

Effect of Simulation-Based Port-A-Cath Care Training on Knowledge and Skill Among Fourth-Year Basic B.Sc. Nursing Students: A Pre-Experimental Study

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ABSTRACT

Background: Port-a-cath devices are commonly used among oncology patients receiving long-term chemotherapy and intravenous therapies. Appropriate care and maintenance of implanted venous access devices are essential to reduce complications such as infection, thrombosis, occlusion, and catheter malfunction. Nursing students often demonstrate inadequate confidence and practical competence in port-a-cath care because of limited clinical exposure. Simulation-based education has emerged as an effective teaching strategy for improving psychomotor skills, clinical judgment, and knowledge retention among nursing students.

Aim: To assess the effect of simulation-based port-a-cath care training on knowledge and skill among fourth-year Basic B.Sc. Nursing students in selected nursing colleges.

Method: A quantitative pre-experimental one-group pre-test and post-test design was adopted for the study. The study was conducted among fourth-year Basic B.Sc. Nursing students were selected using a non-probability convenience sampling technique. Structured questionnaires and observational checklists were used to assess knowledge and skill regarding port-a-cath care. The intervention consisted of simulation-based teaching, including lecture, demonstration, video-assisted training, and hands-on practice in a simulation laboratory. Pre-test and post-test data were analyzed using descriptive and inferential statistics.

Results: The study findings demonstrated a statistically significant improvement in both knowledge and skill scores following simulation-based intervention. Post-test mean knowledge and skill scores were significantly higher than pre-test scores at a $p < 0.05$ level of significance. Simulation-based education enhanced nursing students' confidence, psychomotor performance, and understanding of sterile port-a-cath care procedure.

Conclusion: Simulation-based training was effective in improving knowledge and skill regarding port-a-cath care among fourth-year Basic B.Sc. Nursing students. Incorporation of simulation strategies into nursing curricula can strengthen competency-based oncology nursing education and promote safe patient care.

Keywords: Port-a-cath care; Simulation-based learning; Nursing students; Knowledge; Skill; Oncology nursing; Nursing education; Chemotherapy care.

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1. INTRODUCTION

Cancer is one of the leading causes of morbidity and mortality worldwide and requires multidisciplinary management, including chemotherapy, surgery, radiation therapy, and supportive care. Chemotherapy administration frequently requires long-term venous access devices, such as implanted port-a-cath systems, to ensure safety and repeated vascular access. A port-a-cath is a totally implantable venous access device inserted beneath the skin and connected to a central venous catheter [2].

Port-a-cath devices reduce repeated venipuncture and improve comfort for oncology patients. However, inappropriate handling can lead to severe complications such as infection, thrombosis, catheter occlusion, and extravasation. Nurses play a critical role

in the maintenance and management of implanted venous access devices. Therefore, nursing students must acquire adequate knowledge and psychomotor competence in port-a-cath care before entering clinical practice [3].

Simulation-based learning provides a safe and controlled environment for developing clinical competence without compromising patient safety. It allows repeated practice, immediate feedback, and experiential learning that enhances knowledge retention and confidence. High-fidelity and low-fidelity simulation techniques have proven effective in nursing education, particularly for invasive and technically demanding procedures [5,6].

The present study was conducted to assess the effectiveness of simulation-based port-a-cath care

training on knowledge and skill among fourth-year Basic B.Sc. Nursing students.

Design and Setting:

A quantitative pre-experimental one-group pre-test and post-test research design was used for the study. The study was conducted in selected nursing colleges and simulation laboratories in Pune city, Maharashtra, India.

Participants:

The participants included fourth-year Basic B.Sc. Nursing students who had previous exposure to oncology nursing concepts and consented to participate in the study. Students absent during data collection or unwilling to participate were excluded.

Intervention:

The intervention consisted of simulation-based training regarding port-a-cath care. The teaching session included: Lecture using PowerPoint presentation, demonstration of port-a-cath care, video-assisted learning, hands-on simulation and practice in laboratory settings, sterile technique demonstration, and practice of chemotherapy administration procedures using simulated devices [9,10].

