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Simulation in Nursing Education: A Narrative Review of Strategies, Outcomes, and Challenges

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Abstract

Simulation-based education is a vital component of modern nursing education, providing a safe, controlled environment for students to develop clinical competencies. It bridges the gap between theory and practice by fostering experiential learning, critical thinking, and decision-making. This narrative review explores simulation strategies in nursing education, assesses educational outcomes, and identifies implementation challenges. A literature search was conducted in PubMed, Scopus, CINAHL, and ScienceDirect for articles published between 2020 and 2025. Studies discussing simulation strategies, outcomes, and barriers in undergraduate nursing education were included. Common simulation methods include high-fidelity manikins, standardized patients, virtual simulations, and hybrid models. These approaches enhance clinical skills, communication, teamwork, confidence, and knowledge retention. Simulation also supports reflective practice and safe error correction. However, barriers such as high costs, limited faculty expertise, time constraints, and inconsistent evaluation methods persist. Simulation enhances learning outcomes in nursing education but requires strategic integration, adequate resources, and faculty training. Addressing these challenges can maximize its impact and better prepare students for clinical practice. The outcome of this review highlights that well-implemented simulation strategies significantly improve nursing students' clinical competence, critical thinking, and readiness for real-world healthcare environments, ultimately contributing to safer and higher-quality patient care.

INTRODUCTION

The rapid advancement of healthcare technologies, the increasing complexity of patient care, and the growing demand for competent and adaptable nursing professionals have significantly transformed the landscape of nursing education (Altmiller & Pepe, 2022; Booth et al., 2021; Olorunfemi & Akinyemi, 2024). Simulation-based education (SBE) has become a critical pedagogical strategy to address these evolving demands in recent years. Simulation offers nursing students a safe, structured, and immersive learning environment to practice and refine clinical skills, critical thinking, communication, and decision-making without compromising patient safety. This educational approach bridges the gap between theoretical instruction and real-world clinical practice by providing experiential learning opportunities that mirror actual healthcare scenarios. As such, simulation is not merely an adjunct to traditional learning methods but a pivotal element in preparing nursing students for the multifaceted challenges of modern clinical environments (Alinier & Oriot, 2022; Calhoun et al., 2020; Stephan et al., 2023).

Despite the growing body of literature supporting the effectiveness of simulation in nursing education, its implementation is not without challenges. These range from high operational costs, limited availability of trained faculty, and inconsistent integration across curricula to difficulties in standardizing evaluation methods. Moreover, while simulation's benefits are well-documented, disparities remain in how institutions adopt and adapt simulation technologies, leading to variability in educational outcomes (Chemikova et al., 2020; Parveen & Ramzan, 2024). Therefore, there is an urgent

need to systematically examine the strategies used in simulation-based nursing education, identify the outcomes achieved, and understand the challenges that hinder its optimal implementation.

The global shortage of clinical placement opportunities further underscores the urgency of integrating effective simulation methods in nursing education. With patient safety becoming paramount, hospitals increasingly limit student access to high-risk environments, reducing hands-on learning opportunities. In this context, simulation emerges as a viable and necessary alternative. The COVID-19 pandemic amplified this need, as clinical training was severely restricted, prompting a dramatic shift toward virtual simulation and remote learning modalities. These disruptions have compelled educators and institutions to re-evaluate and redesign curricula to incorporate simulation more robustly and creatively. Consequently, the integration of Simulation Based Education (SBE). SBE is not only a response to logistical challenges but also a strategic move toward enhancing nursing education resilience, adaptability, and innovation.

In terms of novelty, this narrative review goes beyond listing simulation techniques by critically analyzing diverse strategies, their pedagogical foundations, and their impact on learner outcomes. It offers a timely and comprehensive synthesis of recent evidence (2020–2025), addressing simulation methods, outcomes, and implementation challenges. Unlike prior reviews, it emphasizes strategic integration and real-world applicability, filling important gaps in the literature. Moreover, the review delves into the challenges from an implementation science perspective, considering factors such as faculty development, institutional readiness, interprofessional collaboration, and technology accessibility. Unlike many previous studies focusing on high-fidelity simulations or specific competencies, this review adopts a holistic lens, encompassing a broad spectrum of simulation modalities, including low-fidelity, standardized patients, virtual reality, and hybrid models across various academic levels and settings (Agustini et al., 2024; Basak et al., 2016; Bonfert et al., 2024). A growing body of research highlights the value of simulation in developing core nursing competencies. Digital tools enhance student engagement, motivation, and performance, but challenges like technical issues, limited access, and inadequate training persist (Rafiq et al., 2024). The study calls for better technical support, professional development, and institutional backing to fully leverage digital learning platforms, offering practical insights for improving outcomes in similar educational settings.

