# Factors affecting frontline Korean nurses' mental health during the COVID-19 pandemic

**Mijung Cho**[1] RN, MPH (iD), **Oksoo Kim**[2] RN, PhD (iD), **Yanghee Pang**[1] RN, PhD (iD),
**Bohye Kim**[3] RN, PhD (iD), **Hyunseon Jeong**[1] RN, MSN (iD), **Jisun Lee**[4] RN, MSN (iD),
**Heeja Jung**[5] RN, PhD (iD), **Sun Young Jeong**[6] RN, PhD (iD), **Hyun-Young Park**[7] MD, PhD (iD),
**Hansol Choi**[8] M.P.H., PhD (iD) **& Hyunju Dan**[9] RN, FNP, PhD (iD)

[1] Clinical Instructor, [2] Professor, [3] Research Associate, [4] Research Assistant, [9] Instructor, College of Nursing, Ewha Womans University, Seoul, [5] Assistant Professor, [6] Associate Professor, College of Nursing, Konyang University, Daejeon, [7] Director, Department of Precision Medicine, Korea National Institute of Health, Chungcheongbuk-do, [8] Principal Researcher, Division of Population Research, Department of Precision Medicine, Korea National Institute of Health, Chungcheongbuk-do, Korea

**Aim:** To identify the factors affecting fear, anxiety and depressive symptoms among frontline nurses working with COVID-19 patients or are in charge of COVID-19 screening in Korea.

**Background:** Nurses are at a higher risk of COVID-19 infection because they are in closer, longer-duration contact with patients. These situations can negatively affect the mental health of nurses.

**Methods:** This study analysed data from COVID-19 module in the Korean Nurses' Health Study. Data from 906 participants were analysed. To identify the factors influencing mental health, descriptive statistics, Pearson's correlation and hierarchical multiple regression analyses were performed.

**Results:** Caring for patients who are COVID-19-positive increased levels of fear, anxiety and depressive symptoms of nurses. The hospital safety climate influenced mental well-being among nurses.

**Conclusion:** Caring for patients with COVID-19 had a negative impact on fear, anxiety and depressive symptoms. However, the higher was the perceived hospital safety climate, the lower were the nurses' psychological symptoms. Further research on the mental health of nurses is warranted.

**Implications for nursing and health policy:** Institutions should manage human resources to enable periodic rotation of nurses' work and working periods related to COVID-19. In addition, hospital managers should provide sufficient personal protective equipment, related education, and safety climate.

*Keywords*: COVID-19, nurses, fear, anxiety, depressive symptoms, hospital safety climate, mental health pandemic

Correspondence address: Hyunju Dan, College of Nursing, Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul 03760, Korea. Tel +82-10-4112-1538; E-mail: hidan@hanmail.net

## Introduction

Coronavirus disease 2019 (COVID-19) spread globally quickly after its first report in Wuhan, China, in December 2019. As of November 2020, there were 63, 052, 930 confirmed cases of and 1, 464, 764 deaths from COVID-19 in 216 countries (Worldometer, 30 November 2020). The highly contagious nature of COVID-19 has led to a global pandemic state. In Korea, COVID-19 was first reported in January 2020, but the number of cases increased sharply nationwide in winter, especially in the metropolitan area (Statistics Korea 2020).

When there is an outbreak of a new infectious disease, healthcare providers who screen and treat patients on the frontline are at risk of infection. Nurses are at higher risk of infection because they are in closer and longer-duration contact with patients compared to other healthcare providers (Smith et al. 2020). Frontline-healthcare providers in the UK and United States were 3.4 times more likely to be COVID-19 positive than other community members (Nguyen et al. 2020). In China in February 2020, healthcare providers accounted for 3.8% of patients diagnosed with COVID-19 (Wu & McGoogan 2020), and in Italy in March 2020, healthcare providers accounted for 9% of COVID-19 patients (International Council of Nurses 2020).

Nurses may be afraid of caring for patients with new infectious diseases when vaccines are not yet available and treatment protocols have not been confirmed. Nurses fear not only getting infected, but also infecting their family and friends (Goh et al. 2021; Shanafelt et al. 2020). When the COVID-19 outbreak in China began, most nurses working with COVID-19 patients feared infecting their families and were also afraid their co-workers would become infected or die (Hu et al. 2020). The severe acute respiratory syndrome epidemic (SARS) in Taiwan, 15% of medical personnel did not return home after work due to fear of infection and suffered from social prejudice that they posed an infection risk to the public (Bai et al. 2004). In Saudi Arabia, during the Middle East respiratory syndrome (MERS) coronavirus outbreak, healthcare providers feared that they were putting the safety of their co-workers and family members at risk (Khalid et al. 2016).

