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Effectiveness of Simulation-Based Training on Clinical Decision-Making Skills Among Nursing Students

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Abstract

Background: Simulation-based training (SBT) is increasingly recognized as an effective teaching method for developing clinical decision-making skills (CDMS) in nursing education. Traditional classroom methods often fail to bridge the gap between theoretical knowledge and clinical application, creating challenges for students in real-life healthcare settings.

Aim: This study aimed to evaluate the effectiveness of simulation-based training on enhancing clinical decision-making skills among final-year nursing students.

Methods: A quasi-experimental pre- and post-test design was conducted involving 60 final-year nursing students from various colleges in Swat, Pakistan. Participants underwent six simulation sessions over two weeks. Clinical decision-making skills were assessed using a validated tool before and after the intervention. Paired sample t-tests and chi-square tests were employed to analyze the data.

Results: The mean post-test score (25.75 ± 3.90) was significantly higher than the pre-test score (18.40 ± 4.25), with a mean difference of 7.35 ($p < 0.001$), indicating a substantial improvement. No significant associations were found between demographic variables (gender and age) and post-test scores ($p > 0.05$), suggesting that simulation training is practical across different groups.

Conclusion: Simulation-based training significantly improves clinical decision-making skills among nursing students, even those without simulation experience. It is an inclusive and impactful educational approach that can enhance learning outcomes regardless of demographic background. These findings support integrating simulation-based strategies into nursing curricula to better prepare students for real-world clinical practice.

Keywords: Simulation-Based Training, Clinical Decision-Making, Nursing Education, Skill Enhancement

Introduction

Simulation-based training is essential for nursing students because it increases students' clinical decision-making skills (CDMS). (1) Patient safety depends on executing basic skills that link mental assessments directly to appropriate responses. (2). Additional healthcare organizations support SBT because this educational method helps build CDMS effectively since it addresses traditional teaching limitations. Students gain essential direct practice with complex medical settings through this teaching approach. (3)

Students gain a limited benefit from traditional education, which couples theoretical classroom instruction with brief practical experiences, because this methodology fails to combine theoretical knowledge with real-world clinical applications. (4) Students develop uncertainty and anxiety about patient care because they fail to see the relation between their classroom theories and their hands-on practice experience. (3) The complex healthcare setting, rapid technological development, and quick decision processes demand adaptive training methods. SBT approaches resolve the gap between students' theoretical knowledge and practical clinical skill acquisition. (5)

Developing a secure learning environment for CDMS improvement depends on simulation methods incorporating advanced simulation models, virtual reality platforms, and standardized role-playing methodologies. (6). The method allows clinicians to make errors that do not endanger patients and provides swift assessments while enabling reflective practice. Repetitive practice in SBT fosters automaticity in critical thinking and decision-making. Quick and efficient choices must be made in critical situations with high clinical pressure. (7).

Research studies demonstrate how Simulation-Based Training benefits different aspects of the CDMS framework, primarily when performed to assess patients, develop diagnostic skills, and plan medical treatments. (8) People who participate in SBT show better training outcomes than traditional learners. (7). Researchers must examine how to create the best SBT framework and analyze the sustained influence on CDMS operating results. The research enables the deployment of simulation in its most optimal way. (9).

SBT professionals require debriefing sessions for practical training, which involve structured evaluations of performance and assessments of decision processes. (10). The designated sessions help healthcare professionals recognize their weaknesses. Reflecting on practice is a fundamental tool to establish learning achievement while allowing students to develop their abilities for real-world medical practice. (11). The technique generates pathways from simulated to actual clinical practice environments.

Additional research has to study how SBT affects various student demographics practicing in different clinical settings. (12). Investigational studies must determine appropriate simulation period lengths, the number of sessions, and precise simulation parameters. Research must investigate the impact that different simulation methods have on CDMS development. (13). Adequately applying this approach can achieve the most effective simulation tool utilization. (14).

SBT aims to train nursing graduates who demonstrate skill and self-assurance when delivering safe patient care. (15). Nursing programs improve student preparedness for healthcare challenges by teaching critical thinking and decision-making through realistic simulation-based exercises that enhance patient care results. (16, 17). This approach produces nurses who feel more confident and have improved skill capabilities.

