

RESEARCH ARTICLE

Patient safety awareness, knowledge and attitude about fire risk assessment during time-out among perioperative nurses in Korea

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Abstract

Aim: This study aims to investigate the relationship between patient safety awareness, knowledge (risk-Knowledge) and attitude about fire risk assessment during time-out (risk-Attitude) of perioperative nurses.

Design: A cross-sectional study.

Methods: Perioperative nurses ($N = 158$) from 22 small- and medium-sized hospitals participated in the study. Participants' characteristics, knowledge and attitude about fire risk assessment were investigated using structured questionnaires.

Results: Patient safety awareness, risk-Knowledge and risk-Attitude scores were high among nurses who received frequent patient safety education or fire preparedness training, while patient safety awareness partially mediated the effect of risk-Knowledge on risk-Attitude. To increase perioperative nurses' risk-Attitude, it would be effective to increase not only their risk-Knowledge but also overall patient safety awareness.

KEYWORDS

attitude, knowledge, nurses, patient safety, risk assessment

1 | INTRODUCTION

With the recent advances in surgery due to developments in medicine, science and technology, the use of complex and enhanced equipment has improved patient care and safety. However, the use of excess anaesthetic gas, radiation, electrical and electronic equipment in the operating room, and the risk of infection and drug addiction are increasing, threatening the safety of patients and perioperative healthcare workers (Hey & Turner, 2016; Edozien, 2005). Therefore, it is ideal that perioperative nurses be sensitive to environmental factors along with awareness of patient safety and carry out preventive activities by acquiring updated knowledge of patient safety risk factors.

Concerning patients' safety, risk assessment behaviours and accident types have been identified by looking at human factors (e.g. communication and behaviour according to the patient's situation; Carbral et al., 2016), system factors (e.g. work environment; Edozien, 2005; Kim et al., 2018), contributing factors (e.g. organizational control, external factors of policies; El-Jardali et al., 2011; Park et al., 2016) and problem factors (Park & Kim, 2019; Vaismoradi et al., 2020). Further, the importance of human factors has also been identified (The World Alliance for Patient Safety Drafting Group et al., 2009). It has been found that nurses' human and occupational factors and organizational support, safety-related knowledge and awareness, and patient safety culture can all affect the nurse's operation or patient safety management activities related to invasive procedures (Park & Kim, 2019).

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In preoperative patient safety, "fire safety" can be promptly addressed and prevented by regularly assessing and checking risk factors (Jones et al., 2019). Perioperative nurses also perform "time-out" before anaesthesia inductions, skin incisions or before leaving the operating room. In addition to checking the operation site and the patient, they prepare surgical equipment, supplies and gas, check the electric cautery machine during surgery and assess the risks associated with oxygen and oxidizing agents (Coletto et al., 2018; Hey & Turner, 2016). A standardized and comprehensive "time-out" procedure can improve communication between surgical teams and safety culture. To promote the safety of patients and preoperative healthcare workers, the World Health Organization (WHO, 2009) recommends the use of a surgical safety checklist to check the patient's condition and the surgical site, anaesthesia equipment and drugs before induction of anaesthesia; the patient's name, the procedure, role of the surgical team, predicted crisis situation and the images before skin incision; and, ultimately, the instruments, supplies and patient's condition before leaving the operating room (Carbral et al., 2016). The Association of Perioperative Registered Nurses (AORN) encourages staff to use the AORN fire safety tool kit for fire prevention assessment to promote fire prevention during surgery, plan effective strategies and protect patients and medical staff (AORN, n.d.). Such fire risk assessment and early detection can prevent or reduce risk problems (The World Alliance for Patient Safety Drafting Group et al., 2009).

