



# Clinical nurses' patient safety competency, systems thinking and missed nursing care: A cross-sectional survey

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## Abstract

**Aim:** The aim of this study was to examine the relationships among patient safety competency, systems thinking and missed nursing care.

**Background:** Patient safety competency and systems thinking are important nurse attributes that promote patient safety. Missed nursing care is known to negatively impact patient safety. However, how nurses' patient safety competency and systems thinking relate to missed nursing care is unknown.

**Methods:** A cross-sectional survey design was used to collect data from nurses practicing in two general hospitals in South Korea. Data were collected between 3 March and 17 April 2020. Questionnaires were distributed to nurses providing direct care in general and specialty units. Patient safety competency, systems thinking and missed nursing care were measured using reliable and valid instruments. A total of 432 complete sets of data were used in final analysis.

**Results:** Higher patient safety competency of nurses was associated with lower missed nursing care. Systems thinking partially mediated the relationship between knowledge of patient safety competency and missed nursing care, and attitudes of patient safety competency and missed nursing care.

**Conclusions:** The knowledge, skills and attitudes sub-scales of patient safety competency showed somewhat different effects in the relationship between missed nursing care and systems thinking, suggesting that each attribute may tap into a separate aspect of patient safety.

## KEYWORDS

competency, missed nursing care, patient safety, quality of care, systems thinking

## Summary statement

What is already known about this topic?

- Patient safety can be threatened when nurses are not competent to provide safe care to patients.
- Systems thinking is an essential nurse attribute that enhances patient safety competency.
- Greater missed nursing care has been associated with negative patient outcomes including adverse events such as medication error, fall with injury and patient mortality.

#### What this paper adds?

- Higher patient safety competency of nurses was associated with less missed nursing care.
- Nurses' systems thinking had a mediating effect on the relationship between the patient safety knowledge and attitude competencies and missing nursing care.
- Nurses' systems thinking had the effect of reducing missed nursing care, but only when nurses exhibited patient safety knowledge and attitude competencies.

#### The implications of this paper:

- By enhancing patient safety competency, missed nursing care can be reduced and negative patient outcomes may decrease accordingly.
- Strategies to increase systems thinking should be applied as a way to reduce missed care and increase patient safety.

## 1 | INTRODUCTION

Patient safety has been established as an important component of providing nursing care to patients (Cronenwett et al., 2007). Patients themselves have expectations and demands related to patient safety performance of health-care institutions and professionals and these have increased over time (Doyle et al., 2013). Accordingly, accreditation agencies that manage the quality of medical services for health-care institutions around the world have high expectations related to quality, and now include performance indicators related to patient safety (Despotou et al., 2020). Nurses are also actively participating in these efforts to increase patient safety (Despotou et al., 2020).

As the importance of patient safety continues to rise, studies on the patient safety competency of nursing personnel have recently been conducted in South Korea (hereafter, Korea) (Jang & Lee, 2017; Kim et al., 2019; Lee et al., 2014), and the suggestion that nursing students should have patient safety competency programs in their undergraduate curricula as a requirement has also been raised (Korean Accreditation Board of Nursing Education, 2019). Such a stance demonstrates the emphasis of patient safety competency for nurses, rather than performance indicators for patient safety more generally.

When nurses provide patient care, competency to perform safe nursing care is very important. This is because nurses are the professionals who have the closest contact with patients, who administer medications, provide important information and monitor the patient's condition. Studies have shown that when nurses fail to provide safe care to patients (Cho, Han, et al., 2020) or when the work environment is not configured in a way that allows nurses to provide safe care, patient safety is threatened (Choi et al., 2019; Hessels et al., 2019). Therefore, having the competency to provide safe nursing care is an essential ability for nurses, and is known as patient safety competency, which is defined as knowledge, skills and attitudes concerning patient safety, that are required for the provision of safe health care (Cronenwett et al., 2007; Lee et al., 2014).