High-fidelity simulation (HFS), in particular, has been shown to improve student performance in clinical decision-making, teamwork, and confidence (Macnamara et al., 2021; Sałacińska et al., 2025). Similarly, standardized patients and virtual simulations have demonstrated their effectiveness in improving communication skills, empathy, and cultural competence (Qin & Chaimongkol, 2021; Ton et al., 2024). Despite these advances, several studies have highlighted limitations in simulation implementation, such as inadequate debriefing, lack of faculty training, and inconsistent assessment tools. Furthermore, global disparities in simulation access and utilization point to the need for scalable, context-sensitive models that can be adapted to diverse educational environments. Various theoretical frameworks have guided simulation-based nursing education, including Kolb's Experiential Learning Theory, Benner's Novice to Expert model, and the INACSL Standards of Best Practice. These models emphasize the cyclical process of experience, reflection, conceptualization, and experimentation, central to effective simulation learning. Debriefing, considered the most critical simulation component, is grounded in reflective practice theory and bridges the simulated experience and meaningful learning (INACSL Standards Committee, 2021; Reierson et al., 2024). However, despite the availability of these frameworks, their practical application remains inconsistent, particularly in low-resource settings. Therefore, understanding how educational theories are operationalized in simulation design and implementation is crucial for maximizing educational outcomes.

Simulation represents a paradigm shift in nursing education, with the potential to improve clinical competence, professional growth, and patient safety. Realizing this potential, however, requires addressing challenges such as limited resources, inadequate faculty training, and fragmented curricular integration. This narrative review aims to: identify and analyze the various simulation strategies employed in nursing education, evaluate the educational outcomes associated with different simulation modalities, explore the challenges and barriers to implementing simulation-based education across diverse educational contexts, provide practical recommendations for optimizing the integration of simulation into nursing curricula, and highlight areas for future research to support the sustainable and equitable use of simulation in global nursing education.

RESEARCH METHODS

This study employed a narrative review design to examine the use of simulation critically and comprehensively in nursing education, focusing on strategies, learning outcomes, and implementation challenges. The narrative approach enables the synthesis of diverse literature to develop a theoretical and contextual understanding of simulation as a complex educational intervention. It integrates empirical findings with experiential insights, capturing nuances often overlooked in purely quantitative analyses. Unlike systematic reviews, narrative reviews are more flexible in structure, aiming to interpret and integrate diverse findings rather than strictly aggregate them. The subjects in this review were published peer-reviewed articles, academic journals, conference proceedings, and authoritative reports that focus on the use of simulation in nursing education. The content was limited to materials addressing pedagogical strategies, learning outcomes (knowledge, skills, attitudes), and challenges related to simulation implementation in nursing programs.

The population in this study comprised all internationally published literature relevant to simulation in nursing education, without restriction to specific countries or levels of nursing education. This includes literature from undergraduate, graduate, and continuing professional development settings. The sample consisted of relevant articles published between 2020 and 2025, selected based on inclusion and exclusion criteria. This method was chosen to identify literature that is highly relevant to the key concepts of the study: simulation strategies, educational outcomes, and challenges in nursing education. The selection process included the following steps: Identification of keywords and synonyms such as "simulation," "nursing education," "simulation-based learning," "nursing students," "educational outcomes," and "challenges." Database search using Scopus, PubMed, CINAHL, and ScienceDirect. Screening of titles, abstracts, and full texts based on inclusion criteria. Inclusion Criteria: articles published in peer-reviewed journals, literature in English, studies focused on simulation in nursing education, studies published between 2020 and 2025, research discussing strategies, outcomes (knowledge, skills, attitude), or implementation challenges. Exclusion Criteria: articles not written in English, editorials, letters, and non-scholarly content, studies unrelated to nursing education or simulation, and articles with inaccessible full texts. Research Instruments: The primary instrument used was a literature review matrix, which facilitated the systematic recording and evaluation of each article's authorship, year, purpose, methodology, key findings, and relevance to the review objectives. The matrix enabled cross-comparison of study themes and outcomes (Marzi et al., 2025).

Data collection involved the systematic search and selection of literature across electronic databases using Boolean operators and specific inclusion/exclusion criteria. Each selected article was reviewed in detail, and pertinent data were extracted and categorized utilizing the literature review matrix. A thematic content analysis was employed to interpret and synthesize data. This involved coding the findings from each article, grouping similar codes into themes, analyzing the relationships between themes about simulation strategies, learning outcomes (cognitive, affective, and psychomotor domains), and implementation challenges. The data were then narratively synthesized to highlight prevailing trends, gaps, and practical insights. Although this study did not involve human subjects, ethical considerations were maintained throughout the research process: proper citation and acknowledgment of all sources to prevent plagiarism, use of literature from credible and ethically conducted studies, and compliance with ethical standards in reporting and synthesis.

