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Simulation-Based Education for Recognizing and Responding to Deteriorating Patients in Korean Nursing Curricula: A Scoping Review

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Purpose: This study was a scoping review aimed at evaluating Simulation-Based Education for recognizing and responding to deteriorating patients within Korean nursing school curricula, and at developing educational strategies for these competencies. **Methods:** A literature search was conducted from April 1 to April 30, 2024. The review followed the scoping review framework by Arksey and O'Malley and the manual by the Joanna Briggs Institute. Relevant studies were identified through databases such as the Korean Medical Database, Korean Studies Information Service System, DataBase Periodical Information Academic, Research Information Sharing Service, ScienceOn, and the Cumulative Index to Nursing and Allied Health Literature. **Results:** Eleven studies published from 2010 to 2019 were reviewed. The simulations typically included several lectures and practice sessions on advanced cardiopulmonary life support before the simulation exercises, which were then repeated. Cardiac arrest was frequently used as a scenario subject. The learning outcomes focused on the cognitive and psychomotor domains, as well as self-efficacy. **Conclusion:** Although simulation for recognizing and responding to deteriorating patients was available in Korean nursing school curricula, it was infrequently incorporated as a regular part of the training. Future initiatives should include adding educational content to enhance nursing students' competencies in recognizing and responding to deteriorating patient simulations. Subsequent studies should assess the effectiveness of these educational methods.

Key Words: Clinical deterioration; Education, Nursing; Review; Simulation training

INTRODUCTION

The survival rate of patients who experience in-hospital cardiac arrest and survive until discharge is only 10~25% [1,2]. To increase the survival rates of these patients, healthcare organizations are implementing Rapid Response Systems (RRS) designed to identify and address signs of patient deterioration before a cardiac arrest occurs [2-4]. However, if healthcare providers fail to recognize these signs, the RRS cannot be activated, which may delay timely and appropriate interventions. This delay can lead to ICU admissions, further cardiac arrests, or even death [5]. Therefore, it is crucial to train healthcare providers in the early recognition and response to signs of patient deterioration. This training should be coupled with high-quality cardiopulmonary resuscitation education to improve patient safety.

The role of nurses is crucial in the early recognition and appropriate response to signs of patient deterioration before cardiac arrest occurs [6-8]. Specifically, nurses' ability to recognize early signs is key to the effective activation of the RRS, and considerable efforts have been made to train nurses in identifying and responding to symptoms of deteriorating patients [9-13]. In training focused on the recognition and response to deteriorating patients, what the nurse observes in the patient is paramount. Nurses should be trained to consistently monitor the patient's circulation and respiration [14]. Simulation-Based Education (SBE) is a highly effective method for developing the necessary competencies in training programs aimed at recognizing

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and responding to deteriorating patients [15,16]. The inclusion of SBE in training for handling hospital emergencies involving deteriorating patients enhances the effectiveness of the training compared to lectures alone [1]. It is essential that education on the effective recognition and response to deteriorating patients begins at the undergraduate level, and SBE has proven to be an effective tool for nursing students [1,16,17].

In Korea, there is a growing need for education on recognizing and responding to deteriorating patients due to the increasing severity of conditions in hospitalized individuals [18-21]. However, the extent of its integration into nursing school curricula remains unclear. While critical care and emergency nursing courses do cover relevant content, these are often elective courses for majors [18-20, 22]. Furthermore, clinical placements in intensive care units or emergency departments do not necessarily provide nursing students with experience in handling emergencies. Even when emergencies do occur, student involvement is typically restricted [18]. Therefore, this exposure is insufficient for developing robust emergency recognition and response skills. To address this gap, it is crucial to assess the current state of emergency recognition and response education through simulation-based education, which facilitates learning through direct experience. Hyun et al. [23] conducted a meta-analysis on simulation training in emergency nursing, primarily focusing on Advanced Cardiopulmonary Life Support (ACLS). ACLS training aims to prevent cardiac arrest, manage cardiac events, and enhance patient outcomes after the return of spontaneous circulation by implementing complex life-saving interventions [24,25]. Although ACLS training may cover recognizing and responding to deteriorating patients, it is unclear whether this is consistently included in the curriculum. It is vital to differentiate between curricular and extracurricular content since core competencies should be attainable by all nursing program graduates. Additionally, the emergencies featured in SBE can differ based on the instructor's experience and the training environment [19]. Therefore, reviewing the scenario topics used in simulations is necessary to ensure they accurately reflect real-life situations. A comprehensive review of emergency-related training within the curriculum is necessary to fully understand its role in training nurses to recognize and respond to deteriorating patients.

