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EFFECT OF VIRTUAL SIMULATION ON CLINICAL REASONING AMONG UNDERGRADUATE NURSING STUDENTS: AN EVIDENCE-BASED PROJECT

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Abstract

Background: *Clinical reasoning is fundamental to safe nursing practice, yet traditional clinical training offers limited patient exposure and variable learning experiences. Virtual simulation may offer a safe and accessible way to practice reasoning before real-patient care.*

Purpose: *to evaluate the effect of virtual simulation on clinical reasoning among undergraduate nursing students at a private nursing college in Islamabad.*

Methods: *A one-group pretest/posttest design was used with third-year, semester V BS Nursing students. Students completed scenario-based virtual simulations using the Body Interact application. Clinical reasoning was measured with 15-item scenario-based multiple-choice tests before and after the intervention. Students also rated the simulation design using the National League for Nursing Simulation Design Scale.*

Results: *The mean score rose from 7.95 to 9.93 out of 15 (median 8–11). Eighty-five percent of participants agreed or strongly agreed that the simulation design was effective.*

Conclusion: *Virtual simulation with proper guidance and student orientation is a promising strategy for strengthening clinical reasoning skills. The small, uncontrolled sample limits generalizability, and larger controlled studies are recommended in the future.*

INTRODCTION

Clinical reasoning, the process of gathering and interpreting patient information to reach sound decisions, is central to effective clinical practice, and poor reasoning contributes to medical errors (Jay et al., 2024). Nursing students need both theoretical knowledge and specialised practical skills, but traditional clinical training faces recurring challenges. These include limited patient exposure, high student-to-preceptor ratios and variability in learning experiences (Jung & Lee, 2024). Teaching through observation alone is increasingly recognized as insufficient for developing reasoning (Jay et al., 2024).

At the project site, teachers and the project lead observed that students often struggled to apply theory to real-world scenarios, and that opportunities to practise clinical reasoning in a risk-free setting before real-patient interactions were inadequate. After listing and prioritising the problems identified (skill development, problem solving, teamwork, concept e and clinical reasoning), this gap in safe practice opportunities was selected as the priority for action.

Virtual simulation has been associated with improved learning outcomes, skills and performance, critical thinking, self-confidence and learner satisfaction in nursing education (Foronda et al., 2020). This project therefore aimed to evaluate the effect of virtual simulation on clinical reasoning among undergraduate nursing students at a private nursing college in Islamabad.

Review of the Evidence

Evidence supports virtual patients and simulation for teaching clinical reasoning. A systematic review reported that virtual simulation can improve medical students' skills more effectively than traditional methods and achieve at least the same level of knowledge (Watari et al., 2020). A further systematic review concluded that virtual patient educational tools can improve undergraduate medical students' clinical reasoning (Plackett et al., 2022), and an earlier study of virtual patient simulation found significant and meaningful improvement in medical students' reasoning (Aghili et al., 2012). In nursing, a systematic review and meta-analysis examined virtual simulation specifically for clinical reasoning (Sim et al., 2022). A randomized controlled trial using the Body Interact application reported that clinical virtual simulation can improve nursing students' clinical reasoning at an early stage and over time, and increase satisfaction with the learning experience (Padilha et al., 2019). Post-scenario feedback allows learners to review errors, the rationales behind them and expert responses, which supports post-case reflection, a critical element in developing clinical reasoning (Posel et al., 2015).

Theoretical Framework

The project was guided by Kolb's experiential learning theory, which defines learning as the process through which knowledge is created by transforming experience (Kolb, 1984; Kolb et al., 2014). Virtual simulation fits this cycle. Learners make clinical decisions while solving patient scenarios (concrete experience), receive feedback on performance, reflect on it (reflective observation), form conceptual understanding and then apply it in later scenarios (Sim et al., 2022).

Methods

PICO question

The project was structured using the PICO format. The population was BS Nursing students in semester V; the intervention was virtual simulation; the comparison was scenario-based learning (assessed through a one-group pre-/post-test design); and the outcome was clinical reasoning.

Design and setting

A one-group pre-test/post-test design was used at a private nursing college in Islamabad, Pakistan. Permission was obtained from the Head of the Nursing department before the project began.

