Assessing the Impact of Simulation-Based Learning in Nursing Education: A Scoping Review

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Abstract: **Background: Simulation-based learning (SBL) is widely used in nursing education to strengthen clinical competence while protecting patient safety. Objective: To map and summarize evidence (2018–2024) on SBL's effectiveness, benefits, challenges, and implementation considerations in nursing education. Methodology: Scoping review following Arksey & O'Malley's five-stage framework with Levac's enhancements; reported against PRISMA-ScR. Databases: CINAHL, MEDLINE/PubMed; grey literature via Google Scholar. English-language original research and evidence syntheses (2018–2024) involving pre-licensure nursing students and/or registered nurses in academic or continuing-education contexts were charted and narratively synthesized by theme (learning outcomes; critical thinking/clinical judgment; confidence/affective outcomes; teamwork & interprofessional skills; transfer/retention; modality & "dose"; design/debriefing; implementation & cost). Results: Across RCTs, quasi-experimental studies, and recent systematic reviews/meta-analyses, SBL consistently improves knowledge/skills, clinical judgment/critical thinking, and self-confidence versus traditional methods; benefits are strongest when scenarios align with objectives and include structured debriefing aligned to INACSL Standards. Evidence on long-term retention and transfer to clinical practice is promising but mixed; robust effects on patient-level outcomes remain limited. Resource needs (faculty development, debriefing expertise, equipment, space) and cost are the main barriers; cost-utility data suggest screen-based/virtual options can be efficient complements. Conclusion: SBL is an effective, standards-driven pedagogy that can substitute for a portion of clinical hours and enhance key competencies; future work should prioritize longitudinal outcomes, standardized measures, and cost-effectiveness.**

Keywords: **simulation-based learning; nursing education; clinical competence; clinical judgment; critical thinking; self-confidence; debriefing; INACSL; virtual simulation; implementation.**

1. INTRODUCTION

Simulation-based learning (SBL) has gained significant attention in nursing education as a powerful tool for enhancing clinical skills and improving patient outcomes. This scoping review aims to assess the impact of simulation-based learning in nursing education, considering its effectiveness, benefits, and challenges. By examining a range of studies conducted in recent years, this review provides a comprehensive overview of the current state of SBL in nursing education.

Simulation-based learning involves the use of scenarios or situations that mimic real-world clinical experiences, allowing students to practice and develop their skills in a controlled and safe environment (Cant & Cooper, 2020). These simulations can range from low-fidelity to high-fidelity, utilizing various technologies such as mannequins, virtual reality, and computerized models to replicate clinical scenarios accurately. The goal is to provide learners with opportunities to apply theoretical knowledge, improve critical thinking, communication, and decision-making skills, and ultimately bridge the gap between classroom learning and real-world practice (LeFlore et al., 2017).

The impact of SBL in nursing education has been widely studied, and the evidence suggests several positive outcomes. Research has shown that simulation-based learning can improve students' clinical competence (Cant & Cooper, 2020). By engaging in realistic scenarios, learners can practice skills repeatedly, receive immediate feedback, and reflect on their performance, leading to increased confidence and proficiency. Furthermore, SBL has been associated with enhanced teamwork and communication skills, essential components of effective nursing practice (Alinier et al., 2018). Collaborative simulations allow students to work together, develop effective communication strategies, and understand the importance of interprofessional collaboration.

In addition to skill development, simulation-based learning offers a safe space for students to make mistakes and learn from them without compromising patient safety. By creating a realistic environment, SBL encourages learners to think critically, problem-solve, and manage unexpected situations (Hayden et al., 2014). This experiential learning approach promotes active engagement, encourages reflection, and fosters the development of clinical reasoning skills. Moreover, SBL provides an opportunity to expose students to rare or complex clinical scenarios that may not be readily available in their clinical placements, enhancing their exposure to diverse patient presentations and improving their overall clinical preparedness (Cant & Cooper, 2020).

Despite the numerous benefits, the implementation of simulation-based learning in nursing education is not without challenges. One of the primary concerns is the cost associated with acquiring and maintaining simulation equipment and resources (Alinier et al., 2018). High-fidelity simulators and advanced technologies can be expensive to procure, maintain, and update. Additionally, the availability of skilled faculty and adequate physical space to conduct simulations can pose logistical challenges for educational institutions. These factors can limit the widespread adoption of SBL in nursing programs.