Methodology

This study employed a quasi-experimental pre-test and post-test design to evaluate the effectiveness of simulation-based training on the clinical decision-making skills of nursing students. The research was conducted in various nursing colleges located in Swat, Pakistan, selected based on their willingness to participate and the availability of simulation lab facilities. Sixty final-year nursing students (BSN) were recruited through simple random sampling to ensure equal representation and minimize selection bias. The team used G*Power statistical software to calculate the study sample size because researchers depend on this software for precise calculations. These settings were chosen with a Confidence level of 95 percent for a statistical significance test set at 5 percent effectiveness. Appropriate for paired sample t-test analysis. Inclusion criteria were students currently enrolled in the final year of their program, with no prior exposure to structured simulation-based training, and willing to provide informed consent. Students who had previously undergone simulation training or were absent during the intervention sessions were excluded from the study.

Data Collection Procedure

The data collection process spanned three distinct stages, starting from pre-intervention (pre-test) through intervention (simulation-based training) and continuing up to post-intervention (post-test). The same Clinical Decision-Making Skills Assessment Tool was administered as part of standard practice to everyone taking the pre-test among the 60 participants. Stable case-based examples and multiple-choice questions provided the assessment mechanism to determine students' initial clinical judgment abilities. The team administered the pre-test in classrooms under their oversight to maintain standardization while stopping students from sharing thoughts.

The researchers commenced the intervention phase after the pre-test completion. Students enrolled in the training program completed six separate simulation sessions over two weeks. The training sessions reached their 90-minute duration while teaching crucial clinical situations from hospital practice, including respiratory distress, medication errors, cardiac emergencies, and wound care. The simulation program relied on high-fidelity manikins, task trainers, and role-playing to simulate genuine clinical conditions. Faculty members with nursing experience led these sessions to maintain standardizing teaching methods, feedback processes, and debriefing techniques. Students practiced clinical reasoning and critical decision-making while prioritizing care during the safe simulator-based training activities.

After the training sessions were completed, the post-intervention phase commenced. The same Clinical Decision-Making Skills Assessment Tool was administered to all participants as a post-test to evaluate any improvement in clinical decision-making skills due to the simulation training. The post-test was conducted under conditions similar to the pre-test to ensure comparability of results.

Interventional Protocol

1. The intervention involved a structured simulation-based training program over two weeks.
2. A total of six sessions were conducted, each lasting approximately 90 minutes.
3. Sessions included pre-briefing, scenario execution, and debriefing.
4. High-fidelity clinical scenarios were designed around critical care situations.
5. Topics included respiratory distress, medication errors, cardiac emergencies, etc.
6. Students participated in small groups to assess, decide, and act on simulated cases.
7. Trained facilitators guided the sessions and ensured consistent delivery.
8. Debriefing sessions encouraged reflection, discussion, and feedback.
9. Learning materials and clinical guidelines were provided to students.
10. The environment promoted active learning, critical thinking, and ethical conduct.

Data Analysis Procedure

The collected data were analyzed using **SPSS Software version 27**. Initially, the data were checked for completeness, accuracy, and consistency. Descriptive statistics summarized the participants' demographic information and baseline characteristics, including frequencies, percentages, means, and standard deviations.

A paired sample t-test was applied to compare the mean scores of clinical decision-making skills before (pre-test) and after (post-test) the intervention to assess the effectiveness of the simulation-based training. This test helped determine whether there was a statistically significant improvement in students' decision-making abilities following the simulation sessions. A chi-square test assessed the association between demographic variables and post-test scores.

A **p-value of less than 0.05** was considered statistically significant. All analyses were conducted under the guidance of a qualified biostatistician to ensure the results' accuracy and validity. Results were presented as tables and graphs to enhance clarity and interpretation.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of Zalan College of Nursing SWAT before the study commenced. All participants were provided with detailed information regarding the purpose, procedures, potential benefits, and risks associated with the study. **Written informed consent** was obtained from each participant, ensuring voluntary participation.

Confidentiality and anonymity were maintained by assigning unique codes to each participant and securely storing all data. Participation in the study was entirely voluntary, and students were informed of their right to **withdraw at any stage** without any academic or personal consequences. The simulation sessions were conducted in a supportive, non-judgmental environment to avoid psychological distress.