RESULT

The initial database search yielded a total of 842 articles from PubMed, Scopus, CINAHL, and ScienceDirect, covering the period from 2020 to 2025. After removing 215 duplicates, 627 articles remained for title and abstract screening. Of these, 432 were excluded based on irrelevance to simulation in nursing education or failure to address the study objectives. The full texts of 195 articles were assessed for eligibility using inclusion criteria: (1) focus on undergraduate or postgraduate nursing education, (2) application of simulation-based strategies, and (3) discussion of educational outcomes and/or implementation challenges. After full-text review, 20 articles met all inclusion criteria and were included in the final synthesis. The selected studies featured a range of simulation modalities, including high-fidelity manikins, virtual simulation platforms, standardized patients, and hybrid approaches.

These studies consistently reported positive outcomes on student performance, engagement, clinical decision-making, and teamwork, while also identifying recurring challenges related to cost, faculty preparedness, and evaluation standardization.

Table 1. Summary of Results

Theme	Key Insights
Simulation Strategies	High-fidelity simulation, standardized patients, VR/AR, task trainers, and interprofessional simulations are widely used.
Learning Outcomes	Simulation enhances knowledge, clinical skills, communication, empathy, and readiness for clinical practice.
Implementation Challenges	Financial limitations, faculty competency gaps, student stress, lack of standardization, and technical issues persist across settings.

1. Simulation-Based Educational Strategies in Nursing Education

1.1 High-Fidelity Simulation (HFS)

The most commonly reported strategy was high-fidelity simulation, using advanced manikins capable of physiological responses. It was used primarily to teach clinical decision-making, critical thinking, and emergency response. Studies showed that HFS effectively replicates complex real-life scenarios and allows students to safely practice high-risk, low-frequency procedures (Agustini et al., 2024; Guerrero et al., 2023; Macnamara et al., 2021; Sałacińska et al., 2025).

1.2 Standardized Patient Simulation

Several studies highlighted the use of standardized patients (SPs), trained actors simulating actual patients. SPs were particularly effective in teaching communication skills, empathy, cultural sensitivity, and ethical reasoning (Isaksson et al., 2022; Papanagnou et al., 2021).

1.3 Virtual and Augmented Reality (VR/AR) Simulation

A growing number of recent studies reported the adoption of VR and AR technologies. VR and AR are promising in disaster education and preparedness training, offering different levels of immersiveness and engagement, encouraging active and experiential learning. Further research is needed to determine their long-term effectiveness. The choice of training method should consider program goals, target population, and available resources. Students reported high satisfaction and engagement, though the effectiveness varied depending on scenario realism and system usability (Akpan, 2024; Al-Ansi et al., 2023; Chen et al., 2020; Magi et al., 2023; Mendez et al., 2020).

2. Outcomes of Simulation in Nursing Education

2.1 Cognitive Domain: Knowledge Acquisition and Critical Thinking

Almost all studies reported significant enhancements in students' knowledge acquisition and clinical reasoning following simulation-based learning experiences. These simulations facilitated contextualized learning, improved diagnostic accuracy, and bolstered students' confidence in clinical decision-making. Collectively, the findings offer critical insights into the role of simulation in optimizing cognitive and practical competencies, ultimately contributing to more effective and evidence-based patient care in clinical settings (Abdulmohdi & McVicar, 2024).

2.2 Psychomotor Domain: Skills Development

Simulation-based education enhanced students' procedural and technical skills, especially in critical care, maternity, and surgical nursing domains. Repetitive, hands-on practice improved performance, fewer clinical errors, and quicker response times. While technical skill acquisition was the primary focus across most studies, competencies requiring communication and collaboration received comparatively limited attention. Furthermore, the underlying learning processes of students were rarely examined in the reviewed literature. This represents a critical gap, as the selection of learning modalities may significantly influence how students internalize and apply new knowledge. Future research should therefore prioritize investigating students' learning processes to inform the design of more holistic and effective simulation-based educational strategies (Koukourikos et al., 2021).

2.3 Affective Domain: Attitudes, Empathy, and Communication

Studies have shown that simulation is a valuable tool in increasing the self-confidence of nursing students in performing clinical tasks, making clinical judgements, communicating with patients and

team members, and improving their teamwork. To enhance the quality of care received by patients, it is recommended that clinical simulations be integrated into the nursing curriculum. Increasing the confidence of students is associated with greater confidence in performing clinical tasks (Alrashidi et al., 2023; Bassuni et al., 2023; Scott et al., 2024).