As of 2021, about 96.0% of all 3,222 hospitals in South Korea are small- and medium-sized general hospitals, which are constituted in the form of general hospitals focusing on their specialized fields, specialized hospitals and nursing hospitals (Korean Hospital Association, 2021). In Korea, what constitutes a small- or medium-sized hospital has not specifically been defined under the Medical Act, but generally, these refer to hospitals with less than 300 beds and have less hospital-based infrastructure and lower healthcare accreditation levels than larger hospitals (Korea Institute for Healthcare Accreditation, 2018). The Ministry of Health and Welfare of South Korea has reinforced regulations on firefighting, infection prevention and patient safety for hospital facilities and stipulates "time-out in the operating room" as an essential item for the evaluation of medical institutions (Korea Institute for Healthcare Accreditation, 2018). Nevertheless, it has been reported that this is not observed in some small- and medium-sized hospital operating rooms (Kim et al., 2021; Park et al., 2016).

Perioperative nurses who lack knowledge of fire hazards may overlook high-risk situations, which may lead to directly injuring patients (Catalano, 2008; Coletto et al., 2018). To prevent fire accidents, it is necessary to investigate and understand the risks and have an active attitude towards fire prevention activities. In a previous study, perioperative nurses in the United States had relatively high knowledge of the standard guidelines for fire risk assessment and performance methods as well as a positive attitude towards implementing the fire risk assessment method and investing in the time required for the process (Coletto et al., 2018). According to another study, the higher the worker's awareness of their working environment, the manager's interest and the sense of responsibility

for safety, the more knowledge is pursued by recognizing the risk of the situation, thereby increasing safety management activities (Bluff, 2011). Hao et al. (2020) reported that patient safety awareness was high when organizational education was received. Meanwhile, Kishiki et al. (2019) reported that critical action assessment scores such as those for fire risk assessment and fire awareness increased after receiving fire management simulation training in the operating room, and knowledge of fire risk assessment was maintained even after three to six months. Tola and Grailing (2018) reported that surgical fire management capabilities and prevention activities of perioperative nurses improved after training on fire risk assessment during a time-out. This suggests that knowledge and positive attitudes about fire risk assessment serve as a driving force for improving fire safety activities.

Several studies have reported on patient safety awareness, attitudes and activities among nurses at small- and medium-sized hospitals, but there have been insufficient reports on fire safety. Therefore, this study aimed to prepare basic data for a plan to improve the fire safety activities of perioperative nurses by understanding the relationship between patient safety awareness, knowledge about fire risk assessment during a time-out (hereinafter risk-Knowledge) and attitude about fire risk assessment during a time-out (hereinafter risk-Attitude) among perioperative nurses at small- and medium-sized hospitals in South Korea.

2 | METHODS

2.1 | Study design

This study is a cross-sectional descriptive survey, conducted to understand the relationship between patient safety awareness, risk-Knowledge and risk-Attitude of perioperative nurses at small- and medium-sized hospitals.

2.2 | Participants

Perioperative nurses working at 22 small- and medium-sized hospitals (with 100 to 300 beds) in South Korea participated in this study. Perioperative nurses included circulating nurses, scrub nurses and nurse anaesthetists working in the operating room. Nurses with more than three months of experience working in the operating room were included; nurses who were in charge of administrative tasks and did not directly perform patient care were excluded. Questionnaires were distributed to 180 participants taking the potential dropout rate into consideration; 158 participants were finally selected for this study, excluding 22 participants with incomplete information. The minimum number of participants required for regression analysis calculated using the G-Power 3.1.7 program was at least 153 for an effect size of 0.15 (Kim et al., 2018), a significance level of 0.05, and a power of 0.95, and 10 to the number of variables in our regression analysis; therefore, our sample size was sufficient.

2.3 | Ethical considerations

Following ethical guidelines, this study was conducted after obtaining approval from the relevant institutional review board of the affiliated university. When collecting data, the purpose of the study was explained to the participants, along with the fact that the collected data would only be used for the study and that there would be no disadvantages if they were to withdraw from the study. All data and information given were anonymized and used only for the purposes of this study.

2.4 | Measures

2.4.1 | General characteristics

A total of 10 items about the participants' general characteristics were used in the survey: gender, age, marital status, level of education, clinical experience, preoperative experience, position, experience in healthcare accreditation, number of patient safety training sessions attended within a year and number of fire evacuation drills participated in.

