



# Post-traumatic Stress and Related Factors Among Hospital Nurses during the COVID-19 Outbreak in Korea

Da-Jeong Moon<sup>1,2</sup> · Mi Ah Han<sup>3</sup> · Jong Park<sup>3</sup> · So Yeon Ryu<sup>3</sup>

Accepted: 21 March 2021 / Published online: 31 March 2021

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## Abstract

COVID-19 is an ongoing worldwide infectious disease pandemic. The purpose of this study was to investigate post-traumatic stress and related factors among hospital nurses during the COVID-19 outbreak. The subjects of this study were 300 nurses who worked in three general hospitals that operated National Designated Isolation Unit (NDIU) wards during the COVID-19 outbreak. Self-reporting questionnaires were used to collect data on post-traumatic stress, general characteristics, and work-related information. The average post-traumatic stress score was  $20.68 \pm 19.5$  points and 36.7% of participants were at high risk of post-traumatic stress disorder (PTSD). The odds ratio (OR) for PTSD was higher for nurses who worked in the NDIU ward (OR = 16.31, 95% CI = 3.79–70.32), who responded that nurse staffing was poor (OR = 3.03, 95% CI = 1.01–9.10), and who responded that they experienced COVID-19 symptoms (OR = 3.83, 95% CI = 1.89–7.75). Total 36.7% of nurses were at risk of PTSD and the factors related to PTSD were the work department, nurse staffing, and experiencing COVID-19 symptoms. These results could be used to manage PTSD and provide psychological support of nurses during infectious disease epidemics, such as COVID-19.

**Keywords** COVID-19 · Nurses · Disease outbreaks · Post-traumatic stress disorders

## Introduction

COVID-19 is an infectious respiratory disease caused by a new coronavirus, SARS-CoV-2, that has been occurring worldwide, including Korea, since its first outbreak in December 2019 in Wuhan, China [1]. As of January 2021, the cumulative confirmed cases of

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This article is a condensed form of the first author's master's thesis from Chosun University.

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✉ Mi Ah Han  
mahan@chosun.ac.kr

<sup>1</sup> Department of Public Health, Graduate School of Health Science, Chosun University, Gwangju, Republic of Korea

<sup>2</sup> Department of Nursing, Chosun University Hospital, Gwangju, Republic of Korea

<sup>3</sup> Department of Preventive Medicine, College of Medicine, Chosun University, 309 Philmum-daero, Dong-gu, Gwangju 61452, Republic of Korea

COVID-19 worldwide were more than 93 million with over 2 million deaths [2]. In Korea, the first confirmed case was reported on January 20, 2020, and gradually spread nationwide with more than 70,000 confirmed cases and ~1,300 deaths by January 2021 [3]. Although exact numbers have not been reported, the COVID-19 pandemic has caused many deaths of health care workers, including nurses and doctors [4].

Previous studies reported that healthcare workers are at high risk of post-traumatic stress disorder (PTSD) due to new infectious diseases, such as Severe Acute Respiratory Syndrome (SARS) [5]. At two months post-SARS outbreak, the prevalence of PTSD was ~20% and support from supervisors and colleagues associated negatively with PTSD in healthcare workers [6]. In addition to post-traumatic stress, healthcare workers experienced high levels of distress, and nurses reported severe stress due to the SARS outbreak [7]. During the Middle East Respiratory Syndrome (MERS) epidemic, post-traumatic stress among nurses associated significantly with contact with suspected and confirmed MERS patients, work position, shift work [8], and support from supervisors [9].

During the recent COVID-19 pandemic, healthcare workers have experienced significantly higher levels of post-traumatic stress (28.9%), and the post-traumatic stress levels have been higher among healthcare workers who directly care for COVID-19 patients than among healthcare workers who care for COVID-19 patients indirectly [10]. The prevalence of depression (34.3%) and anxiety (18.1%) among nurses during the COVID-19 outbreak has been high, and COVID-19-related stress and psychological factors have affected the mental health of nurses [11]. Among the medical staff, nurses have reported more severe psychiatric symptoms and worse sleep quality [12].

The World Health Organization (WHO) has classified COVID-19 as a pandemic, and the outbreak has been ongoing in Korea from January 2020–January 2021. Due to the nature of their work, nurses could not telework, cared for sick people, and remained anxious that they may be infected with COVID-19. Therefore, we investigated the current status of post-traumatic stress and related factors in nurses at COVID-19 treatment hospitals.