Because nurses have frequent contact with patients, the incidence of anxiety caused by COVID-19 was 1.5 times higher than that of physicians (Huang et al. 2020). In particular, nurses experienced higher anxiety owing to shortage of personal protective equipment (PPE) and lack of disease related information, including on the use of PPE (Zheng et al. 2020).

Approximately half of healthcare providers are experiencing symptoms of depression due to COVID-19 (Lai et al. 2020). During the COVID-19 outbreak, 44% of frontline nurses in emergency departments had depression (An et al. 2020), which is believed to be due to the high likelihood of coming into contact with patients with suspected symptoms, such as fever. Park et al. (2020) reported that healthcare providers who were in charge of COVID-19 screening or exposed to confirmed cases were more likely to be depressed than workers in rare contact departments. Depressive symptoms experienced by nurses can increase turnover intention (Pang et al. 2020).

Because of the COVID-19 pandemic, many nurses are caring for infected patients or performing patient screening tasks in a different manner than they did in the past. Due to the increase of COVID-19 patients around the world, nurses are coming into contact with more patients. Since these situations can negatively affect the mental health of nurses, it is needed to investigate the factors influencing these mental health effects and to develop strategies to reduce mental health concerns. However, there has been a lack of studies on the factors influencing the mental health of nurses working with COVID-19 patients. This study aimed to identify the factors affecting fear, anxiety and depressive symptoms among frontline nurses working with COVID-19 patients or are in charge of COVID-19 screening in Korea.

## Methods

### Participations and Data collection

This cross-sectional study analysed data from the Korean Nurses' Health Study (KNHS). The KNHS used a protocol and questionnaire similar to the Nurses' Health Study 3 carried out in the United States. The purpose of the KNHS was to examine the effects of environmental, vocational and lifestyle factors on the health of Korean female nurses (Kim et al. 2017). The first phase of the KNHS was implemented from 2013 to 2015, and a total of 20,613 nurses of childbearing age working in hospitals nationwide participated in the module 1 survey, which provided baseline data. The second phase of the KNHS was implemented from 2016 to 2019, and the third phase of the KNHS, which was launched in 2019, is currently underway.

This study used data from the COVID-19 module that was developed in response to the 2020 COVID-19 pandemic by KNHS. Data were collected through an online survey from September 18 to 21, 2020. Nurses who participated in the KNHS module 8 survey and worked in hospitals with more than 100 beds were asked to participate in the COVID-19 module. A link to the survey website was included in the text message. Nurses who had contact with confirmed COVID-19 patients or who were in charge of COVID-19 screening work within the past 3 months were included in this study. Of the total 975 participants, the data of 906 people were included in final, excluding 69 with missing data.

## Measures

### General characteristics and COVID-19-related variables
Age, level of education, marital status, annual income, family members living together, position, hospital work experience

and number of hospital beds were included as general characteristics. Participants answered questions to identify COVID-19-related variables. To assess working type, participants were asked 'Have you been caring for COVID-19 patients within the last 3 months?' or 'Have you screened COVID-19 patients within the last 3 months?' To the question of whether a transfer of workplace was made due to COVID-19, participants responded either 'no', 'yes, transferred departments within the hospital' or 'yes, dispatched or volunteered to move to another hospital'. Participants were also asked to answer 'yes' or 'no' to the question of work experience caring for COVID-19 patients or being in charge of COVID-19 screening work more than 3 months and what training they received on wearing PPE related to COVID-19. Regarding perceived safety of COVID-19 when wearing PPE, participants responded using a visual analogue scale by selecting scores between 0 (not safe at all) and 10 (completely safe).

### Hospital safety climate
The Hospital Safety Climate Scale was used to examine hospital safety climate (Gershon et al. 2000). This scale contains 20 items across six subscales for the hospital safe environment. However, only 17 questions were used in this study, with 3 questions related to HIV/AIDS excluded. Each item on this scale was evaluated on a 5-point Likert scale from strongly disagree to strongly agree. A higher score indicated a higher level of perceived organizational commitment to safety. Cronbach's α for this study was in the range of 0.68 to 0.83.

