Western European Journal of Medicine and Medical Science
Volume 4, Issue 06, June 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

SIMULATION-BASED TRAINING AS A STRATEGY FOR REDUCING MEDICATION ERRORS IN MEDICAL EDUCATION: A MIXED-METHOD ANALYSIS

Salaeva Muborak Saidobdullaevna, Kurikkapeedika Sharafuddin Afsana, Kulkaraev Abdisalim Karimovich
Tashkent State Medical University, Tashkent, Uzbekistan

Abstract: Medication errors remain a significant cause of preventable patient harm, particularly during drug administration [1]. Nursing and medical students are especially vulnerable due to limited clinical exposure and insufficient confidence in practical skills. This study evaluates the effectiveness of simulation-based training in reducing medication errors among undergraduate medical students. A mixed-method approach combining literature review and questionnaire-based survey was used. Findings indicate that while students possess theoretical knowledge, they lack confidence in dosage calculation and medication administration. Simulation-based learning significantly improves clinical decision-making, error recognition, and practical competence [3,4]. The study strongly supports integrating simulation into medical curricula to enhance patient safety.
Keywords: Medication errors, Simulation-based learning, Patient safety, Clinical competence, Nursing education, Dosage calculation

Main Text

Introduction

Medication errors are among the most common preventable causes of patient harm worldwide, especially during drug administration [1]. These errors include incorrect dosage calculation, wrong drug administration, and improper timing or route. Medical and nursing students are particularly at risk due to:

- Limited clinical exposure
- Lack of confidence in practical skills
- Inadequate experience in real-life patient care

Traditional teaching methods primarily focus on theoretical knowledge, often failing to provide sufficient hands-on experience. Simulation-based training offers a safe and controlled environment where students can practice clinical skills effectively [3]. Previous studies have demonstrated that simulation enhances knowledge, confidence, and awareness of patient safety [4,5].

Aim and Objectives

Aim: To evaluate the effectiveness of simulation-based training in preventing medication errors among medical students.

Objectives

- To identify common types and causes of medication errors
- To assess students' awareness and confidence regarding medication administration
- To evaluate the impact of simulation on clinical skills and decision-making
- To determine the need for integrating simulation into medical education

Western European Journal of Medicine and Medical Science
Volume 4, Issue 06, June 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

Methodology

Study Design: This study employed a **mixed-method research design**, integrating both **quantitative and qualitative approaches** to comprehensively evaluate the effectiveness of simulation-based training in preventing medication errors. The study combined a structured literature review with a cross-sectional questionnaire survey to ensure both evidence-based and participant-driven insights. The study was conducted among **undergraduate medical and nursing students** enrolled in clinical and pre-clinical years. Participants were selected using a **convenience sampling method** based on availability and willingness to participate. **Sample size:** Approximately 20–50 students

Inclusion criteria:

- Students currently enrolled in a medical or nursing program
- Students with basic theoretical knowledge of pharmacology
- Students who have been exposed to clinical observation programs

Exclusion criteria:

- Students who declined participation
- Incomplete questionnaire responses

Literature Review: A structured review of published scientific literature was carried out to establish the theoretical foundation of the study. Relevant articles were identified through databases such as, PubMed, Google Scholar, and WHO & AHRQ reports. Only peer-reviewed articles and authoritative reports were included to ensure reliability. The review focused on:

- Types and causes of medication errors
- Risk factors contributing to errors among students
- Role of simulation-based training in healthcare education
- Evidence on effectiveness of simulation in improving patient safety

Questionnaire Design: A **self-administered structured questionnaire** was developed based on insights from the literature review. The questionnaire was designed to be simple, clear, and relevant to the study objectives. It consisted of both **closed-ended and Likert scale questions** to assess:

- Awareness of medication errors
- Knowledge of common error types
- Confidence in dosage calculation
- Previous exposure to simulation-based training
- Perceived effectiveness of simulation
- Attitudes toward curriculum integration

Data Collection: Data were collected over a defined study period using an online survey form. Participants were briefed about the purpose of the study before participation. Responses were collected anonymously to encourage honest feedback.

Data Analysis: Quantitative data were analyzed using descriptive statistics such as percentages and frequency distribution, whereas, the **qualitative responses** were interpreted thematically to identify common patterns and perceptions. The results were then compared with findings from the literature review to draw meaningful conclusions.

Ethical Considerations. This study adhered to fundamental ethical principles of research involving human participants. Participation was entirely voluntary, and informed consent was obtained prior to data collection. Participants were assured of the confidentiality and anonymity of their responses, and no personal identifying information was recorded. They

Western European Journal of Medicine and Medical Science
Volume 4, Issue 06, June 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