2.4.2 | Patient safety awareness

Patient safety awareness was measured with a tool modified for this study based on the "Hospital Survey on Patient Safety Culture" developed by the Agency for Healthcare Research and Quality (2004) in the United States to suit the operating room setup of small- and medium-sized hospitals in South Korea. In this study, to understand the patient safety awareness of operating room nurses, items such as patient safety evaluation, frequency of error reporting and the number of accident reports were excluded from the measurement tool. For the revised tool, there were a total of five sub-areas and 30 items. The validity of the revised tool was assessed by two nursing professors, as well as two perioperative nurses with more than 10 years of experience; 25 items with a content validity index (CVI) of 0.8 or higher were selected for the final tool.

This tool consisted of items in the domains of hospital environment (4 items), working environment in the unit (11 items), communication and procedures (5 items), the attitude of direct supervisor and manager (4 items) and patient safety in the unit (1 item). Each question was assessed using a 5-point Likert scale with responses ranging from 1 point for "strongly disagree/very low" to 5 points for "strongly agree/very high"; the higher the score, the higher the level of patient safety awareness. In this study, Cronbach's α was 0.93 (0.72 to 0.86).

2.4.3 | Risk-knowledge and risk-attitude

The tool used to measure the knowledge and attitudes about fire risk assessment during time-out was developed by Upton and Upton

(2006) and modified by Coletto et al. (2018) and was translated into Korean for this study. The original English text was submitted to a specialized translation agency for initial translation. Content validity was assessed by two nursing college professors, one perioperative head nurse and one quality assurance manager; subsequently, only simple linking words were modified to convey a clear meaning. During a pilot survey conducted among 10 perioperative nurses, Cronbach's α was 0.91 for risk-Knowledge and 0.80 for risk-Attitude. Risk-Knowledge encompassed 12 items using a 5-point Likert scale (ranging from 1 point for "strongly disagree/very low" to 5 points for "strongly agree/very high"), and the higher the score, the higher the knowledge about the fire risk assessment during the time-out. Risk-Attitude encompassed five items using a 5-point Likert scale (ranging from 1 point for "strongly disagree/very low" to 5 points for "strongly agree/very high"), and the higher the score, the more positive the attitude about the fire risk assessment during the time-out. In the study by Coletto et al. (2018), Cronbach's α was 0.896 for both risk-Knowledge and risk-Attitude; in this study, Cronbach's α was 0.96 for risk-Knowledge and 0.81 for risk-Attitude.

2.5 | Data collection

Data collection for this study was carried out from July 2018 to December 2018. The data were collected after explaining the purpose and methods of the study to the head of the nursing department at each participating hospital and obtaining permission. The questionnaires were handed to nurses in person; they were distributed in individual envelopes to ensure confidentiality of the participants and then were collected by the researcher through mail sealed in individual envelopes. The time required to complete the questionnaire was about 20 min, and a reward was given to the participants who answered the questionnaire.

2.6 | Data analysis

The collected data were analysed using SPSS 25.0. General characteristics and the scores of patient safety awareness, risk-Knowledge and risk-Attitude were assessed in terms of frequency, percentage, mean and standard deviation. For the univariate analysis of the variables according to general characteristics, *t*-tests, one-way analysis of variance, posthoc Scheffe test and Pearson's correlation coefficients were used. To verify the mediating effect of patient safety perception, a three-step regression analysis was performed, according to Baron and Kenny's procedure (1986). To perform multiple regression, we checked whether our data satisfied the basic assumptions of regression—that is, a normal distribution of residuals, linearity, homogeneity of variance and multicollinearity. To this end, we examined a normal p-p plot of residuals, scatter plot, tolerance, and the variance inflation factor (VIF). Residuals were close to the 45-degree line and demonstrated normal distribution, while the scatter plot of residuals was evenly distributed around 0. Autocorrelation of error

was examined using Durbin–Watson coefficients. The values were close to 2, at 1.82–1.89, confirming the absence of autocorrelation. Meanwhile, tolerance was above 0.1, at 0.94–0.98, and the VIF was below 10, at 1.01–1.12, confirming the absence of multicollinearity. The significance of the mediating effect was verified using the Sobel test.

