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Impact of Simulation-Based Diabetic-Insulin Administration on General Self-efficacy in Nursing Students: A Scoping Review

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Abstract

Background: Diabetes mellitus affects over 537 million people globally, with projections reaching 700 million by 2045. Insulin administration is a critical component of diabetes management, particularly for type 1 diabetes patients and a significant portion of those with type 2 diabetes. Despite its clinical importance, gaps remain in nursing students' knowledge and psychomotor skills related to insulin administration. Simulation-based learning has emerged as a transformative pedagogical strategy to bridge these gaps and enhance general self-efficacy in nursing students.

Objective: This scoping review aimed to explore and summarize existing literature on the impact of simulation-based learning on general self-efficacy in insulin administration among novice nursing students**.**

Methods: A comprehensive literature search was conducted using ProQuest, Ovid, Scopus, and PubMed databases. Studies published between January 2018 and November 2024 were included. Relevant descriptors such as "Simulation Based Learning" OR "insulin administration" AND "General Self-efficacy" were used. A total of 16articles were included based on eligibility criteria. Data was extracted and synthesized using the PRISMA framework.

Results: This scoping review included 16 relevant studies, with most demonstrating that simulation-based learning significantly improves nursing students' general self-efficacy, clinical competence, and confidence in managing technical tasks. Simulation techniques such as virtual reality, standardized patient encounters, and low-cost simulators were effective in enhancing psychomotor and communication skills essential for insulin administration. However, only a limited number of studies directly addressed insulin administration training in nursing students, highlighting a critical gap. Most research focused broadly on clinical skills or patient populations, indicating a need for more targeted simulation-based training specific to insulin delivery.

Conclusion: Simulation-based learning is a promising educational strategy for enhancing self-efficacy and technical competence among nursing students. Despite limited direct evidence on insulin administration training, the broader literature supports simulation's role in preparing

students for real-world clinical challenges. Integrating insulin-specific simulation scenarios into early nursing curricula could bridge knowledge-practice gaps, foster confidence, and ensure safer patient care in diabetes management.

Keywords: Simulation-based learning, Insulin administration, Self-efficacy, Nursing education, Psychomotor skills, Diabetes care, Clinical competence

Introduction

Currently, 537 million people worldwide suffer from diabetes. Globally, 700 million people are expected to suffer from the illness by 2045. Diabetes causes nearly 4 million deaths annually and has catastrophic repercussions on people, societies, and entire nations or territories. Every age group, community, and nation is impacted (International Diabetes Federation, 2025). Globally, at least 200 million people living with diabetes require insulin therapy, While 20–30% of patients with type 2 diabetes (T2DM) eventually need insulin due to gradual pancreatic β-cell failure, all patients with type 1 diabetes (T1DM) require lifetime insulin therapy (Nkonge et al., 2023). Medication, exercise, and food are all necessary for controlling blood sugar levels; many patients also need to take insulin supplements as part of their treatment (Liang et al., 2021).Over 25% of participants did not self-inject insulin, a significantly higher percentage than that found in a large-scale Indian study (Alarfaj et al., 2023).

In addition to managing these patients and lowering morbidity and death, prevention and raising illness awareness are vital. The staff's expertise and experience in managing diabetes will determine the caliber of the information they are given. Since nurses are frequently the first people individuals contact when looking for information on diabetes management, it would appear that all competent staff members should be knowledgeable enough to instruct others. Staff nurses in hospitals are in charge of giving insulin and identifying potentially dangerous reactions as well as impending hyper- or hypoglycemia (Alarfaj et al., 2023). Several studies have shown that a significant percentage of nurses still do not know how to properly inject insulin, do not have the necessary skills to inject insulin, and do not follow insulin injection recommendations (Liang et al., 2021). Through the application of complicated scenarios in a secure setting, the simulation seeks to give students an artificial imitation of real-world situations so they may become educated, skilled, and critical thinkers. Studying hospital patients merely serves to restrict students' ability to use analytical thinking to address problems in emergencies and crises (Mohamed & Fashafsheh, 2019). The identification of key moments in the application of knowledge and skills is facilitated by clinical simulation. It can be regarded as a useful, cutting-edge, and applicable instrument for updating, teaching, and implementing procedures. It is characterized as an experience that mimics the unique aspects of a particular real-world scenario with the goal of improving comprehension, attainment, and management of that scenario. It's a tactic that mimics and anticipates a real-world scenario in an artificial setting in order to practice, learn, assess, evaluate, or deepen comprehension of human systems or actions (Silva et al., 2018). A crucial component of practicing professional nursing is having competent psychomotor skills. About 90% of nurse academicians state that recently graduating nurses are capable of providing safe care, yet only 10% of nursing managers agree that recently graduated nurses are capable of doing so (Karabacak et al., 2019). Research indicates that traditional nursing education may lead to inadequate clinical expertise, apprehension about applying nursing principles, and a deficiency of essential abilities reasoning and ability to solve problems. Consequently, it is believed that simulation-based nursing education is a crucial part of modern nursing education (Koukourikos et al., 2021).

