Review

Transfer of Clinical Decision-Making–Related Learning Outcomes Following Simulation-Based Education in Nursing and Medicine: A Scoping Review

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Abstract

Purpose

Simulation is often depicted as an effective tool for clinical decision-making education. Yet, there is a paucity of data regarding transfer of learning related to clinical decision-making following simulation-based education. The authors conducted a scoping review to map the literature regarding transfer of clinical decision-making learning outcomes following simulation-based education in nursing or medicine.

Method

Based on the Joanna Briggs Institute methodology, the authors searched 5 databases (CINAHL, ERIC, MEDLINE, PsycINFO, and Web of Science) in May 2020 for quantitative studies in which the clinical decision-making performance of nursing and medical students or professionals was assessed following simulation-based education. Data items were extracted and coded. Codes were organized and hierarchized into patterns to describe conceptualizations and conditions of transfer, as well as learning outcomes related to clinical decision-making and assessment methods.

Results

From 5,969 unique records, 61 articles were included. Only 7 studies (12%) assessed transfer to clinical practice. In the remaining 54 studies (89%), transfer was exclusively assessed in simulations that often included one or more variations in simulation features (e.g., scenarios, modalities, duration, and learner roles; 50, 82%). Learners' clinical decision-making, including data gathering, cue recognition, diagnoses, and/or management of clinical issues, was assessed using checklists, rubrics, and/or nontechnical skills ratings.

Conclusions

Research on simulation-based education has focused disproportionately on the transfer of learning from one simulation to another, and little evidence exists regarding transfer to clinical practice. The heterogeneity in conditions of transfer observed represents a substantial challenge in evaluating the effect of simulation-based education. The findings suggest that 3 dimensions of clinical decision-making performance are amenable to assessment—execution, accuracy, and speed—and that simulation-based learning related to clinical decision-making is predominantly understood as a gain in generalizable skills that can be easily applied from one context to another.

Simulation is now a significant component of pre-licensure and continuing education for health professionals. Because it allows for the reproduction of patient encounters in an interactive manner,[1] simulation is often used to prepare learners for clinical practice without compromising patient safety. As such, many have suggested replacing the traditional "see one, do one, teach one" apprenticeship model with a "see one, simulate many, do one" model for clinical education.[2,3]

A widely held assumption is that the more realistic a simulation is, the more likely it is to produce positive educational benefits in terms of preparedness for practice.[4] Thus, the realism of a simulation is often considered to guarantee that learners will be able to apply what they have learned in other contexts[5]—an idea that can be likened to the concept of "transfer of learning." Considered to be both a process and an outcome, transfer of learning can be defined as the extent to which learning that occurs in one context affects how knowledge and skills will be learned or performed in another context.[6] Transfer may be positive or negative depending on whether prior learning facilitates or hinders subsequent learning and performance. Other distinctions in transfer of learning relate to the amount of effort required to transfer (from simple to complex transfer) and the resemblance between 2 contexts (from near to far transfer).[6-8]

Previous reviews have found mixed evidence regarding transfer of learning following simulation-based education in health care. In undergraduate nursing education, Alt-Gehrman [9] found conflicting evidence regarding the transfer of various knowledge and skills in clinical practice. In medicine, one review found more evidence supporting the transfer of skill-based (e.g., laparoscopy, central venous catheter insertion) tasks than it did for rule-based (e.g., advanced cardiac life support) or knowledge-based tasks (i.e., diagnosis).[10] Other reviews examined crisis resource management[11] and surgical skills[12] and found some evidence of transfer to the clinical setting. However, wide variations have been observed in the design of prior studies, especially regarding simulation modalities (e.g., manikins, computers, virtual reality), the number of simulations and time between them, and simulation duration, as well as methods for assessing outcomes that consisted primarily of self-reported satisfaction, confidence, or proficiency,[5] as opposed to more objective performance outcomes.

