Frontline nurses' burnout and its associated factors during the COVID-19 pandemic in South Korea

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ABSTRACT

Background: The Coronavirus disease pandemic is a global health crisis with psychological consequences for healthcare workers.
Purpose: To identify the prevalence and potential factors influencing burnout among frontline nurses in South Korea.
Methods: This cross-sectional study comprised 161 nurses who voluntarily participated in the survey through advertisements at a general hospital. Data on sociodemographic and professional characteristics, insomnia, depression, anxiety, stress, and burnout were collected via an online questionnaire in 2021.
Results: Among the participants, 90 had a high level of burnout. Overall, 59.6 %, 23.0 %, 36.0 %, and 17.4 % of nurses experienced insomnia, depression, anxiety, and stress, respectively. The results showed that the assigned number of patients, insomnia, and depression were the major factors affecting burnout levels of nursing staff.
Conclusions: Frontline nurses were the main force in the fight against public health emergencies. The government and medical institutions must consider professional and psychological factors in ameliorating burnout and safety for nurses.

1. Introduction

Coronavirus disease (COVID-19) is rapidly spreading worldwide. In March 2020, the World Health Organization (WHO) declared the COVID-19 outbreak as a pandemic (WHO, 2020). On February 4, 2022, approximately 386 million confirmed cases were recorded globally, with approximately 934,000 confirmed cases recorded in South Korea (WHO, 2022). The rapid transmission and long-term impact of COVID-19 have led to unprecedented burdens on healthcare systems, such as a shortage of personal protective equipment (PPE) and human resources, high risk of infection, excessive workload, and lack of guidelines. Moreover, it links to physical and psychological problems among healthcare workers

(HCWs) (Behera et al., 2020; Mehta et al., 2021).

During the pandemic, HCWs play a crucial role and make great contributions but also undergo psychological impact. In a study of 2316 HCWs (Lin et al., 2020), 46.9 % of HCWs had depression, 41.1 % felt anxiety, 32.0 % had insomnia, and 69.1 % had stress, which were more evident in frontline HCWs caring for COVID-19 patients. In particular, nurses account for the most infected HCWs (62.5 %), and a high risk of infection could aggravate psychological problems (Barrett et al., 2020; Pappa et al., 2021). According to a previous study (Lai et al., 2020), nurses have more severe degrees of depression, anxiety, insomnia, and distress than other HCWs (e.g., severe depression among physicians vs. nurses: 4.9 % vs. 7.1 %). These psychological symptoms are likely to

induce burnout (Duarte et al., 2020).

Burnout is defined as a "state of physical, emotional, and mental exhaustion that results from long-term involvement in work situations that are emotionally demanding" (Schaufeli & Greenglass, 2001). Prolonged involvement in the COVID-19 pandemic could cause physical fatigue, psychological symptoms, and burnout among HCWs by lengthening contact with patients and increasing infection risk (Dimitriu et al., 2020). Indeed, a qualitative systematic review has found that HCWs experienced emotional challenges and work burnout during the COVID-19 pandemic (Koontalay et al., 2021). Sikaras et al. (2022) reported that 42.9 % of nurses had a high level of burnout during the pandemic, and frontline nurses showed higher burnout than those in a non-COVID-19 department. Burnout symptoms threaten HCWs and negatively affect medical errors, patient safety, and the quality of work (Dimitriu et al., 2020; Wang et al., 2020). Therefore, it highlights the importance of burnout and its prevention among frontline nurses in overcoming the pandemic.

Recently, studies have been conducted in many countries to identify the prevalence of and factors affecting burnout among HCWs during the COVID-19 pandemic. In a multinational study (i.e., United Kingdom, Poland, and Singapore) (Denning et al., 2021), 67 % of HCWs had burnout, and the predictors of burnout were job role, being redeployed, being tested for COVID-19, perceptions of safety, anxiety, and depression. In Portugal, Duarte et al. (2020) concluded that more than half of HCWs experienced high levels of burnout, and female gender, marital status, work experience, direct contact with infected patients, stress, and depression were factors associated with burnout. These studies indicate the importance of considering sociodemographic characteristics, professional characteristics, and psychological impact as the main factors.

