

Anxiety and COVID-19 Related Stressors Among Healthcare Workers Who Performed Shift Work at Four COVID-19 Dedicated Hospitals in Korea

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Objective: To assess the relationship between anxiety and shift work of healthcare workers (HCWs) during COVID-19 pandemic. **Methods:** From four COVID-19-dedicated hospitals in Korea, 381 HCWs were analyzed to estimate anxiety in relation to four COVID-19 job stressors and the impact of shift work on this relationship. Anxiety was measured with a generalized anxiety disorder 7-item scale. Multiple logistic regression models were utilized after stratification by sex, occupation, and shift work, after adjusting for a number of variables. **Results:** Anxiety prevalence was 32%. Among female nurses or nursing assistants who performed shift work, anxiety risk was significantly associated with three COVID-19 related job stressors: contact with confirmed cases or patients, dealing with unpleasant patients, and discomfort from wearing protective equipment. **Conclusions:** Special attention is required for mental health of HCWs working shifts during the COVID-19 pandemic.

Keywords: anxious symptoms, COVID-19, healthcare workers, mental health, nurses, shift work

In December 2019, a novel coronavirus disease (COVID-19) appeared and became a worldwide public health challenge.¹ On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic.² In addition to the enormous physical damage caused by this highly infectious disease, the pandemic also has a grave psychological impact.^{3,4}

In addition to fear or anxiety in the general population during epidemics,⁵ the mental health of numerous healthcare workers (HCWs) is also at great risk, which could cause fear, anxiety, depression, and insomnia.^{6,7} With the sudden emergence of infections such as Severe Acute Respiratory Syndrome (SARS) and COVID-19, HCWs' anxiety has increased⁸⁻¹⁰ due to factors such as explosive patient growth, increased workloads, physical or

emotional exhaustion, lack of protective gear, fear of exposure or transmission, and uncertainty about safety.¹¹⁻¹³

The psychological distress of HCWs facing infectious disease epidemics can be caused by factors inherent in COVID-19, such as the intensity of exposure and the perception of danger in that the experience is unexpected or uncontrollable.¹⁴ In the epidemic of such little known infectious disease, HCWs including nurses inevitably suffer from stress, fear, and anxiety.⁷ Furthermore, unlike the previous epidemic, COVID-19 has an extremely high infectious potential, which can intensify anxiety.¹⁵

Since February 21, 2020, the South Korean government has designated 67 hospitals, including public medical centers and university hospitals, to be solely responsible for screening COVID-19 and treating isolated patients. Therefore, since the outbreak, HCWs of these designated hospitals have inevitably endured new working environments, including unfamiliar perception, uncontrollable hazards, changed work schedules, and isolation,^{11,16} which lead to the amplification of anxiety.

From this point of view, the effect of change in work schedules (such as shift work), on the anxiety of HCWs, requires further examination. Although recent studies on COVID-19 have reported a high prevalence of anxiety symptoms in HCWs¹¹ and increased stress associated with longer working shifts,¹⁷ few studies have investigated the effect of shift work on the relationship between anxiety and COVID-19 related tasks. Additionally, women and nurses have been reported to receive more psychological damage from COVID-19 than men or other occupations such as physicians,¹⁸ this study conducted after stratification by sex and occupation with special interest in female nurses.

The purpose of this study was to investigate the relationship between anxiety and COVID-19 related tasks as occupational stressors among HCWs in designated COVID-19 hospitals, and the impact of shift work on this relationship during the outbreak.

METHODS

Study Design and Participants

This cross-sectional study analyzed HCWs who had performed COVID-19 related work from the end of February 2020 in four public hospitals (Cheonan, Seosan, Gongju, and Hongseong Medical Centers) designated for COVID-19 in Chungnam, Korea. It was conducted through an online survey between April 16 and May 9, 2020. Those eligible for participation were employees including doctors, nurses, nursing assistants, medical technicians, service personnel, and administrative staff working at Cheonan Medical Center, and nurses or nursing assistants of the nursing department of the other three medical centers.

