Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Factors influencing emergency nurses' infection control practices related to coronavirus disease 2019 in Korea

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ABSTRACT

Background: When an infectious disease breaks out, emergency nurses are the front-line specialists. Infection control by emergency nurses is important to minimize the risk of infectious disease and to improve the infection control practices of emergency nurses. Therefore, it is crucial to identify the factors influencing infection control practice related to COVID-19.
Methods: For this cross-sectional study design used survey methods for data collection, a questionnaire survey was conducted with 161 emergency nurses working in five hospitals selected through convenience sampling. Data were collected from November 10 to November 26 in 2020.
Results: Infection control practice related to COVID-19 was affected by the infection prevention environment (β = 0.24, p = .002), monitoring of wearing Personal Protective Equipment (β = 0.19, p = .006), knowledge about COVID-19 (β = 0.18, p = .009), perceived severity related to COVID-19 (β = 0.18, p = .010), and perceived barrier related to COVID-19 (β = −0.15, p = .033).
Conclusion: Creating safe infection prevention measures and revitalizing personal protective equipment monitoring are necessary to improve infection control practices. A systematic infection control education program is needed to improve knowledge about COVID-19, emphasize its perceived severity, and identify and eliminate perceived barriers.

1. Introduction

Emerging infectious diseases, such as Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS-CoV), Ebola virus disease (EVD), and coronavirus disease 2019 (COVID-19) have resulted in numerous deaths worldwide [1]. The healthcare system has subsequently experienced a major crisis. COVID-19 is currently spreading rapidly around the world at an unprecedented rate and greatly burdening each country's quarantine system. The importance of infection control in response to such emerging infectious diseases is currently being emphasized.

In Korea, SARS and swine-origin influenza A (H1N1) were directly or indirectly experienced in 2002 and 2009, respectively. On May 20, 2015, a MERS-CoV outbreak occurred, with 186 patients being diagnosed with the disease, and 38 (20.2%) dying of it [2]. Of these patients, 89 were infected in the emergency department (ED) and problems with the emergency medical systems were identified as the main cause of the outbreak [3]. Therefore, the importance of infection control practices in EDs increased after this outbreak.

When an infectious disease breaks out, emergency nurses are often the first specialists to treat patients affected by it [4]. Thus, infection control by emergency nurses is extremely important to minimize the risk of the disease spreading among patients, staff, visitors, and the community [5]. However, studies have shown that infection control guidelines and protocols are not always followed. A study that observed emergency nurses' adherence to infection control practices during the MERS-CoV outbreak revealed that more than 40% did not follow the guidelines for personal protective equipment (PPE) [6], and their hand hygiene compliance was also low [7].

Studies have also investigated the factors that influence infection control practices related to infectious diseases, including individual and environmental factors. Some studies reported that for nurses who have long clinical careers and work in the infectious medicine ward [8], influenza-related training [9], and knowledge about the respiratory infectious disease are factors that affect infection control practices [10,11], and are significantly correlated with good practices

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[12,13]. In addition, health beliefs [14] and awareness [9] can influence infection control practices. A literature review established that environmental factors, such as the type of isolation facility in the department, availability of PPE, and patient management guidelines affect the practice of wearing PPE [15].

The ED is highly likely to be the first location that patients with infections visit and it is a major pathway for hospitalization. Therefore, stricter infection control is essential for highly contagious infectious diseases, such as COVID-19. To improve the infection control practices of emergency nurses, it is important to first understand them and identify the factors that affect them.

However, few studies analyzed the infection control practices of emergency nurses responsible for patient care during the outbreak of emerging infectious diseases [5,6]. In particular, there has been no study on the factors that influence emergency nurses' infection control practices considering the specific nature of COVID-19. Thus, this study aims to assess emergency nurses' level of COVID-19-related infection control practices and to identify the influencing factors to provide basic information that can be used to improve infection control practices.

2. Methods

2.1. Study design

This cross-sectional study used survey methods for data collection to identify factors that influence emergency nurses' COVID-19-related infection control practices during the COVID-19 outbreak in Korea.

2.2. Participants

The participants were selected using convenience sampling from the EDs of five COVID-19 tertiary and general hospitals located in Seoul city and Gyeonggi-do province, Korea. The researchers included 190 nurses working in the EDs of these hospitals. There were no specific exclusion criteria and all nurses involved in direct patient care working in the EDs were encouraged to participate.