This study aims to conduct a scoping review to assess the current status of SBE for recognizing and responding to deteriorating patients within the curriculum of undergraduate nursing students at Korean nursing schools. A scoping review is a crucial methodology for knowledge synthesis. It explores the breadth and depth of a research area by identifying key concepts, information, and types of evidence that define the field. Additionally, it summarizes and disseminates findings or pinpoints gaps in existing research [26,27]. This study sought to provide foundational data for the development of SBE in nursing school curricula, specifically targeting the recognition and response to deteriorating patients. This objective was pursued by analyzing studies on emergency SBE in Korean nursing schools through a scoping review.

METHODS

1. Study Design

This scoping review aimed to identify empirical literature on the use of simulation to train undergraduate nursing students in recognizing and responding to patient deterioration. It adhered to Arksey and O'Malley's five-stage methodological framework to ensure a rigorous and transparent review process [26]. The stages included (1) identifying research questions, (2) identifying relevant studies, (3) selecting studies, (4) charting the data, and (5) collating, summarizing, and reporting the results.

1) Stage 1: Identification of the research questions

The first stage of this study involved identifying the research questions. Following the guidelines set forth by Arksey and O'Malley [26], we adopted a broad approach to ensure comprehensive coverage of nursing students' recognition and response simulations in emergency situations in Korea. To formulate specific research questions, we utilized the Population, Concept, Context (PCC) framework as recommended by the Joanna Briggs Institute (JBI) [28]. Consequently, the research questions were developed based on a consensus among the research team members. The research questions were:

- How is SBE for recognizing and responding to deteriorating patients integrated into curricula for undergraduate nursing students in Korean nursing schools?
- What simulation scenarios of SBE are implemented in curricula for undergraduate nursing students in Korean nursing schools to recognize and respond to deteriorating patients?
- What learning outcomes are assessed in SBE for recognizing and responding to deteriorating patients, as implemented in curricula for undergraduate nursing students in Korean nursing schools?

2) Stage 2: Identifying relevant studies

In this stage, two authors, YH and HG, discussed search strategies, eligibility criteria, and electronic databases. We employed the PCC framework recommended by the JBI [28] (Table 1) to construct a systematic plan for the database search and to address the research questions. The literature search was conducted from April 1 to April 30, 2024, without limiting the publication period of the studies. A comprehensive search strategy was independently developed by two authors to identify published primary research in the databases searched. These included the Korean Medical Database, Korean Studies Information Service System, DataBase periodical information academic, Research Information Sharing Service, ScienceOn, and Cumulative Index to Nursing and Allied Health Literature. Additionally, we applied the limit of "exp Republic of Korea" or Korean-related terms to focus the search on studies published within Korean contexts. The search strategy is detailed in online supplemental appendix B.

3) Stage 3: Selection of eligible studies

Applying the PCC framework recommended by the JBI, studies that met the inclusion criteria were eligible for review (Table 1). A total of 734 studies were identified through the search strategy (Figure 1).

Abstracts, conference proceedings, systematic reviews, discussion papers, opinion pieces, or studies not published in English were excluded. Two reviewers, YH and HG, screened titles, abstracts, and full-text articles for inclusion. All reviewers independently screened full-text articles for eligibility, using the inclusion criteria to reach a final consensus. Eleven studies that met both the inclusion and exclusion criteria were selected for the scoping review (Figure 1).

4) Stage 4: Charting the data

Data extraction was performed independently for each article, with a third reviewer mediating in cases of disagreement. After extracting the data, key information from each study was organized into a table to provide an overview. This included the first author, study design, participants, course, simulation programs, fidelity or setting, simulation components, and SBE outcomes (Table 2).

RESULTS

1. General Characteristics of the Reviewed Studies

The year of publication, research methodology, and subjects were listed and reviewed to identify the general characteristics of the studies in the literature. The specific results for the 11 articles analyzed are shown in Table 3. Five articles were published from 2010 to 2019, and six were published from 2020 to April 2024 (the search period). The studies varied in methodology: one was qualitative [A6], one utilized mixed methods [A2], and the remaining nine were quantitative. Participants in emergency simulation training predominantly consisted of graduating seniors (54.5%) and juniors (9.1%) from 3-year programs. Most emergency SBE took place in simulation courses. However, one study [A4] conducted simulation training in an alternative clinical practicum course due to coronavirus disease 2019.