The association of patient safety competency with other concepts that affect nursing practice has been investigated. In a previous

study (Hwang, 2015), patient safety competency of nurses was significantly higher in nurses with master's or higher degrees and clinical experience of longer duration suggesting that nurses' patient safety competency could improve with experience and education. Another study reported that nursing educators who were working as clinical instructors in nursing programs or as hospital preceptors still had educational needs related to patient safety (Jang & Lee, 2017), which suggests that nurse educators may lack sufficient knowledge of patient safety competency to impart to nursing students. In addition, one study found that especially newly licensed nurses showed a low level of patient safety knowledge (Murray et al., 2018), which is one of the components of patient safety competency. As such, although nurses' patient safety competency can be enhanced through experience and education, they may lack adequate patient safety competency, especially early in their careers. Since low patient safety competency of nurses was reported to be correlated with adverse outcomes such as low quality of care and patient satisfaction (Son et al., 2019), there is an urgent need to improve nurses' patient safety competency. Despite its importance, there is still a lot that we do not know about patient safety competency. For example, the literature is silent on which of the three aspects of patient safety competency: knowledge, skills or attitudes may be of the greatest value for promoting patient safety during the provision of nursing care.

Systems thinking has recently emerged as an important ability related to patient safety and has been defined as a process where solutions to complex problems are accomplished through collaborative effort (Stalter et al., 2017). Previous studies have been conducted to measure and develop strategies to enhance systems thinking ability of nursing students (Bacon et al., 2018; Fura & Wissler, 2017) and nurses (Phillips et al., 2016). A common theme across these studies is the need for education in systems thinking because it is an essential factor in enhancing the patient safety competency of nurses and nursing students. However, there has been little research on how systems thinking affects patient outcomes or nurse performance.

One plausible outcome of systems thinking is that a patient receives appropriate care. Providing appropriate nursing care means

no omission of required nursing care, which was named as 'missed nursing care' (Kalisch & Williams, 2009). Factors affecting missed nursing care have been reported to be structural factors of the institutions such as nurse work environment (Kim et al., 2018; Lake et al., 2020; Park et al., 2018), including unit type, hospital type (Bragadóttir et al., 2017) and nurse staffing (Cho, Lee, et al., 2020) and process factors such as teamwork (Kalisch & Lee, 2010) and patient safety culture (Hessels et al., 2019; Kim et al., 2018). All of these factors are related to patient safety, so it may be that a contributing factor of missed nursing care may be a lack of systems thinking.

Missed nursing care has been investigated as both a predictor and an outcome. When conceptualized as a predictor, the consequences of missed nursing care were found to be related to negative outcomes of patient safety (Cho, Lee, et al., 2020; Min et al., 2020), including increased adverse events and patient mortality (Ball et al., 2018), decreased quality of care (Cho, Lee, et al., 2020), decreased patient satisfaction (Lake et al., 2016) and increased nurse turnover intention (Smith et al., 2020). These previous studies have shown that patient safety is actually threatened and the quality of nursing is degraded by nurses' omission (Ball et al., 2018; Cho, Lee, et al., 2020; Min et al., 2020). The ability to provide safe nursing care for the patient and the ability to think about the impact of one's actions on a patient's outcome (a component of systems thinking) may be related to the act of missing care.

According to previous studies, nurses' low patient safety competency and high missed nursing care were found to increase negative patient outcomes (Son et al., 2019), including adverse events such as medication error and fall injury (Min et al., 2020). However, the association between nurses' patient safety competency and missed nursing care has not been investigated. Additionally, the influence of systems thinking, which is an important concept in patient safety competency needs to be examined. By revealing direct and indirect relationships among knowledge, skills, and attitude attributes of patient safety competency, missing nursing care and systems thinking, we may be able to develop strategies to reduce missed nursing care and consequently increase nurses' ability to provide safe nursing care.

## 2 | METHODS

### 2.1 | Aim of the study

The aims of this study were (a) to examine the direct relationships among nurses' patient safety competency, systems thinking and missed nursing care and (b) to determine the mediating effects of systems thinking on the relationship between patient safety competency and missed nursing care.