### Fear of COVID-19
The Fear of COVID-19 Scale was utilized to measure fear of COVID-19 infection (Ahorsu et al. 2020). This scale comprises seven items on emotional fear responses to COVID-19. Each item on this scale was evaluated on a 5-point scale between strongly disagree and strongly agree. A higher score indicated a greater fear of COVID-19. Cronbach's α for this study was 0.87.

### Anxiety
The Generalized Anxiety Disorder-7 scale developed by Spitzer et al. (2006) was utilized to measure anxiety level. This scale asks how often the participant suffered from each of the 7 symptoms for the last two weeks. Each item was evaluated on a 4-point Likert scale between not at all and almost daily. A higher score on the Generalized Anxiety Disorder-7 scale indicated a higher level of anxiety among participants. Cronbach's α for this study was 0.91.

### Depressive symptoms
Depressive symptoms were examined utilizing the Patient Health Questionnaire (Kroenke et al. 2001). This scale comprises nine items, each evaluated on a 4-point Likert scale from not at all to almost daily. A higher score indicated a higher level of depressive symptoms among participants. Cronbach's α for this study was 0.86.

### Ethical considerations
This research was performed after approval by the institutional review board of Ewha Womans University (IRB No.e-wha-201904-0012-08). Before participating in the online survey, participants received information on the study including aims, content, and confidentiality, and voluntarily submitted electronic informed consent.

### Data analysis
Data analysis was processed using SPSS Version 26.0 (IBM, Armonk, NY, USA). Descriptive statistics were described using frequency and percentage, mean and standard deviation. ANOVA and t-tests were employed in examining differences in the participants' fear, anxiety and depressive symptoms according to general characteristics and COVID-19-related variables. Welch tests were performed when the assumption of equal variances was violated. Hierarchical multiple regression analyses were carried out to identify the factors affecting mental health. Categorical variables were converted to dummy variables. In Model 1, general characteristics were included, and in Model 2, variables related to COVID-19 and hospital safety climate were included.

## Results

### Characteristics of participants
The general and COVID-19-related characteristics are presented in Table 1. With regard to the age, 30–39 years old was the most common (71.6%), and 63.4% of participants were married. In total, 62.5% of participants lived with a spouse, and 50.3% lived with children. Of the participants, 66.9% had more than 10 years of hospital work experience. In relation to COVID-19, 46.5% of participants cared for COVID-19-positive patients within the past 3 months, and 53.5% screened patients for COVID-19. 40.5% of participants had working experiences more than three months. With regard to work related to COVID-19, 41.4% of participants transferred within their hospital, and 5.0% were dispatched or voluntarily moved to other hospitals. The mean of the participants' hospital safety climate was 57.70 ± 9.22, and the

**Table 1 Baseline characteristics (N = 906)**

| Variables | Categories | N (%) or M ± SD |
|---|---|---|
| Age (years) | ≤29 | 52 (5.7) |
| | 30–39 | 649 (71.6) |
| | ≥40 | 205 (22.6) |
| Level of education | 3-year college | 138 (15.2) |
| | 4-year university | 570 (62.9) |
| | Master degree or higher | 198 (21.9) |
| Marital status | Single/other | 332 (36.6) |
| | Married | 574 (63.4) |
| Annual income (USD) | <3000 | 39 (4.3) |
| | 3000–3999 | 267 (29.5) |
| | ≥4000 | 600 (66.2) |
| Living with a spouse | No | 340 (37.5) |
| | Yes | 566 (62.5) |
| Living with children | No | 450 (49.7) |
| | Yes | 456 (50.3) |
| Living with parents | No | 648 (71.5) |
| | Yes | 258 (28.5) |
| Position | Staff nurse | 578 (63.8) |
| | Charge nurse | 226 (24.9) |
| | Head nurse or higher | 102 (11.3) |
| Hospital work experience (years) | <10 | 300 (33.1) |
| | 10≤ | 606 (66.9) |
| Number of hospital beds | 100–299 | 195 (21.5) |
| | 300–599 | 260 (28.7) |
| | 600–999 | 321 (35.4) |
| | 1000 or over | 130 (14.3) |
| COVID-19-related work type | Caring for positive patients | 421 (46.5) |
| | Screening | 485 (53.5) |
| Work experience more than 3 months | No | 539 (59.5) |
| | Yes | 367 (40.5) |
| Transfer of workplace | No | 486 (53.6) |
| | Yes, within the hospital | 375 (41.4) |
| | Yes, to another hospital | 45 (5.0) |
| Training on wearing PPE | No | 193 (21.3) |
| | Yes | 713 (78.7) |
| Perceived safety of PPE | | 6.37 ± 1.88 |
| Hospital safety climate | | 57.70 ± 9.22 |
| Fear of COVID-19 | | 18.14 ± 5.47 |
| Anxiety | | 5.01 ± 4.22 |
| Depressive symptoms | | 6.42 ± 4.73 |