2. SBE for Recognizing and Responding to Deteriorating Patients in Korean Nursing School Curricula

SBE for recognizing and responding to deteriorating patients was operationalized in the studies analyzed, as shown in Table 2. Seven studies [A2-A8] included one to five sessions as part of an integrated simulation course. Two studies [A2,A8] featured only one scenario simulation course. In contrast, five studies [A3-A7] incorporated one to two sessions of scenario-related theoretical lectures and practical training before the scenario simulation course, followed by one to two scenario simulation courses. Additional lectures were provided before participating in SBE [A5], outside of regular training hours. Students were asked to practice during the pre-briefing [A4]. In two studies, the simulation was repeated in class after the simulation training ended, either for a single performance assessment [A6] or for three repeated simulation exercises

Table 1. PCC Framework of This Scoping Review

PCC framework of this scoping review
Population: Undergraduate nursing students enrolled in bachelor/diploma degree nursing programs who participated in simulation-based education
Concept: Simulation-based education for recognizing and responding to deteriorating patients
Context: Korean nursing school curricula

PCC=population, concept, context.

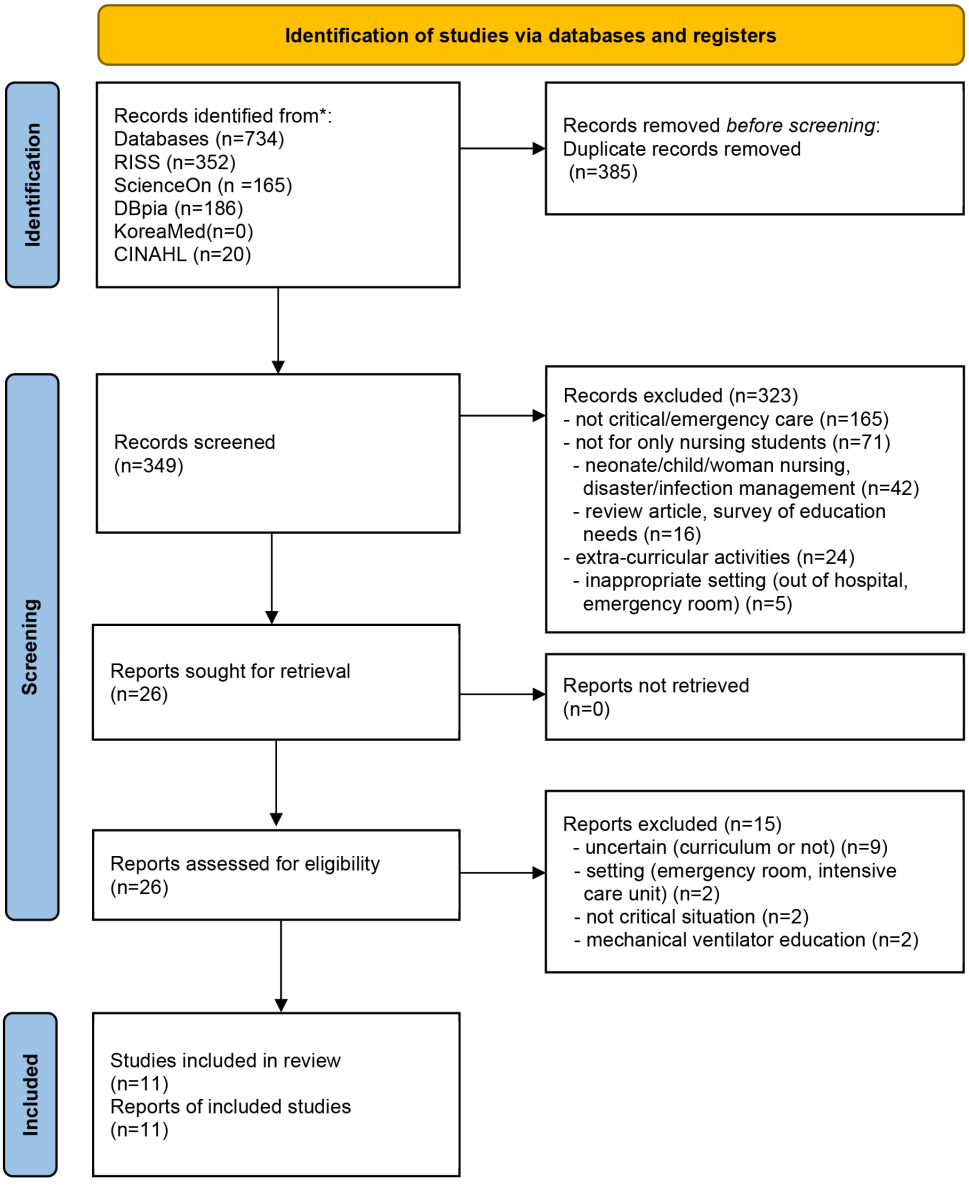

Figure 1. PRISMA flow diagram of study selection.

with role rotation [A5]. In four instances [A1,A9-A11], the simulation course was conducted as an emergency simulation course, running for six to 14 sessions and including two to seven scenarios. A1, A9, and A10 conducted the ACLS algorithm in a cardiac arrest scenario simulation after several sessions of theoretical and practical training required to perform ACLS. A9 practiced the simulation four times with role rotation. Participants were asked to practice team simulation before participating in the SBE [A1,A10]. Seven of the studies analyzed [A2-A4,A6,A7,A9, A11] consisted of a pre-briefing (10~30 min), followed by a scenario simulation (15~20 min) in groups of 2~4 individuals, and a debriefing (20~60 min); [A1, A8, A10] had no pre-briefing, A3 had no debriefing, and A5 included only a scenario simulation.

3. Simulation Scenarios of SBE for Recognizing and Responding to Deteriorating Patients in Korean Nursing School Curricula

The studies examined nine different scenario topics, as depicted in Figure 2. Out of the 25 scenarios, those related to resuscitation-including cardiac arrest, respiratory issues, and post-resuscitation care-were the most prevalent, comprising 68.0% (n=17) of the cases. The other scenarios covered a range of medical emergencies such as asthma at-