However, previous studies mainly focused on sociodemographic and occupational variables to identify risk factors for burnout among nurses, including those in non-COVID-department, during the pandemic (Butera et al., 2021; Galanis et al., 2021). Additionally, Morgantini et al. (2020) reported that the level of burnout differed between countries; it was higher in high-income countries than in low- and middle-income countries. Further, depending on the situation in each country, healthcare systems, such as material resources, healthcare personnel, and policies, may be dissimilar (Kim et al., 2020). This emphasizes the need to establish suitable strategies for psychological health in each country.

In South Korea, the studies related to psychological impact among nurses mostly reported only the mediating effects between burnout and self-efficacy, job performance, and emotional labors (Kim et al., 2022; Lim et al., 2022), and identified factors affecting stress, not burnout (Lee, Shin, & Hong, 2021), or explored the experiences of nurses working in COVID-19-designated hospital (Lee & Lee, 2020). In addition, Kim and Lee's (2021) study compared the level of burnout between nurses with and without COVID-19–related tasks (56.0 % vs 31.5 %) excluding the factors affecting burnout in 2020, and the level of burnout is likely to mildly evolve over time (Teo et al., 2021).

Therefore, it is necessary to explore the prevalence and associated factors of burnout in terms of sociodemographic, professional characteristics, and psychological variables among frontline nurses caring for patients with COVID-19 in South Korea during the 2021 pandemic.

2. Methods

2.1. Study design and settings

This was a cross-sectional descriptive study. An online survey was conducted in a general hospital (>800 beds) with negative pressure isolation wards (NPIWs) for COVID-19 patients in South Korea.

2.2. Participants

The study participants were registered nurses, except head nurses who worked at general hospitals and engaged in caring for patients with COVID-19 in NPIWs during the pandemic. In total, 167 nurses voluntarily participated in the study through advertisements at a general hospital. Among them, 161 were selected as the study sample, and six, who answered that they did not work in NPIWs for COVID-19 patients at the time of the survey, were excluded from the study.

The sample size was calculated using G*Power 3.1.9 program. With an input α of 0.05, a medium effect size of 0.15, a power of 0.90, and the number of predictors at 8 for a multiple linear regression analysis to identify factors influencing burnout (Giusti et al., 2020), the minimum sample size required for this study was 136. Considering a dropout rate of 10 %, it was 150. Therefore, 161 participants met the minimum sample size.

2.3. Procedures

Data were collected using an online questionnaire (Google Forms) from February 8 to February 18, 2021, in one general hospital located in S* city, South Korea. The link to the online survey was distributed through poster advertisements in groupware and NPIWs in the hospital. The survey was conducted after clicking the agreed-upon button in the online informed consent to the question, "Do you wish to participate in the study." The survey did not proceed if the button was not clicked. All participants agreed to enroll in the study, and an electronic gift card was given to them after completing the questionnaires. This study was approved by the Institutional Review Board (IRB) of the Hospital of South Korea (approval number 10-2021-20).

2.4. Measurements

2.4.1. Socio-demographic characteristics

Data on sociodemographic characteristics, including age, sex, marital status, having children, education, and religion, were collected. Age was measured as a continuous variable, while sex, marital status, having children, education, and religion were measured as categorical variables.

2.4.2. Professional characteristics

To assess the professional characteristics of the participants, total work experience as a nurse, work experience in current NPIWs, past work experience in NPIWs, voluntary participation, average number of patients assigned per day, average working hours per week, average days off per month, worry about infection, and worry about contagion were examined. Additionally, worry about infection and contagion was measured using the following question: "How much are you worried about getting infected?" and "How much are you worried about infecting others (e.g., family or friends)." Each question was rated on an 11-point numeric rating scale (0 = not at all to 10 = very much).