PPE, Personal Protective Equipment; M, Mean; SD, Standard Deviation.

mean of fear was 18.14 ± 5.47. The mean of anxiety and depressive symptoms were 5.01 ± 4.22 and 6.42 ± 4.73, respectively.

**Differences in fear, anxiety and depressive symptoms**

Table 2 shows differences in fear, anxiety and depressive symptoms according to the general characteristics and COVID-19-related work. In terms of fear, statistically significant differences were found with regard to marital status ($t = -4.591$, $P < 0.001$), living with a spouse ($t = -5.526$, $P < 0.001$), living with children ($t = -5.003$, $P < 0.001$), and COVID-19-related work type (caring for COVID-19 patients or performing COVID-19 screening; $t = 3.257$, $P < 0.01$) and training on PPE ($t = 2.154$, $P < 0.05$).

There were significant differences in anxiety level according to living with a spouse ($t = -2.262$, $P < 0.05$), COVID-19-related work type ($t = 4.336$, $P < 0.001$), and work experience more than 3 months ($t = -2.315$, $P < 0.05$). Depressive symptoms varied significantly with age ($F = 7.334$, $P < 0.01$), education level ($F = 4.461$, $P < 0.05$), annual income ($F = 3.471$, $P < 0.05$), position ($F = 5.711$, $P < 0.01$), COVID-19-related work type ($t = 5.269$, $P < 0.001$), and transfer of workplace ($F = 3.146$, $P < 0.05$).

**Factors related to fear, anxiety and depressive symptoms**

In this study, Pearson's correlation analysis was utilized to investigate the relationships among fear, anxiety and depressive symptoms. Fear was significantly related to anxiety ($r = 0.532$, $P < 0.001$) and depressive symptoms ($r = 0.411$, $P < 0.001$). Anxiety was significantly associated with depressive symptoms ($r = 0.724$, $P < 0.001$) (data not shown).

Hierarchical multiple regression analyses were performed to identify the factors affecting psychological symptoms. The general characteristics were analysed in Model 1 and variables related to COVID-19 were added in Model 2.

In model 2, after controlling for general characteristics, the factors affecting fear were COVID-19-related work type ($\beta = 0.111$, $P < 0.01$), perceived safety of PPE ($\beta = -0.146$, $P < 0.001$) and hospital safety climate ($\beta = -0.141$, $P < 0.001$). The explanatory power of model 2 was 11.0%.

After controlling for general characteristics, the factors influencing anxiety in model 2 were COVID-19-related work type ($\beta = 0.154$, $P < 0.001$), work experience more than 3 months ($\beta = 0.107$, $P < 0.01$) and hospital safety climate ($\beta = -0.279$, $P < 0.001$), accounting for 12.3% of variance in anxiety.

Lastly, the factors affecting depressive symptoms in model 2 after controlling for general characteristics were COVID-19-

**Table 2 Differences in fear of COVID-19, anxiety and depressive symptoms according to general and COVID-19-related characteristics (N = 906)**

