Research Article

Factors Influencing Military Nurses' Reporting of Patient Safety Events in South Korea: A Structural Equation Modeling Approach

Sookhee Yoon,[1] Taewha Lee[2],*

[1] Department of Nursing, Semyung University, Republic of Korea
[2] Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, Republic of Korea

S U M M A R Y

Purpose: This study explored how just culture, authentic leadership, safety climate, patient safety knowledge, and safety motivation all affect military nurses' reporting of patient safety events.
Methods: This study adopted a cross-sectional and descriptive correlational design. Data were collected from 303 nurses working across eight military hospitals under the jurisdiction of the Armed Forces Medical Command in South Korea, from June 17 to July 25, 2020. The hypothesized model was then validated using structural equation modeling.
Results: The participating military nurses did not show any proactive attitudes toward reporting near misses when compared with their responses to adverse or no-harm events. The final model exhibited goodness of fit. Herein, both safety climate ($\beta = 0.35$, $p = .009$) and patient safety knowledge ($\beta = 0.17$, $p = .025$) directly influence patient safety event reporting. Moreover, just culture indirectly influences patient safety event reporting ($\beta = 0.31$, $p = .002$). The discovered influencing factors account for 22.9% of the variance in explaining patient safety event reporting.
Conclusions: Our findings indicate that just culture, safety climate, and patient safety knowledge either directly or indirectly affected patient safety event reporting among military nurses. These findings then serve to provide a theoretical basis for developing more effective strategies that would then improve military nurses' patient safety behaviors.

Introduction

Internationally, patient safety is one of the most important goals in healthcare institutions. The occurrence of any adverse events caused by unsafe care is one of the top ten causes of death and disability worldwide [1]. In South Korea (hereafter, Korea), the number of adverse events voluntarily reported by medical institutions has more than doubled from 2586 in 2017 to 6932 in 2020 [2]. Patient safety event reporting plays an important role in preventing the recurrence of any adverse events through the initiation of investigations and analyses, which then result in improvements in patient safety, awareness, and the institution's internal and external systems [3]. It has been found that sentinel and adverse events are often eventually disclosed, but that near misses may go underreported if the organizational culture favors concealing or downplaying said events [4].

Nurses comprise the largest proportion of the workforce in medical institutions and are at the frontline of patient care, which then facilitates their ability to identify medical errors [5]. The study by Lee indicated that Korean nurses feel more comfortable reporting events directly rather than filing event reports, as well as the fact that their rate of medication error reporting was 6.3%—29.9% regardless of hospital type [6]. In Taiwan, Chiang et al. found that nearly 60% of nurses demonstrate a non-proactive attitude toward reporting errors or near-miss events [7]. Underreporting then reduces opportunities for shared learning and hinders stakeholders' ability to generate effective changes within the healthcare system that are aimed at preventing the recurrence of errors and improving patient safety [8]. Research has shown that patient safety event reporting is associated with both organizational (e.g., culture, safety climate, and leadership) and individual factors (e.g., safety knowledge and motivation) [9—13].

Sookhee Yoon: https://orcid.org/0000-0003-4677-4899; Taewha Lee: https://orcid.org/0000-0003-2568-3074
* Correspondence to: Taewha Lee, Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, 50-1 Yonsei-ro, Seodaemun-gu, Seoul, 03722, Republic of Korea.
E-mail address: TWLEE5@yuhs.ac

A just culture refers to an organizational climate in which individuals feel that they are treated fairly when issues like patient safety events occur, which then creates a balance between the organizational system and individual accountability [14]. Woo and Avery outlined the fact that nurses often have insufficient experience with voluntary error reporting, with them also pointing out the limitations of organizations in advocating a just and open safety culture to help support error reporting [11]. Furthermore, Lee et al., in a qualitative study of tertiary hospital doctors and nurses, reported themes like fear of blame, inappropriate responses, and the possibility of potential blame as factors that hinder safety event reporting in Korea [4]. Other studies have noted that an open and just culture increases nurses' patient safety activity and has a positive influence on their error reporting experiences [11,15]. Furthermore, others have reported that, within a just culture, authentic leadership has a positive impact on nurses' trust in their managers, which then provides them with a supportive practice environment, encourages them to speak up, and is able to accurately predict patient safety and quality of care [13]. Walumbwa et al. posited that authentic leadership implies a positive leadership style that focuses on ethics, an understanding of oneself and others, the prioritizing of individual growth, the embracing of a transparent relationship between leaders and followers, and the promoting of a positive ethical climate [16]. Further, Dirik and Intepeler found that managers' authentic leadership is an important predictor of safety climate among nurses [17].

Specifically, safety climate refers to a shared perception of the importance and value of safety-related procedures and practices within an organization [18]. Safety climate influences individual factors, such as safety knowledge and safety motivation [19]. Previous research has reported a significant correlation between safety climate and error reporting, with it being established that a positive safety climate fosters better safety event reporting [20].

The knowledge underlying patient safety practices, as outlined in the extant literature, is reported to be a facilitating factor for patient safety event reporting [10,11]. Brasaite et al. found that one of the main requirements in ensuring patient safety is the development and maintenance of medical professional safety knowledge. Moreover, undesirable patient outcomes can be avoided by ensuring knowledge sharing and facilitating error reporting among staff [21]. Safety motivation refers to an individual's willingness to enact safety behaviors according to their own interests and beliefs [22]. Prior research has shown that nurses' lack of motivation acts as a barrier in their reporting of patient safety events [12]. Moreover, it has been demonstrated that safety motivation and knowledge influence corresponding safety behaviors [19].