2.4.3. Insomnia

The 7-item Insomnia Severity Index (ISI) was used to evaluate insomnia severity. The recall period was 2 weeks, and the items assessed the severity of the difficulties in falling asleep, staying asleep, early awakening, satisfaction with sleep patterns, interference with daily functioning, noticeability of sleep problems by others, and worry about sleep problems. Each item is scored on a 5-point Likert scale (0 = none to 4 = very severe), with total scores ranging from 0 to 28, with higher scores indicating greater insomnia severity. The total scores can be

classified as follows: absence of insomnia (0–7), sub-threshold insomnia (8–14), moderate insomnia (15–21), and severe insomnia (22–28) (Morin et al., 2011). Cronbach's alpha for the Korean version and this study was 0.92 and 0.87, respectively (Cho et al., 2014).

2.4.4. Depression, anxiety, and stress

The Depression Anxiety Stress Scales-21 (DASS-21), a short version of the original DASS, was used to measure negative emotional states of depression, anxiety, and stress over the past week. This instrument comprises 21 items using a 4-point Likert scale (0 = did not apply to me at all to 3 = applied to me very much), with seven items in each of the three scales (depression, anxiety, and stress). The scores for each scale were summed from 0 to 21 and multiplied by 2 to calculate the final scores; higher scores indicate greater depression, anxiety, and stress (Lovibond & Lovibond, 1995). The final scores of each scale can be classified as follows: for the depression scale, normal (0–9), mild (10–13), moderate (14–20), severe (21–27), and extremely severe (28 or above); for the anxiety scale, normal (0–7), mild (8–9), moderate (10–14), severe (15–19), and extremely severe (20 or above); for the stress scale, normal (0–14), mild (15–18), moderate (19–25), severe (26–33), and extremely severe (34 or above) (Lovibond & Lovibond, 1996). The Cronbach's alpha for the Korean version (Lee et al., 2019) and this study was 0.93 and 0.95, respectively.

2.4.5. Burnout

The Copenhagen Burnout Inventory (CBI) developed by Kristensen et al. (2005) was used to evaluate the level of burnout. The CBI is a 19-item instrument with three dimensions: personal, work-related, and client-related burnout. The personal burnout dimension comprises six items measuring the degree of fatigue and exhaustion experienced by a person. The work-related burnout dimension containing 7 items is defined as "the degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work." The third dimension measures client-related burnout, which is defined as "the degree of physical and psychological fatigue and exhaustion that is perceived by the person as related to his/her work with clients"; with the author's approval, several phrases were modified and used considering the pandemic (e.g., from "clients" to "isolated patients"). All items were scored from 0 to 100 with five response categories (0 = never/almost never or to a very low degree, 25 = seldom or to a low degree, 50 = sometimes or somewhat, 75 = often or to a high degree, 100 = always or to a very high degree); only item 4 of the work-related dimension was reverse-scored (Kristensen et al., 2005). The score for each dimension is the average of item scores within each scale; higher scores indicate greater burnout, and a score of 50 or above on CBI is considered a high level of burnout (Borritz & Kristensen, 2004). The general burnout score is calculated from the average of the three CBI dimensions ranging from 0 to 100 (Chiu et al., 2015; Milfont et al., 2008). The Cronbach's alphas for the Korean version were 0.91, 0.82, and 0.90. respectively, in each dimension (Jeon et al., 2019; Lee, Ryu, et al., 2021); in this study, they were 0.91, 0.83, and 0.91, respectively.

2.5. Statistical analysis

Data collected through the online survey were exported to a Microsoft Excel file and transferred to IBM SPSS Statistics 23.0 version. All data analyses were performed using SPSS, with a significance level of 0.05. The characteristics of participants, including sociodemographic and professional characteristics, insomnia, depression, anxiety, stress, and burnout, were analyzed using descriptive statistics (e.g., means, standard deviations, proportions, ranges). The normality of data was confirmed by the Kolmogorov-Smirnov test, and independent-sample t-test for categorical variables and Pearson's correlation coefficients for continuous variables were used to search for differences in general burnout according to other variables. In the final phase, hierarchical multiple linear regression analysis was performed to determine the factors affecting general burnout; the factors with $p < .05$, in the bivariate analysis, were entered into the regression model (Chatterjee & Sorenesen, 1998). To assess autocorrelation and multicollinearity among the variables, the Durbin-Watson test and the tolerance and variance inflation factor (VIF) were used.