Invitations to participate and mobile questionnaires were sent by individual text message to 631 HCWs, including all HCWs ($n = 347$) at Cheonan Medical Center, and all nurses or nursing assistants of the nursing department ($n = 284$) at the other three medical centers. Among them, 397 participants who completed the survey (62.9%) were analyzed. Doctors were excluded in analyses because they have somewhat different job characteristics and their number was small ($n = 15$). After excluding one missing values for

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The authors report no conflicts of interest.

Clinical significance: This study shows that increased risk of anxiety is associated with COVID-19 related job stressors among female nurses or nursing assistants who performed shift work. Particular attention including mental health management should be given to frontline healthcare workers who perform shift work during the COVID-19 pandemic.

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sex, 381 participants were included in the final analysis. The response rates of study participants in occupational groups and hospitals are described in Supplementary Table 1, <http://links.lww.com/JOM/A920>.

The research questionnaire included an introductory section stating the purpose of the study, nature of the survey, voluntary participation, informed consent, confidentiality, and anonymity declarations. All participants provided written online consent. This study was approved by the Institutional Review Board of Yonsei University (Y-2020-0034).

Measurements

COVID-19 Related Stressors

Participants were asked about four stressors related to COVID-19 which they face during hospital work. These stressors were obtained after reviewing previous studies on the mental health of HCWs during COVID-19 pandemic and considering the opinions of two or more experts in public health and mental health, including (1) contact with confirmed cases, (2) dealing with angry or unpleasant patients, (3) concealing emotions when working, and (4) discomfort due to wearing protective equipment. (1) and (4) were related to the frequency of exposure to infection risk during the pandemic, and (2) and (3) were existing job stressors which could be more prominent due to excessive workload during the pandemic.^{19–21} Each stressor was estimated on a 6-point Likert scale, from 0 (“never”) to 5 (“every time”).

Anxiety

In this study, the 7-item Generalized Anxiety Disorder scale (GAD-7) was used to measure anxiety. The GAD-7 is a self-reported tool used to screen for generalized anxiety disorder. It contains 7 items measured on a 4-point Likert scale, from 0 (“not at all”) to 3 (“nearly every day”) with a total score ranging from 0 to 21.^{22,23} In several studies, GAD-7 showed excellent reliability and validity with a cutoff point of 8.²⁴ Therefore, anxiety disorder was identified when the scores were 8 or greater in this study. Also, a sensitivity analysis using a cutoff point of 10 was conducted since a few studies proposed the criteria indicating “moderate to severe” and clinically relevant anxiety disorder.²⁵ The results from the sensitivity analysis were presented in Supplementary Tables 2 and 3, <http://links.lww.com/JOM/A920>.

Shift Work and Other Socio-Demographics

In the online structured questionnaire, participants reported their own characteristics of age, sex, marital status (single, married, divorced, or widowed), level of education (high school, college or university, or graduate school), type of occupation (physician, nurse or nursing assistant, others), job tenure, chronic disease (hypertension, dyslipidemia, diabetes, cardiovascular disease, and malignancy), type of work schedule before and after COVID-19, and change of the work schedule after COVID-19. Among the various types of work schedules shift work excluded daytime work (9:00 to 18:00), but included evening (18:00 to 21:00), night shifts (21:00 to 08:00), regular day and night rotating shifts, 24-hour rotating shifts, irregular rotating shifts (3-shift), and other shift schedules.

Statistical Analysis

Chi-square tests were performed to compare characteristics between the normal and anxiety groups, and to examine the association between anxiety and socio-demographic factors. Multiple logistic regression models were applied to investigate the association between anxiety and COVID-19 related tasks and to calculate odds ratios (ORs) and 95% confidence intervals (CIs). Adjusted models included age, marital status, working experience, and chronic disease. The adjusted logistic regression was stratified by sex, occupation, and

shift work. SAS software 9.4 (SAS Institute Inc., Cary, North Carolina) was employed for this study, and *P*-values for all the analyses were introduced with a significance level of <.05.