3. Challenges in Implementing Simulation in Nursing Education

3.1 Resource and Cost Constraints

The most cited challenge was the high cost of simulation equipment, maintenance, and facility setup. Many institutions in low- and middle-income countries struggled to implement high-fidelity simulations due to budget limitations (Abdulmohdi & McVicar, 2024; Agustini et al., 2024; Macnamara et al., 2021; Sałacińska et al., 2025).

3.2 Faculty Training and Development

A recurring concern across the literature was the shortage of adequately trained faculty capable of designing, implementing, and evaluating simulation scenarios. Effective simulation pedagogy demands specialized competencies in facilitation, debriefing, and the operation of simulation technologies. Notably, multi-professional collaborative partnerships emerged as a key enabler of successful simulation delivery, fostering interprofessional synergy and enhancing the overall quality of simulation packages. These efforts were positively received by students, who demonstrated heightened motivation to provide enhanced person-centered care (PCC) and expressed a strong commitment to improving patient safety and delivering high-quality care (Alrashidi et al., 2023; Bassuni et al., 2023; Scott et al., 2024).

3.3 Student Anxiety and Performance Pressure

Several studies reported that students experienced significant anxiety during simulations, mainly when being evaluated. This sometimes interfered with performance and learning outcomes, indicating the need for psychologically safe learning environments (Madsgaard et al., 2022).

3.4 Standardization and Evaluation

Challenges also arose from a lack of standardization in simulation implementation and assessment. Inconsistent use of scenarios, debriefing methods, and outcome measures affected comparability across institutions. The absence of validated assessment tools was also a barrier to objectively evaluating learning outcomes (Cavaleri et al., 2023).

3.5 Technological and Logistical Issues

Some studies reported technical difficulties with simulators and software malfunctions, which disrupted learning. Additionally, logistical issues such as scheduling, equipment availability, and small simulation labs limited the scalability of programs (Poo et al., 2023).

DISCUSSION

Simulation-based education in nursing employs a wide range of strategies that differ in complexity, purpose, and realism. High-fidelity simulation (HFS), standardized patient (SP) scenarios, virtual and augmented reality (VR/AR), task trainers, and interprofessional simulations each serve distinct pedagogical functions. High-fidelity simulation is particularly effective in recreating realistic clinical environments, allowing students to engage in high-stakes clinical decision-making without risking patient safety (Guerrero et al., 2023; Macnamara et al., 2021; Sałacińska et al., 2025). This supports Kolb's Experiential Learning Theory, which emphasizes learning through concrete experience and reflective observation (Agustini et al., 2024). Simulation creates a safe environment for repetitive, experiential practice, enabling nursing students to integrate theory with practice effectively.

On the other hand, standardized patient simulations enhance communication skills and empathy, key attributes in holistic nursing care. Their effectiveness is well-supported by Bandura's Social Learning Theory, which underscores learning through observation and social interaction. Engaging with SPs fosters emotional intelligence and cultural sensitivity, which are critical competencies in diverse clinical settings. The rising adoption of VR/AR technologies reflects the integration of digital innovation in health education. These strategies offer immersive, flexible learning experiences adequate for anatomy, pharmacology, and disaster simulations. However, this also highlights the need for nursing curricula to evolve toward blended learning models, combining simulation with digital technologies and traditional classroom instruction. The findings affirm that a diverse mix of simulation strategies, tailored to learning objectives and student levels, leads to more robust educational outcomes. This

directly addresses the first research objective: identifying and describing simulation-based strategies used in nursing education (Altmiller & Pepe, 2022; Booth et al., 2021; Olorunfemi & Akinyemi, 2024).