3. Results

3.1. Participant's socio-demographic and professional characteristics

A total of 161 nurses participated in this study. The average age was 27.60 years (SD = 3.77; range 23–51 years), and most nurses were aged 20–29 years (79.5 %), female (88.8 %), single (92.5 %), and had a bachelor's degree (97.5 %) at the education level (Table 1).

In terms of professional characteristics, 49 (30.4 %) participants worked as nurses for 5 years or more, with an average work experience of 4.42 years. Nearly 88.8 % of the nurses had <12 months of work experience in NPIWs, 81.4 % had no experience working at NIPWs in the past. Approximately half of the nurses (56.5 %) took care of five or more isolated patients per day. The average score of worry about infection in caring for isolated patients was 7.03 on the scale from 0 to 10 points, and worry about contagion was 7.91.

3.2. Levels of burnout, insomnia, depression, anxiety, and stress

The prevalence of burnout, insomnia, depression, anxiety, and stress among participants is shown in Table 2. The average score for the general burnout was 53.20 (SD = 18.88), and high levels of personal burnout were found in 94 (58.4 %) nurses; in terms of work-related burnout and client-related burnout, it was in 89 (55.3 %) and 98 (60.9 %) nurses, respectively. Approximately 59.6 % of the nurses experienced subthreshold to severe insomnia, 23.0 %, 36.0 %, and 17.4 % experienced mild to extremely severe depression, anxiety, and stress, respectively.

3.3. The relationship between burnout and other variables

The differences in general burnout according to categorical and continuous variables are shown in Tables 3 and 4, respectively. As shown in Table 3, female nurses showed significantly higher burnout than male nurses ($t = 2.048$; $p = .042$). In terms of continuous variables, the number of patients ($r = 0.232$; $p = .003$), worry about infection ($r = 0.278$; $p < .001$), worry about contagion ($r = 0.329$; $p < .001$), insomnia ($r = 0.501$; $p < .001$), depression ($r = 0.585$; $p < .001$), anxiety ($r = 0.495$; $p < .001$), and stress ($r = 0.567$; $p < .001$) were positively correlated with burnout.

3.4. Predictors of burnout

For the regression model, the eight variables with significant differences ($p < .05$) in general burnout in Tables 3 and 4 were entered as the independent variables. This model confirmed the absence of autocorrelation and multicollinearity, and the Durbin-Watson statistic was 1.903 (i.e., $1.8 < D < 2.2$), tolerance ranged from 0.205 to 1.000 (i.e., tolerance >0.1), and VIF ranged from 1.000 to 4.884 (i.e., VIF < 10) (Bae, 2012).

Table 1
Socio-demographic and professional characteristics of participants (N = 161).

Variables	Categories	n (%)	Mean ± SD	Range
Socio-demographic characteristics				
Age (years)	20–29	128 (79.5)	27.60 ± 3.77	23–51
	≥30	33 (20.5)		
Sex	Female	143 (88.8)		
	Male	18 (11.2)		
Marital status	Single	149 (92.5)		
	Married	12 (7.5)		
Having children	Yes	5 (3.1)		
	No	156 (96.9)		
Education level	Associate's degree	4 (2.5)		
	Bachelor's degree	157 (97.5)		
Religion	Yes	55 (34.2)		
	No	106 (65.8)		
Professional characteristics				
Total work experience (years)	<5	112 (69.6)	4.42 ± 3.51	0.8–29.5
	≥5	49 (30.4)		
Work experience in NPIW (months)	<12	143 (88.8)	8.48 ± 13.18	1–115
	≥12	18 (11.2)		
Past work experience in NPIW	Yes	30 (18.6)		
	No	131 (81.4)		
Voluntary participation	Yes	40 (24.8)		
	No	121 (75.2)		
Number of patients	<5 numbers/day	70 (43.5)	4.38 ± 2.45	1–10
	≥5 numbers/day	91 (56.5)		
Working hours	<40 h/week	9 (5.6)	40.31 ± 2.80	32–52
	≥40 h/week	152 (94.4)		
Day off	<10 days/month	64 (39.8)	9.65 ± 1.23	8–14
	≥10 days/month	97 (60.2)		
Worry about infection	<5 points	25 (15.5)	7.03 ± 2.29	1–10
	≥5 points	136 (84.5)		
Worry about contagion	<5 points	10 (6.2)	7.91 ± 1.95	1–10
	≥5 points	151 (93.8)		

NPIW, Negative Pressure Isolation Ward; SD, Standard deviation.