## Materials and Methods

### Study Population

The study population included nurses who worked at three hospitals, C University Hospital in Gwangju, W University Hospital, and G Medical Center in Jeollabukdo, that operate National Designated Isolation Unit wards (NDIUs). With cooperation from the Department of Nursing, nurses who worked during the COVID-19 outbreak were sampled. We excluded nurses who did not care for patients directly, such as nurses who worked on the quality improvement and health insurance review teams. We collected data using self-administered questionnaires and informed consent was obtained from all participants. The survey was conducted from September 3 to September 16, 2020, and a total of 300 nurses participated.

### General Characteristics

General characteristics included sex (men, women), age (20–29,  $\geq 30$  years), marital status (single, married), children (no, yes), education level (college, university, graduate school), work period (<5,  $\geq 5$  years), working position (staff nurse, charge/senior nurse), working

department (NDIU, general ward, intensive care unit, other), monthly salary (<3 million,  $\geq 3$  million Korean won), and living status (live alone, live together).

### **Work Environment during the COVID-19 Outbreak**

The work environment included perceived level of ambient noise from the environment, such as patient monitoring devices, call bells, negative pressure machine (little, moderate, a lot), break time during work (<30,  $\geq 30$  min), overtime work (<30,  $\geq 30$  min), nursing workload (low, moderate, high), nurse staffing (poor, fair, good), adequate provision of personal protective equipment, such as dental mask, N95 mask, protective clothing (yes, no/don't know), frequency of changes to COVID-19 guidelines (no/occasionally, moderate, frequently), support from supervisors (low, moderate, high), and support from colleagues (low, moderate, high).

### **Covid-19-Related Characteristics**

COVID-19-related characteristics included presence of COVID-19 suspected symptoms (no, yes), COVID-19 test performed (no, yes), self-isolation or isolation of family members (no, yes), subjective level of COVID-19 related knowledge (little, average, knowledgeable), education of new infectious diseases (no, yes), and nursing care for suspected and confirmed COVID-19 patients (no, yes).

Among nurses who cared for suspected and confirmed COVID-19 patients, the data collected included the number of times they wore protective clothing (0–10,  $\geq 11$  times), the amount of time per day protective clothing was worn (<2,  $\geq 2$  h), the tightness of the protective clothing (little, moderate, a lot), the number of critical patients they cared for (0, 1–2,  $\geq 3$ ), and whether they cared for patients who died (no, yes).

### **Post-Traumatic Stress**

Post-traumatic stress was assessed using the Korean version of the Impact of Event Scale-Revised (IES-R) tool [13]. The tool uses a five-point Likert scale (0–4) for 22 questions on hyperarousal (6 questions), avoidance (6 questions), intrusion (5 questions), and sleep & numbness (5 questions). How often these symptoms appeared during the COVID-19 outbreak period were assessed; 0 points were allotted for "not at all" responses and 4 were allotted for "very much" responses, and the higher the score, the higher the post-traumatic stress. Out of a maximum of 88 points, individuals with scores of 24 points or less were designated to the normal group and individuals with scores of 25 points or more were designated to the PTSD group.

### **Analysis**

Data were analyzed using the statistical program SPSS version 26. The general characteristics of the study population, work environment, and COVID-19-related characteristics were presented as frequencies and percentages, whereas the post-traumatic stress scores were presented as mean  $\pm$  standard deviation. The chi-square test was used to assess the prevalence of PTSD based on general characteristics, work environment, and COVID-19

characteristics. To identify the factors associated with PTSD, we performed multiple logistic regression analysis.  $p < 0.05$  indicated statistical significance.

## Results

The average post-traumatic stress score was  $20.68 \pm 19.50$ , and 36.7% of the nurses evaluated were in the high-risk of PTSD group (scores  $\geq 25$  points). The prevalence of PTSD was 30.4% for nurses aged 20–29 years, 46.2% for nurses aged  $\geq 30$  years, 47.7% for nurses with children, and 33.6% for nurses without children. The prevalence of PTSD was 31.6% for nurses who worked  $< 5$  years and 45.5% for nurses who worked  $> 5$  years. The prevalence of PTSD was 63.3% for nurses who worked in the NDIU ward, 30.2% for nurses who worked in the general ward, 39.6% for nurses who worked in the intensive care unit, and 21.1% for nurses who worked in other departments (Table 1).