Nursing staff at military hospitals, specifically, have a clear understanding of the hierarchical relationships therein because of the uniform command system that exists within the class-oriented climate, which is a distinguishing characteristic of military culture [23]. The characteristics of military hospitals (wherein healthcare providers regularly rotate every one or two years through various network hospitals or departments) require nurses to function consistently in new work environments, with them then being exposed to an increased risk of patient safety issues [24,25]. Therefore, identifying the factors that affect military nurses' reporting of patient safety events is critical for improving patient safety in military hospitals. Except for studies that focus on the relationships between patient safety culture, safety management activities and competency, and communication with other healthcare professionals [24–26], few have comprehensively investigated the factors that influence military nurses' safety behaviors at both the organizational and individual levels. Thus, this study examined the organizational (including just culture, authentic leadership, and safety climate) and individual (including patient safety knowledge and safety motivation) factors that influence military nurses' patient safety event reporting, while also verifying factors that have a mediating effect on this relationship. This study's findings then provide evidence to facilitate the development of effective intervention strategies to ensure patient safety in military hospitals.

Hypothesized model

The hypothesized model for this study was derived from both a literature review [9–13,15,17,19,20] and the safety model developed by Neal et al. [18]. Their model assumes that organizational climate (which encompasses leadership, work roles, and communication) significantly impacts the overall safety climate, while this climate then influences safety behaviors through its impact on staff members' relevant safety knowledge and motivation. Thus, the hypothesized model of this study (Supplementary Figure S1) is as follows: (1) just culture and authentic leadership have a direct effect on safety climate and patient safety event reporting; (2) just culture and authentic leadership indirectly affect patient safety event reporting through the impact of safety climate, patient safety knowledge, and safety motivation; (3) safety climate has a direct effect on patient safety event reporting; (4) safety climate indirectly affects patient safety event reporting through patient safety knowledge and safety motivation; and (5) patient safety knowledge and safety motivation are individual factors that directly influence patient safety event reporting.

Methods

Study design

This was a cross-sectional, descriptive-correlational study conducted in eight military hospitals under the jurisdiction of the Armed Forces Medical Command in Korea.

Setting and sample

The sample included 396 nurses working at eight military hospitals across Korea who gave their informed consent to participate in this study. The inclusion criteria were as follows: (1) nurses who had been working for at least six months in the same department and (2) nurses who delivered care directly to patients. Nursing managers that worked as head nurses or had an equivalent position were excluded. This study's sample size was found to be adequate because the minimum sample required for the maximum likelihood method (which is commonly used in structural equation modeling) was found to be 200 [27]. Of the 396 candidates, 378 responded (95.4% response rate). Of these 378 responses, 75 were excluded due to incomplete or incorrect responses. Thus, 303 responses were included in our final analysis.

Measurements

Participants were provided with a self-administered questionnaire (specifically developed for this study) that collected data about their general characteristics, patient safety event reporting, the overall just culture, authentic leadership, safety climate, patient safety knowledge, and safety motivation. The general characteristics included their age, sex, educational level, clinical experience in their current department, clinical career, and patient safety education experience.

Patient safety event reporting

Patient safety event reporting was assessed using nurses' perceived levels of their own reporting rates on adverse, no-harm, and near-miss events. These factors were measured using three questions from the translated [28] and modified versions [29] of the Hospital Survey on Patient Safety Culture (HSOPSC) [30], including: (1) "If a patient safety event that causes harm to a patient occurs, how frequently is it reported?" (adverse event report); (2) "If a patient safety event occurs but the patient is unharmed, how often is this reported?" (no-harm event report); and (3) "If a patient safety event is detected and corrected before it affects the patient, how often is this reported?" (near-miss report). The participating nurses responded to the HSOPSC's items on a 5-point Likert scale ranging from 1 ("never") to 5 ("always"). In this study, the Cronbach's α of this scale was found to be 0.71.

Just culture

Just culture was measured using the translated Korean version [31] of the Just Culture Assessment Tool (JCAT) [32]. The JCAT comprises 27 items across six subdomains, including: trust, continuous improvement, quality of the event reporting process, balance, openness of communication, feedback, and communication. The participating nurses responded to the JCAT's items on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). At the time of development, the Cronbach's α for all of its sections was higher than 0.7, except for the quality of the event-reporting process ($\geq$ 0.63). In this study, the Cronbach's α of this scale ranged from 0.83 to 0.86.

Authentic leadership

Authentic leadership was measured using the translated Korean and modified versions [33,34] of the Authentic Leadership Questionnaire (ALQ) [16]. The ALQ has 16 items across four subdomains: self-awareness, rational transparency, internalized moral perspective, and balanced processing sections. Nurses responded to the ALQ's items on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The instrument's original Cronbach's α was 0.79 [16], whereas it was found to be 0.95 in this study.

Safety climate

Safety climate was measured using the translated Korean version [35] of the Safety Attitudes Questionnaire Short Form [36]. This tool includes 31 items measuring teamwork climate, safety climate, job satisfaction, stress recognition, perception of management, and working conditions. Again, nurses responded to this instrument's items on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The stress recognition domain was eliminated due to it having a factor loading lower than 0.1 in this study ($p > 0.05$). The instrument's original Cronbach's α was 0.90 [36] and was 0.90 in this study.

Patient safety knowledge

Patient safety knowledge was measured using the patient safety knowledge domain from the Patient Safety Competency Tool [37]. This tool has six items, with the nurses then rating these on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Cronbach's α was 0.89 in the study by Jang [37] and was found to be 0.87 in this study.