Another challenge is ensuring the transferability of skills learned in simulation to real-world clinical settings. While SBL can effectively enhance students' clinical competence, it is essential to evaluate how well these skills translate into actual patient care (LeFlore et al., 2017). Ongoing research is needed to determine the long-term impact of SBL on patient outcomes and to assess the extent to which simulation experiences prepare nursing students for the complexities and demands of real-world practice.

In conclusion, simulation-based learning has emerged as a valuable approach in nursing education, offering a range of benefits such as improved clinical competence, teamwork, and critical thinking skills. By providing a safe environment for practice, reflection, and experiential learning, SBL bridges the gap between theory and practice. However, challenges related to cost, faculty expertise, and skill transferability remain. Therefore, this scoping review aims to assess the impact of simulation-based learning in nursing education (2018–2024), considering effectiveness, benefits, challenges, and implementation factors, while identifying areas for future research and improvement.

PCC question

In the current scoping reviews are best framed with PCC (Population–Concept–Context).

PICOT	CONTENT	PICOT QUESTION
P	Pre-licensure nursing students and registered nurses in post-licensure/continuing education.	What is the impact of simulation-based learning on knowledge, clinical competence, critical thinking, confidence, and teamwork among nursing students and registered nurses in educational and training settings?
C	Simulation-based learning (all fidelities and modalities, including manikin-based, standardized patients, screen-based and virtual/VR).	
C	Nursing education programs in academic or clinical training settings (Academic courses, skills labs, and CPD settings in nursing education programs).	

Search Strategies

A comprehensive search strategy was developed to capture the breadth of evidence on the impact of simulation-based learning (SBL) in nursing education. The approach followed Arksey and O'Malley's (2005) five-stage framework with enhancements from Levac et al. (2010) and adhered to the **PRISMA-ScR** reporting guidelines.

The search was conducted in **CINAHL (EBSCO)** and **MEDLINE/PubMed**, which are the primary databases for nursing and health sciences literature. To ensure wider coverage, additional searches were undertaken in **Google Scholar** for grey literature, such as conference proceedings, reports, and dissertations, which could provide supplementary insights. The search encompassed studies published between **January 1, 2018, and December 31, 2024**, to reflect the most recent evidence and developments in simulation pedagogy, including the growth of virtual and screen-based modalities following the COVID-19 pandemic.

Search terms were developed using controlled vocabulary (e.g., MeSH terms) and free-text keywords, combined with Boolean operators to increase sensitivity. The core concepts included simulation-based learning, nursing education, and outcomes such as clinical competence, critical thinking, self-confidence, teamwork, and patient outcomes. Example search strings included:

("nurs*" AND "simulation-based learning" OR "simulation" OR "virtual simulation" OR "screen-based simulation") AND ("education" OR "training" OR "clinical competence" OR "critical thinking" OR "self-confidence" OR "teamwork").

Reference lists of included articles and relevant systematic reviews were also hand-searched to identify additional studies not captured in the initial electronic searches.

All retrieved citations were imported into a reference management system, where duplicates were removed before screening. Titles and abstracts were independently screened against predefined inclusion and exclusion criteria, focusing on studies that evaluated the effectiveness, benefits, challenges, or implementation of SBL in nursing education. Full-text screening was subsequently undertaken for eligible studies.