RESULTS

Table 1 illustrates the general characteristics of HCWs and their association with anxiety. The study participants were mostly females, under 50 years old, who had graduated from college or higher, worked for 3 years or more, the occupation of nurses or nursing assistants, and had no comorbidities. About half were never married, and about 70% performed shift work after the COVID-19 outbreak with 57 HCWs (15.28%) who were newly involved in shift work after COVID-19. Out of a total of 381 participants, 122 (32%) had anxiety. The factors that were significantly associated with anxiety included age, marital status, previous working experience, chronic disease, and shift work before/after the outbreak. Compared to those without anxiety, those with anxiety were more likely to be older, married, have a longer working experience, and have a chronic disease. Among those with anxiety, 45.9% did shift work before the COVID-19 outbreak and 60.33% after the outbreak.

Table 2 shows the results of the multiple logistic regression and subgroup analysis between anxiety and COVID-19 related tasks stratified by sex and occupation. Dealing with angry or unpleasant patients (OR 2.10, 95% CI 1.23 to 3.56), concealing emotions when working (OR 2.00, 95% CI 1.17 to 3.43), and discomfort due to wearing protective equipment (OR 2.45, 95% CI 1.23 to 4.89) among female HCWs were significantly associated with anxiety. In the stratified models by occupation, female nurses or nursing assistants showed a significantly increased risk of anxiety associated with COVID-19 stressors, including dealing with angry or unpleasant patients (OR 1.96, 95% CI 1.13 to 3.42), concealing emotions when working (OR 1.88, 95% CI 1.07 to 3.33), and discomfort due to wearing protective equipment (OR 2.63, 95% CI 1.21 to 5.71). In the sensitivity analysis with cutoff point of 10, the results were consistent among female HCWs whereas no significant results were found in female nurses or nursing assistants (Supplementary Table 2, <http://links.lww.com/JOM/A920>).

Table 3 shows the results from the multiple logistic models stratified by shift work after the COVID-19 outbreak among female HCWs. Three of four COVID-19 related stressors significantly increased anxiety risk in female nurses or nursing assistants who did shift work after the COVID-19 outbreak. These included contact with confirmed cases or patients (OR 2.48, 95% CI 1.10 to 5.58), dealing with angry or unpleasant patients (OR 2.64, 95% CI 1.28 to 5.42), and discomfort due to wearing protective equipment (OR 4.45, 95% CI 1.30 to 15.25). In contrast, no significant increase in anxiety risk was found among those who did not perform shift work. In the sensitivity analysis with cutoff point of 10, the results were consistent which female nurses or nursing assistant who performed shift work showed the significantly increased risk of anxiety (Supplementary Table 3, <http://links.lww.com/JOM/A920>).

DISCUSSION

This study found that female nurses or nursing assistants who performed shift work during COVID-19 had a significantly increased association between COVID-19 related work stressors and anxiety disorder. In contrast, there was no significant result in participants in the same institutions who did shift work before the outbreak. This difference can be explained by the different reasons for shift work. Given that 15.28% of HCWs were newly involved in shift work during COVID-19, it can be assumed that they became unavoidably involved in screening and management of COVID-19 in the designated hospitals after the outbreak. Shift work before the outbreak was sometimes voluntarily chosen based on personal preferences or on the nature of certain occupations such as nurses of ward or emergency department. However, after COVID-19,