Table 2
Burnout, insomnia, depression, anxiety and stress of participants (N = 161).

Variables	Categories	n (%)	Mean ± SD	Range
General burnout	Low level	71 (44.1)	53.20 ± 18.88	0–100
	High level	90 (55.9)		
Personal burnout	Low level	67 (41.6)	53.05 ± 21.75	0–100
	High level	94 (58.4)		
Work-related burnout	Low level	72 (44.7)	52.80 ± 18.44	0–100
	High level	89 (55.3)		
Client-related burnout	Low level	63 (39.1)	53.75 ± 22.42	0–100
	High level	98 (60.9)		
ISI	Absence	65 (40.4)	9.21 ± 4.82	1–23
	Sub-threshold	68 (42.2)		
	Moderate	27 (16.8)		
	Severe	1 (0.6)		
DASS-depression	Normal	124 (77.0)	6.17 ± 7.53	0–36
	Mild	12 (7.5)		
	Moderate	15 (9.3)		
	Severe	5 (3.1)		
	Extremely severe	5 (3.1)		
DASS-anxiety	Normal	103 (64.0)	6.22 ± 6.91	0–34
	Mild	21 (13.0)		
	Moderate	21 (13.0)		
	Severe	5 (3.1)		
	Extremely severe	11 (6.9)		
DASS-stress	Normal	133 (82.6)	7.91 ± 7.71	0–40
	Mild	14 (8.7)		
	Moderate	7 (4.4)		
	Severe	5 (3.1)		
	Extremely severe	2 (1.2)		

DASS, Depression, Anxiety and Stress Scale; ISI, Insomnia Severity Index; SD, Standard deviation.

Table 3
General burnout by the characteristics of participants (N = 161).

Variables	Categories	General burnout		
		Mean ± SD	t	p
Socio-demographic characteristics				
Sex	Female	54.27 ± 18.40	2.048	.042*
	Male	44.70 ± 20.97		
Marital status	Single	53.07 ± 19.20	−0.310	.757
	Married	54.83 ± 14.90		
Having children	Yes	45.52 ± 14.62	0.924	.357
	No	53.45 ± 18.98		
Education level	Associate's degree	59.57 ± 14.02	0.683	.496
	Bachelor's degree	53.04 ± 18.99		
Religion	Yes	50.54 ± 18.49	1.290	.199
	No	54.58 ± 19.02		
Professional characteristics				
Past work experience in NPIW	Yes	56.97 ± 16.47	1.215	.226
	No	52.34 ± 19.34		
Voluntary participation	Yes	53.68 ± 17.08	0.185	.853
	No	53.04 ± 19.50		

NPIW, Negative Pressure Isolation Ward; SD, Standard deviation.
* $p < .05$.

Table 5 presents the results of the hierarchical multiple linear regression analysis. In the first stage, a sex variable as sociodemographic characteristics was inputted as an independent variable; sex explained 2.6 % of the burnout (adjusted $R^2 = 0.020$; $p < .001$). The entry of three professional characteristics in the second stage changed R^2 by 0.131, resulting in a total R^2 of 0.156 (adjusted $R^2 = 0.135$; $p = .006$). Model 2 indicated that the number of patients ($\beta = 0.184$; $p = .015$) and worry about contagion ($\beta = 0.298$; $p = .026$) were significantly associated with burnout. In the final stage, insomnia and psychological variables were added in model 3, and there was the largest improvement for the model ($\Delta R^2 = 0.295$; adjusted $R^2 = 0.423$; $p < .001$). Finally, the number of patients ($\beta = 0.129$; $p = .046$), insomnia ($\beta = 0.232$; $p = .003$), and depression ($\beta = 0.342$; $p = .006$) had a significant effect on the level of burnout.