Table 2. Data ExtractionTable (*N*=11)

No.	Author (year)	SD/ Participant	Course	SBE programs	Repetition	Simulation (duration, minutes)			Learning outcomes
						P	SS	D	
A1	Kwon et al. (2023)	QES/ Senior (n=97)	Global emergency & disaster practice	[12 periods] 1: Orientation (BLS practice) 2: BLS evaluation 3~4: airway management, oxygenation 5: Electrical shock 6: Lecture & test (ACLS drugs) 7~12: Simulation (6 scenarios) bradycardia, VT/VF, asystole/PEA, post-resuscitation care, advanced airway /oxygenation ※ Required self-exercise (team)	No	No	2 /5~6 members (ND)	Yes (20)	Clinical reasoning, clinical competence, learning self-efficacy
A2	Ha (2023)	Mixed/ Senior (n=130)	Clinical integrated simulation (part)	[1 period] 1. Simulation (1 scenario): septic shock	No	Yes (30)	2~3 members (15)	Yes (90)	Knowledge, clinical judgment, recognition, performance
A3	Im (2022)	QES/ Senior (n=110)	Integrated simulation (part)	[3 periods, undifferentiated] Preparation (orientation, lecture on simulation algorithm, role discussion, nursing skill practice, simulation for exercise), Simulation for evaluation (1 scenario) - Cardiac arrest	No	Yes (ND)	4~5 members (15)	ND	Self-efficacy of BLS, clinical reasoning
A4	Im et al. (2023)	QES/ Junior (n=122)	Alternative clinical practicum (part)	[3 periods] 1: Online lecture (16 hours) advanced airway management, ventilator, defibrillator, emergency drugs, CPR 2: Skill practice (160 minutes) 3: Simulation (1 scenario): respiratory arrest ※ Exercise during prebriefing	No	Yes (30)	ND (40, including feedback)	Yes (30)	Knowledge, performance competence
A5	Jang et al. (2020)	Survey/ Junior (n=87)	Simulation (part)	[4 periods] 1: Orientation 2~4: Simulation (1 scenario): cardiac arrest ※ Extra lecture on cardiac arrest and evaluation of BLS	3 times (role rotation)	No	5~6 members (ND)	No	Self-efficacy, learning competency
A6	Lee (2020)	Content analysis/ Senior (n=31~34)	Simulation (part)	[5 periods] 1: Orientation, analysis of scenario 2~4: Simulation (2 scenarios) - Cardiac arrest in AMI - Cardiac arrest in chest trauma 5: Simulation for evaluation	Once (evaluation)	Yes (ND)	3~4 members (ND)	Yes (20)	Recognition of problem, performance

ACLS=advanced cardiopulmonary life support; AMI=acute myocardial infarct; BLS=basic life support; D=debriefing; ND=not described; P=prebriefing; QES=quasi-experimental study; SBE=simulation-based education; SD=study design; SS=scenario simulation.

