

Article

What are hospital nurses' strengths and weaknesses in patient safety competence? Findings from three Korean hospitals

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Abstract

Objective: To examine hospital nurses' patient safety competencies and the association between these competencies and safety climate.

Design: Cross-sectional questionnaire survey.

Setting: Three teaching hospitals in Seoul, Korea.

Participants: In total, 459 nurses from general adult nursing care units, intensive care units or operating rooms (response rate = 87.4%).

Method: Self-administered questionnaires were distributed to measure patient safety competency. Multiple regression analyses were performed to examine relationships between patient safety competency and safety climate.

Main Outcome Measure (s): Patient safety competency scores ('teamwork', 'communication', 'managing safety risks', 'human and environmental factors', 'adverse event recognition' and 'safety culture' dimensions) and perceived safety climate.

Results: The mean patient safety competency score was 3.3 (SD = 0.4) out of 5.0; 396 nurses (86.3%) rated their competency as above average. Among subscales, 'managing safety risks' scores were the highest, and 'teamwork' scores were the lowest. Patient safety competency differed significantly by participants' age, educational level, clinical experience and position. Patient safety competency was higher in older nurses with master's or higher degrees and clinical experience of longer duration. Nurse managers' scores were higher than those of staff nurses. Safety climate was perceived as moderate. After adjusting for other individual and organizational characteristics, patient safety competency was positively associated with safety climate perception.

Conclusions: Nurses' safety competency was rated as moderate. In particular, nurses lacked confidence in teamwork. Nurses with higher safety competency perceived safety climate more positively. Efforts emphasizing teamwork to enhance nurses' safety competency should be prioritized, thereby contributing to improvement of safety climates.

Key words: patient safety, professional competence, nurses, teaching hospitals, safety climate

Introduction

A recent report estimated that ~43 million injuries occur worldwide due to medical care in inpatient hospital settings annually [1]. As

patient safety is a priority that should be addressed globally, health-care professionals should be prepared to provide safe, reliable care [2, 3]. In response to this demand, patient safety educational programs

have been developed for healthcare professionals including medical and nursing students [3]. As nurses are frontline care providers, their patient safety competency is critical to ensuring high-quality, safe care.

Patient safety involves the prevention, reduction and alleviation of unnecessary injury and harm. Patient safety competency refers to knowledge, skills and attitudes concerning patient safety, which are required for the provision of safe health care. The Canadian Patient Safety Institute suggested six patient safety competencies: 'contributing to patient safety culture', 'working in teams for patient safety', 'communicating effectively for patient safety', 'managing safety risks', 'optimizing human and environmental factors' and 'recognizing, responding to, and disclosing adverse events' [4]. These are considered central components in enhancing patient safety across healthcare professionals [3, 5, 6].

Studies have been conducted to examine levels of knowledge, skills and attitudes regarding patient safety in healthcare professionals [7–15]. Most involved medical students or physicians and focussed on evaluation of the effects of patient safety education [7–12]. Several other studies focussed on new healthcare professionals or specific aspects of patient safety competency such as knowledge, skills or attitudes [13, 14]. For instance, a study focussing on medical students' and residents' patient safety knowledge found that they correctly answered 58.4% of the test items [13]. Another study involving new medicine, nursing and pharmacy graduates demonstrated moderate levels of patient safety competency, particularly when they were more confident in the effective communication dimension [14]. In addition, some studies have shown differences in patient safety competency according to years of training, educational level, specialty [13] and occupation [14]. One study investigating nursing students' patient safety awareness, skills and attitudes found variation in responses according to age, gender, race and ethnicity [15]. However, information regarding practicing nurses' patient safety competency is scarce. Furthermore, exploring patient safety competency levels using valid, reliable tools could provide valuable insights for patient safety education and training through the recognition of nurses' strengths and weaknesses.

Patient safety climate refers to organizational climates that prioritize patient safety. Organizational climate reflects staff members' perceptions of overall workplace characteristics and practices guiding their behaviours and decisions involving patient care. Organizational climate is a surface feature of organizational cultures at a given point in time and is commonly assessed using self-report questionnaires [16]. Strengthening the safety culture is an essential component in patient safety promotion. Research has demonstrated associations between perceived safety climate and individual and organizational characteristics including occupation, clinical experience, position and workplace [17–19]. However, empirical evidence concerning relationships between nurses' patient safety competency and perceived safety climate is limited.