The sample size was estimated using G-Power 3.1 [16], with α = 0.05, effect size = 0.15, power= 0.80, and a number of predictors= 12 for linear multiple regression. The smallest required sample size was 127. A total of 190 questionnaires were distributed considering the elimination rate and insufficient response among the conveniently selected five hospitals. Of these, 161 questionnaires were used in the analysis as valid data.

2.3. Data collection

The data were collected from November 10–26, 2020. The researcher visited the five hospitals that were designated for treating COVID-19 patients, explained the purpose of this study to each hospital's nursing department, and asked for permission to collect data. A public announcement to recruit participants was posted in the EDs break rooms. It was explained that it should take about 20 min to complete the questionnaire. Participants who voluntarily agreed to participate in the study filled out the questionnaire placed at designated places, sealed them in envelopes, and placed them back at the same designated places for the researcher to collect them later.

A total of 190 questionnaires were distributed; 170 questionnaires were recovered and nine incomplete questionnaires were excluded. Therefore, 161 questionnaires were used in the final analysis.

2.4. Ethical considerations

The Institutional Review Board of the University Hospital Bioethics Committee approved this study (no. 20–2020–244). Participants' anonymity and confidentiality were assured, and they could withdraw consent at any time without penalty.

2.5. Measurements

The questionnaire consisted of one demographic section and four measuring variables sections, the total number of items is 79 items: (a) Demographic section (10 items) (b) Infection control practices related to COVID-19 (16 items), (c) Knowledge about COVID-19 (25 items), (d) Health beliefs related to COVID-19 (17 items), and (e) Infection prevention environment related to COVID-19 (11 items). The tools developed by researchers were tested for feasibility and reliability. The validation of the tool was conducted in two phases. The first content validity index (CVI) was rated by Expert Panel I (a professor and physician of respiratory medicine, an emergency medicine physician, an infection control specialist, and two nursing professors) with expertise in infection control and nursing to check whether the content of items is correct. The second CVI was rated by Expert Panel II (a doctor of nursing, a head nurse, and two nurses who have more than 15 years of clinical practice experience and are currently working in a hospital) to evaluate whether the content is comprehensible and applicable to nurses.

2.5.1. Infection control practices related to COVID-19

A COVID-19 Infection control practice scale was developed by the researcher through a literature review and was based on the World Health Organization's guidelines [17] and the Infection Prevention Management for Healthcare Workers from the COVID-19 Response Guideline provided by the Korea Centers for Disease and Prevention [18]. The first version of the scale consisted of 16 items, and its first CVI was rated by expert panel I. One item was revised based on expert opinion, the second CVI was rated by expert II. The CVI of all items was above 0.8, and the questionnaire comprised a total of 16 questions. A high score indicated a high level of COVID-19-related infection control practices. Each item was answered on a 5-point scale that ranged from 1 (*never do*) to 5 (*always do*). The reliability (Cronbach α) of the scale was.83.

2.5.2. Knowledge about COVID-19

The knowledge about COVID-19 scale was developed by the researcher through a literature review [17,18]. The first version of the scale contained 29 items. Its first CVI was rated by expert panel I, and four items with 1 or 2 points were removed. The second CVI was rated by expert panel II, resulting in a CVI of 0.75 for four items. However, the literature review conducted by this researcher caused them to deem these items necessary for measuring knowledge about COVID-19 treatment and specimen management, and hence, they decided to retain them.

A high score indicated a high level of knowledge. A correct answer was given 1 point and an incorrect answer or "don't know" response was given 0 points. The final CVI of the scale was.95, and its reliability (Kuder-Richardson 20) was.65.

2.5.3. Health beliefs related to COVID-19

Health beliefs related to COVID-19 were measured using a tool developed by Erkin and Özsoy [19], which was translated into Korean, revised by Kim and Cha [20], and then adapted by a researcher for application during COVID-19. The first version of the scale consisted of 23 items, its first CVI was rated by expert panel I, and six items with 1 or 2 points were removed. The second CVI was rated by expert panel II, resulting in a CVI of above 0.8 and 17 questions being retained in the questionnaire.

The health beliefs related to COVID-19 tool was composed of 17 items: four for perceived susceptibility, three for perceived severity, three for perceived benefits, four for perceived barriers, and three for cues to action. Perceived susceptibility is defined as an individual's awareness of the risk of acquiring an infectious disease. Perceived severity is a concept in which the possibility of performing infection control varies depending on how fatal an individual perceives a specific disease to be. Perceived benefits are recognition of the benefits of performing COVID-19-related infection control practices, perceived barriers are estimation of the obstacles that can occur when performing infection control practices, and cues to action refer to action-inducing factors for performing COVID-19-related infection control practices.