### 2.2 | Conceptual framework

The Missed Nursing Care Model (Kalisch & Williams, 2009) guided the conceptual framework of this study, which was developed

based on Donabedian's Structure-Process-Outcomes Model (Donabedian, 1980). In this study, we hypothesized that there would be a direct relationship between patient safety competency and missed nursing care because patient safety competency could determine whether nurses had sufficient competency to do nursing activities without omission. Since systems thinking is concerned with the key interrelationships, structures and processes that control and monitor behaviour (Silverman, 2000), we hypothesized that systems thinking would act as a mediator in the relationship between patient safety competency and missed nursing care.

### 2.3 | Study design

This study used a cross-sectional survey study design to determine the relationships among patient safety competency, systems thinking and missed nursing care of clinical nurses in Korea.

### 2.4 | Settings and participants

One general hospital located in Daejeon city and one tertiary hospital located in Seoul, Korea were selected as study settings. Two University hospitals with a history of more than 20 years in the community, which were accessible by the researcher were selected. The general hospital in Daejeon has 900 beds and provides a full range of in-patient services to the citizens of Daejeon (population about 1.5 million) and surrounding area. Daejeon city is located in the central region of Korea and about 95 miles away from Seoul, which is the capital city of Korea, and has 10 general hospitals. The hospital that was selected from Seoul has 1045 beds. In order to prevent the difference between hospitals from appearing as a potential source of bias, role in the community, size of the hospital and whether it was a university hospital were considered when selecting two hospitals.

The sample size was estimated using G-power programme 3.1.9.2. Performing multiple regression analysis based on the effect size 0.15 (median effect), the power level of 95%, and the significance level  $\alpha = 0.05$ , the appropriate number of participants was estimated to be 199. However, we over-sampled to account for a potential 20% drop out rate, so that the total number of participants in each hospital was 240. Therefore, data were collected from a total of 480 nurses.

To recruit research subjects, after receiving approval from the head of the hospital, 240 clinical nurses from each hospital were invited to participate in the study. To be eligible to participate in this study, a 'clinical nurse' was defined as a nurse who has been working for at least 3 months or more in a general hospital at the time of investigation. In addition, we included nurses working in general wards and specialty units (intensive care unit, emergency room, operating room, anesthesiology department, haemodialysis room etc.) but excluded nurses working in outpatient or administrative departments because they were not involved in direct nursing care.

## 2.5 | Data collection

After receiving approval from the nursing department of each hospital, a recruitment announcement was posted in the hospital online bulletin board. A total of 480 questionnaires were distributed by a researcher to each of the nursing units that indicated their intention to participate. The researcher was not affiliated with the hospitals. Questionnaires were placed in survey packets that consisted of a study introduction letter, consent form, the questionnaire, and an envelope to facilitate return. After completing surveys, nurses sealed them in envelopes individually and submitted them to the collection box. The researcher collected questionnaires at intervals of once a week for a total of 2 weeks for each ward, so that data were collected between 3 March and 17 April 2020 for a total of 52 nursing units in two hospitals.

## 2.6 | Measures

### 2.6.1 | Patient safety competency

Patient safety competency of the nurses was measured using the Patient Safety Competency Self-Evaluation (PSCSE) tool (Lee et al., 2014). The scale consists of a total 41 items with three sub-scales: knowledge (6 items), skills (21 items) and attitudes (14 items). The PSCSE was designed to measure patient safety competency of nursing students with items arranged on a 5-point Likert-type scale. Higher scores mean higher knowledge (ranging from 1 = *not knowledgeable* to 5 = *very knowledgeable*), skills (ranging from 1 = *not uncomfortable* to 5 = *very comfortable*) and attitudes (ranging from 1 = *strongly disagree* to 5 = *strongly agree*), on patient safety competency. The scale was originally developed in Korean for nursing students and the questionnaire items were presented and published in English (Lee et al., 2014). The scale has also been applied to nursing educators (Jang & Lee, 2017). A sample item for the knowledge sub-scale is 'I know how to describe factors that create a culture of safety'. A sample item for the skills sub-scale is 'I can report errors using an organizational error reporting system'. A sample item of the attitudes sub-scale is 'Health care professionals should routinely report when certain errors occur'. Cronbach's alpha for the scale has been reported as 0.86 (knowledge), 0.91 (skills), 0.79 (attitudes) and 0.90 (overall) (Lee et al., 2014). In this study, the Cronbach's alpha was 0.89 (knowledge), 0.94 (skills), 0.78 (attitudes) and 0.94 (overall) for clinical nurses.