TABLE 1. General Characteristics of Participants by Anxiety

Characteristics	Total	Anxiety*		P
		No	Yes	
<i>N</i> (%)	381 (100)	259 (67.98)	122 (32.02)	
Age (yr)				
20–29	133 (34.91)	105 (40.54)	28 (22.95)	0.001
30–39	113 (29.66)	77 (29.73)	36 (29.51)	
40–49	85 (22.31)	52 (20.08)	33 (27.05)	
50 or above	50 (13.12)	25 (9.65)	25 (20.49)	
Sex				
Men	64 (16.8)	46 (17.76)	18 (14.75)	0.464
Women	317 (83.2)	213 (82.24)	104 (85.25)	
Marital status				
Never	186 (48.82)	142 (54.83)	44 (36.07)	0.002
Married, living together	184 (48.29)	109 (42.08)	75 (61.48)	
Married, divorced, or widowed	11 (2.89)	8 (3.09)	3 (2.46)	
Educational level				
High school	33 (8.66)	20 (7.72)	13 (10.66)	0.589
College or university	313 (82.15)	216 (83.4)	97 (79.51)	
Graduate school	35 (9.19)	23 (8.88)	12 (9.84)	
Occupation				
Nurses or nursing assistants	316 (82.94)	212 (81.85)	104 (85.25)	0.411
Other*	65 (17.06)	47 (18.15)	18 (14.75)	
Previous working experience (years)				
0–2	103 (27.03)	79 (30.5)	24 (19.67)	0.002
3–7	95 (24.93)	72 (27.8)	23 (18.85)	
≥8	183 (48.03)	108 (41.7)	75 (61.48)	
Chronic disease†				
0	326 (85.56)	232 (89.58)	94 (77.05)	0.001
≥1	55 (14.44)	27 (10.42)	28 (22.95)	
Having occupational stressors				
Contact with confirmed cases or patients	251 (65.88)	167 (64.48)	84 (68.85)	0.401
Dealing with angry or unpleasant patients	210 (55.12)	135 (52.12)	75 (61.48)	0.087
Concealing emotions when working	254 (66.67)	160 (61.78)	94 (77.05)	0.003
Discomfort due to wearing protectives	310 (81.36)	204 (78.76)	106 (86.89)	0.058
Doing shift work‡ before COVID-19				
No	160 (41.99)	94 (36.29)	66 (54.1)	0.001
Yes	221 (58.01)	165 (63.71)	56 (45.9)	
Doing shift work‡ after COVID-19				
No	110 (29.49)	62 (24.6)	48 (39.67)	0.003
Yes	263 (70.51)	190 (75.4)	73 (60.33)	
Change of work schedule after COVID-19				
Consistent daytime work	101 (27.08)	57 (22.62)	44 (36.36)	0.005
From shift work to daytime work	9 (2.41)	5 (1.98)	4 (3.31)	
Consistent shift work	206 (55.23)	155 (61.51)	51 (42.15)	
From daytime to shift work	57 (15.28)	35 (13.89)	22 (18.18)	

Anxiety was defined by using the generalized anxiety disorder 7-item scale (GAD-7) with cutoff of 8. *P*-values were analyzed by chi-square tests.

*Other included medical technicians, service personnel, and administrative staff.

†Chronic disease included hypertension, dyslipidemia, diabetes, cardiovascular disease, and malignancy.

‡Shift work contains all working schedules except the daytime work including evening or night shift, regular day and night rotating shift, 24-h rotating shift, irregular rotating shift, and others.

HCWs at designated hospitals tended to be unwillingly engaged in shift work, which could act as psychological stressors.

Out of total HCWs, 32% had anxiety, which was in line with high prevalence of psychological disorders from previous studies on the mental health of HCWs. During Middle East Respiratory Syndrome (MERS) and SARS epidemics, HCWs reported a relatively high prevalence of depression, anxiety, and PTSD.^{26–28} HCWs, especially those who directly cared for SARS patients, suffered from acute stress disorder²⁹ and developed long-term sequences such as PTSD.^{30,31}

In this study, the subgroup analysis of female nurses or nursing assistants, who are the main workforce for treatment and screening for COVID-19, resulted in significantly increased anxiety in 3 out of 4 stressors in the shift work group. Nurses play a crucial

role in public health and infection prevention.³² Additionally, the patients-facing nature of their work can increase the chances of occupational exposure to care patients on the frontline during COVID-19 and contribute to a greater risk of the infection.^{33,34} Therefore, they are more vulnerable to psychological stress than other occupations such as physicians.^{16,18,35} In addition, nurses' shift work is known to accompany inadequate rest, sleep, and recovery, which can add to the mental burden of COVID-19 HCWs.¹⁵ Nurses doing night shifts were at twice the risk for developing stress than those who work day shifts,³³ and frequent night shifts were associated with the increased mental fatigue of nurses.³⁶ Besides, after the outbreak some HCWs have worked under unfamiliar conditions such as shift work or long working hours, thus disrupting family and social relationships and reducing