Regarding the work environment, the prevalence of PTSD was 22.8% when there was little noise in the surrounding environment, 35.8% with moderate noise, and 48.7% with a lot of noise. The prevalence of PTSD was 20.0% when the workload was low, 30.3%

**Table 1** General characteristics and post-traumatic stress disorder

Characteristics	Classification	Total	PTSD		<i>P</i>
			Yes	No	
Sex	Men	7(2.3)	4(57.1)	3(42.9)	0.255
	Women	293(97.7)	106(36.2)	187(63.8)	
Age	20–29	181(60.3)	55(30.4)	126(69.6)	0.005
	$\geq 30$	119(39.7)	55(46.2)	64(53.8)	
Marital status	Single	221(73.7)	75(33.9)	146(66.1)	0.101
	Married	79(26.3)	35(44.3)	44(55.7)	
Children	Yes	235(78.3)	31(47.7)	34(52.3)	0.037
	No	65(21.7)	79(33.6)	156(66.4)	
Education level	College	32(10.7)	15(46.9)	17(53.1)	0.320
	University	250(83.3)	87(34.8)	163(65.2)	
	Graduate school	18(6.0)	8(44.4)	10(55.6)	
Work period (years)	$< 5$	190(63.3)	60(31.6)	130(68.4)	0.016
	$\geq 5$	110(36.7)	50(45.5)	60(54.5)	
Working position	Staff nurse	278(92.7)	98(35.3)	180(64.7)	0.071
	Charge/senior nurse	22(7.3)	12(54.5)	10(45.5)	
Working department	National Designated Isolation Unit wards	49(16.3)	31(63.3)	18(36.7)	0.000
	General wards	179(59.7)	54(30.2)	125(69.8)	
	Intensive care units	53(17.7)	21(39.6)	32(60.4)	
	Others	19(6.3)	4(21.1)	15(78.9)	
Salary (Korean won/month)	$< 3$ million	209(69.7)	68(32.5)	141(67.5)	0.024
	$\geq 3$ million	91(30.3)	42(46.2)	49(53.8)	
Living status	Live alone	50(16.7)	13(26.0)	37(74.0)	0.086
	Live together	250(83.3)	97(38.8)	153(61.2)	

Data were expressed as number (%). PTSD, post-traumatic stress disorder

when the workload was moderate, and 45.2% when the workload was high. The prevalence of PTSD was 37.6% when nurse staffing was poor, 41.9% when nurse staffing was fair, and 14.3% when nurse staffing was good. The prevalence of PTSD was 26.2% when the COVID-19 work guidelines had not changed or changed only a little, 34.2% when there were moderate changes to the guidelines, and 44.9% when there were frequent changes in the guidelines (Table 2).

The prevalence of PTSD was 58.1% when nurses experienced COVID-19 symptoms and 31.1% when COVID-19 symptoms were not experienced. The prevalence of PTSD was 42.3% among nurses educated on new infectious diseases and 29.5% among nurses who were not educated on new infectious diseases. The prevalence of PTSD was 26.8% for nurses who cared for suspected and confirmed COVID-19 patients, 26.8% for nurses who wore protective clothing less than 10 times, and 47.9% for nurses who wore protective clothing more than 11 times. The prevalence of PTSD was 19.1% for nurses who wore protective clothing less than 2 h per occasion and 72.7% for nurses who wore protective clothing for more than 2 h. The prevalence of PTSD was 20.9% for nurses who had no critical patients, 31.3% for nurses with 1–2 critical patients, and 70.3% for nurses with 3 or more