Safety motivation

Safety motivation was measured using the translated Korean version [38] of the Safety Motivation Tool [39]. This tool includes five items that were each rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The instrument's original Cronbach's α was 0.93 [39]. In this study, specifically, its Cronbach's α was 0.93.

Data collection

Eight military hospitals in Korea were visited by the researchers to brief potential candidates on the objectives of this study and to obtain their consent for data collection. Nurses who wished to participate were provided with survey packets that included information on the study, the questionnaire, an informed consent form, and a return envelope. Participants were then asked to complete the questionnaire and return it to a sealed box placed in each ward. In addition, they were also informed that they could withdraw from the study at any time. Each participant was provided with a gift certificate of $5 (USD). Research data were collected from June 17 to July 25, 2020.

Statistical analyses

All collected data were analyzed using SPSS 26.0 and AMOS 26.0 software. A descriptive statistical analysis method and Pearson's correlation coefficient were used to analyze participants' characteristics, the mean and standard deviations of the data, the skewness, the kurtosis, and any correlations between variables. Structural equation modeling was then used to test the hypothesized model. First, a confirmatory factor analysis (CFA) was performed to identify the validity of the latent variables [40]. Then, a model estimation and an examination into the effects between variables were performed using the maximum likelihood estimation method. The bootstrapping method was then used to determine the significance of the indirect effects among the study variables. The model's goodness of fit was evaluated using the following indices: the X^2/df ratio index < 3 [27], the comparative fit index (CFI) $\geq$ .90 [41], the standardized root mean square residual (SRMR) $\leq$ .08 [41], and the root mean square error of approximation (RMSEA) $\leq$ .08 [27].

Table 1 *Participants' Characteristics (N = 303).*

Characteristic	n	%	Mean (SD)
Gender			
Men	71	23.4	
Women	232	76.6	
Age			29.46 ($\pm$ 5.91)
$\leq$ 25	85	28.1	
26–< 30	111	36.6	
$\geq$ 30	107	35.3	
Education level			
College degree	29	9.6	
Bachelor's degree	254	83.8	
$\geq$ Master's degree	20	6.6	
Clinical experience in the current department (years)			1.79 ($\pm$ 1.69)
< 1	80	26.4	
1–< 3	189	62.4	
3–< 5	21	6.9	
$\geq$ 5	13	4.3	
Clinical career (years)			6.08 ($\pm$ 5.22)
< 1	13	4.3	
1–< 3	85	28.1	
3–< 5	65	21.5	
$\geq$ 5	140	46.2	
Patient safety education experience (in the previous year)			
0	44	14.5	
1	156	51.5	
2	77	25.4	
$\geq$ 3	26	8.6	

Note. SD = standard deviation.

The RMSEA was reported using the AMOS software with a 90.0% confidence interval. If the RMSEA is 0, the confidence interval becomes one-sided, wherein the upper bound estimate is greater than the RMSEA. Hence, the 90% confidence level was used in this study instead of the more common 95%, which is more conventional for use within two-sided confidence intervals [42].

Ethical considerations

This study received ethical approval from the institutional review board of the Armed Forces Medical Command (approval no: AFMC-20102-IRB-20-102).

Results

Participants' characteristics

As shown in Table 1, the mean age of the participants was 29.46 years (SD = 5.91). Women constituted 76.6% of the total number of participants and 83.8% held a bachelor's degree in nursing. Only 11.2% of the nurses had worked in their current department for more than three years. Additionally, the participating nurses had worked for an average of 6.08 years (SD = 5.22). Finally, 85.5% of the nurses had participated in patient safety training at least once in the past year.

Descriptive statistics and factor loading of the confirmatory factor analysis

As shown in Table 2, the reporting level of near misses (mean = 3.84 ± 0.84, range 1–5) was lower than that of adverse (mean = 4.50 ± 0.80, range 1–5) and no-harm events (mean = 4.11 ± 0.87, range 1–5). Furthermore, participants reported moderate levels of just culture (mean = 3.70 ± 0.50, range 2–5). Additionally, the quality of the event reporting process domain scored the highest, whereas that of trust scored the lowest. Nurses perceived their managers' authentic leadership (mean = 3.64 ± 0.50; range 1–5) and safety climate (mean = 3.61 ± 0.47; range 2–5) as being moderate. Among the

individual factors, although nurses did not exhibit high levels of patient safety knowledge (mean = 3.71 ± 0.68; range 1–5), they did report high levels of safety motivation (mean = 4.59 ± 0.51; range, 3–5). The absolute values of all measures of skewness were less than 2 and the absolute value of the measure of kurtosis was less than 7. Thus, the measured variables were normally distributed. Based on the CFA, the criteria for convergent validity (factor loading ≥ 0.5, AVE > 0.5, and CR > 0.7) were satisfied; however, an AVE value was not greater than the square of the correlation coefficient, therefore, the discriminant validity was only partially satisfied (see the diagonal line in Supplementary Table S1) [27].

Correlations of study variables

Table 3 shows the relationships between the study variables. Patient safety event reporting was found to be significantly and positively associated with just culture (r = .32, p < .001), authentic leadership (r = .18, p = .002), safety climate (r = .40, p < .001), patient safety knowledge (r = .33, p < .001), and safety motivation (r = .19, p = .001).

Testing the hypothesized model

The hypothesized model fit the data well (X^2/df = 2.468, CFI = .908, RMSEA = .070 [90% CI: .064–.075], and SRMR = .068). The model was tested by including all the participants' general characteristics as control variables. The results were consistent with those of the model without control variables (Figure 1).

