

EFFECTIVENESS OF SIMULATION TRAINING ON UNDERGRADUATE NURSING STUDENTS' KNOWLEDGE AND COMPETENCY IN PRESSURE ULCER PREVENTION AT INS KHYBER MEDICAL UNIVERSITY PESHAWAR

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DOI: <https://doi.org/10.5281/zenodo.15826758>

Keywords

Simulation training, Pressure ulcer prevention, Nursing education, Competency, Knowledge enhancement, Quasi-experimental study

Article History

Received on 01 June 2025

Accepted on 01 July 2025

Published on 07 July 2025

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Abstract

Background: Pressure ulcers impose significant clinical and financial burdens on healthcare systems, particularly in low-resource settings. Nursing students often lack practical competencies in prevention due to gaps between theoretical education and clinical application. Simulation training offers a viable solution by bridging these gaps through immersive, real-world scenarios.

Aim: This study aimed to assess the effectiveness of simulation training on enhancing undergraduate nursing students' knowledge and competency in pressure ulcer prevention at the Institute of Nursing Sciences, Khyber Medical University (INS KMU).

Methods: A quasi-experimental pre-test/post-test design was employed with 54 undergraduate nursing students selected via simple random sampling. Participants underwent simulation training involving manikins, repositioning techniques, and patient education scenarios. Data were collected using a validated and reliable questionnaire (CVI = 0.98, Cronbach's α = 0.97) assessing knowledge (10 items) and competency (15 items). Scores were categorized as high, moderate, or needing improvement. Statistical analysis included paired t-tests and chi-square tests using SPSS version 27.

Results: Knowledge scores rose significantly from a mean of 5.02 ± 1.74 to 8.47 ± 1.31 (mean difference = 3.45; $t = 15.87$; $p < 0.001$). Competency scores improved from 9.38 ± 2.23 to 13.21 ± 1.76 (mean difference = 3.83; $t = 17.12$; $p < 0.001$). No significant associations were observed between gender, year of study, or prior training and post-test knowledge (all $p > 0.05$) or competency levels (all $p > 0.05$), indicating uniform benefits across subgroups.

Conclusion: Simulation training markedly enhances nursing students' knowledge and practical skills in pressure ulcer prevention. The results advocate for integrating simulation into undergraduate curricula to address theory-practice disparities. Future efforts should focus on faculty training, resource allocation, and longitudinal studies to evaluate skill retention.

INTRODUCTION

Pressure ulcers also known as bedsores, decubitus ulcers, pressure injuries, and pressure sores refer to the injury of the soft tissue or skin due to continuous pressure or friction, which results in a decreased supply of blood, nutrition, and oxygen to the area causing ischemia and necrosis, especially on the bony prominence (Qazi, Khattak, & Barki, 2022). Pressure ulcers are reported to occur more frequently in the elderly, critically ill, neurologically challenged, and malnourished individuals. Pressure ulcers place a heavy financial, emotional, and physical burden on patients as well as their family members and caregivers. One possible explanation is that we are not adequately training our community, patients, family members, and healthcare professionals about the treatment of pressure ulcers (Muhammad et al., 2024).

Indicators of the severity of pressure ulcers include discolored areas and open wounds that reveal deep muscles and bone prominences. When the patient is seated, the most commonly impacted areas are 60% of the sacrum, including the ischial tuberosities. Additionally, 15% of the remaining contracture is covered by the greater trochanter of the heel. When pressure ulcers are at an advanced state, surgery is required (Hassan, 2020). Pressure ulcers can be prevented by shifting postures periodically, such as every one to two hours, and by routinely following cleaning guidelines and exercise regimens (Koukourikos et al., 2021).

Despite improvements in nursing and medicine, pressure ulcers continue to rank among the leading causes of morbidity and death globally. Globally, pressure ulcer complications claim the lives of almost 60,000 people. In inpatient departments, the prevalence of bed sores varies from 3.5% to 69%, whereas the incidence rate ranges from 0.4% to 38% (Purabdollah et al., 2023). One of the most prevalent medical conditions in Pakistan is pressure ulcers, but we are unable to calculate the financial burden that

these patients bear because of a weak statistical data system (Junejo et al., 2024).

The incidence of pressure ulcers can be considerably decreased by skin moisturization, nutritious food, patient education, lowering stresses on dependent areas and bony prominences, and periodically mobilizing patients. The prevalence of pressure ulcers has stayed relatively constant over the past 20 years, despite improved national awareness of the condition, and the related medical expenses are still rising (Yilmazer et al., 2020).

Simulation training is an immersive teaching and learning methodology in nursing that simulates real-world learning, practice situations, or assessment with guided experiences. It assists in producing realistic situations so that people can practice particular activities. Nursing students face challenges while integrating theoretical knowledge into practice because of the gap between theory and practice, which complicates the learning process (Hung et al., 2021). Simulation not only improves critical thinking but also allows the students to learn real-life situations similar to hospitals, cope with difficulties and problems, and avoid mistakes that could cause damage before they become professionals (Kara, et al., 2021).