Each item was rated on a 5-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). A high score indicates that the respondent has a high level of health beliefs. In a previous study by Erkin and Özsoy [19], the CVI was found to be 0.92, and the scale's reliability (Cronbach α) was.91. In this study, the final CVI of the scale was 1.0. The reliability (Cronbach α) perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action were.84,.71,.79,.82,.70, respectively.

2.5.4. Infection prevention environmental-related to COVID-19

The infection prevention environment related to COVID-19 scale was developed by Han [21], and revised by Ahn et al. [22]. It has 11 items that are answered on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A high score indicates a satisfactory COVID-19-related infection prevention environment. In a previous study conducted by Ahn et al. [22], the CVI of the questionnaire was above.80, and its reliability (Cronbach α) was.85. In this study, the Cronbach α of the scale was.79.

2.6. Data analysis

The data were collected and analyzed using IBM SPSS for Windows, version 21.0 (IBM Corp., Armonk, NY, USA), and the normal distribution of the main variables was confirmed before analysis. The participants' general characteristics, COVID-19-related infection control practices, knowledge about COVID-19, health beliefs related to COVID-19, and COVID-19-related infection prevention environment were analyzed using frequencies, percentages, means, and standard deviations. The scale reliability was assessed using Cronbach's α and Kuder-Richardson Formula 20. Differences in COVID-19-related infection control practices according to the general characteristics were examined using independent t-tests, and analysis of variance. Correlations were calculated using Pearson's correlation test. Multiple regression analysis was performed using the enter method in order to identify the factors that influence COVID-19-related infection control practices.

3. Results

3.1. Participant characteristics

Most participants were 21–30 years old (69.6%, n = 112) and 78.9% (n = 127) were female. The majority (91.3%, n = 147) had associate degrees and bachelor's degrees, most (56.5%, n = 91) had a total clinical career of 1–5 years, and the majority (55.9%, n = 90) had an ED career of 1–5 years. Of the participants, 94.4% (n = 152) had cared for suspected or confirmed patients with COVID-19%, and 89.5% (n = 144) had received COVID-19 education. It was found that 62.7% (n = 101) of the participants had been educated about emerging infectious diseases. Of the participants, 85.7% (n = 138) had been monitored for wearing PPE in preparation for COVID-19%, and 88.8% (n = 143) answered that the most effective COVID-19 infection control education method was a combination of theory and practice (Table 1).

Table 1
Participant characteristics (*N* = 161).

Variables	Characteristics	n	%
Gender	Female	127	78.9
	Male	34	21.1
Age (years)	21 – 30	112	69.6
	31 – 40	41	25.5
	≥ 14	8	4.9
Education level	ADN and BSN	147	91.3
	≥ MSN	14	8.7
Clinical careers (years)	> 1	17	10.6
	1–5	91	56.5
	6–10	34	21.1
	> 10	19	11.8
Clinical careers in ED (years)	> 1	25	15.5
	1–5	90	55.9
	6–10	34	21.1
	> 10	12	7.5
Experience in caring for COVID-19-infected or suspected patients	Yes	152	94.4
	No	9	5.6
Received COVID-19 education	Yes	144	89.5
	No	17	10.5
Received emerging infectious diseases education	Yes	101	62.7
	No	60	37.3
PPE monitoring experience	Yes	138	85.7
	No	23	14.3
Most effective COVID-19 education methods	Theory lecture	3	1.9
	Theory and practice	143	88.8
	Online learning	15	9.3

ADN = Associate Degree in Nursing, BSN = Bachelor of Science in Nursing; COVID-19 = Coronavirus Disease 2019; ED = Emergency Department, M=mean; MSN = Master of Science in Nursing; SD: Standard Deviation; PPE = Personal Protective Equipment.

3.2. Level of infection control practices, knowledge, health beliefs, and infection prevention environment

The participants' mean score for COVID-19-related infection control practices was 4.60 out of 5; for knowledge about COVID-19, 19.53 out of 25; for health beliefs related to COVID-19, 3.96 out of 5; for perceived susceptibility related to COVID-19, 4.37 out of 5; for perceived severity related to COVID-19, 4.16 out of 5; for perceived benefit related to COVID-19, 4.48 out of 5; for perceived barriers related to COVID-19, 3.36 out of 5; for cues to action related to COVID-19, 3.44 out of 5; and for COVID-19-related infection prevention environment, 4.23 out of 5 (Table 2).