As shown in Table 4, just culture indirectly but significantly influences patient safety event reporting (β = 0.31, p = .002). Regarding the specific indirect effect, just culture indirectly influences patient safety event reporting via the safety climate (β = 0.25, 95.0% CI: .080–.153) as well as via both safety climate and patient safety knowledge, serially (β = 0.06, 95.0% CI: .003–.513) (Supplementary Table S2). Furthermore, safety climate directly influences patient safety event reporting (β = 0.35, p = .009), with patient safety knowledge affecting safety event reporting (β = 0.17, p = .025). Additionally, authentic leadership and safety motivation had no significant direct or indirect effects on patient safety event

Table 2 *Descriptive Statistics and Factor Loadings of Confirmatory Factor Analysis (N = 303).*

Variables	Mean ± SD	Range	Skewness	Kurtosis	Factor loading (p)	CR	AVE
Just culture	3.70 ± .50	2–5	−.25	.06		.87	.52
Trust	3.44 ± .63	1–5	−.09	.35	.72 (< .001)		
Continuous improvement	3.83 ± .65	1–5	−.52	.99	.78 (< .001)		
Quality of event reporting process	3.92 ± .52	2–5	−.08	0.00	.73 (< .001)		
Balance	3.53 ± .65	1–5	−.22	.18	.68 (< .001)		
Openness of communication	3.67 ± .70	1–5	−.75	1.19	.79 (< .001)		
Feedback and communication	3.89 ± .68	1–5	−.60	.57	.62 (< .001)		
Authentic leadership	3.64 ± .50	1–5	−.36	.54		.93	.76
Self-awareness	3.55 ± .82	1–5	−.30	−.09	.91 (< .001)		
Transparency	3.73 ± .67	1–5	−.27	.60	.88 (< .001)		
Balanced processing	3.56 ± .86	1–5	−.55	.18	.90 (< .001)		
Moral/Ethical	3.67 ± .67	1–5	−.58	1.39	.78 (< .001)		
Safety climate	3.61 ± .47	2–5	.04	.10		.89	.62
Teamwork climate	3.59 ± .57	2–5	−.22	.27	.79 (< .001)		
Safety climate	3.80 ± .57	2–5	−.08	−.03	.89 (< .001)		
Job satisfaction	3.68 ± .73	1–5	−.38	.05	.80 (< .001)		
Perception of management	3.44 ± .68	1–5	.01	−.19	.70 (< .001)		
Working condition	3.48 ± .66	1–5	−.12	.50	.76 (< .001)		
Patient safety knowledge	3.71 ± .68	1–5	−.18	.16		.87	.53
Safety motivation	4.59 ± .51	3–5	−1.02	.22		.94	.75
Patient safety event reporting						.75	.51
Near miss	3.84 ± .84	1–5	−.63	.33	.55 (< .001)		
No-harm event	4.11 ± .87	1–5	−1.06	1.29	.92 (< .001)		
Adverse event	4.50 ± .80	1–5	−1.86	3.60	.62 (< .001)		

Note. AVE = average variance extracted; CR = construct reliability.

Table 3 Correlations Among the Study Variables (N = 303).

Variables	1 r (p)	2 r (p)	3 r (p)	4 r (p)	5 r (p)	6 r (p)
1. Just culture	1					
2. Authentic leadership	.60 (< .001)	1				
3. Safety climate	.69 (< .001)	.57 (< .001)	1			
4. Patient safety knowledge	.36 (< .001)	.27 (< .001)	.48 (< .001)	1		
5. Safety motivation	.34 (< .001)	.17 (.003)	.35 (< .001)	.31 (< .001)	1	
6. Patient safety event reporting	.32 (< .001)	.18 (.002)	.40 (< .001)	.33 (< .001)	.19 (.001)	1
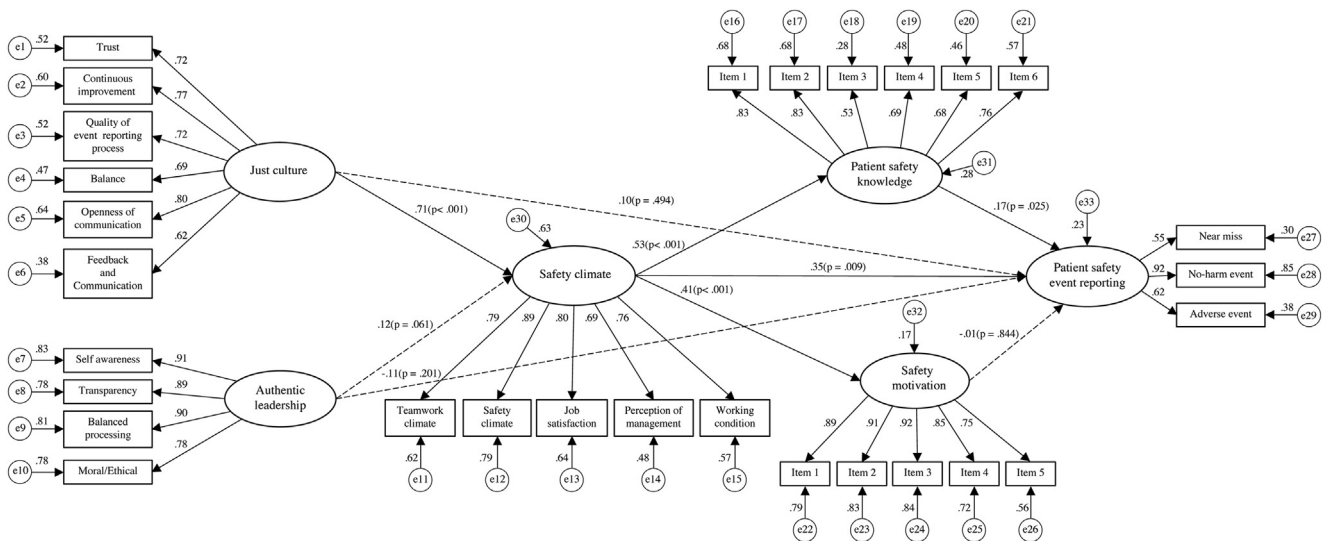
X^2/df = 2.468; CFI = .908; RMSEA = .070 (90% CI: .064-.075); SRMR = .068

Figure 1. Path diagram of the final model.
Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean-square residual.
The dashed lines with arrows represent non-significant relationships.

reporting. These influencing factors accounted for 22.9% of the variance in explaining patient safety event reporting.