Results & Analysis

Demographic Characteristics of Participants.

The study participants were males who comprised 80% of the group, and most were under age 25 at 60%. Every trainee in this study came from an expert background in simulation training and had no previous experience (100% first-time users). Most participants belonged to the early adult range between 22 and 27 years old, while only 6.7% were above 27 years old. (Table 1)

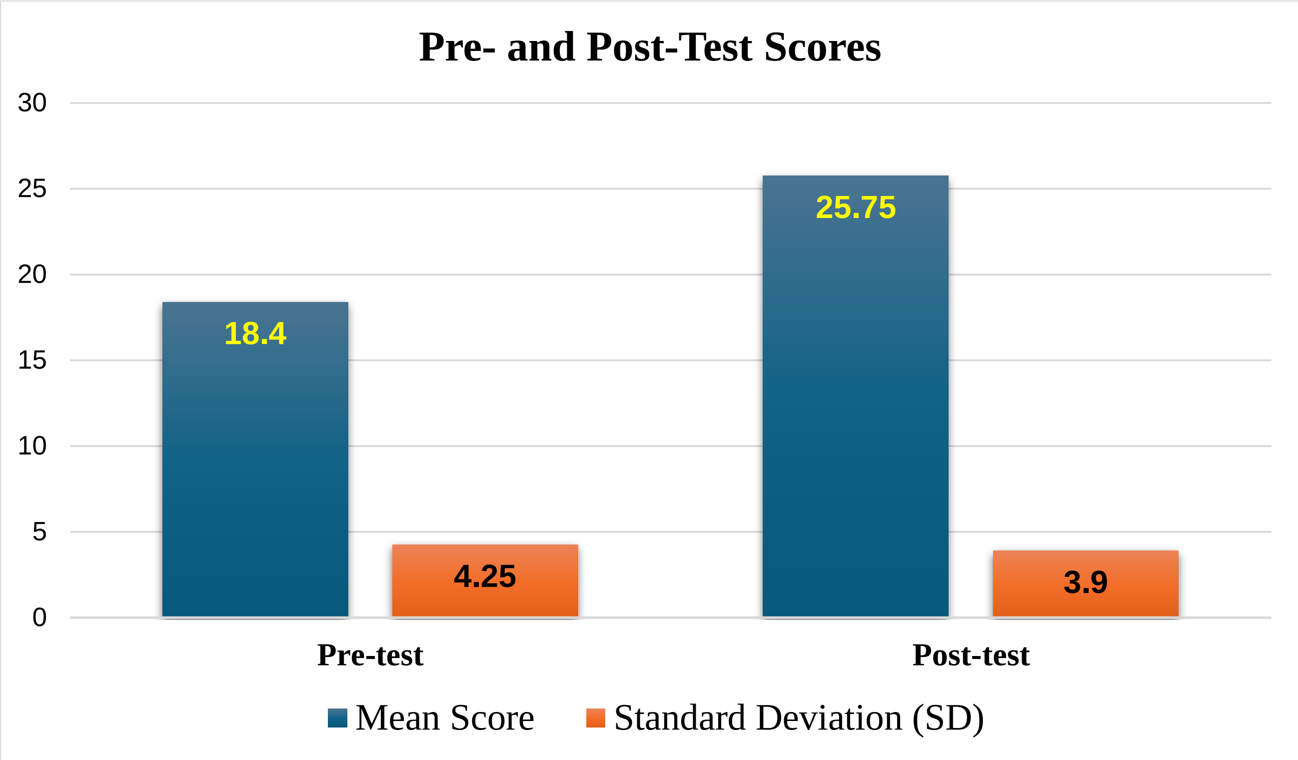
Table 1: Demographic Characteristics of Participants (N = 60)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	48	80.0
	Female	12	20.0
Age Group (years)	22–24	36	60.0
	25–27	20	33.3
	>27	4	6.7
Previous Simulation Experience	Yes	0	0.0
	No	60	100.0

Pre- and Post-Test Scores of Clinical Decision-Making Skills

The post-test mean score (**25.75 ± 3.90**) was significantly higher than the pre-test score (**18.40 ± 4.25**), indicating a performance improvement. The reduced standard deviation in the post-test suggests more consistent results after the intervention. This implies that the training or simulation effectively enhanced participants' knowledge or skills. (Figure 1).