Yet, transfer of learning is also necessary for outcomes related to clinical decision-making, which can be defined as the process by which nurses or physicians reach decisions regarding patient care. Clinical decision-making involves the collection and interpretation of clinical data to reach a judgment and decision on a course of action.[13,14] It is subject to biases that may lead to inaccuracies and errors in patient management.[15] In that respect, simulation is often depicted as an effective tool for clinical decision-making education, because it allows immersion in situations where students and professionals can exercise their skills with minimal consequences for patients.[16,17]

However, to our knowledge and based on database searches, no previous review has focussed on the transfer of learning outcomes related to clinical decision-making following simulation-based education in nursing or medicine. Considering the methodological shortcomings and lack of conceptual clarity observed in prior reviews on the transfer of various learning outcomes following simulation-based education, we deemed that a scoping review was necessary to map these concepts and clarify their conceptual and operational boundaries. Such a review has the potential to inform future studies or systematic reviews seeking to evaluate the effectiveness of simulation-based education for clinical decision-making.

Therefore, this scoping review aimed to map the literature regarding transfer of learning outcomes related to clinical decision-making following simulation-based education in nursing and medicine. Considering studies conducted with both students and professionals, we sought to address the following questions:

1. How is transfer of learning conceptualized and under what conditions is it assessed following simulation-based education for clinical decision-making (i.e., what are the similitudes and differences between simulations for learning and assessment contexts [e.g., simulation, encounter with a real patient])?
2. What learning outcomes related to clinical decision-making are assessed for transfer of learning following simulation-based education and what assessment methods are used?

Method

This scoping review followed the Joanna Briggs Institute (JBI) methodology[18,19] and is reported per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR).[20] The protocol was not registered because the International Prospective Register of Systematic Reviews (PROSPERO) does not allow the registration of scoping reviews.

Eligibility criteria

We considered primary studies with quantitative designs, published in peer-reviewed journals, in English or French, without year restriction. Theses and dissertations, conference proceedings, conceptual or theoretical papers, and opinion papers were excluded. Research reports published by research centers, government agencies, or similar organizations were excluded, as they were not necessarily accessible through database searches.

For the population, we considered studies with university-trained nurses and physicians at any level of education or practice (e.g., nursing students, registered nurses, nurse practitioners, medical students, interns, residents, licensed physicians). This population was chosen primarily to differentiate between registered nurses and licensed practical nurses or nursing aids, for example, as there are various levels of nursing practice. Studies involving professionals from other disciplines were eligible if they included nurses and physicians. All clinical specialties were eligible, except pre-hospital and military care, which could differ significantly from civilian in-hospital care in terms of roles, scopes of practice, and nature of the care environment.[21]

Two key concepts informed this review: clinical decision-making and transfer of learning. For the first, we considered studies reporting on learning outcomes related to nurses' or physicians' clinical decision-making, which was defined as "a contextual, continuous, and evolving process, where data are gathered, interpreted, and evaluated in order to select an evidence-based choice of action."[22(p401)] Studies solely reporting on one isolated component of decision-making, such as health assessment techniques, without addressing other components of the process were not considered. Keeping in line with the definition of transfer of learning presented above, this review focused on the assessment of clinical decision-making performance following simulation-based education; studies using self-reported outcomes were not considered.

The second concept, transfer of learning, was conceptualized as learning in one context, followed by application in another. In the New World Kirkpatrick Model,[23] this refers to level 3 (behavior) learning outcomes—that is, application in practice. Yet, we chose to adopt a broader definition and consider simulation-based practice in addition to clinical practice, since variations in **the simulation features** (e.g., different scenarios or environments) could also solicit transfer of learning. Accordingly, studies had to report on a simulation activity or program whose outcomes had been assessed in at least one follow-up simulation or encounter with a real patient.

For the context, we considered studies where simulation was used to reproduce a clinical encounter for educational purposes (i.e., learners were allowed to interact with a simulated patient to gather and interpret clinical data). Studies that used simulation solely for assessment were excluded. All simulation modalities were considered and a simulation activity was defined as "the entire set of actions and events from initiation to termination of an individual simulation event,"[24(p44)] from the briefing to the debriefing.