| Variables | Fear of COVID-19 | | Anxiety | | Depressive symptoms | |
|---|---|---|---|---|---|---|
| | M ± SD | F/t | M ± SD | F/t | M ± SD | F/t |
| Age (years) | | | | | | |
| ≤29 | 18.10 ± 4.55 | 0.143 | 5.13 ± 4.76 | 2.980 | 6.87 ± 4.62 | 7.334** |
| 30–39 | 18.19 ± 5.52 | | 5.20 ± 4.33 | | 6.73 ± 4.87 | |
| ≥40 | 17.96 ± 5.52 | | 4.38 ± 3.63 | | 5.31 ± 4.13 | |
| Level of education | | | | | | |
| 3-year college | 18.86 ± 5.82 | 2.634 | 5.49 ± 4.64 | 2.365 | 6.81 ± 5.23 | 4.461* |
| 4-year university | 18.18 ± 5.29 | | 5.07 ± 4.23 | | 6.62 ± 4.67 | |
| Master degree or higher | 17.49 ± 5.67 | | 4.51 ± 3.83 | | 5.54 ± 4.45 | |
| Marital status | | | | | | |
| Single/other | 17.08 ± 5.04 | -4.591*** | 4.65 ± 3.10 | -1.959 | 6.74 ± 4.68 | 1.573 |
| Married | 18.75 ± 5.61 | | 5.22 ± 4.33 | | 6.23 ± 4.75 | |
| Annual income (USD) | | | | | | |
| <3000 | 18.97 ± 4.30 | 2.984 | 5.31 ± 3.99 | 2.000 | 7.10 ± 5.05 | 3.471* |
| 3000–3999 | 18.72 ± 5.55 | | 5.42 ± 4.52 | | 6.98 ± 4.72 | |
| ≥4000 | 17.82 ± 5.48 | | 4.81 ± 4.09 | | 6.12 ± 4.70 | |
| Living with a spouse | | | | | | |
| No | 16.86 ± 5.15 | −5.526*** | 4.60 ± 3.97 | −2.262* | 6.66 ± 4.68 | 1.226 |
| Yes | 18.90 ± 5.51 | | 5.26 ± 4.34 | | 6.27 ± 4.76 | |
| Living with children | | | | | | |
| No | 17.23 ± 5.14 | −5.003*** | 4.89 ± 4.20 | −0.882 | 6.68 ± 4.66 | 1.641 |
| Yes | 19.03 ± 5.63 | | 5.13 ± 4.24 | | 6.16 ± 4.79 | |
| Living with parents | | | | | | |
| No | 18.27 ± 5.46 | 1.172 | 5.02 ± 4.13 | 0.050 | 6.45 ± 4.73 | 0.348 |
| Yes | 17.80 ± 5.49 | | 5.00 ± 4.44 | | 6.33 ± 4.75 | |
| Position | | | | | | |
| Staff nurse | 18.39 ± 5.31 | 2.072 | 5.24 ± 4.22 | 2.779 | 6.72 ± 4.70 | 5.711** |
| Charge nurse | 17.86 ± 5.85 | | 4.77 ± 4.24 | | 6.26 ± 4.88 | |
| Head nurse or higher | 17.31 ± 5.37 | | 4.27 ± 4.09 | | 5.04 ± 4.33 | |
| Hospital work experience(years) | | | | | | |
| <10 | 18.25 ± 5.13 | −0.470 | 5.17 ± 4.24 | −0.781 | 6.60 ± 4.54 | −0.808 |
| ≥10 | 18.08 ± 5.63 | | 4.93 ± 4.21 | | 6.33 ± 4.83 | |
| Number of hospital beds | | | | | | |
| 100–299 | 18.42 ± 5.33 | 0.452 | 5.21 ± 4.20 | 0.767 | 6.48 ± 4.77 | 0.216 |
| 300–599 | 18.28 ± 5.41 | | 5.18 ± 4.81 | | 6.58 ± 5.11 | |
| 600–999 | 17.93 ± 5.68 | | 4.74 ± 3.87 | | 6.28 ± 4.54 | |
| 1000 or over | 17.92 ± 5.27 | | 5.06 ± 3.81 | | 6.32 ± 4.39 | |
| COVID-19-related work type | | | | | | |
| Caring for positive patients | 18.77 ± 5.74 | 3.257** | 5.66 ± 4.46 | 4.336*** | 7.29 ± 4.84 | 5.269*** |
| Screening | 17.58 ± 5.16 | | 4.45 ± 3.91 | | 5.66 ± 4.50 | |
| Work experience more than 3 months | | | | | | |
| No | 18.31 ± 5.36 | 1.162 | 4.74 ± 4.01 | −2.315* | 6.22 ± 4.53 | −1.493 |
| Yes | 17.88 ± 5.61 | | 5.40 ± 4.48 | | 6.71 ± 5.01 | |
| Transfer of workplace | | | | | | |
| No | 18.03 ± 5.33 | 1.346 | 4.89 ± 4.10 | 0.518 | 6.07 ± 4.53 | 3.146* |
| Yes, within the hospital | 18.12 ± 5.67 | | 5.18 ± 4.45 | | 6.88 ± 4.98 | |
| Yes, to another hospital | 19.42 ± 5.05 | | 4.91 ± 3.59 | | 6.22 ± 4.54 | |
| Training on wearing PPE | | | | | | |