Discussion

The findings of this study partially support our hypothesized model. The patient safety event reporting of military nurses was found to be both directly and indirectly affected by organizational factors, such as safety climate and just culture, as well as by more individual factors, such as patient safety knowledge. Our finding that organizational factors are greater contributors to nurses' patient safety event reporting than are individual ones confirms the importance of enhancing patient safety in hospital settings through the use of more holistic organizational efforts. Although these results possess an explanatory power similar to those in a previous study [43], it would have been higher if authentic leadership and safety motivation had a significant relationship with patient safety event reporting. Further research is thus needed to examine other factors related to patient safety event reporting given the non-significant effects of the examined variables in our study.

Our study also reveals that military nurses perceive the need to report adverse events and no-harm events more often than near misses, which is consistent with the results of Kim et al. [29]. Chen et al. stated that a high proportion of nurses in Taiwan had limited experience with medical incident reporting [5]. Patient safety event reporting is an important tool for the timely detection and correction of adverse events in order to create a safe medical environment [4]. However, mistakes considered as having a lower severity are not reported as often as more serious errors. Employees often do not feel the need to report errors they perceive as acceptable, being likely that this behavior results in the under-reporting of patient safety events [3,7]. Furthermore, military nurses did not show a proactive attitude toward reporting near misses, as compared to adverse events or no-harm events.

Among all the variables, safety climate had the most significant effect on patient safety event reporting. This study found that, specifically, safety climate positively correlates with nurses' safety behavior [44]. Lee et al. reported that a positive safety climate reduces barriers for nurses to report errors [45]. This is important to note as military nurses must constantly adapt to new working environments due to their profession's rotational policy [23,24]. Thus, to improve their safety climate, nursing managers should promote unit-based patient safety programs that contain resources that would help staff nurses understand the patient safety mechanisms while improving their patient safety communication and teamwork [46]. It is also necessary to conduct periodic leadership walks to ensure that staff nurses trust their managers and are able to communicate with them proactively about patient safety [44,46].

In this study, patient safety knowledge was found to directly affect patient safety event reporting; this finding is supported by those of previous studies [9,47]. For example, Agustian et al. reported that, between organizational and individual factors, patient safety knowledge is the variable with the most significant effect on Indonesian nurses' patient safety event reporting [9]. Additionally, Kim and Eun reported that patient safety knowledge is a predictor of nurses' safety activity. They emphasized the importance of

Table 4 *Standardized Direct, Indirect, and Total Effects of Variables in the Final Model (N = 303).*

Endogenous variables	Exogenous variables	Direct effect (p)	Indirect effect (p)	Total effect (p)	SMC
Safety climate	Just culture	.71 (< .001)		.71 (< .001)	.633
	Authentic leadership	.12 (.061)		.12 (.061)	
Patient safety knowledge	Safety climate	.53 (< .001)		.53 (< .001)	.283
Safety motivation	Safety climate	.41 (< .001)		.41 (< .001)	.166
Patient safety event reporting	Just culture	.10 (.494)	.31 (.002)	.41 (.001)	.229
	Authentic leadership	−.11 (.201)	.05 (.147)	−.06 (.472)	
	Safety climate	.35 (.009)	.08 (.089)	.43 (.002)	
	Patient safety knowledge	.17 (.025)		.17 (.025)	
	Safety motivation	−.01 (.844)		−.01 (.844)	

Note. SMC = squared multiple correlation.

training and education on nurses' patient safety knowledge in increasing their safety-based behaviors [47]. The development of a standardized patient safety education program for nurses in military hospitals is thus necessary to reduce the relevant knowledge gaps among them. In addition, the implementation of objective measurements and differential patient safety training programs according to individual knowledge levels are both required [20].

This research also found that just culture indirectly influences patient safety event reporting via safety climate. This finding is supported by the results of previous studies, which found that organizational factors, such as incident-reporting cultures, just cultures, and safety climates, have a significant effect on safety event reporting [7,15,45]. Our study also found that just culture has a direct effect on safety climate. Thus, it is important to create a just culture in military hospitals to improve patient safety behaviors among nurses. Military hospitals are characterized by a one-sided command system culture and discourage open communication [23,24]. Considering these organizational characteristics and this system's rotational position policy, military nurses are influenced more by the climate of their specific unit rather than by any widescale organizational culture. Therefore, continuous education should be conducted to disseminate the conception and awareness of a widescale just culture among nursing managers and frontline nurses in military hospitals in order to create a positive safety climate for each unit [8]. In addition, just culture was found to have a indirect effect on patient safety event reporting through both safety climate and patient safety knowledge serially. This finding is supported by those of previous studies that outline the fact that organizational factors and safety knowledge are both significant factors within the process of safety event reporting [10,45,47]. This research also found that a positive safety climate enhances safety knowledge through the resulting generation of an environment of training or discussion in which safety information is communicated, either formally or informally [19]. Therefore, in order to improve patient safety reporting by military hospital nurses, efforts to improve the overall system, create a safety culture, and to form a positive working environment should be conducted. Contrary to our expectations, as well as in contradiction to previous studies, just culture did not directly affect patient safety event reporting [7,15]. This study found that military nurses did not positively perceive the organization's just culture, which is consistent with previous studies on clinical nurses [15,48]. Levine, Carmody, and Silk mentioned that current hospital organization cultures do not facilitate the reporting of medical errors because nurses do not associate organizational culture with patient safety [49]. Patient safety education should thus be provided to frontline nurses so that they can recognize the overall just culture and patient safety in connection with clinical practice [14].