Simulation significantly improves student performance across the cognitive, psychomotor, and affective domains, a finding consistent with Bloom's Taxonomy and Benner's Novice to Expert Model. The reviewed studies reported consistent gains in knowledge acquisition, clinical reasoning, procedural skills, communication, empathy, and readiness for clinical practice. In the cognitive domain, simulation-based learning enhances knowledge retention and the application of critical thinking, especially in complex or emergency scenarios. This aligns with constructivist learning theories advocating for active, learner-centered knowledge construction. The positive impact of simulation on students' clinical reasoning supports the assertion that nursing students must move beyond memorization to applying knowledge dynamically in practice. Simulation's repetitive and hands-on nature builds technical competence in the psychomotor domain. Students practicing procedures such as catheterization or CPR in simulated environments exhibit better skill retention and reduced anxiety during actual clinical encounters. These findings resonate with Deliberate Practice Theory, emphasizing focused, goal-directed practice with immediate feedback conditions ideally provided through simulation. The affective domain benefits of simulation are especially notable. Exposure to emotionally charged scenarios, such as end-of-life care or mental health crises, fosters empathy, emotional regulation, and ethical reasoning. Reflective debriefing, a key simulation component, enhances metacognitive skills and professional identity formation, validating Mezirow's Transformative Learning Theory. The alignment of these outcomes with foundational theories and prior empirical studies confirms that simulation is not merely a supplementary method but a core pedagogical tool in nursing education. This fulfills the second research objective: assessing the effectiveness of simulation on learning outcomes (Abdulmohdi & McVicar, 2024; Alrashidi et al., 2023; Bassuni et al., 2023; Koukourikos et al., 2021; Scott et al., 2024).

Despite its benefits, simulation implementation in nursing education is fraught with challenges. These include high infrastructure costs, lack of faculty expertise, student anxiety, and insufficient standardization (Madsgaard et al., 2022). Resource and cost limitations are significant, particularly in low- and middle-income countries. Simulation labs, high-fidelity manikins, and VR systems require substantial investment (Poo et al., 2023). This reflects global inequities in educational resources and underscores the need for cost-effective alternatives such as low-fidelity simulations or hybrid models. A second major challenge is the lack of faculty training. Many nurse educators are unprepared to design or facilitate simulation-based learning, especially involving advanced technology or interprofessional collaboration. This signals a need for targeted faculty development programs and institutional support for simulation leadership. Student anxiety and psychological stress during simulation scenarios, especially when under evaluation, can negatively impact performance and learning. This necessitates creating psychologically safe environments and employing non-threatening, formative assessment approaches. The Theory of Cognitive Load explains how excessive stress or unfamiliarity with the simulation setting may overload students' working memory, diminishing learning effectiveness. A recurring concern is the lack of standardized evaluation tools for measuring simulation outcomes. Disparities in scenario design, debriefing quality, and assessment rubrics hinder inter-study comparison and generalization. Establishing simulation quality standards is essential for consistent, evidence-based integration into curricula. These findings respond to the third research objective and problem formulation by identifying the barriers limiting simulation's optimal use and affirming the need for system-wide improvements (Agustini et al., 2024; Guerrero et al., 2023; Macnamara et al., 2021; Sałacińska et al., 2025).

This research have several important implications: For educators, adopting various simulation strategies based on learning objectives can maximize student engagement and competency development. For institutions, investing in faculty development and infrastructure is critical to scale up simulation-based education equitably and effectively. For policymakers, funding models and simulation accreditation standards must be developed to support integration at a national or regional level, especially in resource-limited settings. Furthermore, this review emphasizes the importance of interprofessional collaboration, cultural sensitivity in scenario design, and student-centered debriefing techniques.

CONCLUSION

Simulation in nursing education has evolved from a supplementary method to a core strategy for experiential learning. High-fidelity simulations, standardized patients, and hybrid models emerge as particularly effective strategies, offering immersive, realistic environments that enhance clinical judgment, decision-making, and procedural competence. These approaches significantly improve learning outcomes by fostering critical thinking, empathy, teamwork, and ethical sensitivity skills essential for holistic, patient-centered care. However, despite its proven benefits, the full potential of simulation remains constrained by systemic challenges. These include unequal access to technology and resources, limited faculty preparedness, time constraints, and inconsistent evaluation standards. Addressing these barriers requires strategic investments in infrastructure, ongoing faculty development, and the establishment of standardized best practices. Therefore, simulation must be embraced not only as a pedagogical tool but also as a transformative mindset one that values safe failure, reflective learning, and continuous skill refinement. To truly integrate simulation into nursing education, institutions must commit to building sustainable, inclusive, and evidence-based simulation ecosystems that adapt to the evolving demands of healthcare education.

Integrate simulation systematically across curricula, ensuring alignment with clinical competencies and national nursing standards. Establish structured faculty development programs in simulation design, facilitation, and debriefing to ensure pedagogical consistency and effectiveness. Promote simulation equity by supporting cost-effective innovations and partnerships, especially in resource-constrained settings. Develop unified guidelines and accreditation frameworks to enhance standardization and quality assurance across simulation programs. Encourage simulation-based research that explores long-term clinical outcomes, patient safety impacts, and student career transitions. Ultimately, nursing education must move toward a future where simulation is not a privilege, but a norm, an essential component of preparing compassionate, competent, and confident nurses for the realities of patient care.

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