3 | RESULTS

3.1 | General characteristics, patient safety awareness, risk-Knowledge and risk-Attitude of participants

A total of 158 nurses participated in this study; their general characteristics are presented in Table 1. The average patient safety awareness score nurses obtained was 3.60 ± 0.44 points (out of a possible of 5 points). Their average risk-Knowledge score was 2.72 ± 0.70 points (out of a possible of 5 points), and their average risk-Attitude score was 3.36 ± 0.54 points (out of a possible of 5 points; Table 2).

3.2 | Relationship of variables according to general characteristics

There were significant differences in patient safety awareness according to age ($p = .012$), the number of patient safety training received ($p = .008$) and the number of evacuation drills received ($p = .002$), as shown in Table 1. There was a significant difference in risk-Attitude according to the number of patient safety training received ($p = .025$) and risk-Knowledge according to the number of evacuation drills received ($p = .011$), as shown in Table 3. As a result of examining the correlations, patient safety awareness was positively correlated with risk-Knowledge ($r = .25$, $p = .002$) or risk-Attitude ($r = .36$, $p < .001$), and risk-Knowledge had a positive correlation with risk-Attitude ($r = .30$, $p < .001$).

3.3 | Mediating effect of patient safety perception in the relationship between risk-Knowledge and risk-Attitude

The mediating effect was verified using the three-step regression analysis of Baron and Kenny (1986). As a result of testing the effect of the independent variable on the parameter in step 1, the independent variable, risk-Knowledge, had a significant effect on the patient safety awareness parameter, while controlling the number of patient safety training received. In other words, the higher the risk-Knowledge score of the perioperative nurses, the higher their patient safety awareness ($\beta = 0.23$, $p = .003$, $R^2 = 0.11$). As a result of analysing the effect of the independent variable on the dependent variable in step 2, the independent variable, risk-Knowledge, had a significant effect on the dependent variable, risk-Attitude. In other

TABLE 1 Differences in patient safety perception according to general characteristics ($N = 158$)

Characteristics	Total n (%)	Patient safety awareness	
		M \pm SD	t/F (p)
Age (year), Mean \pm SD	35.6 \pm 8.7		
≤29	52 (32.9)	3.62 \pm 0.46	4.57 (.012)
30–39(a)	54 (34.2)	3.46 \pm 0.43	a < b
≥40(b)	52 (32.9)	3.71 \pm 0.40	
Gender			
Women	133 (84.2)	3.61 \pm 0.43	0.67 (.505)
Men	25 (15.8)	3.54 \pm 0.49	
Marital status			
Unmarried	68 (43.0)	3.57 \pm 0.48	−0.58 (.561)
Married	90 (57.0)	3.61 \pm 0.41	
Education			
3-year graduation	63 (39.9)	3.54 \pm 0.44	2.90 (.058)
4-year graduation	78 (49.3)	3.59 \pm 0.43	
Graduate school or higher	17 (10.8)	3.82 \pm 0.44	
Clinical experience (month)			
4–24	25 (15.8)	3.58 \pm 0.48	2.57 (.057)
24–59	26 (16.5)	3.70 \pm 0.44	
60–119	25 (15.8)	3.39 \pm 0.39	
≥120	82 (51.9)	3.63 \pm 0.43	
Perioperative experience (month)			
4–24	37 (23.4)	3.64 \pm 0.47	0.71 (.546)
24–59	30 (19.0)	3.58 \pm 0.46	
60–119	39 (24.7)	3.51 \pm 0.41	
≥120	52 (32.9)	3.63 \pm 0.43	
Position			
Staff nurse	122 (77.2)	3.56 \pm 0.44	−0.92 (.057)
Head nurse	36 (22.8)	3.72 \pm 0.43	
Experience in healthcare accreditation			
Yes	128 (81.0)	3.60 \pm 0.44	0.02 (.980)
No	30 (19.0)	3.59 \pm 0.43	
Number of patient safety training received			
0(a)	12 (7.8)	3.28 \pm 0.41	4.07 (.008)
1	65 (41.0)	3.53 \pm 0.43	a < b
2(b)	51 (32.2)	3.70 \pm 0.42	
≥3	30 (19.0)	3.68 \pm 0.44	
Number of fire evacuation drills received			
0(c)	11 (7.0)	3.21 \pm 0.44	6.79 (.002)
1(d)	78 (49.4)	3.56 \pm 0.44	c < d, e
≥2(e)	69 (43.6)	3.70 \pm 0.41	