Interestingly, nursing managers' authentic leadership did not influence the safety climate or directly influence patient safety event reporting, which is a significant difference from the findings of previous studies [17,50]. Labrague et al. stated that nursing managers' authentic leadership significantly affects nurses' safety actions and their quality of care [50]. Nursing managers in military hospitals are mainly active-duty officers, with military nurses being trained to obey the instructions of their superiors. These organizational characteristics encourage frontline nurses to familiarize themselves with managers who have a clear vision, charisma, and the capability to motivate them [23]. Ma et al. reported that military nurse managers need to develop a team leadership ability, set a clear vision, motivate their team personnel, manage conflict and stress, be adaptable, and be able to manage change [51]. Although authentic leadership did not have a significant effect on military nurses' safety event reporting level, to promote their safety behavior, studies need to explore the leadership type most appropriate for nursing managers in military hospitals.

Moreover, safety motivation had no direct effect on patient safety event reporting, which again represents a significant difference from previous studies that posited the influence of safety motivation on safety behavior [19,39]. For example, Toren et al. stated that most nurses (80.0%) demonstrated an intention to report medical errors and near misses, although 53.0% of them had not reported near misses in the past year [52]. Thus, there was a difference found between participants' reported intentions and their actual near-miss reporting. Another prior study showed that 58.0% of nurses did not report adverse events in the preceding 12-month period [20]. For military nurses within a distinct hierarchical relationship, organizational factors and patient safety knowledge (rather than safety motivation that is comprised of a more voluntary nature) have a significant impact on patient safety event reporting [9,10,20,22]. However, few studies have explored the relationship between safety motivation and patient safety event reporting. Further studies on the individual factors of this relationship are thus required.

Strengths and limitations

Our study is the first to identify the organizational and individual factors that affect military nurses' patient safety event reporting, based on Neal et al.'s safety model [18]. This study verified that safety climate and patient safety knowledge directly affect patient safety event reporting. Another notable finding is our confirmation that just culture indirectly influences patient safety event reporting.

Our study contributes to nursing research by comprehensively exploring factors affecting the safety activities of military nurses in ensuring patient safety in military medical institutions. Further, it elucidates a rationale for developing effective strategies and programs to create a just culture and safety climate, as well as for improving military nurses' safety knowledge, in a way that takes into account the unique characteristics of military nursing personnel.

This study does possess several limitations. First, patient safety event reporting was measured through nurses' subjective responses, rather than through their actual reporting rate, meaning that our results should be interpreted with care. Second, because closed questions and direct surveys have inherent limitations in revealing participants' honest answers, other data collection methods (e.g., online surveys and in-depth interviews) should be used in future studies in consideration of the vertical hierarchical structure of the military nursing organization.

Conclusions

This study confirms that safety climate (an organizational factor) and patient safety knowledge (an individual factor) significantly influence military nurses' reporting of patient safety events. Further, this study found that just culture has an indirect effect on patient safety event reporting. However, authentic leadership and safety motivation are not statistically significant factors for patient safety event reporting. This study emphasizes the fact that leaders and nursing managers in military hospitals should create a just culture and a safety climate that fosters nurses' safety activities, keeping in mind the unique characteristics of this organization. Further, nurses should be provided with adequate training that then improves their knowledge of patient safety and the importance of reporting errors so as to enhance the quality of care in military medical organizations.

Funding

Data availability

The data generated and analyzed during the current study is confidential; however, they can be made available from the corresponding author upon reasonable request.

Conflict of interest

All authors declare that there are no conflicts of interest.

Acknowledgments

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anr.2022.05.006.