### 2.6.2 | Systems thinking

Systems thinking was measured by the Systems Thinking Scale (STS) (Dolansky et al., 2020). The scale consists of 20 items arranged on a 5-point Likert-type scale (0 = *never*, 1 = *seldom*, 2 = *some of the time*, 3 = *often* and 4 = *most of the time*). A sample item from this scale is 'When I want to make an improvement, I keep in mind that proposed

changes can affect the whole system'. We used the Korean version of the scale, which was translated and used for nursing students (Jang, 2018). At the time of development, the test-retest reliability of the tool was 0.74, the internal reliability was 0.89, and discriminant validity was verified. The Cronbach's alpha of the scale in this study was 0.92.

### 2.6.3 | Missed nursing care

Missed nursing care was measured using the MISSCARE survey developed by Kalisch and Williams (2009). The MISSCARE survey has been translated into Korean and used to examine nurses' performance in Korea (Cho et al., 2015). The MISSCARE survey is the most widely validated tool to measure unfinished nursing care across countries (Palese et al., 2021) including Korea.

The first part of the MISSCARE survey explores perceptions of missed care and the second part includes the reasons for missed care. In this study, only the first part of MISSCARE survey was used because we focused on analysing the degree rather than the cause of omission. Nurses were asked to answer on a 4-point Likert-type scale how frequently they had missed each of 24 nursing care elements (1 = *rarely*, 2 = *occasionally*, 3 = *frequently* and 4 = *always*). Higher scores indicated a greater extent of missed care. The first part of the MISSCARE survey ask nurses how frequently they miss items such as 'turning patient every 2 hours', 'mouth care' or 'PRN medication requests acted on within 15 minutes' when they are providing nursing care to patients. Cronbach's alpha for the 24 elements of missed care in the Korean nurse study (Cho et al., 2015) was 0.89. In this study, Cronbach's alpha for the overall 24 elements of missed care was 0.89.

## 2.7 | Data analysis

Descriptive statistics including means, standard deviations, frequencies and percentages were used to describe the general characteristics of participants and main variables. For patient safety competency, the mean score for each sub-scale and for the overall scale was calculated. Systems thinking, and missed nursing care were calculated as the mean of the item responses. Higher scores of patient safety competency and systems thinking indicated higher levels of those variables. Higher scores of missed nursing care indicated higher occurrence of missing nurse activities.

Multiple linear regression was conducted to analyse the effects of independent variables on missed nursing care. Finally, Hayes (2012)'s Model 4 and bootstrapping were used to identify the mediating effects of systems thinking on the relationship between patient safety competency and missed nursing care. Models were run to demonstrate the mediating effects of systems thinking on the relationship between patient safety competency overall as well as each sub-scale and missed nursing care.

One of the respondents was immediately excluded because she or he was not a nurse providing direct nursing care, and the data of

seven additional respondents whose questionnaires had a page missing were also excluded. In addition, 40 participants returned questionnaires with missing answers to questions about the main variables and these questionnaires were excluded. Therefore, a total of 48 questionnaires were excluded and data from 432 participants were used for the final analysis. Data analysis was performed using SPSS 24.0 statistical package (IBM Corporation) and PROCESS (version 3.3) macro for SPSS.