4. Discussion

In our study, 55.9 % of South Korean frontline nurses caring for patients with COVID-19 experienced high levels of general burnout (personal, work-related, and client-related burnout = 58.4 %, 55.3 %, and 60.9 %, respectively) in February 2021. It is similar to the result of study (Kim & Lee, 2021) that the prevalence of burnout among nurses with COVID-19-related tasks in Korea was 56.0 % in August 2020. Teo et al. (2021) reported the proportion of HCWs reporting job burnout increased by approximately 1.2 % per month during the pandemic; however, there was no difference in the burnout prevalence between this study and a previous study (Kim & Lee, 2021) (55.9 % vs 56.0 %). This is probably due to the following reasons; in the previous study (Kim & Lee, 2021), the burnout was defined as a high score in either the emotional exhaustion or depersonalization sub-scale using Maslach Burnout Inventory, unlike this study, which considered the average score in all three subscale using CBI; therefore, if burnout is defined based on the same criteria as previous study (Kim & Lee, 2021), the prevalence of burnout may be measured higher.

Compared with other studies on nursing staff from hospitals, including non-COVID-19 wards in other countries during the pandemic (general burnout = 42.9 %, personal burnout = 53.4 to 54.0 %, work-related burnout = 50.0 to 56.8 %, client-related burnout = 33.1 to 47.5 %) (Alameddine et al., 2021; Sikaras et al., 2022), the prevalence of burnout was slightly higher in this study. Such results support the conclusions of this study (Galanis et al., 2021), demonstrating that nurses working in a high-risk environment (e.g., COVID-19 wards) had higher burnout levels. Indeed, Sikaras et al. (2022) reported that nurses in a

Table 4
Correlations between general burnout and other variables (N = 161).

Variables	General burnout	Age	Total work experience	Work experience in NPIW	Number of patients	Working hours	Day off	Worry about infection	Worry about contagion	ISI	DASS-depression	DASS-anxiety
Age (years)	-0.065											
Total work experience (years)	-0.030	0.930***										
Work experience in NPIW (months)	0.024	0.035	0.093									
Number of patients (numbers/day)	0.232**	0.122	0.141	-0.005								
Working hours (hours/week)	0.085	-0.012	0.017	0.043	0.103							
Day off (days/month)	-0.121	-0.174*	-0.121	-0.057	-0.186*	-0.195*						
Worry about infection	0.278***	0.026	0.017	-0.161*	0.102	0.090	-0.056					
Worry about contagion	0.329***	-0.001	-0.011	-0.167*	0.107	0.084	-0.089	0.831***				
ISI	0.501***	-0.048	-0.049	-0.017	0.169*	0.185*	-0.176*	0.303***	0.365***			
DASS-depression	0.585***	-0.042	-0.040	-0.018	0.117	0.042	-0.113	0.224**	0.283***	0.442***		
DASS-anxiety	0.495***	-0.117	-0.093	-0.027	-0.028	0.107	-0.038	0.242**	0.323***	0.425***	0.767***	
DASS-stress	0.567***	-0.066	-0.057	0.002	0.028	0.103	-0.068	0.277***	0.329***	0.563***	0.844***	0.775***

DASS, Depression, Anxiety and Stress Scale; ISI, Insomnia Severity Index; NPIW, Negative Pressure Isolation Ward.

* $p < .05$.
** $p < .01$.
*** $p < .001$.

COVID-19 department had more severe general burnout scores than those in a non-COVID-19 department (mean = 49.46 vs. 44.18).