References

1. Jha A. Patient safety—a grand challenge for healthcare professionals and policymakers alike. In: Presentation at a roundtable at the grand challenges meeting of the Bill & Melinda Gates Foundation; 2018 October 18. 2019.
2. Ministry of Health and Welfare, Korea Institute for Healthcare Accreditation. Korean patient safety incident report 2020. Seoul: Korea Institute for Healthcare Accreditation; 2021.
3. Soydemir D, Seren Intepeler S, Mert H. Barriers to medical error reporting for physicians and nurses. West J Nurs Res. 2017;39(10):1348–63. https://doi.org/10.1177/0193945916671934
4. Lee W, Kim SY, Lee SI, Lee SG, Kim HC, Kim I. Barriers to reporting of patient safety incidents in tertiary hospitals: a qualitative study of nurses and resident physicians in South Korea. Int J Health Plan Manag. 2018;33(4):1178–88. https://doi.org/10.1002/hpm.2616
5. Chen LC, Wang LH, Redley B, Hsieh YH, Chu TL, Han CY. A study on the reporting intention of medical incidents: a nursing perspective. Clin Nurs Res. 2018;27(5):560–78. https://doi.org/10.1177/1054773817692179
6. Lee E. Reporting of medication administration errors by nurses in South Korean hospitals. Int J Qual Health Care. 2017;29(5):728–34. https://doi.org/10.1093/intqhc/mzx096
7. Chiang HY, Lee HF, Lin SY, Ma SC. Factors contributing to voluntariness of incident reporting among hospital nurses. J Nurs Manag. 2019;27(4):806–14. https://doi.org/10.1111/jonm.12744
8. Richter JP, McAlearney AS, Pennell ML. Evaluating the effect of safety culture on error reporting: a comparison of managerial and staff perspectives. Am J Med Qual. 2015;30(6):550–8. https://doi.org/10.1177/1062860614544469
9. Agustian I, Lubis AN, Siregar FLS. Individual and organization affects perceptions of reporting patient safety incidents in Medan City Hospital. Eur J Mol Clin Med. 2020;7(10):1228–34.
10. Archer S, Hull L, Soukup T, Mayer E, Athanasiou T, Sevdalis N, et al. Development of a theoretical framework of factors affecting patient safety incident reporting: a theoretical review of the literature. BMJ Open. 2017;7(12): e017155. https://doi.org/10.1136/bmjopen-2017-017155
11. Woo MWJ, Avery MJ. Nurses' experiences in voluntary error reporting: an integrative literature review. Int J Nurs Sci. 2021;8(4):453–69. https://doi.org/10.1016/j.ijnss.2021.07.004
12. Hamed MMM, Konstantinidis S. Barriers to incident reporting among nurses: a qualitative systematic review. Forthcoming West J Nurs Res. 2022;44(5): 506–23. https://doi.org/10.1177/0193945921999449, 193945921999449.
13. Wong CA, Spence Laschinger HK, Cummings GG. Authentic leadership and nurses' voice behaviour and perceptions of care quality. J Nurs Manag. 2010;18(8):889–900. https://doi.org/10.1111/j.1365-2834.2010.01113.x
14. Marx D. Patient safety and the just culture. Obstet Gynecol Clin North Am. 2019;46(2):239–45. https://doi.org/10.1016/j.ogc.2019.01.003
15. Kim BB, Yu S. Effects of just culture and empowerment on patient safety activities of hospital nurses. Healthcare (Basel). 2021;9(10). https://doi.org/10.3390/healthcare9101324
16. Walumbwa FO, Avolio BJ, Gardner WL, Wernsing TS, Peterson SJ. Authentic leadership: development and validation of a theory-based measure. J Manage. 2008;34(1):89–126. https://doi.org/10.1177/0149206307308913
17. Dirik HF, Intepeler SS. The influence of authentic leadership on safety climate in nursing. J Nurs Manag. 2017;25(5):392–401. https://doi.org/10.1111/jonm.12480
18. Neal A, Griffin MA, Hart PM. The impact of organizational climate on safety climate and individual behavior. Saf Sci. 2000;34(1-3):99–109. https://doi.org/10.1016/S0925-7535(00)00008-4
19. Christian MS, Bradley JC, Wallace JC, Burke MJ. Workplace safety: a meta-analysis of the roles of person and situation factors. J Appl Psychol. 2009;94(5):1103–27. https://doi.org/10.1037/a0016172
20. Hong S, Li Q. The reasons for Chinese nursing staff to report adverse events: a questionnaire survey. J Nurs Manag. 2017;25(3):231–9. https://doi.org/10.1111/jonm.12461
21. Brasaite I, Kaunonen M, Suominen T. Healthcare professionals' knowledge, attitudes and skills regarding patient safety: a systematic literature review. Scand J Caring Sci. 2015;29(1):30–50. https://doi.org/10.1111/scs.12136
22. Neal A, Griffin MA. A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. J Appl Psychol. 2006;91(4):946–53. https://doi.org/10.1037/0021-9010.91.4.946
23. Oh H, Cho Y. Effects of organizational culture, transformational leadership and transactional leadership on organizational effectiveness - comparing military hospitals with civil hospitals. Korean J Mil Nurs Res. 2016;34(1):54–69. https://doi.org/10.31148/kjmnr.2016.34.1.54
24. Choi YJ, Lee MS, Kang MS, Kim JH, Kim JE, Kim SY. Military nursing staff's perception and satisfaction on communication with other healthcare professionals and their job satisfaction in Korean military hospitals. Korean J Mil Nurs Res. 2017;35(2):46–60. https://doi.org/10.31148/kjmnr.2017.35.2.46
25. Yoon S, Lee T, Maeng S, Kwon J-E. The Influence of nurses' communication competency, critical thinking disposition, and perception of patient safety culture on patient safety competency in armed forces hospitals. Korean J Occup Health Nurs. 2020;29(2):123–32. https://doi.org/10.5807/kjohn.2020.29.2.123
26. Hwang J, Lee S, Jeon Y, Lee H, Kwak Y, Lee J. A descriptive study of military nurses' perception on patient safety culture and their performance on patient safety nursing. J Mil Nurs Res. 2014;32(1):92–104.
27. Bae B-R. Structural equation modeling with Amos 24. Seoul: Chenngram Books; 2017. p. 76–309.
28. Kim J-E, Kang M-A, An K-E, Sung Y-H. A survey of nurses' perception of patient safety related to hospital culture and reports of medical errors. J Korean Clin Nurs Res. 2007;13(3):169–79.
29. Kim SA, Kim E-M, Lee J-R, Oh EG. Effect of nurses' perception of patient safety culture on reporting of patient safety events. J Korean Acad Nurs Adm. 2018;24(4):319–27. https://doi.org/10.11111/jkana.2018.24.4.319
30. Rockville W, Sorra J, Gray L, Streagle S, Famolaro T, Yount N, et al. AHRQ hospital survey on patient safety culture: user's guide [Internet]. Agency for Healthcare Research and Quality; 2018 [cited May 28, 2021]. Available from https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patientsafetyculture/hospital/userguide/hospitalusersguide.pdf
31. Kim SA. Quality of work life among nurses who had patient safety incidents; mixed methods design [dissertation]. Seoul: Yonsei University; 2020.