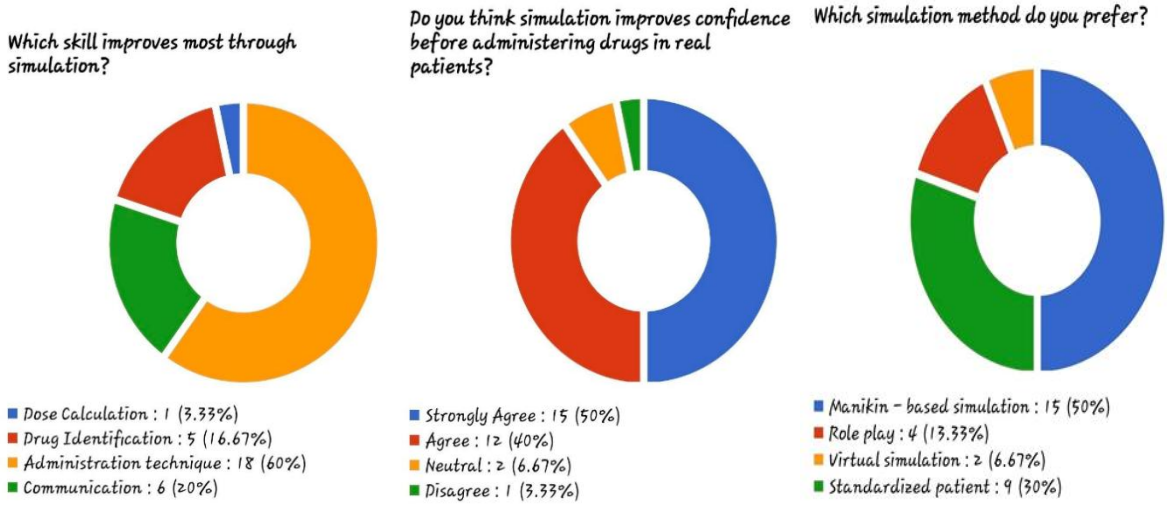
were informed of their right to withdraw from the study at any stage without any consequences. The study posed no physical or psychological risk to participants.

Results

1. Literature Review Findings: Medication errors are a major preventable cause of patient harm [1]. The most common types include, incorrect dosage calculation, wrong drug administration, and incorrect timing or route. Simulation-based training significantly improves medication safety knowledge, clinical decision-making, and error recognition skills [3,4]

2. Questionnaire Survey Findings: The survey findings indicated that a majority of participants were aware of medication errors as a common issue in clinical practice, with **81.5%** acknowledging their frequent occurrence. Additionally, **70.3%** of students identified multiple types of errors, including incorrect dosage, route, and timing. Despite this level of awareness, **77.8%** of respondents reported uncertainty in dosage calculation, reflecting limited confidence in practical skills.

Exposure to simulation-based training varied among participants, with **59.3%** having prior experience and **40.7%** reporting no exposure. Notably, a large majority agreed on the benefits of simulation, with **92.6%** stating that it improves confidence and **81.5%** agreeing that it helps reduce medication errors. Most participants also reported improvement in practical skills, particularly in medication administration techniques. Furthermore, **92.6%** of respondents strongly recommended the integration of simulation-based training into the medical curriculum. Overall, the findings highlight that while students possess moderate theoretical knowledge, their practical confidence remains limited, alongside strong support for simulation-based learning.



Discussion

The findings highlight a critical gap between theoretical knowledge and practical competence among medical students. Medication errors are largely caused by lack of practical exposure, poor dosage calculation skills, and low confidence [2]. Simulation-based learning effectively addresses these gaps by providing experiential learning and enhancing decision-making skills [3,4]. Survey findings support these observations. While students demonstrated awareness of medication errors, they reported low confidence in practical application. This indicates a disconnect between theoretical knowledge and clinical competence.

Western European Journal of Medicine and Medical Science
Volume 4, Issue 06, June 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

Furthermore, students showed a strong positive perception towards simulation. Most participants agreed that simulation improves confidence, enhances practical skills, and reduces medication errors, aligning with previous research findings [4,5]. Patient safety frameworks also emphasize the importance of training and system-based approaches to reduce medication errors [6].

Future Directions

Future research and educational strategies should focus on the systematic integration of simulation-based training into medical curricula to enhance medication safety competencies [3,5]. There is a need to develop and implement **high-fidelity simulation scenarios** that closely replicate real clinical environments, enabling students to gain deeper practical experience [4]. Additionally, **longitudinal studies** should be conducted to evaluate the sustained impact of simulation training on clinical performance and error reduction over time [5]. The incorporation of **advanced technologies**, such as virtual and digital simulation platforms, may further enhance accessibility and learning outcomes [3]. Continuous professional development programs and regular simulation-based assessments are also recommended to reinforce safe medication practices and ensure ongoing skill enhancement [2,6].

Conclusion

Simulation-based training is a highly effective strategy for preventing medication errors in medical education. While students possess foundational knowledge, they often lack confidence and practical skills, particularly in dosage calculation and drug administration. Simulation bridges this gap by providing a safe learning environment, improving clinical competence, and enhancing confidence [3,4]. Therefore, integrating simulation into healthcare education is essential to reduce medication errors and improve patient safety and quality of care [1,6].

References

1. World Health Organization. *Medication Errors: Technical Series on Safer Primary Care*. Geneva: WHO; 2016. Available from: https://www.who.int/publications/i/item/medication-errors-technical-series
2. Institute for Safe Medication Practices (ISMP). *Medication Safety Resources*. Available from: https://www.ismp.org
3. Lateef F. *Simulation-based learning: Just like the real thing*. J Emerg Trauma Shock. 2010;3(4):348–352. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2966567/
4. Gaba DM. *The future vision of simulation in healthcare*. Qual Saf Health Care. 2004;13(Suppl 1):i2–i10. Available from: https://qualitysafety.bmj.com/content/13/suppl_1/i2
5. Cant RP, Cooper SJ. *Simulation-based learning in nurse education: systematic review*. J Adv Nurs. 2010;66(1):3–15. Available from: https://pubmed.ncbi.nlm.nih.gov/20674199/
6. Agency for Healthcare Research and Quality (AHRQ). *Patient Safety Network*. Available from: https://psnet.ahrq.gov