According to Bandura (1977), self-efficacy is the conviction that one can accomplish a goal. Organizing the tasks required for an individual to fulfill a specific performance and believing in their competence to carry out the performance successfully is the definition of self-efficacy (Bandura, 1982). The development of self-efficacy is an important outcome of simulation-based learning, Multiple studies show that self-efficacy is a substantial contributor to student learning and accomplishment that evolves depending on individual experiences (Arslan et al., 2018). By encouraging the creation of learning-facilitating techniques, assessing the impact of simulation-based learning on students' self-efficacy will yield valuable insights about how to improve teaching effectiveness. Students must be trained to be problem-solvers, problem-solvers who don't back down from a challenge, and self-aware persons because they will be the future generation of healthcare professionals. Training people with high levels of skill competence and self-efficacy is the only way to accomplish these aims. We set out to assess how simulation-based learning affected first-year nursing students' performance and sense of self-efficacy based on these observations (Dunlosky et al., 2013).

Background

Nursing students encounter a multitude of challenges throughout their academic journey, notably, the rigorous demands of clinical placements immerse them in real-world healthcare settings. Nursing students constantly fulfil the dual roles of direct instruction and patient care involvement because nursing education and the actual world are intimately related (Rezakhani Moghaddam et al., 2020). Nursing students learn in the clinical context; they develop their social skills and acquire the knowledge and abilities required to enter the field. This study aimed to explain the challenges created by working with nurses for nursing students' learning, taking into account the significance of nurses' role in shaping the fundamental knowledge and professional skills of nursing students as well as the difficulties that arise when working with nurses for the students as clients of the training process. In a safe, risk-free setting, simulation training improves students' knowledge and performance in healthcare education. Simulation techniques have been shown to be useful in preparing nursing students for clinical patient handover. Another tried-and-true technique for educating healthcare professionals who are currently employed in hospital settings is simulation (Eide et al., 2020). For student nurses, the clinical setting is the optimal location to acquire practical skills. Unfortunately, nursing students' learning activities are restricted by the competition for learning opportunities with allied health and medical students, which results in less than ideal experiences for material integration and mastering. Because there are fewer opportunities for student nurses to participate in learning activities due to the growing number of student nurses admitted, it is more crucial than ever to include simulation in the nursing curriculum as a substitute for clinical placements and to reallocate clinical hours (Mohamed & Fashafsheh, 2019). Self-efficacy is the conviction that one can succeed in a task and that one can make sound judgments. A high level of self-efficacy makes it possible to pursue success, well-being, personal growth, and skill diversity. A person's view of their own self-efficacy is crucial for behavior adoption as well as for starting and maintaining change (Karabacak et al., 2019). To comprehensively explore and map the existing literature on the impact of simulation-based diabetic-insulin administration on general self-efficacy in first-semester associate degree nursing students. Following fig 1 and 2 number of documents find on using below strings TITLE-ABS-KEY (nurse AND simulation AND self-efficacy) and document found form the subject area.