Note: a, b, c, d, e: Scheffe test.

words, the higher the risk-Knowledge score of the perioperative nurses, the more positive their risk-Attitude was ($\beta = 0.29$, $p < .001$, $R^2 = 0.10$). As a result of simultaneously analysing the effect of the

TABLE 2 Knowledge and attitude about fire risk assessment during time-out, and patient safety awareness (N = 158)

Variables	Mean \pm SD	Median	Range
Patient safety awareness	3.60 \pm 0.44	3.64	2.56–4.68
Hospital environment	3.81 \pm 0.58	4.00	2.00–5.00
Working environment in the unit	3.47 \pm 0.47	3.45	2.36–4.55
Communication and procedures	3.71 \pm 0.56	3.80	2.20–5.00
Attitude of direct supervisor and manager	3.57 \pm 0.53	3.50	2.25–5.00
Patient safety in the unit	3.66 \pm 0.68	4.00	2.00–5.00
Knowledge about fire risk assessment during time-out	2.72 \pm 0.70	2.83	1.00 \pm 4.33
Attitude about fire risk assessment during time-out	3.36 \pm 0.54	3.40	1.60–4.80

independent variable and the parameter on the dependent variable in step 3, patient safety awareness had a significant effect on the dependent variable, risk-Attitude ($\beta = 0.29$, $p < .001$, $R^2 = 0.18$), indicating a mediating effect. The independent variable, risk-Knowledge, also had a significant effect on the dependent variable, risk-Attitude ($\beta = 0.23$, $p = .003$), indicating that the effect of risk-Knowledge on risk-Attitude was partially mediated by patient safety awareness. The results of the Sobel test showed that the mediating effect size of patient safety awareness was significant ($Z = 2.37$, $p = .018$; Table 4, Figure 1).

4 | DISCUSSION

This study aimed to investigate the relationship between patient safety awareness, knowledge and attitudes about fire risk assessment in perioperative nurses at small- and medium-sized hospitals in South Korea. The findings show that perioperative nurses at small- and medium-sized hospitals in South Korea had lower patient safety awareness in terms of the “attitude of direct supervisor and manager” and the “working environment in the unit” compared to the “hospital environment.” These results are in line with a previous study conducted in South Korea (Park et al., 2016). The safety activities in the hospital environment, which all members of the department must perform, are considered important as they can affect the performance of nursing managers and departments and their performance evaluation (Kieft et al., 2014). However, safety in the department is relatively neglected. Specific treatment and nursing work are performed in each department, and safety awareness about the unit's working environment is closely associated with patient safety. It was found that the patient safety awareness was higher when associated with the department manager's high level of expectations, departmental teamwork and communication and feedback on errors (El-Jardali et al., 2011); therefore, it would be necessary to motivate active leadership of nursing managers to promote patient safety in the operating room. It has also been reported that nurses' safety awareness on patient safety culture influenced patient safety management activities (Farokhzadian et al., 2018; Park & Kim, 2019); therefore, it is urgent to improve nurses' awareness of safety activities in perioperative nursing work.