Table 2 *Continued*

| Variables | Fear of COVID-19 | | Anxiety | | Depressive symptoms | |
|---|---|---|---|---|---|---|
| | M ± SD | F/t | M ± SD | F/t | M ± SD | F/t |
| No | 18.89 ± 5.51 | 2.154* | 5.55 ± 4.73 | 1.834 | 6.93 ± 5.13 | 1.712 |
| Yes | 17.93 ± 5.44 | | 4.87 ± 4.06 | | 6.28 ± 4.61 | |

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; PPE, Personal Protective Equipment; M, Mean; SD, Standard Deviation.

related work type ($\beta = 0.177$, $P < 0.001$), working experience more than 3 months ($\beta = 0.092$, $P = 0.003$), transfer within a hospital ($\beta = 0.065$, $P = 0.042$), perceived safety of PPE ($\beta = -0.067$, $P = 0.045$) and hospital safety climate ($\beta = -0.301$, $P < 0.001$). The explanatory power of model 2 was 15.1% (Table 3).

## Discussion

This study attempted to identify factors affecting fear, anxiety and depressive symptoms experienced by frontline nurses working with a or are in charge of COVID-19 screening work in Korea. The results of this study showed that factors affecting nurses' mental health were COVID-19-related work type and hospital safety climate. Nurses working with patients with COVID-19 experienced higher levels of negative emotional responses than nurses in charge of COVID-19 screening work. In a study of nurses and midwives, work with suspected patients with COVID-19 was not related to depression, but caring for confirmed COVID-19 patients was related to depression (Yörük & Güler 2020). Another previous study reported that nurses who felt their physical condition worsened or who had pandemic uncertainty were more likely to develop mental concerns such as depression, anxiety and insomnia (Cai et al. 2020). Therefore, more active physical and mental health assessment and support should be considered for nurses in charge of COVID-19-positive patients. Moreover, the application of interventions such as consultation may help prevent the occurrence of mental health issues.

In the current study, hospital safety climate was a significant factor influencing fear, anxiety and depressive symptoms in frontline nurses. Workplace safety climate has mainly been reported to be related to employee incidents and safety compliance (Gershon et al. 2000; Kim et al. 2019), but a relationship between safety climate and employee depression and general health has also been described (Katz et al. 2019). In Katz et al.'s study, the better the perceived workplace safety climate was, the lower employees' depressive symptoms and the higher the employees' overall health of self-awareness

were. This study found that high perceived hospital safety climate significantly lowered negative emotional reactions among nurses in charge of COVID-19-related tasks. Similar to previous study results suggesting that higher perceived risk of COVID-19 elevates fear, depression and anxiety (Gázquez Linares et al. 2021; Yildirm et al. 2020), we observed decreased psychological symptoms with higher perceived hospital safety climate and lower perceived COVID-19 risk. Therefore, strengthening safety-related management, safety-related feedback, and communication in a hospital environment will help improve the mental status of nurses in charge of COVID-19-related tasks.

The present study demonstrated that fear was affected by perceived safety of PPE. Perceived safety of PPE also affected depressive symptoms in this study. Fear and depressive symptoms in frontline nurses decreased significantly as perceived safety of PPE increased. This result supports previous findings in the United States and China that nurses who perceived PPE as insufficient experienced more depression (Arnetz et al. 2020; Xiao et al. 2020). To the best of our knowledge, no prior studies have investigated the impact of PPE on fear of COVID-19; however, the effect of PPE on the risk of infection may reduce the fear of infection among healthcare providers (Chu et al. 2020). Therefore, it is necessary to provide training related to PPE and a sufficient supply of PPE to nurses. In this study, nurses who live with family such as a spouse or children experienced more fear. Nurses working with COVID-19 patients experience the fear of transmitting COVID-19 to family, friends, or co-workers, and the unfamiliarity with the new virus and limited information on how to treat it could increase the fear of transmission to family members (Tayyib & Alsolami 2020). Therefore, it is necessary to consider and discuss ways to ensure maximum safety for family members in order to reduce nurses' fear.