**Table 2** Work environment during COVID-19 outbreak and post-traumatic stress disorder

Characteristics	Classification	Total	PTSD		P
			Yes	No	
Ambient noise	Little	57(19.0)	13(22.8)	44(77.2)	0.008
	Moderate	165(55.0)	59(35.8)	106(64.2)	
	A lot	78(26.0)	38(48.7)	40(51.3)	
Break time during work (minutes)	<30	196(65.3)	77(39.3)	119(60.7)	0.196
	≥30	104(34.7)	33(31.7)	71(68.3)	
Overtime work (minutes)	<30	168(56.0)	58(34.5)	110(65.5)	0.385
	≥30	132(44.0)	52(39.4)	80(60.6)	
Nursing workload	Low	10(3.3)	2(20.0)	8(80.0)	0.017
	Moderate	155(51.7)	47(30.3)	108(69.7)	
	High	135(45.0)	61(45.2)	74(54.8)	
Nurse staffing	Poor	109(36.3)	41(37.6)	68(62.4)	0.009
	Fair	148(49.3)	62(41.9)	86(58.1)	
	Good	43(14.3)	7(16.3)	36(83.7)	
Adequate provision of personal protective equipment	Yes	197(65.7)	69(35.0)	128(65.0)	0.415
	No/don't know	103(34.3)	41(39.8)	62(60.2)	
Changing frequency to COVID-19 guidelines	No/occasionally	65(21.7)	17(26.2)	48(73.8)	0.032
	Moderate	117(39.0)	40(34.2)	77(65.8)	
	Frequently	118(39.3)	53(44.9)	65(55.1)	
Support from supervisors	Low	11(3.7)	5(45.5)	6(54.5)	0.760
	Moderate	155(51.7)	58(37.4)	97(62.6)	
	High	134(44.7)	47(35.1)	87(64.9)	
Support from colleagues	Low	7(2.3)	3(42.9)	4(57.1)	0.897
	Moderate	124(41.3)	44(35.5)	80(64.5)	
	High	169(56.3)	63(37.3)	106(62.7)	

Data were expressed as number (%). PTSD, post-traumatic stress disorder

critical patients. The prevalence of PTSD was 63.3% for nurses who had patients who died and 22.2% for nurses who did not have patients who died (Table 3).

Multiple logistic regression analysis showed that the adjusted odd ratio (AOR) for PTSD was higher for nurses working in the NDIU ward than for nurses working in the general ward (OR = 2.85, 95% CI = 1.21–6.71). The AOR for PTSD was higher for nurses who responded that nurse staffing was poor (OR = 3.03, 95% CI = 1.01–9.10) or fair (OR = 4.10, 95% CI = 1.47–11.46) than for nurses who responded that nurse staffing was good. Experiencing COVID-19 symptoms associated with a higher risk of PTSD (OR = 3.83, 95% CI = 1.89–7.75; Table 4).

## Discussion

We investigated the prevalence of PTSD and related factors among nurses. Overall, 36.7% of nurses were at high risk of PTSD. Working in the NDIU ward, experiencing poor nurse staffing, and experiencing COVID-19 symptoms associated with a higher risk of PTSD. In this study during the COVID-19 outbreak, the mean post-traumatic stress score was  $20.68 \pm 19.50$  points out of a maximum of 88 points, and 36.7% of the nurses had scores  $\geq 25$  points and were in the high risk of PTSD.

Among front-line nurses in the Philippines, 37.8% were found to have dysfunctional levels of COVID-10-related anxiety [14]. In a cross-sectional study, 64% of nurses experienced acute stress disorder due to the COVID-19 pandemic and were at risk for PTSD [15]. A study measuring post-traumatic stress among nurses after the MERS outbreak in Korea used the same IES-R tool and showed that the mean PTSD score was  $7.80 \pm 10.15$  with 7.1% of nurses at high risk of PTSD [8]. A study that addressed psychological distress during SARS outbreaks showed that 11% of nurses experienced the stress reaction syndrome [16]. The higher PTSD score in this study is due to the higher numbers of infections and deaths from COVID-19 than MERS and SARS. During the SARS outbreaks, there were 8,096 infections worldwide (3 in Korea) and 774 deaths (0 in Korea). During the MERS outbreak, there were 1,167 infections worldwide (186 in Korea) and 479 deaths (38 in Korea) [17]. Currently, more than 93 million people worldwide have been infected with COVID-19 and more than 2 million people worldwide have died from COVID-19. In addition, the number of confirmed COVID-19 cases continues to increase.

In this study, we found that the work department associated with the risk of PTSD. The OR for PTSD was significantly higher for nurses who worked in the NDIS ward than for nurses who worked in the general ward. In the NDIS ward, nurses directly cared for suspected and confirmed COVID-19 patients and had to perform new tasks, including wearing protective clothing, adhering to strict infection control guidelines, and working long hours in full-body suits [18]. Because nurses in the NDIS ward directly care for COVID-19 patients, their risk of infection and psychological burden was high.