Table 2. Data ExtractionTable (Continued) (*N*=11)

No.	Author (year)	SD/ Participant	Course	SBE programs	Repetition	Simulation (duration, minutes)			Learning outcomes
						P	SS	D	
A7	Ha et al. (2017)	QSE/ Junior (n=59)	Integrated critical care (part)	[3 periods] 1: Lecture (mechanical ventilator, SBAR) 2~3: Simulation (2 scenarios) - Asthma attack, respiratory arrest	No	Yes (10)	2~3 members (7~8)	Yes (30)	SBAR score
A8	Kim et al. (2016)	Descriptive survey/ Senior (n=84)	Simulation (part)	[1 period] 1: Simulation (1 scenario) - Cardiac arrest	No	No	2~3 members (15)	Yes (20~30)	Self-efficacy, clinical competence
A9	Hur et al. (2013)	QSE/ Senior (n=60)	Simulation	[14 periods] 1~2: Orientation & lecture 3~5: Self-study (online skill video, algorithm) 6~9: Skill practice & evaluation 10~14: Simulation (7 scenarios), 4 scenarios (cardiac arrest in ACLS algorithm) 3 scenarios respiratory distress, hypoglycemia, seizure attack	4 times (role rotation) No (repeated observation)	Yes (30)	4 members (15, cardiac arrest, role rotation) 1 member (15, another scenarios)	Yes (60) Yes (60)	Self-efficacy, critical thinking, problem-solving
A10	Kim et al. (2011)	Descriptive survey/ Junior (n=127), diploma	Simulation-based education on emergency nursing care	[5 periods, undifferentiated] Team learning (scenario presented), lecture & skill practice (advanced airway management, EKG, defibrillator, intubation, ACLS), Simulation (some scenario, ALCS and ACS) ※ Required self-exercise (team)	No	No	5~6 members (15)	Yes (15)	Academic achievement (knowledge, performance), self-efficacy
A11	Kim et al. (2010)	QSE/ Junior (n=100), diploma	Simulation-based critical care	[6 periods, 3 periods per scenario] 1: Lecture (anatomy, physiology, pharmacology) 2: Skill practice, MicroSim® 3: Simulation (scenario 1) - asthma attack 4~6: Scenario 2 (same as scenario 1) - AMI	No	Yes (15~20)	4~5 members (15~20)	Yes (ND)	Academic achievement (knowledge), clinical performance

ACLS=advanced cardiopulmonary life support; ACS=acute coronary syndrome; AMI=acute myocardial infarct; D=debriefing; EKG=electrocardiography; ND=not described; P=prebriefing; SBAR=situation, background, assessment, recommendation; SBE=simulation-based education; SD=study design; SS=scenario simulation; QES=quasi-experimental study.

tacks, acute coronary syndrome, unstable arrhythmias, septic shock, hypoglycemia, and seizure attacks. Notably, all studies provided only the topics of the scenarios without detailing how the simulation scenarios progressed in terms of recognizing and responding to deteriorating patients.

4. Learning Outcomes of SBE for Recognizing and Responding to Deteriorating Patients in Korean Nursing School Curricula

The learning outcomes of SBE for recognizing and responding to deteriorating patients within Korean nursing school curricula are shown in Table 3. These outcomes were

assessed in various domains. In the cognitive domain, the outcomes included knowledge [A2,A4,A10,A11], clinical reasoning [A1,A3], critical thinking [A9], clinical judgment [A2], recognition [A2,A6], and problem-solving [A9]. In the psychomotor domain, the outcomes encompassed performance [A1,A2,A4,A6,A8,A10,A11] and the Situation-Background-Assessment-Recommendation (SBAR) score [A7]. Additionally, self-efficacy was evaluated [A1,A3,A5, A8-A10] in the context of these educational activities.