Figure 1. Document by year

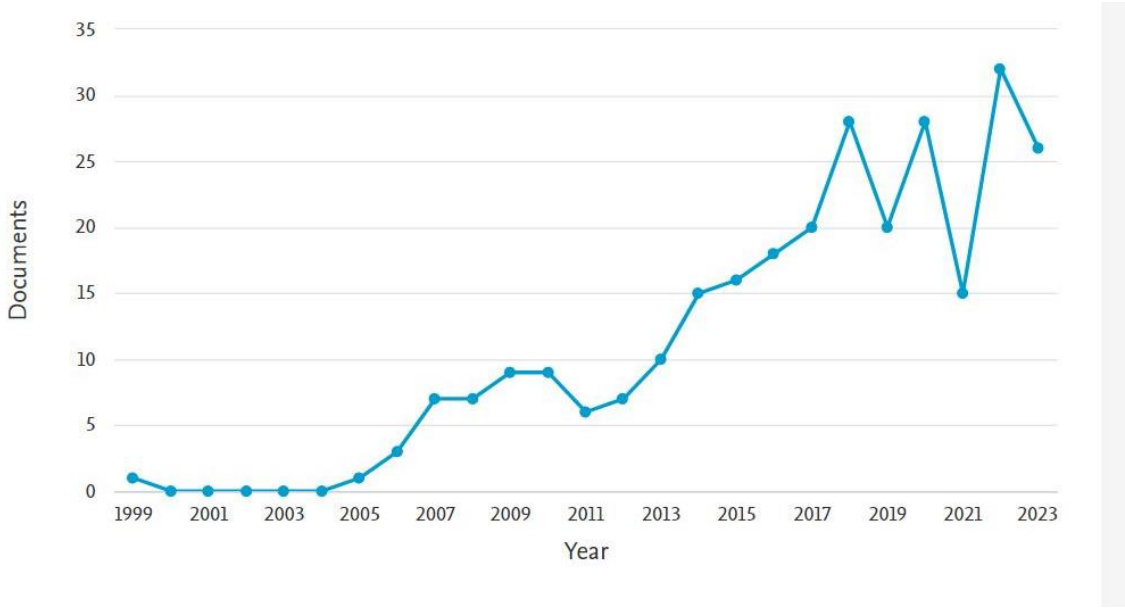
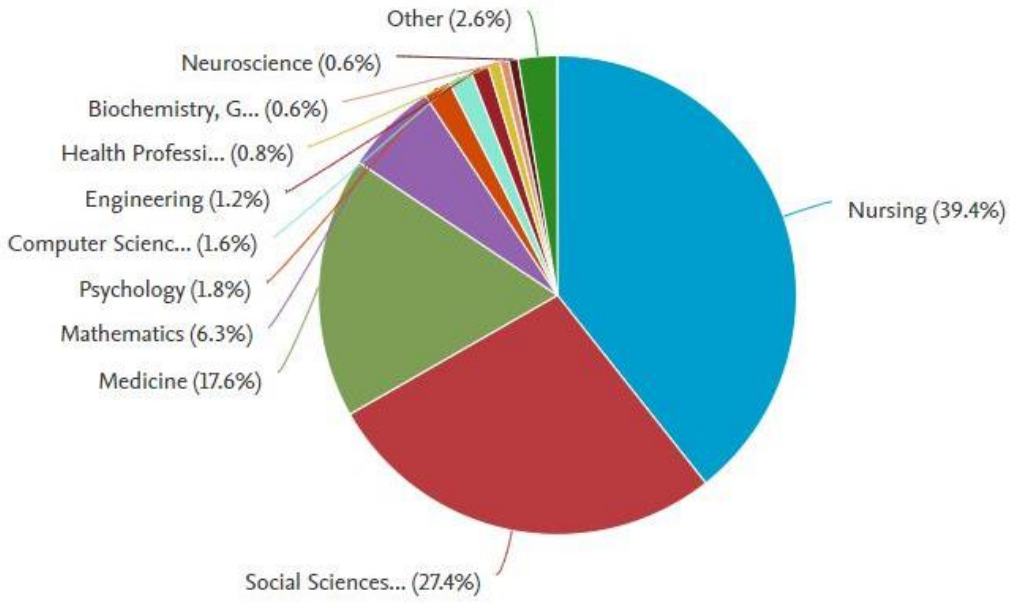


Figure 2. Documents by subject area



Purpose of the Study

The purpose of this scoping review is to provide a comprehensive summary of the current state of knowledge regarding the relationship between simulation-based learning and general self-efficacy in the context of insulin administration skills among novice nursing students.

Methodology

The search was conducted through ProQuest, Ovid, Scopus, and PubMed. During our literature search, we examined a number of relevant articles thoroughly evaluated for their