Information sources and selection of evidence

We followed the 3-step search strategy of the JBI methodology.[18] First, we performed an initial search in 2 databases (MEDLINE and Cumulative Index of Nursing and Allied Health Literature [CINAHL]) with relevant keywords and index terms (e.g., physicians, nurses, decision-making, transfer, and simulation) in November 12, 2019. We extracted keywords and index terms from the retrieved papers to develop a comprehensive search strategy (see Supplemental Digital Appendix 1 at [LWW INSERT LINK] for an example strategy). Second, we searched 5 databases on May 21, 2020: CINAHL, Education Resources Information Center (ERIC), MEDLINE, PsycINFO, and Web of Science (Science Citation Index and Social Sciences Citation Index). Third, the reference lists of identified articles were hand-searched for additional records.

Records were exported into Covidence (Veritas Health Innovation, Melbourne, Victoria, Australia) and duplicates were removed. Titles and abstracts were independently assessed by 2 of the authors (P.L., A.L., M.-A.M.-C., G.F., I.K.) **and/or** a research assistant (Mélanie Radermaker). Then, the full texts of potentially eligible records were reviewed independently by 2 of the authors (P.L., A.L., M.-A.M.-C., G.F., I.K.). At each stage, disagreements were resolved by discussion or involvement of a third author (P.L., A.L., M.-A.M.-C.).

Data extraction and synthesis

Full texts of included articles were imported into MAXQDA 2020 (VERBI Software GmbH, Berlin, Germany). Based on the JBI methodology[18] and the research questions, we created a list of first-level codes to extract segments related to the following data items: study characteristics and methods (location, aim, design, setting, population, number of participants), definitions of transfer, simulation features (setting, learning objectives, briefing, scenario, debriefing, simulation modality [e.g., manikin, computer, standardized patient], additional learning activities), and clinical decision-making outcomes (nature [e.g., data gathering, interpretation, diagnosis], assessment methods, context of assessment, sequence of intervention and assessment). One of the authors (A.L., M.-A.M.-C.) coded segments from included articles that presented data related to the data items given above. A second author (P.L.) verified coding for accuracy and exhaustiveness.

Coded segments were further analyzed through a second round of coding, which followed methods of inductive content analysis.[25] Based on the content of the extracted data, one author (P.L.) defined and applied a set of second-level codes, which was revised and refined until it accurately reflected the content of the articles. The accuracy and exhaustiveness of the second-level coding were verified by a second author (A.L., M.-A.M.-C.).

Based on the research questions, we organized and hierarchized second-level codes into patterns to describe conceptualizations and conditions of transfer, as well as learning outcomes related to clinical decision-making and assessment methods. The analytical process for this organization and hierarchization was based on code frequencies and co-occurrences in the articles. Results are presented based on the number of articles that included a code or a pattern of codes. The total count sometimes exceeds the number of articles under review; this is because some articles included 2 or more codes or patterns. It is also important to note that some articles did not report certain data items. All percentages given below are reported based on the total number of included studies (n = 61).

Results

From a pool of 5,969 unique records, 61 articles[26-86] were included in this review (Figure 1). Study characteristics are presented in Table 1. The majority aimed to compare the effects of 2 or more educational interventions (30, 49%) or describe the effect of a single simulation-based intervention (24, 39%); other studies examined emotions or cognitive load in simulation (4, 7%) or the growth of skills over time (3, 5%). Sample sizes varied from 11 to 266 participants, with a median of 59 participants (interquartile range = 52.5).

Conceptualizations of transfer

The term transfer of learning was mentioned in 21 studies (34%), but none provided an explicit definition or conceptualization; 40 studies (66%) did not use the term. Three forms of transfer were discussed: from simulation to clinical practice (19, 31%), between different cases or clinical presentations (3, 5%), and between educational formats (e.g., from computer-based to manikin-based simulation, from simulation to multiple-choice questions; 2, 3%).