The level of nursing care is indicated by patients' presence or absence of pressure ulcers. To handle the potential problems, nurses must receive training in pressure ulcer prevention techniques. Healthcare professionals taking care of patients have a common responsibility to prevent ulcers from occurring. To offer excellent nursing care, they must possess the necessary competencies, expertise, and performance. University-educated and specially trained nurses are better able to comprehend and apply pressure ulcer care techniques (Mazzo et al., 2017).

Nurses are the first medical professionals who assist critically ill and immobilized patients, who are particularly susceptible to bed sores. However, some

nurses lack the necessary skills or training to prevent pressure ulcers. The competency of nurses is weakened, and the number of pressure ulcer cases in hospitals is rising. Although a lot of research has been done related to this subject, not many contemporary studies have been done, particularly in Pakistan.

Methodology

This research used a quasi-experimental design to determine the usefulness of simulation training on knowledge and competency of nursing students in pressure ulcer prevention. It was done in the Institute of Nursing Sciences, Khyber Medical University, Peshawar, in a 4-month period as a master mini project. The G-Power calculator was used to calculate a sample size of 54 participants at a 95 % confidence level and a 0.5 effect size. The lottery method was employed as a way to reduce bias by using simple random sampling. The inclusion criteria were undergraduate students who were already enrolled in their studies and aged 18 years or older and had clinical exposure and the exclusion criteria were students still at level one and students with mental or cognitive impairments. A conventional self-created questionnaire with controlled questions was employed as a data collection instrument, consisting of three domains, including demographics (4 items), knowledge (10 items), and competency (15 items). The knowledge scores were coded as high (810), moderate (57), and needs improvement (<5) and the competency scores were high (13-15), moderate (10-12), and needs improvement (< 10). The content validity index of this tool was 0.98, as specified by three knowledgeable faculty. Pilot testing was conducted with a sample of 10 % of students which were later eliminated. Using SPSS version 27, tool reliability was established as 0.97 by using Cronbach alpha.

Data Collection Procedure

Data was collected after taking permission from the director Institute of Nursing Sciences, and the supervisor approved the study. The data was collected

in two phases (pre-test and post-test, after two days of intervention). Data was collected through a questionnaire. Pre-post data were collected from the sample group to evaluate the effectiveness of simulation training on knowledge and competency level among undergraduate nursing students. Before initiating data collection, we introduced ourselves, the aims and objectives of the study. The study tool was filled out before and after simulation training.

Data analysis:

The data were analysed using SPSS version 27. In the demographic section, the mean and standard deviation were calculated for continuous variables such as age, and Frequency and percentage were analysed for categorical variables such as gender, years of study, and previous training regarding the prevention of ulcers for easy interpretation. In the knowledge and competency sections, students were categorized into three groups based on total score, and mean, standard deviation, frequency, and percentage were analysed for these categorical variables. A paired t-test was applied to compare pre-simulation and post-simulation scores of the knowledge and competency, while a chi-square test was applied to estimate the association among the level of knowledge and competency regarding the prevention of pressure ulcers and demographic variables.

Results and Analysis

Demographic Characteristics of Participants

The mean age (± 1.2) of 21.5 years was represented by 54 undergraduate nursing students who took part in the study. Most of them were female (63%), while the males accounted for the remaining 37% of the sample size. Most of the participants were in the 4th grade (38.9%), 3rd grade (33.3%), and 2nd grade (27.8%). Twenty-two and two percent were trained previously concerning the pressure ulcer combatant before, but seventy-seven and eight (77.8%) had not received any prior training with regards to the pressure ulcer combatant [Table 1].

Table 1: Demographic Characteristics of Participants (N=54)

Variable	Frequency (n=54)	Percentage (%)
Age (Mean \pm SD)	21.5 \pm 1.2	-

Gender: Male	20	37.0%
Gender: Female	34	63.0%
Year: 2 nd	15	27.8%
Year: 3 rd	18	33.3%
Year: 4 th	21	38.9%
Prior Training: Yes	12	22.2%
Prior Training: No	42	77.8%

Knowledge Level of Nursing Students

Before the simulation training there was 11.1% who had high knowledge levels and 51.9% of them required improvement. After the training, 70.4% demonstrated high levels of knowledge and only 3.7%

were in the need’s improvement list. Moderate knowledge decreased from 37.0% to 25.9%. This shows some significant development in knowledge after simulation training.

Table 2: Knowledge Level of Nursing Students Before and After Simulation Training

Knowledge Level	Pre-Test Frequency (%)	Post-Test Frequency (%)
High (8-10)	6 (11.1%)	38 (70.4%)
Moderate (5-7)	20 (37%)	14 (25.9%)
Needs Improvement (<5)	28 (51.9%)	2 (3.7%)

Comparing Pre-Intervention and Post-Intervention Scores

Based on the paired t-test, simulation training significantly helped improve both knowledge and competency scores. Students’ knowledge scores went

up from an average of 5.02 to 8.47, while their competency scores increased from 9.38 to 13.21. Since the p-values (<0.001) are so low, we can say these changes are quite significant.