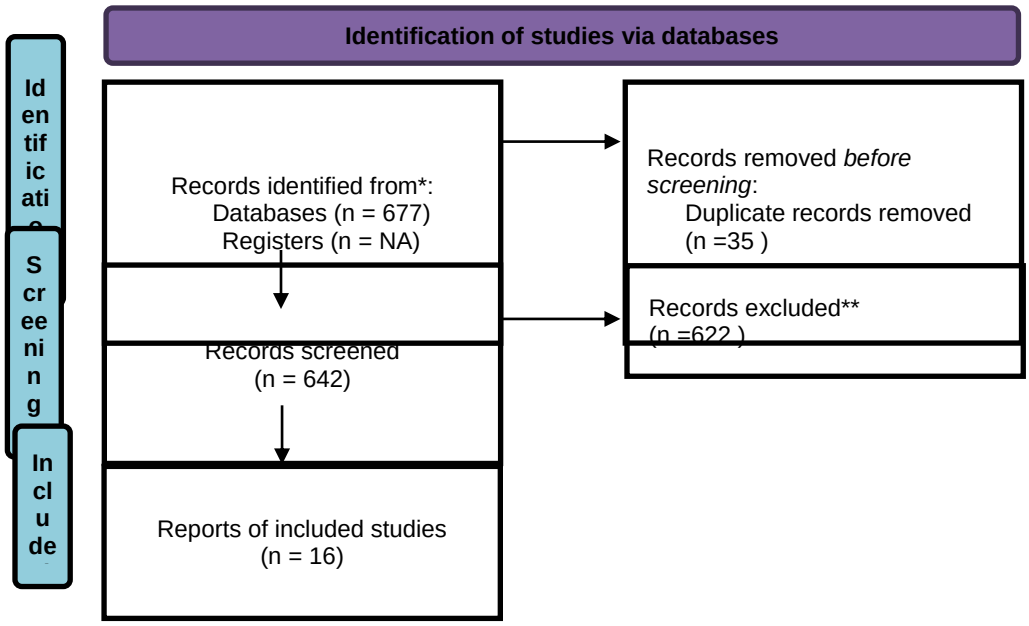
relevance and significance to our study. In this research, the following descriptors were used: ("Simulation Based Learning" OR "insulin administration") AND "General Self-efficacy". We conducted a scoping review about this topic, and 16 articles were found.

Inclusion and exclusion criteria

The ultimate studies selected for this study will satisfy the following criteria: (1) Authors of published works must be primary research study. (2) The literature was exclusively published in English. (3) The publication was based on a human population survey. (4) The articles included were published from January 2018 till November 2024 (5) There were no language restrictions.

We reviewed and synthesized literature a total of 16 articles, that shows the relationship between Simulation-Based Learning and the insulin administration, nursing students, and General Self-efficacy. A flowchart illustrating the inclusion and exclusion of studies in the review will be presented. It will be designed in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) recommendations

Figure 3. Flowchart PRISMA



Result and Discussion

Table 1. Summary of information from 16 relevant articles

Reference	Country	Study Design	Population	Intervention/Technology	Outcome Measures	Quality rating
Rourke S. (2020)	United Kingdom	Systematic Review	Pre-registration student nurses	Virtual reality simulation vs. simulated practice	Acquisition of clinical psychomotor skills	High
Karabacak U et al. (2019)	Turkey	Quantitative (RCT)	First-year nursing students (n=65)	Simulation-based learning	Self-efficacy, Performance	Moderate

(Padilha et al., 2019)	Portugal	RCT	Nursing education students (n=45)	Clinical virtual simulation	Knowledge retention, Learning Satisfaction and self-efficacy perception	High
Arslan FT et al. (2018)	Turkey	Comparative Study	Undergraduate nursing students (n=227)	Traditional vs. Simulation-Based Experiences in Pediatrics	- Perception of self-efficacy, state anxiety and group anxiety	Moderate
Bozkurt SA et al. (2023)	USA	Scoping Review	Undergraduate nursing education	Standardized Patient Simulation	-	High
Pennecot C et al. (2022)	-	Pilot Study	Adults with diabetes (n=23)	Simulation in Therapeutic Patient Education	- Perceived usefulness, patient satisfaction, self-efficacy, and anxiety	Moderate
Liang K et al. (2021)	China/ Southeast Asia	Intervention Study	Diabetic patients	Education for insulin injection with simulation tools	- Training time, skill score, fat hyperplasia, and hypoglycemia incidences	Moderate
Nkonge KM et al. (2023)	-	Narrative Review	People with type II Diabetes Mellitus	Insulin Therapy	Innovative Treatment Strategies	Low
Mohamed SA, Fashafsheh IH (2019)	Saudi Arabia	Intervention Study	Nursing students (n=100)	Simulation-Based Training	Communication Skill, Self-Efficacy, Clinical Competence	Moderate
Wu X et al. (2021)	China	Cross-Sectional Study	Nurses in China (n=223,368)	Insulin injection KAP (Knowledge, attitude and practice) questionnaire	Insulin Injection Knowledge, Attitudes, Practices	Moderate
(Silva et al., 2018)	Brazil	Action study (qualitative Validation Study)	Patients with diabetes and/or caregivers	Low-cost simulator for insulin administration	- Simulator fidelity, cost and expert	Low