Participants

Third-year, semester V, BS Nursing students were selected for the project. A group of 15 students was recruited after providing informed consent.

Intervention

Students completed virtual patient scenarios on the Body Interact application, in which they assessed the patient, made and observed the consequences of their actions. Faculty members provided support throughout, and students received orientation and guidance on using the application. Each scenario was followed by structured feedback and reflection on decisions made. The strategy was considered feasible because it is cost-effective, requires manageable technical expertise, is and provides safe training.

Outcome measures

Clinical reasoning was the desired outcome. It was measured with a pre-test and a post-test, each comprising 15 scenario-based multiple-choice questions developed from the scenarios and the Body Interact application. In addition, students evaluated the design of the simulation using the Simulation Design Scale (student version; National League for Nursing, n.d.). This 20-item instrument uses a five-point scale to assess five design features: objectives and information, support, problem solving, feedback, and fidelity.

Data analysis

Pre-test and post-test scores were summarized descriptively using mean, median and range, and the distribution of scores was examined. Simulation Design Scale responses were summarized as the percentage of participants who agreed or strongly agreed.

Ethical considerations

Permission was granted by the college admi and participation was voluntary with informed consent.

Results

Pre-test scores had a mean of 7.95 out of 15 (median 8; range 4–13). Post-test scores had a mean of 9.93 out of 15 (median 11; range 5–13), an average gain of 1.98 points, or about 13 percentage points (Table 1). The post-test distribution shifted toward higher scores, with most students scoring between 10 and 13 points, whereas pre-test scores clustered between 4 and 6 and between 9 and 10.

Table 1 Pre-test and Post-test Clinical Reasoning Scores

Measure	Pre-test (n = 19)	Post-test (n = 15)	Change
Mean score (out of 15)	7.95	9.93	+1.98
Mean score (%)	53.0%	66.2%	+13.2
Median score	8	11	+3
Range	4–13	5–13	—

Note. Maximum score = 15.

On the Simulation Design Scale, 85% of participants agreed or strongly agreed with the statements regarding the simulation design, indicating that students found the objectives, support, problem-solving opportunities, feedback and fidelity of the simulations satisfactory.

Discussion

Scores on the clinical reasoning assessment were higher after the virtual simulation intervention, with both the mean and the median increasing. This is consistent with earlier reviews and trials reporting gains in clinical reasoning following virtual simulation or virtual patient use (Padilha et al., 2019; Plackett et al., 2022; Sim et al., 2022; Watari et al., 2020). The experiential learning cycle offers a plausible explanation. Students actively made decisions in realistic scenarios without risk to patients, and structured feedback allowed them to reflect on errors and their rationales (Posel et al., 2015).

Students' favorable ratings of the simulation design suggest the scenarios were clear, supportive and sufficiently realistic. Good design is an important condition for effective simulation, so this finding strengthens confidence that the observed learning was linked to a well-constructed learning experience.

Strengths and limitations

The strengths of virtual simulation observed in this project were increased safety for learners and patients, flexibility, cost-effectiveness and independence from time and location. Several weaknesses should be noted. The sample was small and drawn from a single institution, and there was no control group, so improvement cannot be attributed to the intervention alone and may partly reflect familiarity with the test items. The pre-test and post-test were not necessarily completed by the same number of students (21% attrition), and no inferential test of significance was applied, so the findings are descriptive. Other

limitations included user discomfort with the technology, the need for specialized training, technical difficulties, dependence on internet access and devices, and the quality of simulation design. Transferability to other settings is limited.

Implications for nursing education

Virtual simulation can complement clinical placements by giving every student repeated, safe exposure to a range of clinical situations. Successful adoption requires faculty support, student orientation to the technology, reliable internet and devices, and scenarios built on sound design principles with structured feedback and reflection. Future work should use larger samples, control or comparison groups, validated clinical reasoning instruments and longer follow-up, and should assess whether gains transfer to real clinical performance.

Conclusion

This evidence-based project showed improved clinical reasoning scores among undergraduate nursing students after virtual simulation, and students rated the simulation design highly. With proper guidance and training for students, virtual simulation can be a valuable approach for enhancing clinical reasoning abilities. Larger controlled studies are needed to confirm these findings.

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Conflict of Interest

The author declares no conflict of interest.

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