In this study, nurses aged 40 years or older had higher patient safety awareness than those in their 30s, similar to the result reporting that the higher the age of healthcare workers, the higher the patient safety awareness (Hao et al., 2020). Older nurses tend to have had more practical experiences related to patient safety (Elsous et al., 2017) and more opportunities to acquire safety knowledge (Biresaw et al., 2020). In addition, the nurses who regularly participated in patient safety or fire preparedness training within a year had higher patient safety awareness than those who did not. This suggests that continuous and systematic education at the hospital level is important for improving patient safety awareness (Lee & Dahinten, 2020) among nurses. In a previous study, perioperative nurses said that it was occasionally bothersome to perform a time-out for patient safety or to receive patient safety education, but responsibility for patient care and repeated training helped them realize the importance of this knowledge (Blomberg et al., 2018; Park et al., 2016). In this study, risk-Knowledge scores among perioperative nurses at small- and medium-sized hospitals in South Korea were lower than the level of knowledge of perioperative nurse anaesthetists at provincial city hospitals in the United States (Coletto et al., 2018). On the other hand, risk-Attitude scores were slightly lower than in the previous study results (Coletto et al., 2018). This implies that the level of risk-Attitude in perioperative nurses in small- and medium-sized hospitals in South Korea is relatively good, but the level of risk-Knowledge is relatively low, implying that there is an urgent requirement to provide training on risk-Attitude to improve the quality and safety of perioperative nursing.

Similar to patient safety awareness in this study, the levels of risk-Knowledge and risk-Attitude were higher in those who had experience in education or training compared to those who did not. This suggests that repeated education and training in preparation for practice is effective in improving safety knowledge and attitudes. Kishiki et al. (2019) reported that a group of healthcare workers (surgeons, physician assistants, nurse anaesthetists and anaesthesiologists) who participated in simulation training exhibited higher coping capabilities compared to a group of healthcare workers who had only received classroom training on operating room fire management. In addition, Tola and Graling (2018) supported this result by reporting improvements in risk awareness, assessment and

Characteristics	risk-Knowledge		risk-Attitude	
	<i>M</i> ± <i>SD</i>	<i>t/F</i> (<i>p</i>)	<i>M</i> ± <i>SD</i>	<i>t/F</i> (<i>p</i>)
Age (year)				
≤29	2.69 ± 0.64	0.19 (.823)	3.33 ± 0.57	1.67 (.192)
30–39	2.69 ± 0.72		3.29 ± 0.61	
≥40	2.77 ± 0.74		3.47 ± 0.40	
Gender				
Female	2.73 ± 0.70	0.40 (.691)	3.37 ± 0.53	−0.05 (.963)
Male	2.67 ± 0.72		3.36 ± 0.59	
Marital status				
Unmarried	2.79 ± 0.64	1.16 (.250)	3.43 ± 0.56	1.39 (.168)
Married	2.66 ± 0.74		3.31 ± 0.51	
Education				
3-year graduation	2.70 ± 0.69	0.67 (.515)	3.28 ± 0.54	1.29 (.278)
4-year graduation	2.69 ± 0.68		3.41 ± 0.52	
Graduate school or higher	2.90 ± 0.82		3.46 ± 0.58	
Clinical experience (month)				
4–24	2.83 ± 0.76	0.64 (.591)	3.28 ± 0.61	0.63 (.596)
24–59	2.57 ± 0.53		3.43 ± 0.61	
60–119	2.68 ± 0.65		3.28 ± 0.48	
≥120	2.74 ± 0.74		3.40 ± 0.51	
Perioperative experience (month)				
4–24	2.77 ± 0.69	1.44 (.234)	3.34 ± 0.56	0.23 (.878)
24–59	2.48 ± 0.60		3.31 ± 0.59	
60–119	2.78 ± 0.63		3.37 ± 0.51	
≥120	2.77 ± 0.80		3.41 ± 0.52	
Position				
Staff nurse	2.71 ± 0.68	−0.16 (.877)	3.35 ± 0.57	−0.72 (.471)
Head nurse	2.73 ± 0.78		3.41 ± 0.39	
Experience in healthcare accreditation				
Yes	2.71 ± 0.72	−0.18 (.855)	3.38 ± 0.52	0.58 (.562)
No	2.74 ± 0.63		3.31 ± 0.62	
Number of patient safety training received				
0 (a)	2.24 ± 0.47	2.14 (.097)	2.93 ± 0.64	3.22 (.025)
1	2.73 ± 0.68		3.36 ± 0.54	a < b, c
2 (b)	2.78 ± 0.77		3.41 ± 0.53	
≥3 (c)	2.78 ± 0.65		3.47 ± 0.40	
Number of fire evacuation drills received				
0 (d)	2.23 ± 0.72	4.46 (.011)	3.22 ± 0.61	1.41 (.248)
1	2.66 ± 0.69	d < e	3.32 ± 0.56	
≥2 (e)	2.86 ± 0.67		3.44 ± 0.49	