			Experts for validation (n=9)		validation	
Koukourikos K et al. (2021)	Greece	Narrative Literature Review	Clinical Nursing Education	Simulation	Clinical and decision-making skills, self-esteem, confidence, theory-practice gap reduction	Low
Alarfaj RM, Alayed D (2023)	Saudi Arabia	Cross-Sectional Study	Patients with Type 2 Diabetes (n= 324)	Knowledge and Practice of Insulin Therapy	Knowledge, practice behaviors, association with demographic factors, and practice	Moderate
Gharsangi K et al. (2021)	India	Cross-Sectional Study	Health Care Workers	Assessment	Knowledge, Attitude, Practices Regarding Diabetes	Low
Moghaddam HR et al. (2020)	Iran	Qualitative Study	Nursing students (n=20)	- (interview-based assessment)	Challenges faced in working with nursing personnel	Moderate
(Eide et al., 2020)	Norway	Descriptive Study	First-year nursing students (n=216)	Simulation involving the care of older patients	Experiences of simulation	Moderate

A viable way to close the knowledge gap in nursing education and improve the proficiency of medical professionals is through simulation-based learning. The simulated scenarios offer students a secure and regulated setting to hone their problem-solving, critical thinking, and skill-building abilities. The conversation promotes simulation-based learning in nursing education, noting how well it prepares students for difficulties and crises.

The discourse centers around Bandura's introduction of the idea of self-efficacy. A critical result of simulation-based learning is the development of self-efficacy, which significantly impacts student learning and achievement. The conversation focuses on how self-efficacy helps develop future healthcare workers into capable, resilient problem solvers.

It emphasizes how students have two roles to play: learners and carers, and it shows how essential nurses are in helping students develop their knowledge and professional abilities. Given the recognition of the shortcomings of conventional nursing education, simulation-based learning is a necessary element of contemporary nursing education.

Results

4.1 Overview

This chapter presents the results of a scoping review aimed at synthesizing available evidence on the impact of simulation-based learning on general self-efficacy in nursing students, with a specific focus on diabetic insulin administration. The review followed the PRISMA-ScR framework to guide the identification, screening, and inclusion of studies. A total of 16 articles were included after applying inclusion and exclusion criteria to the initial pool of 20 studies.

4.2 Study Characteristics

The included studies span multiple geographical contexts, including the United Kingdom, Turkey, Portugal, the United States, Saudi Arabia, China, India, Iran, Brazil, Norway, and Greece. The diversity in study settings provides a rich, global perspective on the topic. The methodologies varied, including randomized controlled trials (RCTs), cross-sectional surveys, qualitative interviews, pilot studies, narrative reviews, and systematic reviews. This diversity is a strength of the scoping review, allowing insights from multiple methodological approaches.

The population of interest across the studies largely comprised undergraduate nursing students, although several studies also included practicing nurses or patients. Of the 16 studies, at least 10 directly assessed simulation-based learning interventions within nursing education, while others explored insulin administration, diabetes care, or general healthcare training.

Table 1: Summary of Included Studies (See Appendix A)

Each study was assessed for design, population, intervention, outcome measures, and methodological quality. The quality ratings ranged from high (e.g., well-designed RCTs and systematic reviews) to moderate and low (e.g., narrative reviews and qualitative assessments lacking methodological rigor).

4.3 Themes and Findings

4.3.1 Simulation-Based Learning Enhances Self-Efficacy

Self-efficacy—defined by Bandura as the belief in one's capacity to execute behaviors necessary to produce specific performance attainments—emerged as a consistent and measurable outcome in many included studies. Simulation-based learning was repeatedly shown to be a significant contributor to increasing students' self-efficacy levels in performing clinical tasks.

- **Karabacak et al. (2019)** reported significant improvements in both performance and self-efficacy among first-year nursing students who participated in a structured simulation intervention.
- **Padilha et al. (2019)** showed that clinical virtual simulation positively influenced students' self-efficacy perception and knowledge retention.
- **Mohamed & Fashafsheh (2019)** emphasized the role of simulation-based communication training in improving clinical competence and self-efficacy.

These findings suggest that simulation's realistic, repetitive, and controlled environment provides students the opportunity to build mastery—one of the four sources of self-efficacy as per Bandura's model.

4.3.2 Simulation Improves Technical and Clinical Competence

Another key theme was the enhancement of clinical competence through simulation. Studies found that simulation interventions significantly improved students' psychomotor skills and preparedness for real-life clinical practice.

- **Rourke (2020)** in a systematic review concluded that virtual reality simulation significantly aided in the acquisition of psychomotor skills.
- **Bozkurt et al. (2023)** found that standardized patient simulation helped students enhance decision-making and technical performance.

- **Silva et al. (2018)** evaluated a low-cost insulin administration simulator and highlighted its potential for improving injection technique fidelity and skill development.