The educational session focused on a self-structured educational module that included sterile procedural flow, along with the definition and purpose of port-a-cath, indications and contraindications, equipment preparation, sterile handling procedures, needle insertion and flushing techniques, infection prevention measures, documentation and aftercare, identification and management of complications [11].

Instruments:

Two instruments were used for data collection:

1. Structured Knowledge Questionnaire (score range 1-5):
 - Included 20 multiple-choice questions related to port-a-cath care.
 - Covered anatomy, indications, procedure, complications, documentation, and infection prevention [9,10].
 - Validated and tested for reliability [12,13] (Cronbach’s $\alpha = 0.92$)
2. Observational Skill Checklist (score range 1-3):
 - Used 48 points to assess psychomotor performance during simulated port-a-cath care [11].

- Validated and tested for reliability [12,13] (Cronbach’s $\alpha = 0.86$)
- Included sterile technique, procedural accuracy, safety measures, and post-procedure care.
- The researcher has also developed a self-structured educational module on port-a-cath care specifically for this research study. The content, design, and organisation of the module were prepared exclusively for academic and research use within the present study.

Data Collection:

Data collection was conducted in three phases:

1. Pre-test assessment of knowledge and skill.
2. Simulation-based educational intervention.
3. Post-test assessment after completion of the training session.

Participants completed the structured questionnaire and demonstrated practical skills before and after the intervention.

Ethical Considerations:

Ethical approval was obtained from the Institutional Ethical Committee and the concerned authorities. Written informed consent was obtained from all participants before data collection. Confidentiality, anonymity, and voluntary participation were maintained throughout the study.

Data Analysis:

Data were analyzed using descriptive and inferential statistics. Frequency, percentage, mean, and standard deviation were used for descriptive analysis. A paired t-test was used to compare pre-test and post-test knowledge and skill scores [12,1]. The association between demographic variables and knowledge or skill scores was analyzed using appropriate statistical tests. Statistical significance was considered at $p < 0.05$.

2. RESULTS

Participant Characteristics:

The demographic profile indicated that most participants were female fourth-year Basic B.Sc. Nursing students. Most had prior theoretical exposure to oncology nursing but limited hands-on experience with port-a-cath care.

Comparison of knowledge scores:

Table 1: Pre-test and post-test knowledge score

N=41					
Knowledge	Mean (μ)	SD	df	t	p-value
Pre-test	9.90	1.89	40	23.76	0.000**
Post-test	17.75	1.37			