## 2.8 | Ethical considerations

The study received institutional review board (IRB) approval (IRB No. 2020-015-01) from the university of the first author. This study was conducted in accordance with the principles of the Declaration of Helsinki and the guidelines provided by the IRB. Nurses completed a written consent form prior to participating in the survey voluntarily. They were informed that they could stop the survey whenever they wanted without any harmful consequences for their career. Participants' personal information was managed in a separate master file from the dataset used for analysis.

## 3 | RESULTS

General characteristics of the participants are presented in Table 1. The majority of the nurses were female (95.4%) and most of the participants had bachelor's degrees (86.6%). The average age of the nurses was 28.7 years. More than half of the nurses worked in general care (i.e., medical and/or surgical) wards (60.6%) and had more than 3 years of unit experience (67.8%), with an average of 5.9 years.

Table 2 presents the means and standard deviations of patient safety competency, systems thinking and missed nursing care scales. The average mean score of patient safety competence was  $3.81 \pm 0.39$ . Among the subscales, attitudes ( $4.01 \pm 0.46$ ) was the highest, followed by skills ( $3.84 \pm 0.47$ ) and knowledge ( $3.44 \pm 0.66$ ). The mean score of systems thinking was  $2.73 \pm 0.46$  and missed nursing care was  $1.39 \pm 0.32$ .

Relationships among patient safety competency, systems thinking and missed nursing care are presented in Table 3. In examining direct relationships, patient safety competency overall showed an inverse relationship with missed nursing care. However, when examining subscales, only the skills sub-scale of patient safety competency had a significant inverse effect on missed nursing care ( $\beta = -0.126$ ,  $p = 0.014$ ). Systems thinking did not show a significant, direct relationship with missed nursing care.

The mediating effects of systems thinking on the relationship between patient safety competency and missed nursing care are presented in Figure 1. Patient safety competency knowledge ( $\beta = -0.073$ ,  $p = 0.002$ ), skills ( $\beta = -0.160$ ,  $p < 0.001$ ), attitudes ( $\beta = -0.113$ ,  $p < 0.001$ ) and overall ( $\beta = -0.198$ ,  $p < 0.001$ ) showed direct inverse effects on missed nursing care. Adding systems thinking to the model as a mediator showed different results depending on

**TABLE 1** General characteristics of participants ( $N = 432$ )

Characteristics	Category	N (%) or M $\pm$ SD
Gender	Female	412(95.4)
	Male	20(4.6)
Age (years) <sup>a</sup>	22-24	70(16.2)
	25-27	159(36.8)
	$\geq 28$	202(46.8)
		28.7 $\pm$ 4.88
Education level <sup>b</sup>	Associate degree	40(9.3)
	Bachelor's degree	374(86.6)
	Master's or higher	16(3.7)
Hospital type (location)	General (non-metropolitan)	217(50.2)
	Tertiary (metropolitan)	215(49.8)
Type of nursing unit	Medical ward	128(29.6)
	Surgical ward	134(31.0)
	Intensive care unit	94(21.8)
	Emergency room	15(3.5)
	Others	61(14.1)
Duration of unit experience (years) <sup>c</sup>	<1	79(18.3)
	1-2	59(13.7)
	$\geq 3$	293(67.8)
		5.94 $\pm$ 4.97

<sup>a</sup>One missing value in category of age.

<sup>b</sup>Two missing values in category of education level.

<sup>c</sup>One missing value in category of duration of unit experience.

**TABLE 2** Scores of patient safety competency, systems thinking and missed nursing care of participants ( $N = 432$ )

Characteristics	M $\pm$ SD	Range	Min-Max
Patient safety competency	3.81 $\pm$ 0.39	1-5	2.90-5.00
Knowledge	3.44 $\pm$ 0.66	1-5	1.67-5.00
Skills	3.84 $\pm$ 0.47	1-5	2.62-5.00
Attitudes	4.01 $\pm$ 0.46	1-5	2.71-5.00
Systems thinking	2.73 $\pm$ 0.46	0-4	1.55-4.00
Missed nursing care	1.39 $\pm$ 0.32	1-4	1.00-3.67