In terms of simulation features that promote transfer of learning, 2 studies argued that realistic cases and authentic situations facilitate transfer to clinical practice.[31,53] Another study guided by situated learning theory[87] suggested that transfer of auditory learning (i.e., diagnosing auscultation findings) could be attributed to the similarity between the simulation and the clinical setting, as opposed to the transfer of knowledge-based learning that would be facilitated by metacognition (i.e., awareness and evaluation of one's cognitive processes).[38] One study found that learning from errors and opportunities for reflection promoted transfer to clinical practice.[67]

In addition, 3 studies discussed the content specificity of clinical decision-making to explain transfer—or lack thereof—between various cases or clinical presentations.[37,38,48] Another study involving a series of 6 different scenarios presented patient assessment as a transferable skill that benefits from repeated practice.[79] However, the authors observed that it was not readily mobilized in a particularly challenging cardiac arrest scenario.

Conditions of transfer

In all but one study (60, 98%), simulations were embedded in educational programs that also included other activities, such as lectures or clinical experiences. In 33 studies (54%), participants received specific preparation for the simulation activities through methods such as lectures, individual study, or video demonstrations. A briefing was reported in 37 studies (61%). Simulation modalities included manikins (42, 69%), computers (10, 16%), standardized patients (8, 13%), part task trainers (4, 7%), and role play (2, 3%); 8 studies (13%) involved 2 or more modalities. In addition, 22 studies (36%) used embedded participants to provide cues during the simulations.

In 45 studies (74%), participants were exposed to a series of scenarios depicting different cases. A frequent pattern, involving 19 studies (31%), was to present a variety of respiratory, cardiac, neurological, or infectious issues in adult patients—these studies often referred to the Airway, Breathing, Circulation, Disability, Exposure (ABCDE) approach. Another pattern, involving 22 studies (36%), was to present a series of miscellaneous events related to a role (e.g., anesthesia, nursing) or clinical specialty (e.g., obstetrics and gynecology, trauma). Four studies (7%) presented diverse cases for training in a single health assessment technique (e.g., cardiac auscultation). Only 16 studies (26%) focussed on a particular clinical issue (e.g., abdominal pain, congestive heart failure).

The length of simulation activities was difficult to compare: 24 studies (39%) presented the time participants spent with simulated patients (mean = 21 minutes, standard deviation = 12 minutes) and 16 studies (26%) reported the total duration of a single or multiple simulation activities (ranging from 45 to 210 minutes).

A post-simulation debriefing was mentioned in 52 studies (85%). In most cases, debriefings were led by an instructor (32, 52%) and consisted of feedback and reflection on the simulated experience (31, 51%) or review of the participants' videotaped performance (16, 26%). Most debriefings lasted for 15 to 30 minutes (8, 13%) or 30 to 45 minutes (7, 11%). There were 10 computer simulation studies (16%), with 7 studies (11%) that included automated feedback on participants' performance.

Assessment of transfer

Transfer of learning to clinical practice was assessed in 7 studies (11%), with 5 studies (8%) exclusively assessing transfer in clinical practice during interactions with patients experiencing conditions similar to those that were depicted in simulations (e.g., cardiac diseases, trauma, pediatric resuscitation). The other 2 studies (3%) combined simulation-based and clinical practice–based assessments. In one case, learners participated in a simulation of postoperative nursing care, and transfer was assessed 8 weeks later during clinical placement and 9 weeks later during a similar simulation activity.[77] In the other, learners experienced or observed 2 critical care simulations, and transfer was assessed in a subsequent critical care simulation with a different scenario and during intensive care unit rotations.[81]

The remaining 54 studies (89%) assessed transfer of learning in simulations exclusively, with only 4 (7%) assessing transfer in simulations similar to the ones that the learners had first experienced. The other 50 studies (82%) included one or more variations in simulation features. Variations in the scenarios were the most common, with 45 studies (74%) assessing transfer in simulations portraying different cases (e.g., atrial fibrillation followed by abdominal trauma) or different presentations of an issue (e.g., postpartum hemorrhage caused by either vaginal or uterine lacerations). Variations in the modalities (e.g., virtual simulation followed by manikin-based simulation), duration (e.g., 60 minutes for learning, 7 minutes for assessment), and learner roles (e.g., participant, observer) were noted in 10 (16%), 8 (13%), and 3 studies (5%), respectively. Although often not reported, learners sometimes participated in group simulations and were later assessed in individual simulations in at least 9 studies (15%).