The purpose of this study was 2-fold: (i) to examine patient safety competencies in practicing nurses and (ii) to explore relationships between safety competencies and safety climate perception. These findings could contribute to the development of effective interventions to enhance patient safety competencies in the current nursing workforce. Furthermore, the findings could suggest practical strategies for improving the culture of patient safety in hospitals.

Methods

Study design

This cross-sectional questionnaire survey was part of a larger project involving the development of a patient safety educational program.

The university's Institutional Review Board approved the wider study protocol, which included this study (No.KHSIRB-14-010(RA)).

Settings and participants

The study was conducted in three teaching hospitals with 878, 669 and 240 inpatient beds, in Seoul, Korea. The hospitals were accredited by the Korea Institute for Healthcare Accreditation. A total of 525 nurses working in adult nursing care units, intensive care units or operating rooms in the study hospitals were invited to participate. Response rates for Hospitals A, B and C were 87.1% (216/248), 88.8% (191/215) and 83.9% (52/62), respectively. Although Hospitals A and C have different operating systems and presidents, the nursing departments operate under the same governance system, in which one nursing executive officer manages all nurses in both hospitals. The sample size was considered sufficient based on a recommended minimum of 10 cases per item in factor analysis [20]. After cases with incomplete data were excluded listwise, 459 participants' data were analysed. We performed post hoc power analysis, which incorporated degrees of freedom, significance level, sample size and root mean square error of approximation indices from confirmatory factor analysis (CFA) [21, 22]. The calculated power was >0.999. Greater power implies higher probability of detecting a reasonably correct model, particularly in CFA.

Measures

Patient safety competency was measured using the Health Professional Education in Patient Safety Survey (H-PEPSS), which was selected because it includes comprehensive patient safety competency dimensions and has good reliability and validity [6, 14]. The H-PEPSS is applicable to various healthcare professionals and consists of 16 items and six subscales: 'working in teams with other health professionals' (3 items), 'communicating effectively' (3 items), 'managing safety risks' (3 items), 'understanding human and environmental factors' (2 items), 'recognizing and responding to adverse events' (2 items) and 'culture of safety' (3 items). Each item is rated on a 5-point Likert scale ranging from 1 (not at all confident) to 5 (very confident). Higher scores indicated higher patient safety competency.

We obtained the developers' permission to use the questionnaire. The first author translated the items into Korean. The relevance of the translation was validated by a bilingual nursing professor, two quality improvement and patient safety experts and three medical professors. Understandability was verified via a pilot test involving 6 fourth-year medical students, 10 fourth-year nursing students, 10 nurses and 5 physicians. Minor revisions were made to the wording, based on their feedback. CFA yielded a 16-item, six-factor model that fitted the data very well: goodness-of-fit index (GFI) = 0.943; root mean square error of approximation (RMSEA) = 0.058; standardized root mean square residual (SRMSR) = 0.036; Bentler's comparative fit index (CFI) = 0.959; Bentler–Bonett's non-normed fit index (NNFI) = 0.944 and Bentler–Bonett's normed fit index (NFI) = 0.934. Cronbach's α was 0.91 for the entire scale and ranged between 0.69 and 0.82 for the subscales (Table 1).

Safety climate was measured using the safety climate subscale of the Safety Attitudes Questionnaire (SAQ), which has several versions for various clinical settings and has demonstrated good construct validity and internal consistency [23, 24]. All versions consist of 30 identical core items and six subscales: teamwork climate, safety climate, perceptions of management, job satisfaction, working conditions and stress recognition. The safety climate subscale comprises seven items [23]. Respondents were asked to rate their agreement using a 5-point Likert