Table 3. General Characteristics of the Included Studies (*N*=11)

Variables	Categories	n (%)
Publication year	2010~2019	5 (45.5)
	2020~	6 (54.5)
Type of studies	Quantitative	
	Quasi-experimental study	7 (63.6)
	Descriptive survey	2 (18.2)
	Qualitative	
	Content analysis	1 (9.1)
	Mixed-methods	1 (9.1)
Year of participants in the academic program	Freshman	0 (0.0)
	Sophomore (diploma program)	1 (9.1)
	Junior	
	Diploma program	1 (9.1)
	Bachelor program	3 (27.3)
	Senior	6 (54.5)
Course	Simulation	10 (90.9)
	Alternative clinical practicum	1 (9.1)

DISCUSSION

This study aimed to assess the current implementation of SBE for recognizing and responding to deteriorating patients within the curricula for undergraduate nursing students in Korean nursing schools. Utilizing a scoping review, the study sought to provide foundational data for curriculum development. A literature search strategy was developed around the core research questions. This section discusses the findings from 11 articles published since 2010.

SBE designed to recognize and respond to deteriorating patients in Korean undergraduate nursing programs primarily targets fourth-year students nearing graduation. It is predominantly implemented within the integrated simulation course curriculum. This approach suggests that fourth-year students possess the requisite level of integrated knowledge and skills to address emergency patient situations [14,16,29-31]. The structured sequence of SBE typically includes lectures, practical training, and team performance exercises prior to the actual simulation experience, as observed in most studies (9/11, 81.8%). This sequence often incorporates ACLS training, which is essential for effectively managing hospital emergencies [24,25]. ACLS programs equip students with the knowledge and skills needed for complex interventions that are crucial for patient survival in cases of cardiac arrest, symptomatic dysrhythmia, advanced airway management, and acute coronary syndrome [24,25]. While adult nursing courses may cover ACLS-related content, additional lecture time is often dedicated to this area to ensure that students are prepared to perform specialized skills in simulation labs,

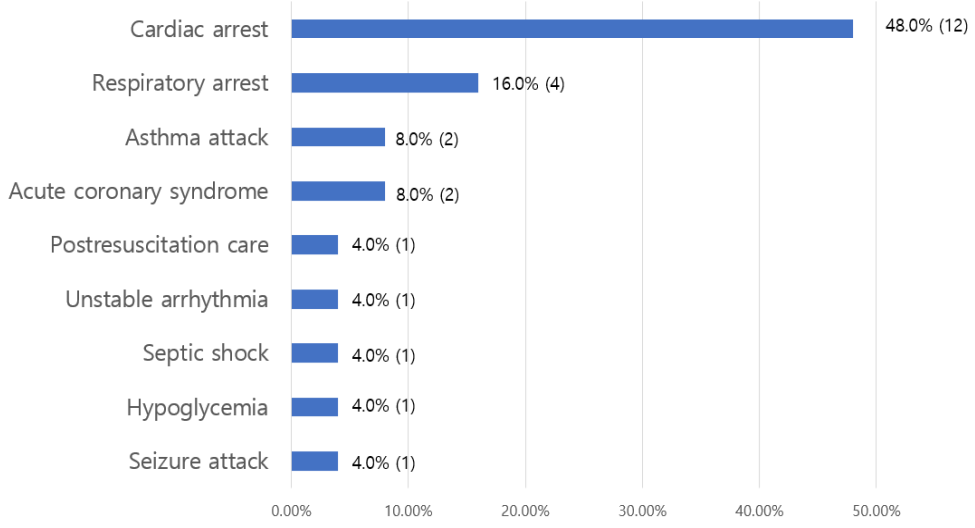

Figure 2. Simulation scenarios of simulation-based education for recognizing and responding to deteriorating patients.

particularly for handling complex scenarios. According to studies [A5,A6,A9], simulation practice is repeated following the initial simulation education. However, emergency education is less effective when delivered in short-term formats; therefore, repeated training sessions are recommended [18,30,32,33]. Furthermore, education on recognizing and responding to deteriorating patients should begin during nursing school to develop cognitive competencies and continue into clinical practice. Consequently, the curriculum should be structured in stages that integrate with clinical practice sites [4,33].