Assessment methods and clinical decision-making outcomes

Forty studies (66%) used specific checklists whose content and items were defined according to the scenarios or cases for which they were designed. Checklists consisted of lists of observable actions rated on dichotomous (performed or not performed) or ordinal (from 3 to 10 points) behaviorally anchored scales. The following aspects of clinical decision-making were assessed: clinical data gathering (e.g., measuring vital signs; 23, 38%), actions to manage clinical issues (e.g., installing oxygen; 21, 34%), cue recognition (e.g., recognizing asystole; 14, 23%), accuracy of diagnoses (e.g., diagnosing anaphylaxis; 14, 23%), prioritization of clinical issues (4, 7%), and calling for help (3, 5%). In 10 studies (16%), checklists also measured the time it took for learners to perform key actions in the simulations. In addition to clinical decision-making, some checklists included global rating scales of learners' overall performance (5, 8%) or items to assess teamwork (5, 8%), and/or communication (4, 7%). Five studies (8%) used checklists but did not detail their content.

Eleven studies (18%), exclusively with nursing participants, used generic rubrics designed to assess learning outcomes in a variety of clinical situations without being specific to a case or scenario. The Lasater Clinical Judgment Rubric[88] was the most frequently used (10, 16%) and was the sole rubric that focused on decision-making by assessing 4 dimensions defined after a clinical judgment model[13]: noticing, interpreting, responding, and reflecting. Three other rubrics—the Seattle University Simulation Evaluation Tool,[89] the Sweeney-Clark Simulation Evaluation Rubric,[90] and the CANE rubric[79]—were each used in one of two studies (3%).[26,79] These rubrics assess learners' performance in assessment (i.e., data gathering), cue recognition, and actions to manage clinical issues, as well as other aspects such as communication, patient education, and professionalism.

Fourteen studies (23%), exclusively with medicine or with interprofessional (i.e., medicine, nursing, and other disciplines) participants, assessed clinical decision-making as a nontechnical skill using the Anaesthetists' Non-Technical Skills system (5, 8%),[91] the Ottawa Crisis Resource Management Global Rating Scale (3, 5%),[92] the Non-Technical Skills for Surgeons system (3, 5%),[93] modified Oxford Non-Technical Skills scales (2, 3%),[94,95] or the Teamwork Skills Assessment for Ward Care scale (1, 2%).[96] Like generic rubrics, these tools are designed for various clinical scenarios. They use 4- to 7-point behaviorally anchored rating scales to assess clinical decision-making related to patient assessment, consideration of options or alternatives, risk assessment, decisions, and communication of a plan. These tools are also used to assess communication, teamwork, task management, leadership, and situation awareness. Additionally, one study (2%) used the Situation Awareness Global Assessment Technique[97] to test nursing students' situation awareness—often described as a nontechnical skill—as a proxy for clinical decision-making in simulations.[48]

Discussion

This scoping review aimed to map the literature regarding transfer of learning outcomes related to clinical decision-making following simulation-based education in nursing and medicine. Results show that research has disproportionately focussed on transfer of learning from one simulation to another among students. There is little evidence regarding transfer of simulation-based learning to clinical practice for students and even less for licensed professionals. As noted in prior reviews,[9-12] we observed diversity in studies' designs, especially in simulation features (e.g., preparation, simulation modalities, scenarios, duration, debriefing), complicating the review process. Incomplete or inconsistent reporting of certain simulation features (e.g., briefing, duration, debriefing) further complicated the review process. Nevertheless, this review revealed patterns and trends that warrant further reflection.