The search and selection process ensured a transparent, reproducible, and comprehensive identification of relevant evidence, enabling the review to provide a robust overview of current knowledge on the impact of simulation-based learning in nursing education.
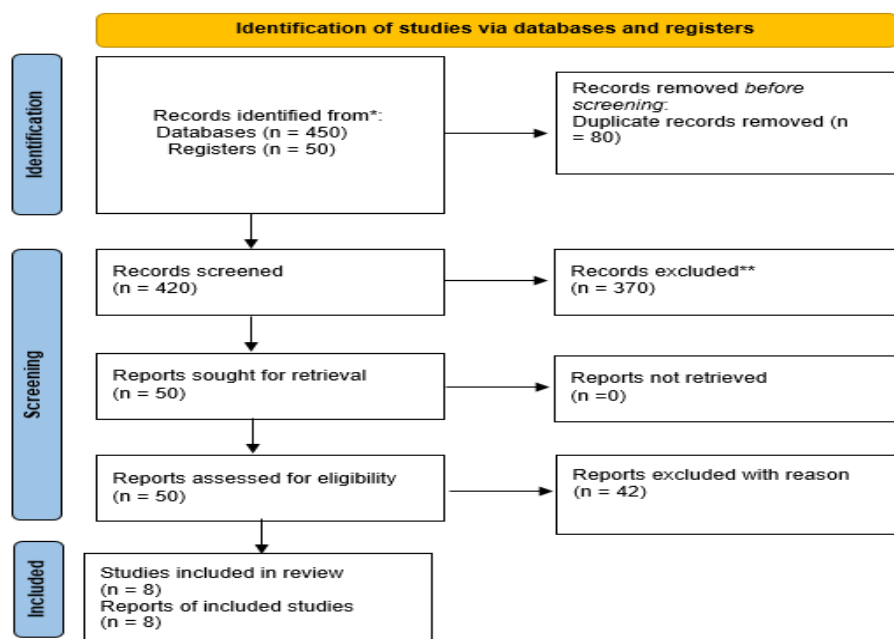
Articles Retrieved and Screening Process

The study selection process followed the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) guidelines to ensure transparency and methodological rigor. First, all records retrieved from database and grey literature searches were imported into a reference management software, and duplicate citations were removed. Titles and abstracts were then screened independently against the predefined Population–Concept–Context (PCC) framework to determine preliminary eligibility.

Full-text articles were subsequently retrieved for studies that met, or appeared to meet, the inclusion criteria. Each article was assessed in detail to confirm eligibility, with reasons for exclusion documented at this stage (e.g., not nursing-focused, not simulation-based, outside the date range, or non-English).

Eligible studies were then charted into a standardized data extraction matrix, which included the following domains: study population, educational setting, simulation modality and fidelity, scenario design and debriefing approach, comparator or control (if applicable), reported outcomes, and follow-up duration. To enhance the robustness of the synthesis, priority was given to high-quality empirical studies, recent systematic reviews, and representative trials. Exemplar and highly cited works were highlighted to anchor the thematic synthesis.

PRISMA 2020 flow diagram

Source: Page MJ, et al. BMJ 2021; 372:n71. doi: 10.1136/bmj.n71.

2. FINDING AND RESULTS

The search identified a diverse body of literature examining the role of simulation-based learning (SBL) in nursing education. Studies included randomized controlled trials, quasi-experimental designs, mixed-methods evaluations, and systematic reviews, reflecting both pre-licensure and post-licensure nursing populations across academic and clinical education contexts. Thematic synthesis of the evidence yielded eight major themes. Themes are illustrated in table 1 below.

TABLE 1: Scope Review Theme

Theme	Name	Representative Study/Studies	Key Insights
Theme 1	Knowledge and clinical competence	Tong et al. (2024); Alharbi et al. (2024); Cant & Cooper (2020)	SBL consistently improves knowledge and skills; high-fidelity simulation (HFS) effective for short-term gains, though retention effects vary.
Theme 2	Clinical judgment and critical thinking	Wei (2024); Cant & Cooper (2020)	SBL enhances decision-making and critical thinking; scenarios with structured debriefing promote clinical reasoning.
Theme 3	Self-confidence and self-efficacy	Guerrero et al. (2024); Alharbi et al. (2025); Alrashidi et al. (2023)	Strong improvements in confidence, satisfaction, and perceived readiness for practice across student and practicing nurse groups.
Theme 4	Teamwork and communication	Cant & Cooper (2020)	Team-based and interprofessional simulations strengthen communication, collaboration, and situational awareness, supporting patient safety.
Theme 5	Transferability and retention of skills	Tong et al. (2024); Alharbi et al. (2024)	Initial gains in competence may diminish over time without reinforcement; long-term transfer and patient-level outcomes remain underexplored.
Theme 6	Simulation modality and dosage	Tong et al. (2024); Cant & Cooper (2020)	HFS demonstrates strong effects on performance; virtual/screen-based modalities are effective and cost-efficient complements.
Theme 7	Design and debriefing quality	Wei (2024); Cant & Cooper (2020)	Learning outcomes depend heavily on scenario design and structured debriefing, aligned with INACSL Standards.
Theme 8	Implementation challenges and cost considerations	Guerrero et al. (2024); Alharbi et al. (2025)	High costs, faculty training needs, and space requirements are barriers; positive outcomes justify investment, but cost-effectiveness data remain limited.