Note: M = mean; SD = standard deviation; Min = minimum; Max = maximum.

which sub-scale of patient safety competency was being tested. Systems thinking had a significant mediating effect on the relationship between both knowledge ( $\beta = -0.120$ ,  $p = 0.002$ ) and attitudes ( $\beta = -0.114$ ,  $p = 0.004$ ) of patient safety competency and missed nursing care (Figure 1a,c). The indirect effect of systems thinking was significant for patient safety knowledge ( $\beta = -0.045$ ; BootCI =  $-0.074$  to  $-0.019$ ) and attitudes ( $\beta = -0.060$ ; BootCI =  $-0.102$  to  $-0.019$ ), which indicated systems thinking as a partial mediator of the relationship between patient safety knowledge and attitude

**TABLE 3** Multiple linear regression analysis of patient safety competency, systems thinking and missed nursing care ( $N = 432$ )

	Patient safety competency Coefficient ( $p$ ) (95% CI)			Systems thinking Coefficient ( $p$ ) (95% CI)
	Knowledge	Skills	Attitudes	
Missed nursing care	-0.004(.881) (-0.062, 0.053)	-0.126(.014) (-0.225, -0.026)	-0.001(.974) (-0.085, 0.082)	-0.058(.214) (-0.149, 0.034)

Note: Adjusted for gender, age, education level, hospital type, unit type and duration of unit experience. CI indicates confidence intervals.

competency and missed nursing care. However, there was no significant mediating effect of systems thinking on the relationships between either skills or overall patient safety competency and missed nursing care (Figure 1b,d).

## 4 | DISCUSSION

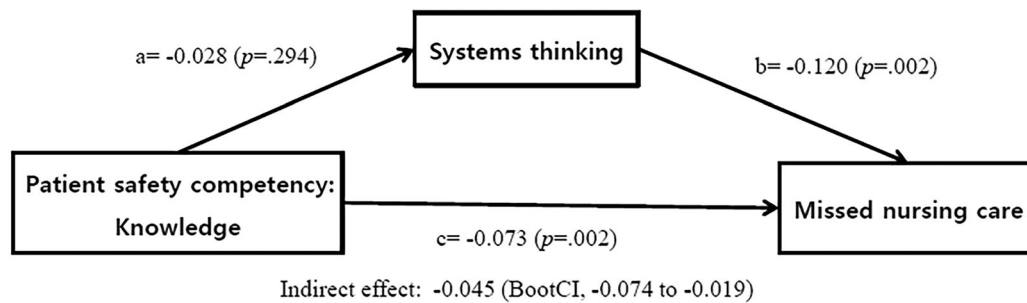
In this study, we found that higher patient safety competency had a significant inverse effect on missed nursing care such that nurses who reported higher patient safety competency also reported less missed nursing care. However, in sub-scale analysis only the skills sub-scale of patient safety competency was significantly associated with missed nursing care, suggesting that of the three patient safety competency attributes, skills are the most relevant to missed nursing care. This makes sense because skill competency is the most closely related to nurses' direct behaviour and directly influences nursing care provided to patients through communication, resource utilization, evidence-based practice, infection prevention and safe nursing practices, which are all components of skill competency (Lee et al., 2014). The results further suggest that nurses with lower skill competency may be more likely to miss nursing care.

Similar to previous studies, nurses' patient safety competency attitudes, skills and knowledge (in that order) were found to be high (Jang, 2018; Jang & Lee, 2017). However, we found that the level of knowledge, skills and overall patient safety competency of clinical nurses was higher and the attitude competency was lower compared to nursing students in a previous study (Jang, 2018). In addition, compared to a study also conducted in Korea with nursing educators (e.g., school clinical instructors and hospital nurse preceptors), all scores related to patient safety competency in this study were found to be at lower level (Jang & Lee, 2017). Through comparison with previous studies (Hwang, 2015; Jang & Lee, 2017), we expected that the level of patient safety competency of clinical nurses would increase as education, training and career experience increased. Our finding that clinical nurses' scores of attitude competency were lower than that of nursing students may be due to changes in attitude that can occur over time when nurses work in environments that do not support professional nursing practice (Manojlovich, 2005). Attitude plays an important role in establishing a patient safety culture, such as understanding the activities that promote patient safety and prevent errors, and duties as a health-care professional (Lee et al., 2014). Previous studies have reported that missed nursing care negatively affects the