3.3. Differences in infection control practice related to COVID-19

The level of COVID-19-related infection control practices was significantly higher in nurses who had received education about emerging infectious diseases and in those who had been monitored for wearing PPE compared to those who had not (Table 3).

Table 2
Level of infection control practices, knowledge, health beliefs, and infection prevention environment related to COVID-19 (*N* = 161).

Variables	Mean (SD)	Observed Range
Knowledge about COVID-19	19.53 (2.21)	0–25
Health beliefs related to COVID-19	3.96 (0.71)	1–5
Perceived susceptibility	4.37 (0.65)	1–5
Perceived Severity	4.16 (0.69)	1–5
Perceived Benefit	4.48 (0.56)	1–5
Perceived barriers	3.36 (0.94)	1–5
Cues to Action	3.44 (0.76)	1–5
Infection prevention environment	4.23 (0.50)	1–5
Infection control practices	4.60 (0.42)	1–5

COVID-19 = Coronavirus Disease 2019; SD = Standard Deviation.

Table 3
Differences in infection control practice related to COVID-19 (N = 161).

			Infection control practice related to COVID-19	
Variables	Characteristics	n	M ± SD	t or F (p)
Gender	Female	127	73.50 (6.89)	0.52 (0.061)
	Male	34	74.18 (6.26)	
Age (years)	21 – 30	112	73.10 (7.09)	2.85 (0.062)
	31 – 40	41	74.12 (5.95)	
	≥ 41	8	78.75 (2.19)	
Education level	ADN and BSN	147	73.65 (6.80)	0.08 (0.942)
	≥ MSN	14	73.50 (6.38)	
Clinical careers (years)	> 1	17	70.35 (9.13)	2.27 (0.081)
	1–5	91	73.44 (6.62)	
	6–10	34	74.68 (6.31)	
	> 10	19	75.68 (4.64)	
Clinical careers in ED (years)	> 1	25	75.68 (4.64)	1.07 (0.362)
	1–5	90	73.37 (6.59)	
	6–10	34	74.71 (6.43)	
	> 10	12	75.67 (4.60)	
Experience in caring for COVID-19-infected or suspected patients	Yes	152	73.53 (6.82)	0.83 (0.411)
	No	9	75.44 (5.43)	
Received COVID-19 education	Yes	144	73.67 (6.87)	0.14 (0.883)
	No	17	73.41 (5.80)	
Received emerging infectious diseases education	Yes	101	74.70 (6.48)	-2.64 (0.009)*
	No	60	71.85 (6.86)	
PPE monitoring experience	Yes	138	74.27 (6.66)	-2.96 (0.004)*
	No	23	69.87 (6.15)	
Most effective COVID-19 education methods	Theory lecture	3	76.00 (3.46)	0.19 (0.831)
	Theory and practice	143	73.60 (6.76)	
	Online learning	15	73.53 (7.32)	

ADN = Associate Degree in Nursing, BSN = Bachelor of Science in Nursing; COVID-19 = Coronavirus disease 2019; ED = Emergency Departments; M=mean; MSN = Master of Science in Nursing; SD: standard deviation; PPE = Personal Protective Equipment.
* $P < .01$

3.4. Correlation among the main variables

COVID-19-related infection control practices were significantly correlated with knowledge, perceived severity, perceived benefit, perceived barriers, and the COVID-19-related infection prevention environment ($p < .05$) (Table 4).

3.5. Factors influencing COVID-19-related infection control practices

To confirm the factors influencing emergency nurses' infection control practice related to COVID-19, a regression analysis was performed. Independent variables were education experience related to emerging infectious diseases and PPE monitoring experience, which showed a significant difference in general characteristics. In addition, knowledge, perceived severity, perceived benefits, perceived barriers, and infection prevention environment that were significantly correlated with infection control practices, were included. COVID-19-related infection prevention environment was the biggest influencing factor for COVID-19-related infection control practices, with the level of COVID-19-related infection control practices being higher when the infection prevention environment was good. In addition, a high level of knowledge about COVID-19, high perceived severity, low perceived barriers and being monitored when wearing PPE increased COVID-19-related infection control practices. These variables explained 29.6% of the variance in COVID-19-related infection control practices. Furthermore, the Durbin– Watson statistic was 1.985 in the error autocorrelation test for the regression analysis, which indicated that there was no autocorrelation. The tolerance for testing the multicollinearity was higher than 0.1, and the variance inflation factor was 1.01–1.30, which was lower than the reference level of 10. Thus, there was no multicollinearity problem (Table 5).