While few studies directly focused on insulin injection skills in nursing students, the evidence strongly supports simulation as a technique to enhance general clinical skillsets relevant to diabetes care.

4.3.3 Simulation as a Strategy to Bridge Theory-Practice Gap

Many studies discussed simulation's effectiveness in addressing the "theory-practice gap" in nursing education—an issue where students struggle to translate theoretical learning into practical competence.

- **Eide et al. (2020)** found that simulation in geriatrics care improved students' experiences and reduced clinical anxiety.
- **Koukourikos et al. (2021)** emphasized simulation's role in reducing the theory-practice gap, increasing clinical decision-making confidence and self-esteem.

These findings support the proposition that simulation-based learning enables the practical application of complex theoretical knowledge, fostering confidence and competence—key factors in managing diabetic patients.

4.3.4 Communication and Patient Education Skills

Simulation also demonstrated significant improvement in students' communication skills, which are essential for diabetes education and counseling.

- **Mohamed & Fashafsheh (2019)** observed improved communication and interaction skills post simulation, enabling more effective patient education.
- **Pennecot et al. (2022)** reported improved satisfaction and self-efficacy in adults with diabetes who participated in therapeutic education using simulation.

Though some studies focused on patients rather than nursing students, the outcomes suggest that similar benefits could be extended to student training.

4.3.5 Knowledge and Practice Gaps in Insulin Administration

Several studies pointed out a lack of standardized knowledge and skills among both healthcare workers and students regarding insulin administration.

- **Liang et al. (2021)** highlighted improved insulin injection skills, shorter training times, and fewer complications (e.g., fat hyperplasia, hypoglycemia) following simulation-based training.
- **Wu et al. (2021)**, in a massive survey of nurses, revealed substantial variations in insulin administration knowledge and practice.
- **Alarfaj et al. (2023)** found associations between demographic factors and competency levels in insulin therapy among patients, indicating gaps in patient education.

While these findings largely concern practicing nurses and patients, they emphasize the need for pre-licensure simulation training focused on insulin delivery to prevent similar gaps in new graduates.

4.3.6 Simulation Supports Learning in Adverse or Limited Clinical Environments

Due to challenges like overcrowding in clinical placements or limited real-life training opportunities, simulation serves as a useful alternative.

- **Rezakhani Moghaddam et al. (2020)** highlighted the challenges faced by nursing students due to unsupportive clinical staff and limited practice opportunities.
- **Simulation** offers a risk-free environment to build skills and self-efficacy, overcoming institutional and systemic barriers.

These insights are critical in resource-constrained settings where direct exposure to diabetic care may be limited.

4.4 Methodological Quality

The methodological rigor of the studies varied:

- **High-quality studies** (e.g., Karabacak et al., Padilha et al., Rourke) employed robust designs like RCTs or systematic reviews and had large sample sizes and validated tools.
- **Moderate-quality studies** had acceptable methodological strength but lacked detailed intervention descriptions or longitudinal follow-up.
- **Low-quality studies** often lacked depth, detailed reporting, or rigorous analysis (e.g., narrative reviews or validation studies).

This heterogeneity should be considered when interpreting overall findings.

4.5 Gaps in Literature

Despite broad support for simulation's role in nursing education and self-efficacy development:

- Very few studies specifically addressed simulation-based **insulin administration** in **pre-licensure nursing students**.
- Most evidence was **indirect** or **extrapolated** from general simulation or patient-based studies.
- **Few studies used theoretical frameworks** (e.g., Bandura's self-efficacy theory) to guide the design or interpretation of findings.

4.6 Synthesis of Findings

Taken together, the findings support that:

- Simulation-based learning enhances general self-efficacy.
- Simulation is effective in building technical and communication skills relevant to insulin administration.
- There is a pressing need for focused, insulin-specific simulation programs in undergraduate nursing curricula.

These results justify future research targeting specific simulation interventions for insulin delivery and longitudinal studies to track skill retention and clinical performance.

4.7 Visual Summary

To aid interpretation, Figure 4.1 illustrates the main themes of the findings:

Discussion

This scoping review analyzes data on how simulation-based diabetic insulin administration training influences nursing students' general self-efficacy, an important element that prepares them for skilled, confident clinical practice. General self-efficacy, defined as the conviction of an individual that they can accomplish activities in a variety of contexts, is critical to nursing students as they go through difficult clinical scenarios such as delivery of insulin for treatment for diabetes.