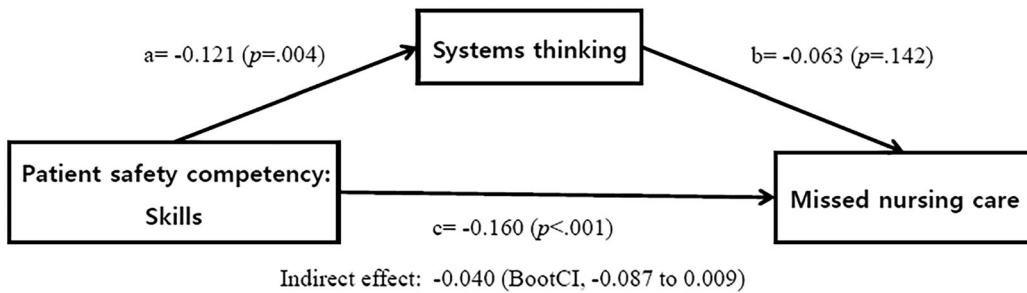
quality of nursing and causes more adverse events (Min et al., 2020; Recio-Saucedo et al., 2018). Our findings suggest that by increasing patient safety competency, it may be possible to reduce the amount of nursing care that is missed and eventually reduce the risk of negative effects on patients.

However, the story becomes more nuanced because we also tested the mediating effect of systems thinking on the relationship between patient safety competency and missed nursing care. Another major finding of this study was that systems thinking showed a significant mediating effect on the relationship between patient safety knowledge competency and missed nursing care, and patient safety attitude competency and missed nursing care, but not patient safety competency overall or the skill sub-scale. In other words, both patient safety knowledge and attitude competencies contributed to a decrease in missed nursing care through nurses' use of systems thinking. This finding suggests that nurses who use a systems thinking approach do not have to also have patient safety competency skills, as long as they have patient safety knowledge and attitudes. Systems thinking has been applied not only in the health-care field (Wilkinson et al., 2018), but in many other fields as well (Zhang et al., 2020) and is considered as a way to enhance safety and quality. Accordingly, studies have been conducted to analyse the effects of educational programs to increase systems thinking for medical students (Aboumatar et al., 2012) and nursing students (Bacon et al., 2018). The Quality and Safety Education for Nurses (QSEN) programme also emphasizes systems thinking as one of the key concepts in developing quality and safety competencies in nursing (Dolansky & Moore, 2013). Education programs related to patient safety or systems thinking are not included as a requirement in Korea (Korean Accreditation Board of Nursing Education, 2019). This fact may explain why we found that the mean score of systems thinking of clinical nurses was lower compared to that of nursing students in other countries (Bacon et al., 2018; Fura & Wisser, 2017).

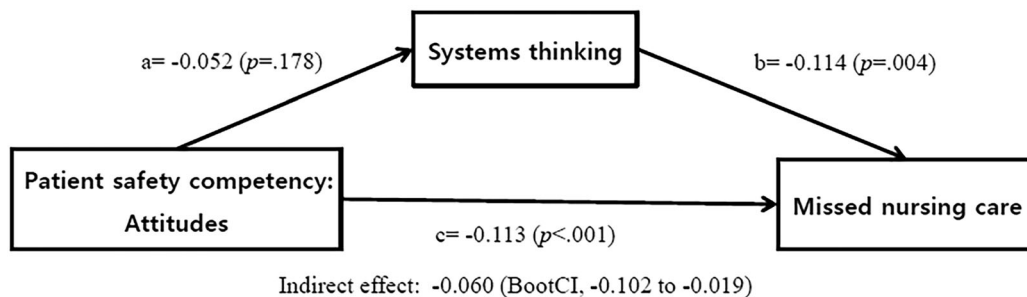
The impact of educational methods that can reinforce systems thinking and demonstrate an effect on outcomes such as patient safety and quality of care require further study. In particular, the effectiveness of such education can be investigated by testing direct effects of the relationship of nurses' systems thinking on patient outcomes, after an educational programme has been implemented. In addition, it may be possible to reinforce patient safety in the overall hospital environment by promoting the value of systems thinking not only to nurses but also to all health-care professionals who participate in the treatment of patients.