Table 1 Levels of patient safety competencies

Scale/items	<i>n</i> ^a	% ^a	Mean	SD	α
Overall patient safety competency	396	86.3	3.3	0.4	0.91
Teamwork dimension	351	76.5	3.1	0.5	0.70
Managing inter-professional conflict	342	74.5	2.9	0.6	
Sharing authority, leadership and decision-making	399	86.9	3.2	0.7	
Encouraging team members to speak up, question, challenge, advocate and be accountable as appropriate to address safety issues	411	89.5	3.3	0.7	
Communication dimension	423	92.2	3.5	0.5	0.80
Enhancing patient safety through clear and consistent communication with patients	443	96.5	3.5	0.6	
Enhancing patient safety through effective communication with other healthcare providers	434	94.6	3.5	0.6	
Effective verbal and non-verbal communication abilities to prevent adverse events	433	94.3	3.4	0.6	
Managing safety risks dimension	430	93.7	3.5	0.5	0.79
Recognizing routine situations in which safety problems may arise	444	96.7	3.5	0.6	
Identifying and implementing safety solutions	443	96.5	3.5	0.6	
Anticipating and managing high-risk situations	432	94.1	3.4	0.6	
Human and environmental factors dimension	416	90.6	3.3	0.6	0.82
The role of human factors, such as fatigue, which effect patient safety	431	93.9	3.4	0.6	
The role of environmental factors such as work flow, ergonomics and resources, which effect patient safety	422	91.9	3.3	0.6	
Adverse event recognition dimension	424	92.4	3.4	0.6	0.69
Recognizing an adverse event or close call	432	94.1	3.4	0.7	
Reducing harm by addressing immediate risks for patients and others involved	431	93.9	3.4	0.6	
Safety culture dimension	403	87.8	3.3	0.6	0.78
The importance of having a questioning attitude and speaking up when you see things that may be unsafe	428	93.3	3.4	0.7	
The importance of a supportive environment that encourages patients and providers to speak up when they have safety concerns	427	93.0	3.3	0.7	
The nature of systems (e.g. aspects of the organization, management or the work environment including policies, resources, communication and other processes) and system failures and their role in adverse events	403	87.8	3.2	0.7	

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^aNumbers and proportions of the nurses who rated their patient safety competency above 3.0, respectively. The bolds indicate the scores for overall scale and subscales.

scale ranging from 1 (strongly disagree) to 5 (strongly agree). Negatively worded items were reverse coded. Higher scores indicated that perceptions of safety climate were more positive. The first author translated safety climate questions into Korean. The fluency of the translation and relevance of the scale in Korean settings were reviewed by three medical professors and an English instructor. The clarity and readability of the items were then pretested by a group of healthcare students, nurses and physicians, as in the H-PEPSS pilot test. No additional revisions were made. Cronbach's α for the scale was 0.75. The scores for the two instruments were calculated by averaging related items.

We also collected information regarding participants' general characteristics. These variables included age, gender, educational level, duration of clinical experience, position and clinical workplace.

Data collection procedure

Questionnaires with return envelopes were distributed to nurses via the study hospitals' nursing departments. To encourage survey participation, we provided a small gift (an umbrella worth USD 5) with questionnaire packages, regardless of participation. The package included cover letters explaining the study's purpose and participants' rights to voluntary participation, assured anonymity and informed consent. Completed questionnaires were collected via the nursing departments 2 weeks later and sent to the research team in enclosed envelopes to ensure anonymity and confidentiality.

Data analysis

Data were analysed using the SAS program, version 9.2 (SAS Institute, Cary, NC, USA). The internal consistency was examined using

Cronbach's alpha coefficients. The construct validity of the H-PEPSS was determined using CFA. We examined six standard measures of model fit, with RMSEA < 0.06, SRMSR < 0.08, and GFI, CFI, NNFI and NFI \geq 0.9 as cut-off values [25, 26].

General participant characteristics were summarized using descriptive statistics. Independent *t*-tests and ANOVAs were performed to determine differences in patient safety competencies according to participants' characteristics. These tests are robust for non-normal distribution [20]. Post hoc tests were performed using Tukey's studentized range test. Pearson correlation coefficients were calculated for continuous variables. After adjusting for other individual and organizational characteristics, multiple regression analyses were performed to examine relationships between patient safety competency and perceived safety climate at overall scale and subscale levels. We examined the residual versus predicted value plot for the linearity and homoscedasticity assumptions, which showed no trends or patterns. Durbin-Watson statistics ($D = 1.987$ and 1.943 , respectively) were close to 2, which indicated that there was no autocorrelation. The values for variance inflation factor were < 4.0 in both models, which indicated no multicollinearity between independent variables. The level of significance was set at $P < 0.05$.