Additionally, unlike previous studies (Alameddine et al., 2021; Sikaras et al., 2022), South Korean nurses scored higher on the client-related burnout scale than on the personal and work-related burnout scales. In Korea, patients and their families tend to mainly participate in care and decision-making regarding treatment due to the family-oriented culture (Ryu et al., 2016); thus, infected patients may experience severe fear of being alone in the isolation ward and sometimes project their stress onto HCWs. Patients' guardians also expressed dissatisfaction by the phone and asked for many requests from the nurse (Kim, 2018; Noh et al., 2021). It might cause nurses' high level of client-related burnout that identifies the degree of fatigue perceived by patients and their guardians. Therefore, especially in South Korea, to reduce client-related burnout, it is necessary to strengthen nursing staff and improve satisfaction with life and psychological health (e.g., depression, stress) (Duarte et al., 2020; Shoorideh et al., 2015).

The number of patients was the main factor as professional characteristics, affecting the burnout levels of nursing staff in this study. Increasing the number of infected patients caring leads to excessive workload among frontline HCWs, and the perceived workload causes psychological problem (Bruyneel et al., 2021; Elbay et al., 2020). In a study by Shoja et al., HCWs who faced COVID-19 patients at the workplace had significantly more workload (i.e., total task load score) than those who had no contact with COVID-19 patients (Shoja et al., 2020). In addition to the heavy workload, the number of assigned patients is related to infection risk. According to the study, an inadequate nurse-to-patient ratio (i.e., low nurse staffing) might lead to limited time to change gloves and hand hygiene (Sturdy et al., 2020), which could increase the infection risk among HCWs. Infection risk leads to concerns about infection, which can negatively affect mental health, such as burnout (Pappa et al., 2021). In South Korea, the level of staffing is lower than that in other developed countries, such as England and the United States (Kang & Shin, 2020). Furthermore, the number of active Korean nurses per 1000 inhabitants was 7.9 in 2019, which is below the average of nine nurses per 1000 inhabitants among Organization for Economic Co-operation and Development (OECD) (2022) countries. During the COVID-19 pandemic, the nurse-to-patient ratio was recommended to 1.8:1 in ICUs (i.e. severe condition), 0.9:1 in sub-ICUs (i.e. moderate to severe condition), 0.36 to 0.2:1 in general wards (i.e. moderate condition) by the South Korean government (MOHW, 2021). Therefore, it is necessary to adjust the number of patients assigned per nurse and retain nurses in the profession to relieve the workload and infection risk and ultimately decrease the burnout level.

Furthermore, insomnia and depression are associated with burnout. Among frontline nurses, 17.4 % had moderate to severe insomnia, and 15.5 % felt moderate to extremely severe depression in this study, which is similar to a previous study using the same measurement (Patel et al., 2021). In a study by Stewart (Stewart et al., 2021), direct care for COVID-19 patients was associated with increased odds of insomnia (OR = 1.8). Frontline nurses caring for infected patients have a high level of fear of infection, which is one of the main factors affecting insomnia (Zhan et al., 2020). Fewer sleep hours or poor sleep quality due to insomnia leads to fatigue, which increases the burnout level and reduces performance (Dorrian et al., 2008; Sikaras et al., 2022). In this context, fatigue and burnout might disturb the caution of HCWs so that self-protection measures are neglected and infection risk is increased, thus threatening patient safety (Dimitriu et al., 2020). Therefore, it is important to manage nurses' insomnia affecting burnout to protect themselves and their patients. Reportedly, mobile interventions for nurses with insomnia showed significant improvement in sleep quality (Omeogu et al., 2020), and, consequently, non-contact interventions should be preferentially considered in terms of the COVID-19 pandemic.

Many studies have reported that depression affects burnout (Duarte et al., 2020; Tan et al., 2020). The HCWs working in COVID-19 wards experienced higher levels of depressive symptoms than those in other

Table 5
Factors associated with general burnout in hierarchical regression analysis ($N = 161$).