Although most studies did not use the term transfer of learning, those that did often discussed transfer from simulation to clinical practice. Yet, only a very small proportion of studies assessed this form of transfer.[34,38,41,47,58,77,81] Those that did assess this form of transfer used both rubrics and checklists, sometimes in combination. With the exception of one study[77] that did not specifically report this, assessment in these studies always involved patients who experienced health issues similar to those depicted in simulations. This reflects conditions of near transfer to a similar context, at least in terms of clinical content. However, designing such studies may present feasibility challenges in terms of recruiting these patients, as well as in assessing learners' clinical decision-making performance when interacting with them. In 5 of the studies that assessed transfer from simulation to clinical practice,[34,38,47,77,81] learners' performance was observed either directly or by video recordings; in the 2 other,[41,58] documentation of care was used. The number and frequency of assessments also varied from once after a simulation to several times over 12 months, all depending on the availability of eligible patients. Taken together, the small number of studies and the diversity of methods suggest that the assessment of transfer of learning outcomes related to clinical decision-making in clinical practice remains a challenging enterprise that will require further methodological development and creativity. At present, there is too little evidence and too much heterogeneity to produce a meaningful synthesis.

Although the conceptualization of transfer from simulation to clinical practice aligns with the New World Kirkpatrick Model,[23] we encourage educators and researchers to acknowledge other forms of transfer following simulation-based education. This review showed that more studies have assessed transfer of clinical decision-making outcomes from one simulation to another. However, simulations for learning and simulations for assessment within a single study often differed considerably in terms of scenarios, modalities, duration, and number or role of participants. The nature and extent of these differences was one of the most striking findings from this review and reflects conditions of far transfer to a dissimilar or remote context.[8,98] Yet, these variations were not accounted for either in the study design or in the statistical treatment of data. From a knowledge synthesis perspective, this heterogeneity in conditions of transfer presents a challenge for evaluating the effect of simulation-based education. It highlights the imperative of defining precise inclusion criteria for future systematic reviews of the effectiveness of simulation-based education and to anticipate how differences between simulations for learning and simulations for assessment might affect results. In addition, studies investigating the effects of these differences (i.e., differences in scenarios, modality, duration, and number or role of participants) could help guide future work in terms of determining in advance the expected effect of these differences, so that they could be accounted for using appropriate statistical methods.[99] Still, studies that focused on the impact of different simulation features on learning accounted for only about a third (i.e., 19) of the studies included in this review. Such efforts could shed more light on the processes involved in the transfer of learning following simulation-based education and could inform educational practices. For example, beyond the realism or authenticity of cases and the similitudes with the clinical environment that are often considered to guarantee learner preparedness for practice, a couple of studies have begun to address the role of errors, reflection, and metacognition in the transfer of simulation-based learning.[38,67] These ideas deserve to be fleshed out and reflected on in greater depth through practice and research.

Although methods of assessment varied, this review identified the dimensions of clinical decision-making performance that are currently assessed for transfer in simulation-based education. The findings suggest that 3 dimensions of clinical decision-making performance are amenable to assessment: execution, accuracy, and speed (Figure 2). With respect to assessment methods, two thirds of the studies (40, 66%) used checklists with items specifically defined according to the simulation scenarios used. A smaller but somewhat sizeable proportion of studies (25, 41%) used generic tools designed for application in various situations (i.e., rubrics in nursing, nontechnical skills assessments in medicine). In both cases, these tools mostly focus on the execution of actions conducive to or arising from clinical decisions (e.g., collecting pieces of clinical information, implementing actions to manage an issue). Assessments of clinical decision-making accuracy (e.g., reaching a correct diagnosis or accurately detecting a cue) and of speed (i.e., time required to reach certain objectives) were less frequent.