32. Petschonek S, Burlison J, Cross C, Martin K, Laver J, Landis RS, et al. Development of the just culture assessment tool: measuring the perceptions of healthcare professionals in hospitals. J Patient Saf. 2013;9(4):190–7. https://doi.org/10.1097/PTS.0b013e31828fff34

33. Kim D, Bae E, Han M. Mediating effects of teacher's self-directed learning ability on the relationship between principal's authentic leadership and teacher's organizational commitment in early childhood educational institutes. Korea J Bus Adm. 2013;26(10):2561–82.

34. Song B, Seomun G. The influential factors related to organizational citizenship behavior of nurses: with focus on authentic leadership and organizational justice. J Korean Acad Nurs Adm. 2014;20(2):237–46. https://doi.org/10.11111/jkana.2014.20.2.237

35. Kim KJ, Han JS, Seo MS, Jang BH, Park MM, Ham HM, et al. Relationship between intra-organizational communication satisfaction and safety attitude of nurses. J Korean Acad Nurs Adm. 2012;18(2):213–21. https://doi.org/10.0000/jkana.2012.18.2.213

36. Sexton JB, Helmreich RL, Neilands TB, Rowan K, Vella K, Boyden J, et al. The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. BMC Health Serv Res. 2006;6:44. https://doi.org/10.1186/1472-6963-6-44

37. Jang H-N. Evaluation and application of patient safety competence assessment tool-survey for nurses [Master's thesis]. Seoul: Seoul National University; 2013.

38. Moon D-H. The effects of new nurses' patient safety management motivation, patient safety management attitude on patient safety management behavior [Korean]. J Korean Appl Sci Technol. 2021;38(6):1587–95. https://doi.org/10.12925/jkocs.2021.38.6.1587

39. Vinodkumar MN, Bhasi M. Safety management practices and safety behaviour: assessing the mediating role of safety knowledge and motivation. Accid Anal Prev. 2010;42(6):2082–93. https://doi.org/10.1016/j.aap.2010.06.021

40. Kim SY. Fundamental and extention of structural equation modeling with MPLUS examples. Seoul: Hakjisa; 2016.

41. Hooper D, Coughlan J, Mullen M. Evaluating model fit: a synthesis of the structural equation modelling literature. In: Brown A, editor. 7th European Conference on Research Methodology for Business and Management Studies. London: Regent's College; 2008 Jun 19-20.

42. Kline RB. Principles and practice of structural equation modeling. 4th ed. New York: The Guilford Press; 2016.

43. Farag A, Vogelsmeier A, Knox K, Perkhounkova Y, Burant C. Predictors of nursing home nurses' willingness to report medication near-misses. J Gerontol Nurs. 2020;46(4):21–30. https://doi.org/10.3928/00989134-20200303-03

44. Manapragada A, Bruk-Lee V, Thompson AH, Heron LM. When safety climate is not enough: examining the moderating effects of psychosocial hazards on nurse safety performance. J Adv Nurs. 2019;75(6):1207–18. https://doi.org/10.1111/jan.13911

45. Lee YS, Ryu SY, Park J, Choi SW. The association of safety climate and transformational leadership of head nurse with barrier to medication error reporting among nurses in a hospital. J Health Info Stat. 2016;41(2):147–54. https://doi.org/10.21032/jhis.2016.41.2.147

46. Morello RT, Lowthian JA, Barker AL, McGinnes R, Dunt D, Brand C. Strategies for improving patient safety culture in hospitals: a systematic review. BMJ Qual Saf. 2013;22(1):11–8. https://doi.org/10.1136/bmjqs-2011-000582

47. Kim MY, Eun Y. Perceptions of patient safety culture, safety care knowledge and activity among nurses at an orthopedic hospital. J Muscle Jt Health. 2017;24(1):14–23. https://doi.org/10.5953/JMJH.2017.24.1.14

48. Lee G-S, Park J-Y. Impact of nursing work environment on nurses' perception of just culture. Korean J Health Promot. 2021:37–43. https://doi.org/10.15384/kjhp.2021.21.1.37

49. Levine KJ, Carmody M, Silk KJ. The influence of organizational culture, climate and commitment on speaking up about medical errors. J Nurs Manag. 2020;28(1):130–8. https://doi.org/10.1111/jonm.12906

50. Labrague LJ, Al Sabei SD, AbuAlRub RF, Burney IA, Al Rawajfah O. Authentic leadership, nurse-assessed adverse patient events and quality of care: the mediating role of nurses' safety actions. J Nurs Manag. 2021;29(7):2152–62. https://doi.org/10.1111/jonm.13356

51. Ma H, Chihava TN, Fu J, Zhang S, Lei L, Tan J, et al. Competencies of military nurse managers: a scoping review and unifying framework. J Nurs Manag. 2020;28(6):1166–76. https://doi.org/10.1111/jonm.13068

52. Toren O, Dokhi M, Dekeyser Ganz F. Hospital nurses' intention to report near misses, patient safety culture and professional seniority. Int J Qual Health Care. 2021;33(1):mzab031. https://doi.org/10.1093/intqhc/mzab031