Figure 1: Pre- and Post-Test Scores of Clinical Decision-Making Skills.



Comparison of Pre- and Post-Test Scores

The paired t-test revealed a statistically significant increase in scores from pre-test to post-test (mean difference = 7.35, $p < 0.001$). The large t-value (11.52) and highly substantial p-value confirm a strong effect of the intervention. These results suggest that the training or simulation substantially and meaningfully impacted participant performance. (Table 2).

Table 2: Paired Sample t-test Results of Pre- and Post-Test Scores

Comparison	Mean Difference	t-value	df	p-value	Significance
Post-test vs. Pre-test	**7.35**	**11.52**	**59**	**< 0.001**	**Significant**

Comparison Between Demographic Variables and Post-Test Score Categories

The analysis using χ^2 tests revealed no substantial relationships between participant gender or age and their performance results (all p values exceeded 0.05). The main study results showed participants achieving moderate to high scores with no correlation between their simulation background or scores. Significance levels were non-significant (NS), which indicates that these demographic factors did not influence performance outcomes. (Table 3).

Table 3: Comparison Between Demographic Variables and Post-Test Score Categories (N = 60)

Variable	Category	Low (≤20)	Moderate (21–25)	High (>25)	χ^2 value	p-value	Significance
Gender	Male	3	25	20	4.215	0.121	NS
	Female	2	4	6			

Age Group (years)	22–24	3	16	17	3.801	0.433	NS
	25–27	2	10	8			
	>27	0	3	1			
Simulation Experience	No	5	29	26	-	-	-

Discussion

According to study results, simulation-based training enhanced clinical decision-making abilities. Simulation improved participant performance levels because the post-test mean score exceeded pre-test measurements and demonstrated a significant p-value. Post-intervention standard deviation reduction indicates learners developed a more synchronized understanding of the concepts through the training program.

Demographic characteristics, including gender and age, failed to produce significant relations with post-test outcomes because simulation training delivers equivalent educational value to all participant groups. Simulation is an equally beneficial teaching approach because it generates similar learning effects for students of any demographic background. The research failed to observe age effects and experience-based differences in performance because all participants were new to simulation training. (18, 19).

The observed educational growth demonstrates that one simulation training session produces beneficial learning outcomes regardless of new trainee status. Combining immersive simulation practices and engaging features helps students translate theoretical concepts directly into clinical practice while actively learning (20).

The results showed no substantial difference in outcomes between male participants and other students in the research, although the population contained primarily males. Simulation training provides inclusive educational results to all types of learners because it adapts to different student characteristics. (21). The study results support simulation in the clinical educational curriculum. The observed advancements demonstrate the capability of simulation to better healthcare trainees' clinical choices. (22, 23). Research with broader demographic populations with more balanced representation would strengthen finding validity while studying the long-term educational effects of recurrent simulation-based exposure. (21, 24).

Conclusion

The research reveals robust evidence showing that simulation-based training produces significant improvements to clinical decision-making abilities within trainees who are new to this method. Post-test score improvements alongside the lack of demographic variables show that simulation provides effective educational delivery, which generates inclusive learning outcomes. Simulation proves successful for various learner groups in creating consistent objectives that enhance meaningful educational outcomes. Integrating simulation into healthcare education enables promising methods to develop clinical proficiency and preparation for future healthcare practitioners.

Limitations

Multiple restrictions exclude specific interpretations from the researched data. The study used limited trainee participants and a small sample size, which affects the capability of the results to be extended to broader population sets. The research evaluations only include participants who used simulation training as first-timers since the study fails to consider how experience with repeated simulation sessions might affect their development. The research evaluated the immediate effects of the training but did not investigate how well participants maintained learned skills nor checked their training results over time.

Recommendations

Future research must design long-term assessments to track both knowledge maintenance and skills durability after simulation training during extended periods. The evaluation should include multiple simulation sessions to determine how continuous exposure develops the decision-making abilities of clinical professionals. Qualitative methods through interviews or reflective journals should be added to existing research to understand learners' perceptions and educational experiences. Integrating simulation-based training into clinical education standards creates a recommendation for permanent educational inclusion to foster active learning with improved critical thought abilities and enhanced clinical proficiency among healthcare students.

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