Theme 1: Knowledge and Clinical Competence

Several studies highlighted the role of simulation-based learning (SBL) in strengthening students' knowledge and clinical competence. Tong et al. (2024) demonstrated that high-fidelity simulation (HFS) significantly improved short-term clinical skills compared with computer-based and case-study groups, though retention diminished over time. Similarly, Alharbi et al. (2024), in a systematic review of 33 studies, confirmed that SBL was associated with improved psychomotor skills, theoretical knowledge, and clinical performance across diverse nursing contexts. Cant and Cooper (2020) further reinforced these findings, reporting in their systematic and umbrella reviews that SBL produced measurable gains in competence, particularly when aligned with clear objectives and combined with feedback and reflection.

Theme 2: Clinical Judgment and Critical Thinking

SBL was consistently associated with the development of higher-order reasoning skills. Wei (2024) reported that nursing students who engaged in simulation scenarios demonstrated significant improvements in decision-making, diagnostic

reasoning, and critical thinking compared with lecture-only groups. Cant and Cooper (2020) similarly found that across multiple systematic reviews, simulation was more effective than traditional teaching in cultivating clinical judgment, particularly when debriefing was structured and scenarios mirrored complex real-world conditions.

Theme 3: Self-Confidence and Self-Efficacy

Learners' self-confidence and belief in their capabilities were markedly enhanced through SBL. Guerrero et al. (2024) showed that practicing oncology nurses who participated in simulation reported higher self-efficacy and satisfaction compared with those in conventional CPD modules. Alharbi et al. (2025) observed similar trends in undergraduate nursing students, noting significant improvements in competence, satisfaction, and self-confidence following simulation experiences. Alrashidi et al. (2023) synthesized evidence from 19 studies and concluded that SBL consistently bolstered students' confidence and performance, helping to reduce anxiety when transitioning to clinical practice.

Theme 4: Teamwork and Communication

Team-based and interprofessional simulations were found to improve collaborative practice. Cant and Cooper (2020) identified consistent evidence that simulation strengthens communication, teamwork, and situational awareness, all of which are critical for safe patient care. Scenarios requiring group problem-solving and role delineation were particularly effective in enhancing learners' understanding of team dynamics and interprofessional collaboration.

Theme 5: Transferability and Retention of Skills

Evidence on the long-term retention and transfer of skills was mixed. Tong et al. (2024) reported that while HFS participants showed strong short-term competence, the benefits declined after three months, suggesting a need for reinforcement or repeated simulation sessions. Alharbi et al. (2024) similarly noted that although simulation improved immediate competence, few studies tracked outcomes over longer periods, and evidence of transfer to clinical practice and patient care remains limited. These findings suggest the importance of longitudinal evaluation to establish the durability of simulation outcomes.

Theme 6: Simulation Modality and Dosage

Different simulation modalities yielded varied outcomes. Tong et al. (2024) found that HFS produced the greatest short-term improvements, though computer-based simulation remained beneficial, especially for knowledge reinforcement. Cant and Cooper (2020) emphasized that while high-fidelity simulations tend to deliver stronger performance outcomes, lower-cost virtual and screen-based modalities can provide effective, scalable alternatives. The reviews also supported curriculum-wide integration of simulation and indicated that simulation could replace a portion of clinical hours without compromising outcomes, though the "optimal dose" of simulation remains uncertain.

Theme 7: Design and Debriefing Quality

Simulation design and debriefing emerged as critical determinants of effectiveness. Wei (2024) underscored that well-structured scenarios incorporating guided reflection significantly enhanced learning outcomes. Cant and Cooper (2020) emphasized that structured debriefing, clear objectives, and fidelity appropriate to learning goals were essential for maximizing SBL's impact. These findings are consistent with the INACSL Healthcare Simulation Standards of Best Practice, which advocate for debriefing as a cornerstone of simulation pedagogy.

Theme 8: Implementation Challenges and Cost Considerations

Implementation challenges were identified across several studies. Guerrero et al. (2024) reported that while simulation improved competence and self-efficacy in oncology nurses, cost and resource demands were barriers to broader adoption. Alharbi et al. (2025) noted similar concerns among nursing programs, where faculty training, space requirements, and technology maintenance posed challenges. Despite these barriers, the strong learning outcomes across studies suggest that investment in simulation infrastructure is justified, particularly when supplemented with cost-efficient modalities such as virtual or screen-based platforms.