TABLE 2. Association Between Occupational Stressors and Anxiety by Sex and Occupation

	Men			Women		
	<i>N</i>	OR* (95% CI)	<i>P</i>	<i>N</i>	OR* (95% CI)	<i>P</i>
Total participants (<i>N</i> = 381)						
Contact with confirmed cases or patients	64	1.10 (0.31–3.88)	.883	317	1.66 (0.97–2.86)	.067
Dealing with angry or unpleasant patients	64	1.51 (0.42–5.41)	.524	317	2.10 (1.23–3.56)	.006
Concealing emotions when working	64	1.98 (0.40–9.70)	.399	317	2.00 (1.17–3.43)	.012
Discomfort due to wearing protectives	64	1.29 (0.25–6.81)	.763	317	2.45 (1.23–4.89)	.011
By occupation						
Nurses or nursing assistants (<i>N</i> = 316)						
Contact with confirmed cases or patients	30	1.09 (0.09–13.60)	.949	286	1.49 (0.84–2.65)	.174
Dealing with angry or unpleasant patients	30	2.47 (0.31–19.52)	.392	286	1.96 (1.13–3.42)	.018
Concealing emotions when working	30	1.31 (0.15–11.08)	.807	286	1.88 (1.07–3.33)	.030
Discomfort due to wearing protectives	30	0.87 (0.12–6.34)	.888	286	2.63 (1.21–5.71)	.015
Other† (<i>N</i> = 65)						
Contact with confirmed cases or patients	34	1.42 (0.22–9.20)	.711	31	3.33 (0.36–30.99)	.291
Dealing with angry or unpleasant patients	34	0.69 (0.10–4.71)	.706	31	5.24 (0.42–64.75)	.197
Concealing emotions when working	34	1.69 (0.09–32.72)	.729	31	5.11 (0.40–65.72)	.211
Discomfort due to wearing protectives	34	3.00 (0.07–123.10)	.563	31	4.63 (0.16–133.70)	.372

Anxiety was defined by using the generalized anxiety disorder 7-item scale (GAD-7) with cutoff of 8.

CI, confidence interval; OR, odds ratio.

*Multiple logistic regression analysis was adjusted for age, marital status, working experience, and chronic disease.

†Other included medical technicians, service personnel, and administrative staff.

the opportunity for rest breaks and days off, which can lead to anxiety.³⁷

Regarding the sex differences in the relationship between anxiety and COVID-19 tasks, it has already been established that women are vulnerable to anxious symptoms,³⁸ which indicates that female HCWs are likely to report this mental problem more frequently. The recent review also found that female HCWs had a higher prevalence of depression, anxiety, and distress.¹¹ For

anxiety, a pooled prevalence of 20.9% for males and 29.1% for females was estimated in six cross-sectional studies undertaken in China, with a total of 19,950 participants who were mainly female nurses.¹¹ In addition, the HCWs in this study had more shift work after the outbreak than before, because their hospital has become a COVID-19 designated hospital. Therefore it was likely to be involuntary, and accordingly, female HCWs are expected to have greater distress and anxiety due to the disruption of balance between

TABLE 3. Multiple Logistic Regression Between Occupational Stressors and Anxiety Stratified by Shift Work Among Female Healthcare Workers During COVID-19 Pandemic