In this current study, anxiety was affected by work experience longer than 3 months. In addition, work experience more than 3 months influenced depressive symptoms. Nurses who had contact with COVID-19 patients or were in charge

**Table 3** Hierarchical multiple regression on fear of COVID-19, anxiety and depressive symptoms among frontline nurses facing COVID-19 (N = 906)

| Variables | Fear of COVID-19 | | | | Anxiety | | | | Depressive symptoms | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Model 1 | | Model 2 | | Model 1 | | Model 2 | | Model 1 | | Model 2 | |
| | β | t | β | t | β | T | β | t | β | t | β | t |
| Age | −0.056 | −1.206 | −0.018 | −0.386 | −0.103 | −2.180* | −0.086 | −1.905 | −0.107 | −2.251* | −0.084 | −1.907 |
| Level of education | | | | | | | | | | | | |
| Master degree or higher | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| 3-year college | 0.071 | 1.665 | 0.048 | 1.172 | 0.052 | 1.210 | 0.032 | 0.775 | 0.054 | 1.250 | 0.028 | 0.708 |
| 4-year college | 0.045 | 1.034 | 0.013 | 0.314 | 0.027 | 0.603 | −0.012 | −0.282 | 0.060 | 1.365 | 0.017 | 0.423 |
| Marital status | | | | | | | | | | | | |
| Single/other | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| Married | −0.123 | −1.537 | −0.109 | −1.410 | 0.024 | 0.297 | 0.042 | 0.544 | −0.043 | −0.532 | −0.029 | −0.380 |
| Annual income (USD) | | | | | | | | | | | | |
| ≥4000 | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| <3000 | 0.029 | 0.842 | 0.006 | 0.186 | 0.007 | 0.207 | −0.019 | −0.583 | 0.034 | 0.960 | 0.006 | 0.171 |
| 3000–3999 | 0.063 | 1.713 | 0.041 | 1.154 | 0.035 | 0.928 | 0.016 | 0.443 | 0.060 | 1.586 | 0.040 | 1.129 |
| Living with a spouse | | | | | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 0.236 | 2.962** | 0.237 | 3.056*\* | 0.093 | 1.151 | 0.072 | 0.937 | 0.009 | 0.108 | −0.007 | −0.086 |
| Living with children | | | | | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 0.134 | 2.706** | 0.135 | 2.836*\* | −0.001 | −0.021 | 0.015 | 0.308 | 0.004 | 0.078 | 0.022 | 0.478 |
| Living with parents | | | | | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 0.029 | 0.819 | 0.039 | 1.139 | 0.032 | 0.901 | 0.035 | 1.018 | −0.028 | −0.773 | −0.022 | −0.667 |
| Hospital work experience (years) | | | | | | | | | | | | |
| ≥10 | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| <10 | 0.013 | 0.323 | 0.009 | 0.231 | −0.028 | −0.669 | −0.044 | −1.127 | −0.066 | −1.601 | −0.085 | −2.208* |
| Number of hospital beds | | | | | | | | | | | | |
| 1000 or over | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| 100–299 | −0.021 | −0.434 | −0.018 | −0.366 | −0.016 | −0.325 | −0.024 | −0.504 | −0.019 | −0.383 | −0.025 | −0.537 |
| 300–599 | −0.006 | −0.131 | −0.021 | −0.444 | −0.002 | −0.040 | −0.039 | −0.823 | 0.005 | 0.099 | −0.031 | −0.655 |
| 600–999 | −0.024 | −0.488 | −0.013 | −0.272 | −0.046 | −0.926 | −0.049 | −1.041 | −0.007 | −0.143 | −0.005 | −0.102 |
| COVID-19-related work type | | | | | | | | | | | | |
| Screening | | | Ref. | | | | Ref. | | | | Ref. | |
| Caring for positive patients | | | 0.111 | 3.286** | | | 0.154 | 4.604*** | | | 0.177 | 5.397*** |
| Work experience more than 3 months | | | | | | | | | | | | |
| No | | | Ref. | | | | Ref. | | | | Ref. | |
| Yes | | | −0.010 | −0.301 | | | 0.107 | 3.329** | | | 0.092 | 2.929** |
| Transfer of workplace | | | | | | | | | | | | |
| No | | | Ref. | | | | Ref. | | | | Ref. | |
| Yes, within the hospital | | | 0.022 | 0.677 | | | 0.023 | 0.723 | | | 0.065 | 2.039* |
| Yes, to another hospital | | | 0.047 | 1.427 | | | −0.017 | −0.515 | | | −0.018 | −0.571 |
| Training on wearing PPE | | | | | | | | | | | | |
| Yes | | | Ref. | | | | Ref. | | | | Ref. | |