In this study, the experience of caring for suspected and confirmed COVID-19 patients did not associate with PTSD. In a prior study of nurses during the MERS outbreak, the experience of caring for suspected and confirmed MERS patients was a significant factor for PTSD [8]. In addition, post-traumatic stress scores were higher for nurses who were in contact with SARS patients than for nurses who were not in contact with SARS patients [6]. Perhaps the prolonged outbreak of COVID-19 led to nurses becoming accustomed to patients with COVID-19 and reduced awareness and fear.

**Table 3** COVID-19 related characteristics and post-traumatic stress disorder

Characteristics	Classification	Total	PTSD		P
			Yes	No	
Presence of COVID-19 suspected symptoms	Yes	62(20.7)	36(58.1)	26(41.9)	0.000
	No	238(79.3)	74(31.1)	164(68.9)	
COVID-19 test performed	Yes	77(25.7)	35(45.5)	42(54.5)	0.063
	No	223(74.3)	75(33.6)	148(66.4)	
Self-isolation or isolation of family members	Yes	15(5.0)	5(33.3)	10(66.7)	0.783
	No	285(95.0)	105(36.8)	180(63.2)	
Subjective level of COVID-19 related knowledge	Little	50(16.7)	12(24.0)	38(76.0)	0.119
	Average	209(69.7)	81(38.8)	128(61.2)	
Education of new infectious disease	Knowledgeable	41(13.7)	17(41.5)	24(58.5)	0.023
	Yes	168(56.0)	71(42.3)	97(57.7)	
Nursing care for suspected and confirmed COVID-19 patients	No	132(44.0)	39(29.5)	93(70.5)	0.330
	Yes	112(37.3)	45(40.2)	67(59.8)	
Number of times wore protective clothing (times) †	No	188(62.7)	65(34.6)	123(65.4)	0.029
	≤10	41(36.6)	11(26.8)	30(73.2)	
Amount of time per day protective clothing was worn (hours) †	≥11	71(63.4)	34(47.9)	37(52.1)	0.000
	<2	68(60.7)	13(19.1)	55(80.9)	
Tightness of the protective clothing †	≥2	44(39.3)	32(72.7)	12(27.3)	0.126
	Little	15(13.4)	3(20.0)	12(80.0)	
Number of critical patients cared †	Moderate	8(7.1)	2(25.0)	6(75.0)	0.000
	A lot	89(79.5)	40(44.9)	49(55.1)	
Death of patients cared †	No	43(38.4)	9(20.9)	34(79.1)	0.000
	1–2	32(28.6)	10(31.3)	22(68.8)	
Death of patients cared †	≥3	37(33.0)	26(70.3)	11(29.7)	0.000
	No	49(43.8)	14(22.2)	49(77.8)	
Data were expressed as number (%)	Yes	63(56.3)	31(63.3)	18(36.7)	0.000
	Only included nurses participated in COVID-19 care				

In this study, the OR for PTSD was significantly higher for nurses who responded that nurse staffing was poor and fair than for nurses who responded that nurse staffing was good. When nurse staffing is inadequate, nurses care for numerous patients and have a high workload. Previous studies showed that the more patients in a nurse's care, the higher the stress on the nurse [19], and chronic exposure to stress associates significantly with PTSD [20]. The number of hours worked per week associated significantly with stress among nurses during the COVID-19 outbreak in Wuhan, China [21]. In addition, an increase in the number of patients was shown to increase burnout and decrease job satisfaction among nurses [22]. The number of patients per nurse is higher in the NDIU ward than in other departments because the minimum number of nurses are assigned alternately to minimize contacts with confirmed patients. Further, due to the nature of infectious diseases, it is difficult to predict the number and severity of infectious diseases, which likely increases psychological pressure.

**Table 4** Factors related to post-traumatic stress disorder

Characteristics	Classification	OR	95% CI
Age	20–29	1.00	
	≥ 30	1.44	0.57–3.61
Children	Yes	1.38	0.60–3.17
	No	1.00	
Work period	< 5	1.00	
	≥ 5	1.19	0.42–3.37
Working department	National Designated Isolation Unit wards	2.85	1.21–6.71
	General ward	1.00	
	Intensive care units	1.47	0.71–3.04
	Others	0.17	0.04–0.68
Salary (10,000won/month)	< 300	1.03	0.41–2.55
	≥ 300	1.00	
Ambient noise	Little	1.00	
	Moderate	2.11	0.95–4.65
	A lot	1.72	0.70–4.22
Nursing workload	Low	1.00	
	Moderate	1.59	0.25–10.16
	High	3.62	0.51–25.58
Nurse staffing	Poor	3.03	1.01–9.10
	Fair	4.10	1.47–11.46
	Good	1.00	
Frequency of changes to COVID-19 guidelines	No/occasionally	1.00	
	Moderate	1.52	0.71–3.28
	Frequently	2.14	0.99–4.62
Education of new infectious disease	Yes	1.68	0.87–3.25
	No	1.00	
Presence of COVID-19 suspected symptoms	Yes	3.83	1.89–7.75
	No	1.00	