The majority of the simulation scenarios focused on cardiac arrest [A1,A3,A5,A6,A8-A10] and respiratory arrest [A4]. This focus likely stems from the availability of standardized ACLS provider training programs and assessment tools, which are commonly used in nursing education. However, scenarios that involve recognizing and responding to patients who are deteriorating before reaching a state of cardiac or respiratory arrest were infrequently used and lacked progressive complexity. In Korea, the educational focus on recognizing and responding to deteriorating patients has been addressed only to a limited extent [21]. Internationally, there have been efforts to effectively implement SBE for this purpose, utilizing a variety of scenarios [4,15,34,35]. These scenarios typically begin with conditions such as postoperative hemorrhage, hypovolemic/septic shock, respiratory distress, chest pain, and infection, and may progress to respiratory or cardiac arrest [4,15,34,35]. During these scenarios, participants are encouraged to use tools such as the Modified Early Warning Score (MEWS) or SBAR to identify signs of patient deterioration [4,15,34]. It remains unclear whether this specific training on recognizing and responding to deteriorating patients is included in the regular curriculum for nursing students. However, it could potentially be integrated into standard educational frameworks through the use of e-learning and virtual simulation [35]. Therefore, it is necessary to develop a variety of scenarios that allow students to learn experientially how to recognize the symptoms and signs of deterioration before cardiac or respiratory arrest occurs.

In SBE aimed at recognizing and responding to deteriorating patients, the learning outcomes include knowledge, clinical reasoning, critical thinking, clinical judgment, recognition, and problem-solving within the cognitive domain, as well as performance and SBAR score in the psychomotor domain. The performance outcomes vary depending on the specific objectives of the SBE. In scenarios such as cardiac arrest, the Training of In-Hospital Cardiac Arrest (TROICA) assessment instrument, developed for ACLS training, is employed. Emergencies requiring rapid recognition and response can overwhelm healthcare providers and adversely affect their decision-making capabilities. SBE provides a structured approach to recognizing deteriorating patients, incorporating tools like SBAR, and fosters competency in handling such situations. The integration of SBAR with the MEWS and the Airway-Breathing-Circulation-Disability-Exposure protocol in SBE has demonstrated improvements in cognitive performance [4,15]. There is a need to establish a cognitive framework in emergency situations and to assess the effectiveness of training programs. However, international studies have indicated challenges in evaluating the recognition of deterioration signs in simulation education for deteriorating patients [1]. Therefore, it is necessary to explore ways to develop and evaluate the cognitive competence of nursing students.

The significance of this study lies in its comprehensive analysis of Korean nursing curricula, underscoring the urgent need for educational initiatives aimed at enhancing nursing students' abilities to recognize and respond to patient deterioration. By identifying these educational gaps and suggesting pertinent considerations for curriculum implementation, the study makes a valuable contribution to the advancement of nursing education. However, this study has limitations, and caution should be exercised when interpreting the findings. It was based on published papers, which means that the results might not encompass all aspects of actual curriculum operations that remain unpublished. Additionally, the process of selecting literature could have overlooked studies that were ambiguous in terms of their focus on curricula or their presentation of scenarios as emergencies.

CONCLUSION

Nurses play a critical role on the front lines of patient safety by recognizing signs of deterioration in patients and providing early and appropriate responses. Their skills in recognizing and responding to deteriorating patients should be effectively developed through SBE, starting in nursing schools. However, a review of emergency SBE in Korean nursing school curricula revealed that emergencies were primarily identified as cardiac or respiratory arrests, with simulation education focusing on the cardiac arrest algorithm in ALCS. In contrast, simulation education for recognizing and responding to deteriorating patients was found to be insufficient.

SBE is appropriate for fourth-year students as it demands clinical judgment and advanced performance in

complex situations. Prior to engaging in SBE, the curriculum must be structured to ensure that students undergo training that establishes a consistent framework for recognizing signs of patient deterioration and includes specialized training in airway management. Additionally, the curriculum should be designed to assess the cognitive competencies developed through this framework in simulation training and to facilitate repeated simulation practice.

We recommend the following actions based on the findings presented above. First, nursing schools and clinical sites should collaborate to develop a simulation curriculum focused on recognizing and responding to deteriorating patients. Second, it is essential to conduct a study to evaluate the effectiveness of this newly designed curriculum. Third, efforts should be made to develop an assessment tool that measures nurses' competency in recognizing deteriorating patients.

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and/or design acquisition - HYK; analysis - HYK and KHJ; interpretation of the data - HYK and KHJ; and drafting or critical revision of the manuscript for important intellectual content - HYK.

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