Limitations

This scoping review is subject to several limitations that should be acknowledged. First, although a comprehensive search strategy was applied across major databases and supplemented with grey literature, the review was restricted to studies published in English between 2018 and 2024. This language and date restriction may have excluded relevant evidence published in other languages or prior to 2018, particularly early foundational studies on simulation-based learning (SBL).

Second, the included studies demonstrated considerable heterogeneity in terms of study design, simulation modalities, fidelity levels, outcome measures, and assessment tools. Such variability limited direct comparison across studies and precluded quantitative synthesis of effect sizes. Third, the majority of the evidence relied on short-term outcomes such as knowledge acquisition, competence, or self-confidence, whereas fewer studies reported long-term retention, transferability of skills to clinical practice, or patient-level outcomes.

As a result, the durability and real-world impact of SBL on patient safety and quality of care remain less well established. Fourth, variations in reporting quality—particularly regarding scenario design, debriefing practices, and adherence to the INACSL Healthcare Simulation Standards of Best Practice—hinder the ability to evaluate which simulation elements are most critical for learning outcomes. Finally, this review synthesized published literature only and did not include unpublished institutional reports or evaluation data, which may have introduced publication bias favoring studies with positive results. Despite these limitations, this review provides a comprehensive overview of recent evidence and identifies important gaps for future research in the field of nursing education.

Strengths of the Review

This scoping review has several strengths that enhance its rigor and relevance. First, it followed a systematic and transparent methodology guided by Arksey and O'Malley's framework, enhanced by Levac et al., and reported in accordance with the PRISMA-ScR guidelines, ensuring reproducibility and methodological integrity. Second, the review synthesized evidence from 2018 through 2024, capturing the most recent developments in simulation-based learning, including the rise of virtual and screen-based modalities that became increasingly prominent during and after the COVID-19 pandemic. Third, a broad and inclusive search strategy was employed across multiple databases and supplemented with grey literature, reducing the likelihood of missing key studies. Fourth, the review provides a comprehensive thematic synthesis, organizing findings into clear domains—knowledge and competence, critical thinking, self-confidence, teamwork, transferability, modality, design, and implementation—allowing readers to understand both the breadth and depth of SBL's impact. Finally, by mapping gaps such as long-term retention, cost-effectiveness, and patient-level outcomes, the review offers direction for future research and practical insights for educators and policymakers seeking to integrate simulation into nursing curricula.

3. CONCLUSION

This scoping review demonstrates that simulation-based learning (SBL) is a highly effective pedagogical approach in nursing education, consistently associated with improvements in knowledge, clinical competence, critical thinking, confidence, and teamwork. By providing a safe, experiential learning environment, SBL enables students and practicing nurses to integrate theory with practice, engage in decision-making under realistic conditions, and refine essential clinical and communication skills without compromising patient safety. The evidence from 2018 to 2024 further underscores the value of emerging modalities such as virtual and screen-based simulation, which offer scalable and cost-effective alternatives or complements to high-fidelity manikin-based training.

Despite these clear benefits, challenges remain. The heterogeneity of study designs and outcome measures limits comparability, and the majority of evidence continues to emphasize short-term educational outcomes rather than long-term retention, transfer to clinical practice, or measurable patient-level impacts. Implementation barriers—including high costs, faculty expertise, and resource limitations—also constrain the wider adoption of SBL in nursing programs.

In summary, SBL is a proven and evolving educational strategy that bridges the gap between classroom learning and clinical practice. Its integration into nursing curricula should be guided by rigorous design principles, structured debriefing, and adherence to international standards, such as those established by the INACSL Healthcare Simulation Standards of Best Practice. Future research should prioritize longitudinal studies, cost-effectiveness analyses, and outcomes directly linked to patient care, ensuring that the growing investment in simulation translates into measurable improvements in both nursing education and healthcare delivery.

4. RECOMMENDATIONS

For Nursing Education and Practice

1. **Curriculum Integration:** Nursing programs should adopt simulation-based learning (SBL) as a core teaching strategy, not as an adjunct, embedding it longitudinally across curricula rather than in isolated sessions.