4. Discussion

This study aimed to identify the factors influencing emergency nurses' COVID-19-related infection control practices. We found that infection prevention environment, PPE monitoring, knowledge about COVID-19, perceived severity, and perceived barriers related to COVID-19 are influencing factors in improving COVID-19-related infection control practices.

COVID-19-related infection control practice score was 4.60 out of 5 in this study. However, it is difficult to accurately compare this result with that of other studies because of differences in disease and

Table 4
Correlations among the main variables (N = 161).

Variable	1	2	3	4	5	6	7	8
1. Knowledge	1.00							
2. Perceived susceptibility	-0.07	1.00						
3. Perceived severity	.00	.19*	1.00					
4. Perceived benefit	.12	.28***	.25*	1.00				
5. Perceived barriers	-0.10	.32*	-0.01	-0.02	1.00			
6. Cues to Action	.13	-0.01	.17*	.11	.04	1.00		
7. Infection prevention environment	.21**	.01	.13	.30***	-.33***	.21**	1.00	
8. Infection control practices	.29***	-.05	.26**	.25**	-.27***	.14	.41***	1.0

* $P < .05$,
** $P < .01$,
*** $P < .001$

Table 5
Linear Regression analysis for influencing infection control practices related to COVID-19 (N = 161).

Variables	*B*	*SE*	β	*t*	*p*	VIF
Constant	37.63	6.41		5.87	< 0.001	
Education experience related to emerging infectious diseases	1.16	0.96	.08	1.20	.229	1.08
PPE monitoring	3.58	1.28	.19	2.79	.006**	1.01
Knowledge about COVID-19	0.56	0.21	.18	2.66	.009**	1.07
Perceived severity	0.48	0.18	.18	2.61	.010 *	1.10
Perceived benefit	0.42	0.29	.10	1.42	.157	1.18
Perceived barriers	-0.27	0.13	-0.15	2.15	.033 *	1.12
Infection prevention environment	0.29	0.09	.24	3.21	.002**	1.30

R^2 = .327, Adjusted R^2 = .296, F= 10.61, p < .001
COVID-19 = Coronavirus disease 2019; PPE = Personal Protective Equipment.
* P < .05, * * P < .01

measuring tools. Previous studies reported nurses' MERS-CoV infection control practice score to be 3.34 out of 4 [8], and their influenza infection control practice score to be 3.33 out of 4 [9]. These results are lower than the score of the emergency nurses' COVID-19-related infection control practices. This may be due to the emphasis on the importance of infection control and reinforcement of education after the MERS-CoV outbreak in Korea. However, one study found better performance in wearing PPE when working in the influenza ward than in the ED [23], and another showed that the outpatient nurses' infection control practice score was higher than that of emergency nurses during the H1N1 influenza outbreak [24]. Thus, in the future, it will be necessary to evaluate the practice of infection control in other departments using the same tool.

The level of COVID-19-related infection control practices was significantly higher among emergency nurses who received education about emerging infectious diseases. This result is similar to a study in which nurses who had received influenza-related education had a high degree of infection control [9]. Although education about emerging infectious diseases was not shown to be a factor that influenced COVID-19-related infection control practices for emergency nurses in this study, it may have had an indirect effect on these infection control practices. Therefore, hospital administrators should strive to improve infection control practices by providing education about emerging infectious diseases for emergency nurses.

In addition, the level of COVID-19-related infection control practices in this study was significantly higher in emergency nurses whose PPE use was monitored and was a factor that affected their infection control practices. Hu et all [25] also reported that monitoring of compliance by supervisors is related to high compliance. This result suggests that repeated training and monitoring play an important role in increasing compliance with PPE use. However, in a simulation experiment that examined the PPE use of medical personnel, many cases of contamination were identified, despite the possibility that participants were aware that they were being filmed and being paid more attention [26]. It seems that the monitoring method should be applied when considering various ways of increasing the participant's practice and that a specific and practical method should be employed that takes into account the monitoring application method, timing, and characteristics of the participant.