**Table 3** *Continued*

| Variables | Fear of COVID-19 | | | | Anxiety | | | | Depressive symptoms | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 1 | | Model 2 | | Model 1 | | Model 2 | |
| | β | t | β | t | β | T | β | t | β | t | β | t |
| No | | | 0.048 | 1.438 | | | 0.033 | 1.013 | | | 0.015 | 0.462 |
| Perceived safety of PPE | | | −0.146 | −4.282*** | | | −0.047 | −1.395 | | | −0.067 | −2.008* |
| Hospital safety climate | | | −0.141 | −4.073*** | | | −0.279 | −8.091*** | | | −0.301 | −8.877*** |
| $R^2$ | 0.057 | | 0.129 | | 0.023 | | 0.143 | | 0.023 | | 0.170 | |
| Adjusted $R^2$ | 0.043 | | 0.110 | | 0.009 | | 0.123 | | 0.009 | | 0.151 | |
| F | 4.121*** | | 6.570*** | | 1.612 | | 7.370*** | | 1.642 | | 9.062*** | |
| $\Delta R^2$ | 0.073 | | | | 0.120 | | | | 0.147 | | | |

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; PPE, Personal Protective Equipment; Ref, Reference group.

of COVID-19 screening for more than 3 months experienced more anxiety and depression compare to nurses who weren't involved in COVID-19 patient care or screening more than 3 months. Previous studies showed that anxiety and depression increased with increased duration of work as a frontline nurse during the COVID-19 breakout (Hu et al. 2020). It is thought that the longer nurses are in charge of COVID-19-related work, the greater will be their worry on the risk of infection and the more severe will be their anxiety and depression. As the COVID-19 pandemic situation lengthens, the duration of COVID-19-related work may continue to increase. Adjusting the duration of COVID-19-related tasks through periodic work rotation may help to alleviate nurse anxiety and depression.

This present study revealed that another factor influencing depressive symptoms was transfer within a hospital. Nurses who transferred departments within the hospital experienced more depression compared to those who were dispatched or volunteered to transfer to another hospital, and those who remained in the same department. It is necessary to provide support for nurses who have transferred work places due to COVID-19 to prevent negative effects on coping responses. In this study, nurses who worked less than 10 years in a hospital environment experienced fewer depressive symptoms than nurses with more than 10 years of hospital experience, in contrast with findings from previous studies in which hospital work experience was not a significant factor (Lu et al. 2020; Pouralizadeh et al. 2020). In this study, 70% of nurses with more than 10 years of hospital experience were married and 60% had children, and thus concern about family infection may partially explain this.

## Limitations

Because this study identified factors affecting psychological symptoms based on a cross-sectional design, the causality of these correlations cannot be determined. In addition, in terms of the characteristics of COVID-19-related work, the degree of and factors affecting anxiety, fear and depressive symptoms may differ between nurses working with COVID-19 patients and in charge of screening work only. In this study, the influence on the subscale of the hospital safety climate on the mental health of nurses was not confirmed, so it is necessary to analyse these effects according to the subscale of hospital safety climate.

## Implications for nursing and health policy

Caring for COVID-19 patients was an important factor affecting frontline nurses' mental health in Korea. To address this, nursing and institutional managers need human resources management to enable periodic rotation of nurses' work and working period related to COVID-19. In addition, hospital managers should provide information on the safety of PPE through training and should ensure that sufficient PPE is available. To strengthen the hospital safety climate, supportive policies are needed that encourage enhanced communication to identify the needs and difficulties of frontline nurses, as well as regular COVID-19 testing of the nursing staff. These efforts may maintain the mental health of nurses even in a COVID-19 pandemic situation.

## Conclusion

This study investigated factors affecting fear, anxiety and depressive symptoms of Korean frontline nurses during the

COVID-19 pandemic. The results of this study indicate that contact with COVID-19 patients had a negative impact on mental health. However, the higher was the perceived hospital safety climate, the lower were the nurses' fear, anxiety and depressive symptoms. Therefore, it is necessary to manage psychological symptoms among those who care COVID-19 patients and strengthen policies that will improve hospital safety climate.

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## Author contributions

Study design: MC, OK, YP, BK, HJ, JL, HJung, SYJ and HD
Data Collection: OK, YP and HD
Data analysis: OK and HD
Manuscript writing: MC, OK, YP, BK, HJ, JL and HD
Manuscript review: H-YP, HC, HJung and SYJ
Study supervision: OK

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