Results

General participant characteristics

Participants' general characteristics are shown in Table 2. Participants were nearly all female (97.8%), and their mean age was 33.2 (SD = 7.8) years. Of 459 nurses, 56.4% held 4-year baccalaureate degrees, and 88.5% were staff nurses. The mean duration of clinical experience was 109.1 (SD = 96.7) months for the 357 nurses who provided

relevant data. Nearly half of the participants (45.7%) worked in general medical/surgical care units.

Patient safety competency score

The mean score for overall patient safety competency was 3.3 (SD = 0.4), and 396 (86.3%) nurses rated their competency above 3.0, indicating that they were confident in patient safety practices (Table 1). At a subscale level, the 'communication' and 'managing safety risks' scores were the highest, both with a mean of 3.5 (SD = 0.5), and the

Table 2 General characteristics of the participating nurses and patient safety competency scores

Variable	n	%	Patient safety competency		P	Post hoc test ^a
			Mean	SD		
Gender						
Female	449	97.8	3.3	0.4	0.221	
Male	10	2.2	3.2	0.5		
Age						
19–29 years	201	43.8	3.3	0.4	<0.001	B
30–39 years	174	37.9	3.4	0.4		B
40–59 years	84	18.3	3.5	0.4		A
Educational level						
3-year diploma	104	22.7	3.3	0.4	<0.001	B
4-year baccalaureate	259	56.4	3.3	0.4		B
Master or higher	96	20.9	3.5	0.5		A
Position						
Staff	406	88.5	3.3	0.4	<0.001	
Manager	53	11.6	3.6	0.5		
Clinical experience						
≤36 months	89	19.4	3.3	0.4	<0.001	B
37–120 months	151	32.9	3.3	0.4		B
>120 months	117	25.5	3.5	0.4		A
Missing	102	22.2	3.3	0.5		B
Hospital type						
A	216	47.1	3.3	0.4	0.012	A
B	191	41.6	3.4	0.5		A
C	52	11.3	3.4	0.5		A
Clinical department						
Medical care units	125	27.2	3.4	0.4	0.362	
Surgical care units	85	18.5	3.3	0.4		
Intensive care units	99	21.6	3.3	0.4		
Operating rooms	77	16.8	3.3	0.4		
Traditional medicine	73	15.9	3.4	0.4		

^aTukey's studentized range test.

Table 3 Pearson correlation coefficients between safety climate and patient safety competencies

Variables	SC	PSC	TW	COM	MSR	HEF	AER
Safety climate	1.00						
Overall patient safety competency	0.40	1.00					
Teamwork dimension	0.43	0.73	1.00				
Communication dimension	0.34	0.81	0.53	1.00			
Managing safety risks dimension	0.28	0.81	0.41	0.62	1.00		
Human and environmental factors dimension	0.18	0.71	0.41	0.48	0.50	1.00	
Adverse event recognition dimension	0.25	0.79	0.47	0.52	0.63	0.56	1.00
Safety culture dimension	0.33	0.82	0.52	0.55	0.59	0.48	0.61

SC, safety climate; PSC, overall patient safety competency; TW, teamwork; COM, communication; MSR, managing safety risks; HEF, human and environmental factors; AER, adverse event recognition dimension.

P < 0.001 for all correlations.

'teamwork' score was the lowest, with a mean of 3.1 (SD = 0.5). The percentage of nurses with ratings above 3.0 was over 90% for all subscales except 'teamwork' (76.5%) and 'safety culture' (87.8%).

Patient safety competency scores differed significantly according to nurses' age, educational level, position and clinical experience (Table 2). Post hoc tests revealed that safety competency scores were higher in nurses aged 40 years or older relative to nurses aged 39 years or younger. Scores were higher in nurses with master's or higher degrees relative to nurses with 3-year diplomas or 4-year baccalaureate degrees. Nurse managers' safety competency scores were higher relative to those of staff nurses. Nurses with >10 years' clinical experience demonstrated higher competency scores relative to less experienced nurses. Other groups did not differ significantly with respect to clinical experience.