	<i>N</i>	OR* (95% CI)	<i>P</i>
Female nurses or nursing assistants			
No shift work			
Contact with confirmed cases or patients	68	1.03 (0.37–2.93)	.950
Dealing with angry or unpleasant patients	68	1.93 (0.63–5.92)	.253
Concealing emotions when working	68	2.63 (0.88–7.81)	.082
Discomfort due to wearing protectives	68	1.83 (0.59–5.69)	.296
Shift work			
Contact with confirmed cases or patients	210	2.48 (1.10–5.58)	.028
Dealing with angry or unpleasant patients	210	2.64 (1.28–5.42)	.008
Concealing emotions when working	210	2.02 (0.98–4.15)	.057
Discomfort due to wearing protectives	210	4.45 (1.30–15.25)	.018
Other female occupations†	31		
No shift work			
Contact with confirmed cases or patients	17	2.06 (0.10–43.61)	.642
Dealing with angry or unpleasant patients	17	16.38 (0.09–999.99)	.289
Concealing emotions when working	17	1.95 (0.12–30.90)	.637
Discomfort due to wearing protectives	17	1.04 (0.02–61.91)	.986
Shift work			
Contact with confirmed cases or patients	14	4.11 (0.16–104.29)	.392
Dealing with angry or unpleasant patients	14	6.35 (0.13–308.58)	.351
Concealing emotions when working	14	2.32 (0.04–149.27)	.693
Discomfort due to wearing protectives	14	12.18 (0.00–999.99)	.628

Anxiety was defined by using the generalized anxiety disorder 7-item scale (GAD-7) with cutoff of 8.

CI, confidence interval; OR, odds ratio.

*Multiple logistic regression analysis was adjusted for age, marital status, working experience, and chronic disease.

†Other occupations included medical technicians, service personnel, and administrative staff.

family and work, thereby disturbing their lifestyle. As female workers are more inclined to play a domestic caregiver role,³⁹ they are more susceptible to concerns about the risk of being exposed or infected with COVID-19 at work and transmitting the infection to their family members,^{40,41} which can increase their anxiety.

During the COVID-19 outbreak, frontline HCWs have been considered to require particular attention.³⁵ A recent COVID-19 study focusing on the mental health of frontline HCWs reported that those who are directly involved in diagnosis, treatment, and care for COVID-19 patients are exposed to psychological distress.²⁹ Working on the frontline can increase the exposure of contact with confirmed or suspected cases which is related to the extent of mental disturbances.⁴² Likewise, occupational stressors in this study were specified as performing frontline tasks during COVID-19, such as direct contact with patients, emotional labor, and wearing protective equipment. Recognizing sources of anxiety such as job stressors in this study is one of the important interventions to reduce anxiety of HCWs.⁴⁰ According to a review conducted regarding the stress reduction techniques for HCWs in COVID-19 era, several strategies were recommended, including enhancing awareness of COVID-19 and related stressors, stress management such as mindfulness training and self-care practices, providing mental health services, increasing social support, and organizational measures to improve work environment such as enhancing communication skills and providing additional rest and exercise.⁴³

This study has several limitations. First, it was limited in sample sizes and scope. This study included only 400 or so HCWs from four designated hospitals in Chungnam Province, Korea, which may restrict the generalization of our findings to other settings and cannot represent all HCWs. However, it is meaningful in that it has investigated the mental health of employees in an extreme and special case of the COVID-19-designated hospital. Second, in spite of a substantial response rate of 62.9%, response bias cannot be neglected if non-respondents did not respond because of extreme stress or very low stress which could bring low interest to the survey. Third, previous mental health status was unknown, including anxiety status. To minimize this error, the survey items asked questions regarding anxiety symptoms “due to the COVID-19 pandemic.”

Despite these limitations, this study is meaningful in that it examined the mental health of frontline HCWs at COVID-19 designated hospitals just at the time of the virus outbreak. Moreover, this study addressed their anxiety risk in association with detailed occupational stressors and shift work during COVID-19.

In conclusion, this study revealed the increased risk of anxiety in female nurses who work in shifts during COVID-19 pandemic. The mental health of HCWs during COVID-19 pandemic can be worsened by unfamiliar occupational environments including shift work, which requires special attention and intervention.

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