Overall, these findings suggest that simulation-based learning related to clinical decision-making is predominantly understood as a gain in generalizable skills that can be easily applied from one context to another. This observation is reminiscent of the decades-old debates surrounding the content- or context-specificity of clinical decision-making, a point that was raised in 3 studies included in this review.[37,38,48] Although clinical decision-making is often considered as a general skill, prior studies have shown that health care professionals' performance on identical cases in different occasions correlates moderately, thereby, indicating that the context of performance might be just as, if not more, influential than the content of cases.[100-102] This suggests that additional, unaccounted for factors related to the individuals, the environment, and their interactions could affect performance[103] and the assessment of performance.[104] Furthermore, the use of generic assessment tools that leave it to the observer to understand and account for the specifics in the content of cases adds another layer to this dilemma. Thus, we would argue that future research on the transfer of clinical decision-making in simulation-based education requires more consideration of what is transferred and the contexts in which it is learned and transferred, for example, evidence from psychology suggests that physical, temporal, functional, and social factors related to learning should be accounted for.[98] Moreover learners' knowledge base and motivation should be considered, as well as the opportunities and time they have to practice and learn.[105] While simulation allows for reproducing various patient encounters, increased attention to the interactions that occur between factors related to the individual and their environment is warranted, perhaps through theories of situated learning,[87] situativity,[106] or activity.[107]

Interpretations of this review's findings should keep in mind its strengths and limitations. This scoping review was based on a recognized and rigorous methodological framework (JBI); every step of article selection, data extraction, and data analysis was performed independently or verified by a second author to favor the credibility of the results. We only included peer-reviewed quantitative studies, as we expected that the number of such papers would be sufficient to produce a representative synthesis. Examination of qualitative or mixed-methods study could yield additional findings related to the conceptualization of transfer of learning. Since we used a broad operational definition, most studies did not explicitly mention the term transfer of learning and were not necessarily conducted from this perspective. Another limit inherent to scoping reviews is the difficulty of producing recommendations for educators, as we did not assess the quality of the included studies nor produce a quantitative synthesis. Finally, the results reflect our interpretation of the studies' reports. Although we independently verified codes on multiple occasions, inconsistencies in the studies' reporting were frequent.

Conclusions

This scoping review sought to map the literature regarding transfer of learning outcomes related to clinical decision-making following simulation-based education in nursing and medicine. The findings clarified the dimensions of clinical decision-making that are currently assessed for transfer in simulation-based education. However, the wide variations in simulation features and conditions of transfer must be considered in greater depth before conducting a systematic review to assess the effectiveness of simulation for transfer of clinical decision-making learning outcomes. This would require more thorough descriptions of the context for learning (i.e., simulation features) and the conditions of transfer (e.g., variations in physical, temporal, functional, and social factors between simulation for learning and assessment context), as well as statistical models to account for any variations in these.