TABLE 3 Differences in knowledge and attitude about fire risk assessment during time-out according to general characteristics (*N* = 158)

Note: a, b, c, d, e: Scheffe test; risk-Knowledge = Knowledge about fire risk assessment during time-out; risk-Attitude = Attitude about fire risk assessment during time-out.

prevention activities for the use of oxidizing agents as a result of providing fire safety training to healthcare workers at an outpatient surgery centre.

In this study, the higher the risk-Knowledge scores of perioperative nurses at small- and medium-sized hospitals, the more positive their risk-Attitude was, indicating that patient safety

TABLE 4 The mediating effect of patient safety awareness ($N = 158$)

Variable	Step 1 risk-Knowledge → Patient safety awareness			Step 2 risk-Knowledge → risk-Attitude			Step 3 risk-Knowledge, Patient safety awareness → risk-Attitude		
	B	β	t (p)	B	β	t (p)	B	β	t (p)
risk-Knowledge	0.14	0.23	3.06 (.003)	0.23	0.29	3.85 (<.001)	0.17	0.23	3.00 (.003)
Patient safety awareness							0.35	0.29	3.74 (<.001)
R^2	0.11			0.10			0.18		
Adjusted R^2	0.09			0.09			0.16		
F (p)	9.17 (<.001)			8.85 (<.001)			11.06 (<.001)		

Note: Adjusted for number of patient safety training received after dummy coding.

risk-Knowledge = Knowledge about fire risk assessment during time-out; risk-Attitude = Attitude about fire risk assessment during time-out; Sobel test was performed to verify the significance of the mediating effects of patient safety awareness ($Z = 2.37, p = .018$).

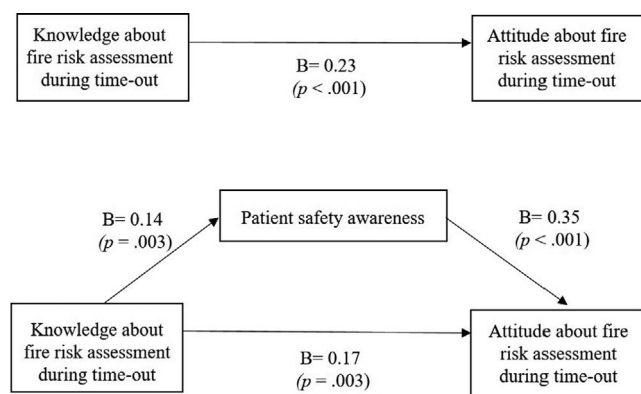


FIGURE 1 Mediating effect of patient safety awareness in the relationship between knowledge and attitude about fire risk assessment during time-out