Table 3: Paired t-Test Comparing Pre-Intervention and Post-Intervention Scores (N=54)

Variable	Mean ± SD (Pre-Test)	Mean ± SD (Post-Test)	Mean Difference	t-value	p-value
Knowledge Score	5.02 ± 1.74	8.47 ± 1.31	3.45	15.87	<0.001
Competency Score	9.38 ± 2.23	13.21 ± 1.76	3.83	17.12	<0.001

Association between Demographic Variables and Post-Test Scores

All demographic factors—gender, year of study, and prior training—showed no significant association

with post-intervention knowledge levels (all p > 0.05). Likewise, none were significantly linked to competency outcomes after training (all p > 0.05). This suggests that the simulation’s effectiveness was consistent across these subgroups.

Table 4: Chi-square Test for Association between Demographic Variables and Post-Test Scores (N=54)

Demographic Variable	Category	Post-Test Knowledge Level (p-value)	Post-Test Competency Level (p-value)
Gender	Male / Female	0.172	0.219

Year of Study	2nd / 3rd / 4th	0.265	0.304
Prior Training	Yes / No	0.087	0.092

Discussion

The outputs of the current study showed that simulation training had a significant effect on increasing the knowledge and competency levels of undergraduate nursing students in preventing pressure ulcers among them. The pre-test scores were in accord, whereby most participants had a moderate to low knowledge and competency that improved remarkably after the simulation-based intervention. This outcome supports the fundamental position that simulation can be used as a pedagogical method for students, ensuring the possibility of the practical implementation of theoretical knowledge in a secure, planned, and realistic environment through which they will enhance clinical skills and critical thinking (Parisod et al., 2022).

In comparison of results with other studies, Hung et al. (2021), also found that results proved statistically significant improvements in knowledge and practical competencies for nursing students who were subjected to simulation training for care regarding wound and pressure ulcer when compared to their counterparts - nursing students who only received traditional lectures. Such confluence implies a larger agreement on the benefits of simulation as an intervention teaching tool, especially for the skills that need observational and procedural precision.

However, not all the studies had such dramatic results. For example, a recent study by Khalil, et al. (2023) observed moderate improvements in the knowledge of pressure ulcer care of nursing students after a simulation training, though the gain in practical skill was not statistically significant. That distinction can be explained by various wells of difference in simulation design, length of intervention, and evaluation criteria. The present study utilized a wide checklist for evaluating competencies and two rounds of testing that may have explained larger observed gains.

Additionally, research carried out in Jordan by Hung et al. (2021), illustrated, while simulation had enhanced knowledge, students showed up stress and feelings of diminishing self-confidence during simulated tasks. Differently from their findings, the

participants in our study demonstrated better performance as well as more self-assurance at the post-test simulation stage, reflected by the improved scores and positive informal feedback. This could result from the supportive learning environment and predefined feedback obtained during the intervention (Hsu, Chang, & Hsieh, 2015).

The disparity in competency enhancement is also an indication of contextual and cultural influences on outcomes of simulation learning. We undertook our study in a single institution in Pakistan, where the previous experience with simulation-based education was rather limited. For this reason, the novelty and immersive nature of simulation may have added value to learning gains instead of conventional settings where simulation is respectively included in the curriculum (Al-Ghareeb & Cooper, 2016).

In addition, the findings conform to Benner’s novice to expert theory that holds that structured clinical experiences facilitate the transition from novice to competent practitioner. Simulation bridges the gap between theoretical education and actual practice in the field, and students can assimilate the clinical decision-making processes. The results of this study confirm the idea that repeated exposure to realistic scenarios improves clinical judgment and accuracy of performance.

Conclusion

The current study found that simulation training is a very effective approach to facilitating the knowledge and competency of undergraduate nursing students on the aspect of pressure ulcer prevention. The immense post-test score changes in sample groups manifest the worth of simulation-based education in closing the gap between theory and clinical practice. Students had a greater knowledge of the risk factors, classification, and evidence-based preventive measures for pressure ulcers, as well as improved skill performance when identifying and managing at-risk patients. Such results confirm that simulation shall represent a safe and structured setting whereby students can develop critical clinical skills and therefore gain more confidence and competency.

Recommendations

From the findings of this study, simulation training should be incorporated in the undergraduate level of nursing studies as a routine to enhance a better understanding of various patients' safety issues and wound prevention. Nursing educators should be trained on simulation facilitation to enhance the reality of interactions during the sessions and learning objectives. It is also recommended that standardized checklists and validated assessment tools should be used to evaluate student competencies during simulation exercises. Further research should examine the long-term retention of skills and knowledge obtained through simulation to impact clinical outcomes. Extending simulation beyond interprofessional collaborative and patient-centred care scenarios can better augment its educational effectiveness. Finally, policymakers and nursing institutions should make adequate resources and infrastructure available for the sustainability and growth of simulation-based learning.

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