By analyzing the factors that influence emergency nurses' COVID-19-related infection control practices, this study confirmed that the infection prevention environment was the most important variable and that it was correlated with COVID-19-related infection control practices. Previous studies also showed that a safety climate was significantly associated with a higher level of infection control practices [15,25]. Previous research reported, emergency nurses experiencing difficulties nursing patients due to a lack of hospital resources during the outbreak of emerging infectious diseases [4,5]. Thus, hospital administrators should make an effort to establish hospital facilities, secure supplies, manage the environment, and provide clear guidelines for staff management in order to improve COVID-19 related infection control practices among emergency nurses.

Knowledge about COVID-19 was found to be another factor that influenced COVID-19-related infection control practices, and the result is similar to that of other studies [9,11]. Incorrect knowledge about infection control affects practice, which can delay diagnosis, make it difficult to control infection, and lead to the spread of the disease [27]. Therefore, knowledge is important for improving infection control practice against emerging infectious diseases, such as COVID-19, and it is necessary to check the new guidelines, periodically revise and supplemented the educational content, and provide specific and practical educational programs.

Among the health beliefs, perceived severity and perceived barriers were identified as factors that influence infection control practice. Consistent with this result, Lau et al. [28] found that those who perceived high mortality rates in infected patients during the H1N1 outbreak were more likely to regularly wear a face mask than those who did not. The current study's finding is due to the emergency nurses' awareness of the severity of the current situation of increasing infectious diseases and deaths caused by COVID-19. Therefore, specific data should be provided in the educational program, such as the incidence, mortality, and fatality rate of emerging infectious diseases. The lower the perceived barrier, the higher the level of infection control practices. Among the perceived barrier, the item with the highest score was "I think wearing personal protective equipment causes physical discomfort." The factors that make infection control difficult and the emergency nurses' negative perceptions are associated with the inconvenience caused by using PPE. Other studies have mentioned that the discomfort of wearing PPE is a barrier to infection control practice [29,30]. Thus, policy support is essential to expanding the various approaches, and it is necessary to increase the rate of wearing PPE.

This study has several limitations. First, its results cannot be generalized to all nurses, as the respondents were selected using convenience sampling from emergency nurses in tertiary and general hospitals during the outbreak of COVID-19 in Korea. Therefore, in the future, large-scale studies should be conducted. Second, this study cannot eliminate the possibility of response bias owing to respondents' social desirability while completing the questionnaire survey. Third, we developed a new tool for this study because of a lack of a standardized scale designed to measure infection control practices, and knowledge related to COVID-19; the knowledge tool, however, suffered from a low reliability of.65. Fourth, the health beliefs scale was adapted for COVID-19, and its content validity was verified. However, a potential limitation may be the limited cultural and linguistic equivalency between the original and the adapted scale. Further, the process of changing and removing items may have also affected the validation of the latter instrument. Finally, the model only accounted for 29.6% of the variance. There might be various other factors affecting infection control practice related to COVID-19; however, this study could not include all confounding variables. Therefore, the study's findings should be interpreted with caution.

5. Conclusion

This study aimed to understand the COVID-19-related infection control practices of emergency nurses who have frontline contact with patients, in the context of the virus's outbreak in Korea, and to identify the factors that affect their infection control practices. The findings indicate that the participants' COVID-19-related infection control practices were most affected by the infection prevention environment. Accordingly, an appropriate hospital environment

should be created for emergency nurses to respond to infectious diseases, and the government and hospitals need to provide support facilities and secure supplies such as PPE. The second factor influencing emergency nurses' infection control practices was PPE monitoring. The result suggests that it is essential to reinforce PPE monitoring by considering various methods. Moreover, it is important to supply practical and specific infection control training programs to improve knowledge about COVID-19. Lastly, nurse managers should formulate strategies to remove nurses' the obstacles experienced while carrying out infection control, reduce their perceived barriers, and provide them with timely information about the degree of risk of COVID-19 so that they can recognize the perceived severity. Particularly in the field of emergency nursing, it is vital to develop effective and systematic infection control practice programs in preparation for possible future outbreaks of emerging infectious diseases.

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CRediT authorship contribution statement

Sang Ok Kim: Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft, Writing - review & editing. **Kon Hee Kim:** Conceptualization, Supervision, Writing - review & editing, Project administration.

Provenance and conflict of interests

The authors declare that there is no conflict of interest.

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