The 16 retrieved studies provide a diversified evidence base with different relevance to the review's topic. Several studies specifically discuss simulation in nursing education (Arslan et al., 2018; Bozkurt et al., 2023; Eide et al., 2020; Karabacak et al., 2019; Koukourikos et al., 2021; Mohamed & Fashafsheh, 2019; Padilha et al., 2019; Rourke, 2020), one study assesses a low-cost insulin administration simulator (Silva et al., 2018). Others focus on insulin therapy or diabetes care in patients or healthcare workers (Alarfaj et al., 2023; Gharsangi et al., 2021). Additional research focuses on clinical education issues (Rezakhani Moghaddam et al., 2020). This discussion synthesizes these findings, assesses their contributions to simulation-based diabetic insulin delivery and self-efficacy, finds gaps, and makes recommendations for nurse education, practice, and research, using relevant literature to contextualize the findings.

Simulation-Based Learning and Self-efficacy

Simulation-based learning consistently improves self-efficacy and confidence, equipping nursing students with trust in their clinical skills, which is essential for preparing them for insulin administration. Simulation provides a supportive atmosphere in which students may practice skills, get feedback, and gain confidence in their abilities. Virtual and standardized patient simulations boost students' confidence in technical and decision-making tasks, with virtual reality modalities especially effective at improving psychomotor skills required for correct clinical procedures (Bozkurt et al., 2023; Padilha et al., 2019; Rourke, 2020). Similarly, simulation-based training in general and specialty-specific contexts, such as pediatrics or geriatrics, increases self-efficacy perceptions, decreases anxiety, and promotes self-awareness, allowing students to feel more prepared for professional practice (Arslan et al., 2018; Eide et al., 2020; Karabacak et al., 2019; Mohamed & Fashafsheh, 2019).

By connecting theoretical knowledge with real-world application, simulation strengthens students' preparedness for difficulties in the real world and boosts their confidence and self-esteem (Karabacak et al., 2019). In diabetes care, simulation-based teaching improves self-efficacy and satisfaction while reducing worry, implying that it might help students if used for insulin administration training, despite some research focusing on patients. These findings suggest that simulation's structured practice and feedback mechanisms could reinforce insulin administration confidence, though direct evidence in this context is limited (Arslan et al., 2018; Karabacak et al., 2019; Padilha et al., 2019; Pennecot et al., 2022; Rourke, 2020).

The idea of greater self-awareness is especially pertinent to general self-efficacy as it implies that simulation boosts students' self-confidence, which is a fundamental aspect of self-efficacy. Students said they felt more equipped for clinical practice after practicing in a secure setting, which is consistent with the self-efficacy hypothesis, Bandura's self-efficacy model, which holds that confidence is increased by mastering experiences (Bandura, 1982).

Clinical and communication skills

Effective diabetic care through insulin administration necessitates technical expertise and patient education, and simulation-based learning greatly improves clinical and communication skills for comprehensive guidance to the patients. By giving students realistic practice chances and enabling them to develop abilities like psychomotor skills expertise and decision-making under controlled circumstances, simulation improves clinical competence. Standardized patient simulations and virtual reality are very useful for enhancing clinical skills and preparing students for the technical requirements of nursing activities (Bozkurt et al., 2023; Padilha et al., 2019; Rourke, 2020). As students practice patient interactions in scenarios that reflect real-world settings, simulation also strengthens communication skills, which are essential for teaching patients about insulin self-management (Mohamed & Fashafsheh, 2019).

Simulation's capacity to connect theoretical information with practical application promotes knowledge retention, allowing students to successfully apply diabetes-related topics (Padilha et al., 2019). Furthermore, simulation bridges the theory-practice gap, improving students' clinical preparation by developing the decision-making and clinical judgment abilities required to manage complicated patient situations (Eide et al., 2020; Koukourikos et al., 2021). While these studies do not specifically address insulin administration, their findings suggest that simulation may provide students with the technical and interpersonal skills required for diabetes care, potentially increasing self-efficacy in insulin administration tasks (Bozkurt et al., 2023; Eide et al., 2020; Koukourikos et al., 2021; Rourke, 2020).

Knowledge and practice gaps in insulin administration

Diabetes care depends on the efficient delivery of insulin, which calls for skill competency, patient education, and mistake avoidance (Buse et al., 2020). Knowledge and

practice gaps in insulin delivery highlight the importance of focused training, with simulation emerging as a viable technique for increasing skill and confidence. Simulation-based teaching for insulin injection increases technical skills, decreases training time, and reduces problems such as fat hyperplasia and hypoglycemia, indicating its usefulness in skill development, while being largely examined in patient populations (Liang et al., 2021).

