which will be reported soon.

Finally, the hardiness subtype of resilience is determined as a protective factor. A study conducted on hospital workers during COVID-19 showed that even inexperienced hospital workers were more likely to have better mental health if they had persistence and hardiness among the resilience subtypes.¹⁹ During MERS, nurses with higher hardiness showed better mental health.²⁰ The hardiness factor reflects the notions of personal competence, high standards, and tenacity,²⁶ including items such as "able to adapt to change," "can deal with whatever comes," "can handle unpleasant feelings," and

"I like challenges." Therefore, hardiness reflects an individual's adaptability, problem-solving ability, control, and perception of challenges.³⁰ This suggests that workers with more "hardiness" exercised self-efficacy and control to better deal with problems. This may be related to the result that PT8 (loss of control) was a risk factor. Resilience programs focusing on hardiness aspects may be more effective and helpful for hospital workers during the pandemic era.

This study had several limitations. First, it was based on an anonymous voluntary survey; therefore, the data may be subject to some response biases, e.g., non-participants were either too stressed to respond or not stressed enough to be interested in this survey. Second, there might be some overlap between the initial phase and the third wave participants, but it could not be confirmed because this study based on an anonymous survey. However, since this study was a comparison between February 2020 (initial phase) and December 2020 (third wave), if there were many overlapping participants, the average age should inevitably rise, but rather the average age has decreased. This could be an indirect evidence that the overlap was not the majority. Some researchers insist that the independent T-test is eligible in such anonymous surveys, but still the T-values (Z value in this study) and p-values could be overrated. Third, the perceived threat questionnaire was not standardized. As a result of our additional factor analysis, 9 items except PT10 (acceptance of duty) were loaded on one factor. However, each item represented a known risk factor, such as stigmatization, fear of infection, or resignation; therefore, it was deemed worthwhile to analyze 10 items as risk factors and compare the results to those of previous studies to gain insights into the mental health of hospital workers during the pandemic. Fourth, the proportion of the psychiatric high-risk group as assessed by the KGHQ-20 was only 2.8% in the initial phase. Unlike the cutoff score of the original GHQ-20 by Goldberg, which was 3/4, the KGHQ-20 cutoff score was 12/13. Researchers in the validation study suggested that this was because of the nuanced differences in language; for Koreans who repressed positive expressions, negative questions could be accepted as more universal—this trend was noticed in other Korean validation studies, such as the Center for Epidemiologic Studies Depression Scale (CES-D) study.²⁴ The KGHQ-20 was validated in 2001; over the past two decades, Korean culture has evolved to become more expressive and positive; therefore, the cutoff score for the KGHQ-20 may have changed. In a 2014 study of South Korean auxiliary policemen under 25 years, the mean KGHQ-20 was 4.62, similar to our

result (mean=4.1 in the initial phase).³¹ In a 2018 study of Seoul citizens of all ages, the mean was 6.84, and mental health tended to be worse in older adults in South Korea.³² All studies showed lower mean scores than those in the original study in 2001 (mean=9.18 for young university students); therefore, our KGHQ-20 results are likely to be dependable. Fifth, GHQ is a tool for screening people with mental illness or risk group for mental illness. Originally, it consisted of a total of 60 questions and was composed of sub-factors such as depression, anxiety, social dysfunction, somatic symptoms, and insomnia.²³ In this study, however, the simplified KGHQ-20, so that sub-factors of KGHQ-20 can be classified into 4 categories: anxiety factors, depressive factors, social dysfunction and going out frequency.²⁴ This scale has limitations in that it is difficult to evaluate somatic symptoms. Finally, the hospital in this study simultaneously treated COVID-19 patients and general patients (dual health track),²¹ and over half of the participants were not in contact with COVID-19 patients. Therefore, there may have been differences in mental health compared to hospitals where only COVID-19 patients were hospitalized; thus, a comparative study is needed.

Conclusions

The proportion of the psychiatric high-risk group among hospital workers increased significantly as the pandemic progressed. Perceived job stress, loss of control, and considering resignation emerged as risk factors for poor mental health during the third wave of the pandemic. Therefore, monitoring and managing the job stress and personal pressure is important for maintaining mental health of hospital workers as the pandemic continues. The findings showed that presence of children, workplace satisfaction, and hardiness in resilience are key protective factors for mental health; therefore, monitoring workers' needs in the workplace and providing resilience programs to improve "hardiness" aspects are worth considering. This requires systematic support from hospitals and national governance.

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