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Table 1

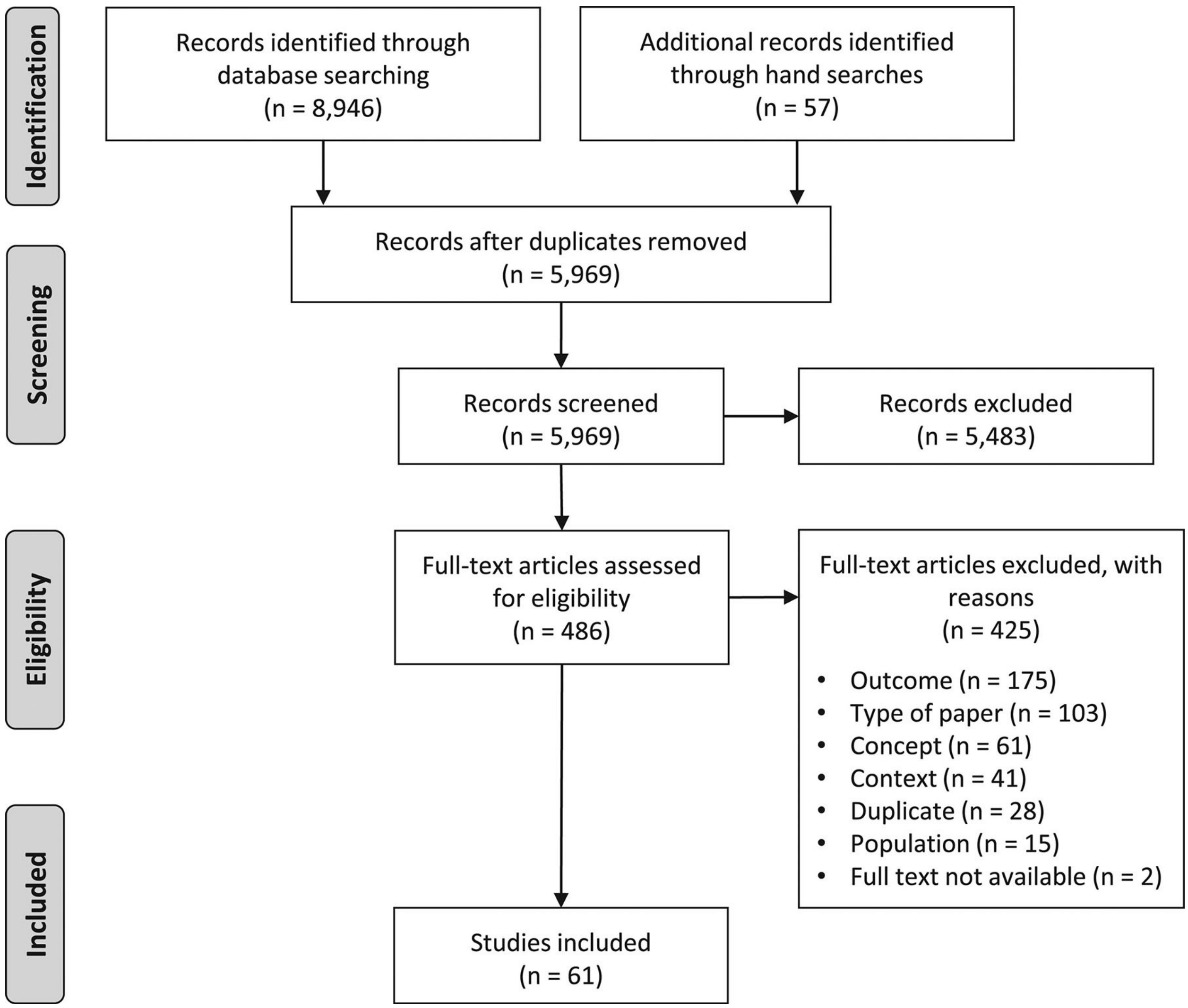
Characteristics of Studies (n = 61) Assessing Transfer of Learning Related to Clinical Decision-Making Following Simulation-Based Education in Nursing and Medicine From a May 2020 Scoping Review

Characteristic	No. (%)
Location	
North America	37 (61)
Asia	12 (20)
Europe	7 (11)
South America	3 (5)
Oceania	2 (3)
Participants	
Physicians	35 (57)
Medical students	18 (30)
Interns or residents	16 (26)
Anesthesiologists	1 (2)
Nurses	22 (36)
Nursing students	18 (30)
Registered nurses	4 (7)
Interprofessional[a]	4 (7)
Students	2 (3)
Students and professionals	2 (3)
Study design	
Randomized controlled trials	31 (51)
Single-group studies	23 (38)
Nonrandomized controlled trials	7 (11)

[a]Studies with interprofessional participants included both physicians and nurses. Additionally, one study[68] included physiotherapy, occupational therapy, and speech language pathology students.

Figure Legends

Figure 1



Preferred Reporti ng Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR)[20] flow diagram of study selection for a May 2020 scoping review aiming to map the literature regarding transfer of learning outcomes related to clinical decision-making following simulation-based education in nursing and medicine.

Figure 2

Dimensions of clinical decision-making performance (left) and clinical decision-making outcomes (right) assessed for transfer of learning in simulation-based education for nursing and medical students and professionals from a May 2020 scoping review aiming to map the literature regarding transfer of learning outcomes related to clinical decision-making following simulation-based education in nursing and medicine. The size of each dimension and outcome is determined by how frequently it appeared in the included studies (n = 61), with larger and bolder words being ones that appeared more often.