awareness in combination with risk-Knowledge could actively improve risk-Attitude. This result is in line with the results of previous studies, including a study reporting that a higher level of patient safety knowledge in nurses resulted in a higher level of awareness (Catalano, 2008). The study reported that a higher level of risk-Knowledge was associated with a more positive risk-Attitude (Coletto, 2016). Another previous study reported that Egyptian nurses with a higher level of disaster-related knowledge were more enthusiastic in terms of awareness and attitude; the higher the disaster-related awareness, the more enthusiastic the attitude (Diab & Mabrouk, 2015). In addition, a previous study reported that nurses with higher safety awareness actively performed tasks related to their department and jobs (Vaismoradi et al., 2020), which is in line with the findings of this study. Therefore, risk-Knowledge scores of perioperative nurses at small- and medium-sized hospitals directly affect risk-Attitude; however, it has a greater effect on the formation of an enthusiastic attitude about fire risk assessment when mediated with patient safety awareness. The risk-Knowledge of perioperative nurses can help them effectively plan their work within a

reasonable timeframe for the effective performance of safety activities (Sandelin & Gustafsson, 2015). To increase the risk-Attitude scores of perioperative nurses, it is effective to increase not only their knowledge of fire risks but also overall patient safety awareness. Standardization of nursing processes and administrative support, such as the provision of appropriate equipment and systems (Vaismoradi et al., 2020), can also help nurses comply with patient safety principles. It is necessary to establish a fire safety policy in Korea at the national government level and prepare plans for regularly conducting and evaluating operating room fire simulation drills annually for not only operating room nurses but also medical teams in hospitals.

Since this study was conducted among perioperative nurses at small- and medium-sized hospitals in South Korea, there is a limitation in generalizing the research results to all perioperative nurses. In addition, in this study, patient safety awareness and risk-Knowledge about risk-Attitude were only 18.0%, so caution is needed in interpreting the results. Future research on latent variables affecting the relationship between these variables is required. While this study analysed the effect of risk-Knowledge on risk-Attitude in perioperative nurses at small- and medium-sized hospitals, it was not possible to directly measure the effect of their attitude on the actual performance of patient safety activities. Further, this study also has a limitation in that it did not consider the characteristics of 22 hospitals when collecting data from participants.

This study could not simultaneously compare the nurses at small- and medium-sized hospitals with those at tertiary hospitals either. Based on the results of this study, further research is needed to compare risk-Knowledge, risk-Attitude, fire safety activities and patient safety awareness according to hospital size. Nevertheless, this study is significant as the first research study on the fire safety of perioperative healthcare workers, and it gives the basis for the development of interventions by identifying the level and relatedness of patient safety awareness, risk-Knowledge and risk-Attitude in perioperative nurses at small- and medium-sized hospitals.

5 | CONCLUSION

The findings of this study show that safety awareness among nurses needs to be proactively increased through education and training. It is necessary to develop an educational programme through multidisciplinary team simulation in the perioperative working environment. This includes patient safety and fire safety at the hospital level.

In this study, the patient safety awareness of the “working environment in the unit” was lower than the safety awareness of the “hospital environment” in perioperative nurses. The levels of risk-Knowledge and risk-Attitude were higher in the nurses who received education or training compared to those who did not. The effect of risk-Knowledge on risk-Attitude was partially mediated by patient safety awareness in perioperative nurses. The findings demonstrate that training nurses are imperative to increase the safety of patients and to prevent fire accidents. In addition, information related to continuing professional education and exploring values training is suggested to improve patient safety awareness. It is necessary to investigate hazards related to the perioperative environment and plan and analyse safety improvement activities. In practice, patient safety and fire prevention items should be set as key performance indicators for departments and individuals to motivate and monitor nurses.

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CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

AUTHOR CONTRIBUTIONS

OC: analysis of data, interpretation of data, drafting the manuscript and revising it for intellectual content. DL: acquisition of data, drafting the manuscript and revising it for intellectual content. KH: acquisition of data, analysis of data, interpretation of data, drafting the manuscript and revising it for intellectual content.

ETHICAL APPROVAL

Ethics approvals were obtained from Human Research Ethics Committee of Kongju National University (project no. KNU 2018-28) prior to study commencement.

DATA AVAILABILITY STATEMENT

No data were available online. All supporting data can be provided upon request to the authors.

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