Perceived safety climate and its relationship with patient safety competencies

Nurses rated their safety climates as moderate, with a mean score of 3.2 (SD 0.5) out of 5.0. There was a positive correlation between perceived safety climate and overall patient safety competency (Pearson $r = 0.40$ $P < 0.001$) (Table 3). At the subscale level, perceived safety climate was also significantly correlated with the six subscales ($P < 0.001$), with the correlation being strongest with 'teamwork' ($r = 0.43$) and weakest with 'human and environmental factors' ($r = 0.18$).

After adjusting for other individual and organizational characteristics, multiple regression analyses were performed to determine relationships between patient safety competencies and perceived safety climate (Table 4). Because of a strong correlation between age and duration of clinical experience ($r = 0.94$), we only included the age variable in the models. The model accounted for 19.4% of the variance ($F(12, 446) = 8.93$, $P < 0.001$). Overall, patient safety competency was positively associated with perceived safety climate. We also explored this relationship at the subscale level. This model accounted for 24.2% of the variance ($F(17, 441) = 8.30$, $P < 0.001$), and the 'teamwork' and 'communication' dimensions were significantly associated with perceived safety climate.

Discussion

Frontline healthcare professionals' patient safety competencies are critical to ensuring high-quality care. Information regarding patient safety competencies in practicing nurses, gained using valid and reliable instruments, is scarce. This is the first study to examine nurses' patient safety competencies in Korean hospitals. The findings

Table 4 Multiple regression results for perceived safety climate

Variable	Model 1			Model 2		
	Coefficient	SE	P	Coefficient	SE	P
Intercept	1.69	0.29	<0.001	1.68	0.28	<0.001
Age	0.00	0.00	0.350	0.00	0.00	0.423
Female (reference = male)	0.19	0.14	0.182	0.14	0.14	0.327
Educational level (reference = 3-year diploma)						
4-year baccalaureate	-0.03	0.05	0.595	-0.01	0.05	0.846
Master or higher	0.03	0.07	0.718	0.02	0.07	0.798
Staff position (reference = manager position)	-0.02	0.09	0.858	-0.01	0.09	0.910
Clinical department (reference = surgical care units)						
Medical care units	-0.01	0.06	0.845	-0.01	0.06	0.898
Intensive care unit	-0.21	0.07	0.002	-0.20	0.06	0.002
Operating rooms	0.00	0.07	0.961	-0.02	0.07	0.783
Traditional Korean medicine	0.02	0.11	0.840	0.03	0.11	0.811
Hospital type (reference = C)						
A	-0.01	0.05	0.910	0.00	0.05	0.955
B	-0.13	0.12	0.280	-0.08	0.12	0.502
Patient safety competencies						
Overall patient safety competency	0.45	0.05	<0.001			
Teamwork dimension				0.28	0.05	<0.001
Communication dimension				0.12	0.05	0.030
Managing safety risks dimension				0.05	0.06	0.389
Human and environmental factors dimension				-0.06	0.04	0.142
Adverse event recognition dimension				-0.01	0.05	0.779
Safety culture dimension				0.09	0.05	0.076

Model 1 includes overall patient safety competency, and Model 2 includes six dimensions of patient safety competency, after adjustment for other individual and organizational characteristics.

SE, Standard error; The bolds indicate statistically significant values in patient safety competencies.

indicated that nurses perceived their safety competencies as moderate, which was slightly lower than levels previously reported in newly graduated healthcare professionals including nurses [14]. This could be attributed to the fact that most practicing nurses receive little or no formal education at college or university to prepare them for patient safety issues. In Korea, interest in patient safety issues has become more widespread since the launch of the hospital accreditation program in November 2010.

An increased need to improve patient safety leads to explicit integration of patient safety education into formal nursing curricula. In the current study, teamwork with other healthcare professionals was rated lowest of six dimensions of patient safety competency, which was consistent with previous findings [14]. This may reflect weakness in current healthcare systems due to discipline or occupation-specific specialization. The results highlighted a need to promote teamwork competency across healthcare professionals. With increasing complexity in healthcare systems, effective teamwork is necessary to ensure patient safety and quality care. Therefore, development of interventions that emphasize teamwork competency is required. To this end, inter-professional teamwork training programs could be adapted [27].