CI Confidence interval, OR Odds ratio, PTSD post-traumatic stress disorder



The OR for PTSD was significantly higher for nurses who responded that they had COVID-19 symptoms than for nurses who did not have COVID-19 symptoms. An Australian study conducted during the COVID-19 outbreak revealed concern for work-related risks, such as an insufficient supply of personal protective equipment, that may cause nurses to quit their jobs [23]. There has been a worldwide shortage of personal protective equipment, and many medical professionals have died of COVID-19 [24]. Therefore, when nurses who cared for patients on the frontline experienced symptoms of COVID-19, such as fever, cough, and phlegm, their post-traumatic stress likely increased because they suspected that they may be infected with COVID-19.

Among nurses who treated COVID-19 patients, more instances and longer periods of wearing protective clothing associated with a higher risk of PTSD. An essential component of level D protective clothing is the N95 face mask. A previous study showed that wearing the N95 face mask may lead to headaches and that wearing the N95 masks for shorter durations may reduce the headaches [25]. A situation in which a nurse is in physical pain but cannot take off their protective clothing due to caring for a patient may lead to mental stress. In addition, the higher number of critically ill patients a nurse cares for and death of a patient associated with a high risk of PTSD. A previous study reported that intensive care nurses have a higher prevalence of PTSD than nurses in general wards [26]. Due to the nature of COVID-19 care, it is difficult to rearrange or replace nursing personnel frequently, thus post-traumatic stress management is necessary for nurses who take care of COVID-19 patients.

A limitation of this study was that it was conducted in only three hospitals in Korea, thus it is difficult to expand the interpretation to nurses across the entire country. Because data were collected using self-reporting surveys, some data may be over-reported or under-reported. However, this study is meaningful in that it provides the current PTSD status and the factors related to PTSD among frontline nurses caring for COVID-19 patients, thus these data can be used to manage post-traumatic stress among nurses during future infectious disease outbreaks.

A total of 36.7% of the nurses in this study were at risk of PTSD. Working in NDIU wards, inadequate nurse staffing, and experiencing COVID-19 symptoms associated with PTSD. Further studies on personal or hospital level interventions for post-traumatic stress prevention or management, such as shift work for nurses, will help manage PTSD among nurses.

**Authors' Contributions** Conceptualization: Da-Jeong Moon, Mi Ah Han, Jong Park, So Yeon Ryu. Methodology: Da-Jeong Moon, Mi Ah Han, Jong Park, So Yeon Ryu. Formal analysis: Da-Jeong Moon, Mi Ah Han. Investigation: Da-Jeong Moon, Mi Ah Han. Data curation: Da-Jeong Moon, Mi Ah Han. Original draft preparation: Da-Jeong Moon, Mi Ah Han. Review: Da-Jeong Moon, Mi Ah Han, Jong Park, So Yeon Ryu. Editing: Da-Jeong Moon, Mi Ah Han, Jong Park, So Yeon Ryu.

**Data Availability** Not applicable.

**Code Availability** Not applicable.

**Declarations**

**Ethics Approval** This study was approved by the Institutional Review Board of Chosun University Hospital (CHOSUN2020-06-017-001).

**Consent to Participate** Informed consent was obtained from all participants.

**Consent for Publication** Not applicable.

**Conflicts of Interest/Competing Interests** The authors have no potential conflicts of interest to disclose.

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**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Da-Jeong Moon** MPH, is a nurse in Chosun University Hospital, Gwangju Republic of Korea.

**Mi Ah Han** MD, PhD, is a professor in the Department of Preventive Medicine, College of Medicine, Chosun University, Gwangju, Republic of Korea.

**Jong Park** MD, PhD, is a professor in the Department of Preventive Medicine, College of Medicine, Chosun University, Gwangju, Republic of Korea.

**So Yeon Ryu** MD, PhD, is a professor in the Department of Preventive Medicine, College of Medicine, Chosun University, Gwangju, Republic of Korea.