2. **Adherence to Standards:** All simulations should be designed and implemented in line with the INACSL Healthcare Simulation Standards of Best Practice, ensuring alignment of learning objectives, fidelity appropriate to the intended outcomes, and structured debriefing.

3. **Faculty Development:** Investment in faculty training is essential, particularly in facilitation and debriefing skills, to maximize the pedagogical value of simulation and ensure consistency in learner experience.

4. **Modality Mix:** Institutions should consider a balanced use of high-fidelity manikins, standardized patients, and virtual/screen-based simulation, tailoring modality choice to learning objectives, available resources, and learner needs.

5. **Resource Planning:** To address barriers related to cost and space, academic institutions should develop strategic plans for simulation investment, including the use of cost-efficient virtual platforms and shared simulation centers.

6. **Assessment and Feedback:** Simulation outcomes should be systematically assessed with validated tools for competence, critical thinking, and confidence, coupled with structured feedback to strengthen reflective learning.

For Future Research

1. **Longitudinal Outcomes:** Future studies should move beyond short-term measures to evaluate retention of knowledge and skills, transfer to clinical practice, and long-term professional competence.

2. **Patient-Level Impact:** Research should examine whether SBL contributes to improved patient outcomes, including safety indicators, quality of care, and error reduction.

3. **Cost-Effectiveness:** Rigorous economic evaluations are needed to assess the cost-utility of different simulation modalities, especially virtual and screen-based formats, in comparison with traditional teaching and clinical placements.

4. **Standardized Reporting:** Researchers should align study reporting with PRISMA-ScR for reviews and INACSL Standards for simulation interventions, to improve comparability and reproducibility.

5. **Interprofessional Education:** Future work should explore the role of SBL in fostering interprofessional collaboration, communication, and teamwork, extending beyond nursing to include other healthcare disciplines.

6. **Optimal Dosage:** Research should clarify the most effective "dose" of simulation (frequency, duration, and clinical substitution percentage) across learner levels and educational contexts.

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Data Extraction Table/ Review Matrix

Author, Year	Country	Study Objective	Study Design	Sample (n) & Participants	Intervention (SBL)	Comparison Group	Main Findings
Tong et al., 2024	China	To compare high-fidelity simulation, computer-based simulation, and case studies in nursing education	Multicenter RCT	n=210; undergraduate nursing students	High-fidelity simulation, 2×60-min sessions	Case study and computer-based simulation groups	HFS improved short-term skills/competence more than CBS or case study; differences diminished at 3 months
Alharbi et al., 2024	Saudi Arabia	To evaluate the effectiveness of SBL on competence and performance	Systematic review (33 studies)	Not applicable	Various SBL modalities (HFS, VR, SPs)	Traditional teaching/clinical placement	SBL improved competence, skills, and performance across settings
Wei, 2024	China	To assess the impact of SBL on decision-making and critical thinking	Quasi-experimental	n=96; undergraduate nursing students	Simulation scenarios with structured debriefing	Lecture-based teaching	Improved decision-making, critical thinking, and knowledge scores
Guerrero et al., 2024	Colombia	To evaluate simulation-based oncology education for nurses	Quasi-experimental	n=60; practicing oncology nurses	High-fidelity simulation on chemotherapy	Conventional CPD module	Significant gains in competence, self-efficacy, and confidence
Alharbi et al., 2025	Saudi Arabia	To explore competence, satisfaction, and self-confidence among nursing students in SBL	Mixed-methods	n=150; undergraduate nursing students	SBL sessions across clinical topics	Traditional lectures	Higher competence, satisfaction, and self-confidence with SBL
Alrashidi et al., 2023	Saudi Arabia	To review effects of SBL on self-confidence and performance	Systematic review (19 studies)	Not applicable	Various simulation modalities	Traditional teaching	SBL consistently improved self-confidence and performance
Cant & Cooper, 2020	Australia	To systematically review the effectiveness of SBL in nursing education	Systematic review (30+ studies)	Not applicable	Simulation in pre-licensure nursing education	Traditional methods/clinical placements	SBL improved knowledge, skills, critical thinking, and teamwork
Cant & Cooper, 2020	Australia	To synthesize umbrella evidence on SBL effectiveness	Umbrella review (multiple systematic reviews)	Not applicable	High-, medium-, and low-fidelity simulation	Traditional teaching	SBL shown to be effective across modalities, with stronger effects in high-fidelity and structured debriefing