Nurses' safety competency levels varied significantly according to age, educational level, clinical experience and position. The results regarding educational level and years of clinical experience were consistent with previous findings [13, 15]. Levels of patient safety competency were higher in nurses with higher levels of education. Nurses with master's or higher degree qualifications are likely to have more opportunities to learn topics relevant to patient safety within their study programs, which could contribute to confidence in patient safety practices. In addition, nurses with more experience in clinical practice were more confident in patient safety practices. This was consistent

with findings indicating that safety knowledge scores were higher in medical trainees at later stages of training [13].

Nurses face and address various issues pertaining to patient safety in clinical practice. They are likely to gain confidence in addressing patient safety issues through accumulated experience. Patient safety competency was higher in older nurses. This result can be interpreted in a similar manner to the finding that duration of clinical experience was strongly correlated with nurses' age. Relative to staff nurses, managers were more confident regarding patient safety, which could be related to their authority; as leaders, they are responsible for ensuring patient safety. Therefore, future education concerning patient safety should focus primarily on younger, less experienced staff nurses with diplomas or baccalaureate degrees.

Positive associations were observed between safety competencies and safety climate perception. This was consistent with previous findings demonstrating moderate positive associations between safety climate and performance [19]. Nurses with higher safety competencies are more likely to be committed to patient safety, thereby contributing to a positive safety climate. Alternatively, strong safety climates that include leadership with an emphasis on patient safety could affect individual nurses' knowledge, skills and attitudes regarding patient safety. Although we did not explore a causal relationship, this finding demonstrated that nurses' improved preparedness, via patient safety education, could contribute to strengthening safety cultures. In particular, teamwork and communication dimensions were critical factors with respect to safety climate perception. Therefore, factors related to teamwork and effective communication should be emphasized in the development and implementation of programs to improve safety competency, which could promote a culture of safety. Additionally, nurses in intensive care units had less favourable perceptions of safety climate than those in surgical care units. This is consistent

with previous findings of variations in safety climate across workplace types [17, 18], possible owing to workplace characteristics such as care delivery model [28].

This study had several limitations. First, as it only involved nurses in three teaching hospitals, the generalizability of the findings is limited. Second, we measured patient safety competencies using self-administered surveys. While the instrument has good construct validity and reliability, methods such as objective structured clinical examination incorporating clinical observation and standardized patient interactions could be used to assess actual behaviours regarding patient safety. Third, we examined the association between individual nurses' safety competencies and safety climate using a cross-sectional study design. Therefore, interventional studies to improve nurses' patient safety competencies and safety climate, explore changes in nurses' safety competencies and safety climate over time, and examine these relationships from a longitudinal perspective are required. Such interventions might include standardization of care processes with measurement of nurses' engagement in unit-level safety practices [29, 30]. Moreover, further research is required to investigate nurses' patient safety competencies in different care settings.

Conclusions

Practicing nurses' patient safety competencies were rated as moderate. Some nurses (~14%) lacked confidence in patient safety practices. In particular, nurses were least confident when working in teams with other healthcare professionals. There were also significant differences in safety competency levels according to nurses' age, clinical experience, educational level and position. Specifically, younger, less experienced nurses with staff positions of diploma or baccalaureate degrees were less confident regarding patient safety practices. Therefore, educational programs emphasizing teamwork factors should target these nurses as a priority. Hospital executives and nurse managers should support and enhance nurses' patient safety competencies by providing opportunities for them to undertake relevant education and listening to their views regarding safety practices. They should also be actively involved in creating systems to facilitate and sustain effective multidisciplinary teamwork.

The study findings demonstrated evidence of a positive association between patient safety competencies and safety climate perception. Strengthening safety climate in the workplace is an essential step towards improving patient safety. At the dimensional level of patient safety competencies, teamwork and communication were significantly associated with perceived safety climate. Therefore, improving nurses' safety competency, with an emphasis on teamwork and effective communication, could contribute to building strong safety cultures.

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