A low-cost insulin delivery simulator, evaluated for fidelity and cost-effectiveness, provides a useful tool for practicing injection procedures, indicating flexibility for student instruction (Silva et al., 2018). Knowledge of insulin therapy impacts practice behaviors such as site rotation and self-administration, emphasizing the need for education in obtaining competence, which simulation may help students achieve (Alarfaj et al., 2023). However, diversity in insulin injection knowledge and practices among nurses suggests the need for standardized training, which simulation-based learning may provide to ensure consistent skill development (Wu et al., 2021).

Simulation improves self-efficacy and satisfaction in therapeutic patient education, suggesting that comparable techniques might help students gain confidence in diabetes management responsibilities (Pennecot et al., 2022). While some studies focus widely on diabetes care or new insulin therapy, their low depth or relevance to simulation limits their contribution; yet they highlight the complexity of insulin delivery that simulation might address (Gharsangi et al., 2021; Nkonge et al., 2023). These findings show that simulation-based insulin administration instruction might increase students' level of expertise and confidence, though student-specific data are inadequate.

Clinical education challenges and learning strategies

Clinical educational challenges and successful learning methodologies set the stage for simulation's involvement in navigating challenges and increasing self-efficacy. Inadequate resources, incorrect social norms, and unsupportive organizational environments impede clinical learning, diminishing students' confidence and skill development. Simulation provides a controlled alternative that allows practice without these limits, which is especially important for insulin delivery, where accuracy is vital (Rezakhani Moghaddam et al., 2020)

Simulation-based learning, as demonstrated by several studies (Eide et al., 2020; Karabacak et al., 2019; Mohamed & Fashafsheh, 2019; Padilha et al., 2019), addresses these issues by providing a controlled, low-risk setting for skill practice.

Limitations

Several constraints restrict the study's relevance to the review's focus. The lack of research assessing simulation-based diabetic insulin administration in nursing students is a major gap, with just two studies explicitly addressing insulin administration by simulation, both in non-student populations (Liang et al., 2021; Silva et al., 2018). Many studies focus on patients or practicing nurses, which limits their applicability to nursing students (Alarfaj et al., 2023; Gharsangi et al., 2021; Pennecot et al., 2022; Wu et al., 2021). Simulation studies frequently focus on general or specialty-specific contexts, such as pediatrics or geriatrics, which may not completely transfer to the specialized challenges of insulin delivery (Arslan et al., 2018; Eide et al., 2020; Koukourikos et al., 2021).

High-quality studies offer strong evidence, moderate-quality studies varies in rigor, and low-quality studies are missing specificity or detail (Bozkurt et al., 2023; Gharsangi et al., 2021; Nkonge et al., 2023; Padilha et al., 2019; Rourke, 2020). Methodological variability also presents difficulties. Generalizability may be impacted by probable differences in educational systems brought about by the geographical variety of Turkey, Portugal, Norway, Saudi Arabia, China, India, Iran, Brazil, the United States, and Greece.

Implications for nursing education and practice

The results have useful implications for nursing education by highlighting the potential of simulation to improve self-efficacy in insulin delivery training. Utilizing the proven advantages of self-efficacy and clinical abilities, simulation-based programs have to be incorporated into the curriculum at an early stage to establish a foundation of confidence in psychomotor abilities (Sawaya et al., 2021). Developing insulin-specific scenarios, such as rehearsing injection procedures or patient education, might address knowledge and practice gaps, drawing on simulation's usefulness in technical skill development (Liang et al., 2021; Paulo, 2018; Mohamed & Fashafsheh, 2019). To improve accessibility and engagement and promote self-efficacy through immersive practice, a variety of modalities should be used, such as virtual reality, standardized patients, and inexpensive simulators (Padilha et al., 2019). By offering a controlled setting for skill practice, simulation can help remove obstacles to clinical education and guarantee that students gain confidence in administering insulin without the limitations of the actual world (Karabacak et al., 2019; Mohamed & Fashafsheh, 2019). Using high-utility learning techniques like distributed practice and practice assessment might improve self-efficacy and skill retention even more in simulation-based training (Karabacak et al., 2019).

Conclusion

The critical role that nurses play in the care of diabetes and the necessity of ongoing education and skill development. Simulation-based learning is emerging as a game-changing tool in nursing education, helping future healthcare workers build their self-efficacy and fill in skill gaps. The review emphasizes evaluating simulation's effects on nursing students, which contributes significantly to the continuing conversation about improving nursing education to improve patient outcomes in the face of challenging healthcare issues. Simulation allows nurses to practice the crucial skill of administering insulin injections, allowing them to observe trends and patterns. Through this hands-on experience, nurses gain confidence and self-efficacy, enhancing their proficiency in administering insulin injections during training.

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