Variables	Model 1				Model 2				Model 3			
	B	SE	β	p	B	SE	β	p	B	SE	β	p
Constant	44.698	4.406		<.001***	19.066	6.868		0.006**	22.146	5.682		<.001***
Sex (ref. male)	9.573	4.675	0.160	.042*	5.631	4.482	0.094	0.211	4.935	3.694	0.083	.184
Number of patients					1.418	0.577	0.184	0.015*	0.997	0.495	0.129	.046*
Worry about infection					0.008	1.092	0.001	0.994	0.170	0.895	0.021	.850
Worry about contagion					2.892	1.284	0.298	0.026*	0.666	1.088	0.069	.541
ISI									0.910	0.299	0.232	.003**
DASS-depression									0.857	0.309	0.342	.006**
DASS-anxiety									0.156	0.282	0.057	.581
DASS-stress									0.153	0.325	0.063	.638
R^2 (ΔR^2)	0.026 (0.026)				0.156 (0.131)				0.452 (0.295)			
Adjusted R^2	0.020				0.135				0.423			
Δ F (p)	4.193 (0.042)*				8.058 (<.001)***				20.457 (<.001)***			

DASS, Depression, Anxiety and Stress Scale; ISI, Insomnia Severity Index; SE, Standard error.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

wards (Di Tella et al., 2020). In particular, depressive symptoms could lead to increased burnout, a predictor of suicide risk in nursing staff (Silva et al., 2015). Davis et al. (2021) demonstrated that in the United States, nurses had a higher suicide rate than the general population, and among females, the suicide incidence of nurses was greater than that of physicians (relative risk = 1.70). This emphasizes the importance of timely intervention strategies for depression among frontline nurses. According to a systematic review (Muller et al., 2020) describing interventions to relieve mental health problems caused by the pandemic among HCWs, there is a mismatch between risk factors for psychological problems in the pandemic (e.g., workload, lack of personal protective equipment) and current interventions focusing on individual psychopathology (e.g., counseling). Therefore, interventions that decrease this mismatch might be an important strategy to effectively prevent and reduce the negative impacts on mental health, such as depression, among frontline nurses.

Interestingly, in our study, no significant difference was found between burnout and gender, worry about contagion, worry about infection, anxiety, or stress in the multiple linear regression analysis; however, there was a significant association between the two variables in the bivariate analysis. Several studies have indicated that female gender, increased perceived threat of infection, fear of infecting others, and high levels of anxiety and stress are factors affecting burnout during a pandemic (Duarte et al., 2020; Galanis et al., 2021; Norman et al., 2021). These differences in the study results may be due to dissimilar participants and working conditions, such as working hours and nurse-to-patient ratios. However, these variables are also important factors in reducing burnout and should be considered for intervention. Additionally, further studies are needed to explore the relationship between the two variables among South Korean frontline nurses.

This study revealed the prevalence and predictors of burnout in nurses caring for COVID-19 patients during a pandemic in South Korea. The study findings may be beneficial in reducing burnout among frontline nurses effectively and contribute to the safety of HCWs and patients. However, this study has several limitations. First, it was conducted in a single hospital, which restricts the generalizability of the findings. Thus, future studies should explore factors related to burnout in diverse hospital settings. Second, although all frontline nurses caring for COVID-19 patients in one hospital had equal opportunities to participate in this study, we could not identify differences between respondents and non-respondents. Therefore, it is necessary to interpret the study results carefully. Third, the questionnaires were administered online, and the absence of trained interviewers could lead to response bias. We checked Cronbach's alpha to confirm a careless response; however, there is a possibility that a potential bias remains.

5. Conclusions

In this study, frontline nurses who had experience caring for COVID-19 patients showed high levels of burnout. The main factors affecting burnout were the number of patients assigned, insomnia, and depression. To decrease burnout among frontline nurses, interventions focused on these variables are important and expected to promote psychological well-being and the quality of work-life of HCWs in response to a pandemic crisis.

CRediT authorship contribution statement

Eun-Young Noh: Data Curation, Formal analysis, Investigation, Validation, Visualization, Writing - Original Draft, Writing - Review & Editing. **Yeon-Hwan Park**: Conceptualization, Methodology, Data Curation, Funding acquisition, Investigation, Supervision, Project administration, Validation, Writing - Original Draft, Writing - Review & Editing. **Young Jun Chai**: Data Curation, Funding acquisition, Project administration, Validation. **Hyun Jeong Kim**: Funding acquisition, Validation. **Eunjin Kim**: Data Curation, Investigation, Validation.

Declaration of competing interest

None.

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