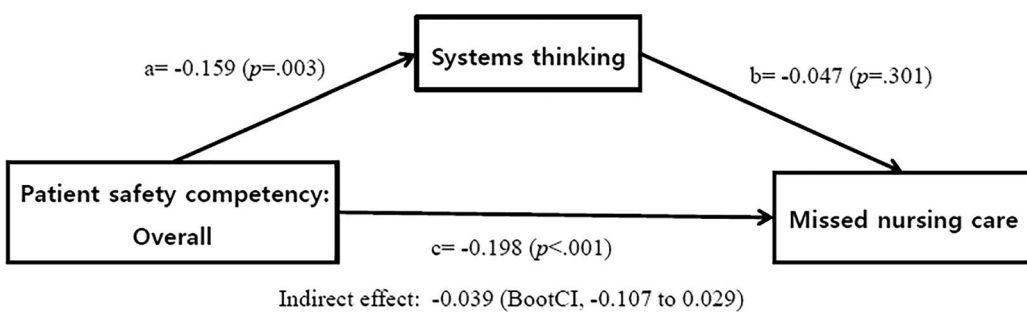
(a) Mediating effect of systems thinking in relationship between patient safety competency (knowledge) and missed nursing care



(b) Mediating effect of systems thinking in relationship between patient safety competency (skills) and missed nursing care



(c) Mediating effect of systems thinking in relationship between patient safety competency (attitudes) and missed nursing care



(d) Mediating effect of systems thinking in relationship between patient safety competency (overall) and missed nursing care

**FIGURE 1** (a–d) Relationships among patient safety competency, systems thinking and missed nursing care. Mediating effect of systems thinking

### 4.1 | Limitations

This study has several limitations. First, the relationships among patient safety competency, systems thinking and missed nursing care do not reflect causal relationships due to the cross-sectional survey

design. Longitudinal studies are needed to confirm the effects of nurses' patient safety competency and systems thinking on nursing performance. Second, the findings from this study may not be generalizable to nurses in other countries or in other hospital settings. Specifically, there may be differences in nursing practice and the scope of

nursing across countries that affect the perception of unfinished nursing care. Third, self-report may not accurately reflect nurses' true practice behaviours. Further observational studies or patient surveys may enable more objective results to emerge. Fourth, since we only used the first part of the missed nursing care tool, there were limits in our ability to make direct comparisons with studies that used the full instrument.

## 5 | CONCLUSION

In conclusion, this study provides additional evidence of the multifaceted nature of patient safety competency. The knowledge, skills and attitudes sub-scales of patient safety competency showed somewhat different effects in the relationship between missed nursing care and systems thinking, suggesting that each attribute may tap into a separate aspect of patient safety. Strategies to increase systems thinking should be applied as a way to reduce missed care and increase patient safety. Through ongoing investigation, the differential effects of the sub-scales of patient safety competency on systems thinking and other factors may be further revealed and used to develop strategies to strengthen the required competencies of nurses, so that missed nursing care is progressively reduced.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHORSHIP STATEMENT

All listed authors meet the authorship criteria and that all authors are in agreement with the content of the manuscript.

HEC and MM designed the study. HEC collected the data. HEC and MM analysed the data. HEC and MM prepared the manuscript. All authors approved the final version for submission.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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