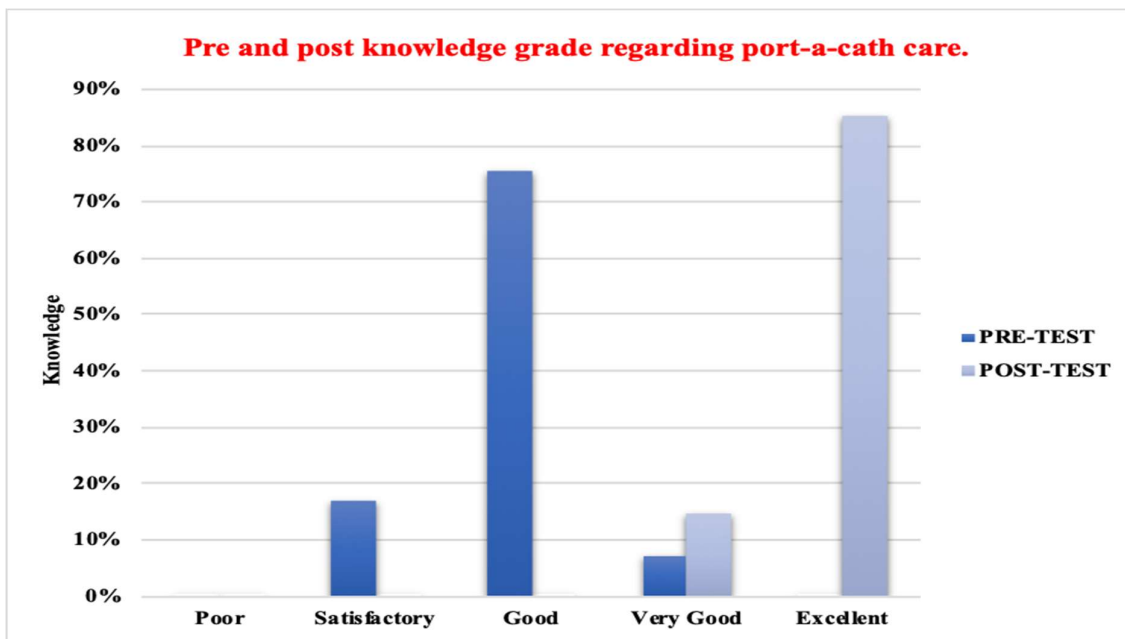


Figure 1: Changes in knowledge scores after simulation-based training regarding port-a-cath care
Comparison of skill scores:

Table 1. Pre-test and post-test skill score

N=41					
Skill	Mean (μ)	SD	df	t	p-value
Pre-test	26.58	1.30	40	66.16	0.000**
Post-test	46.97	1.44			

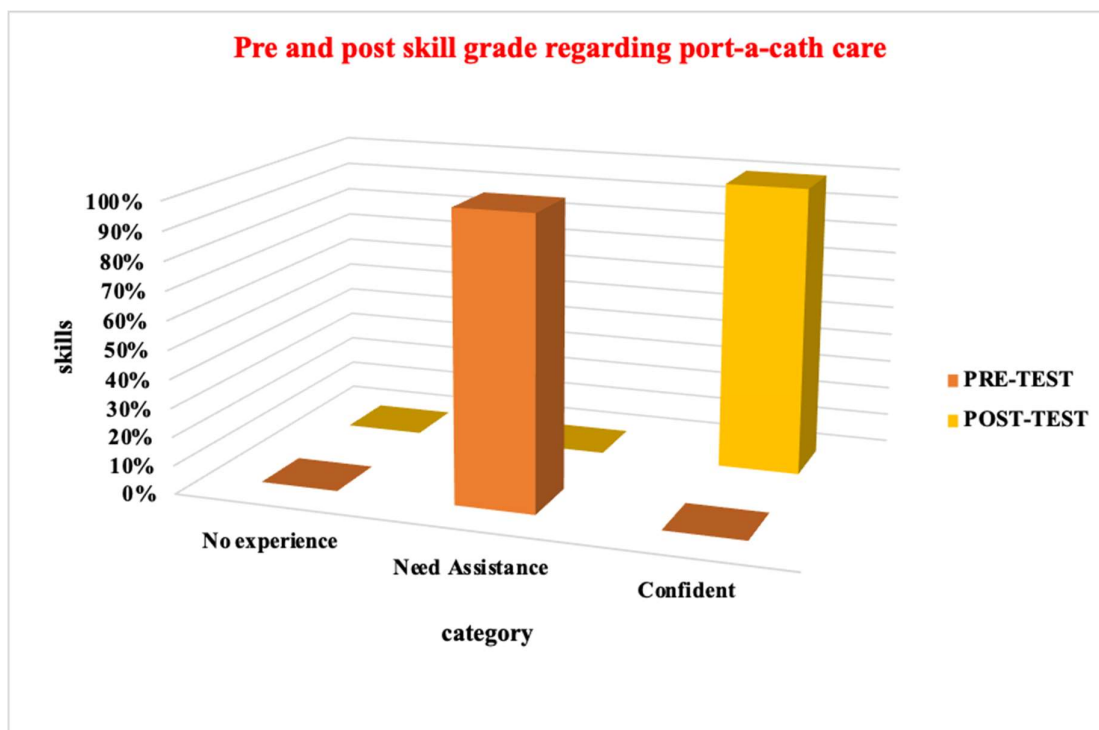


Figure 2: Changes in skill scores after simulation-based training regarding port-a-cath care

3.

DISCUSSION

The present study evaluated the effectiveness of simulation-based port-a-cath care training among

fourth-year Basic B.Sc. Nursing students. The findings revealed a statistically significant improvement in both knowledge and skill scores following the intervention.

The improvement observed in post-test knowledge scores suggests that simulation is an effective educational strategy for teaching complex oncology nursing procedures. Similar findings were reported by previous studies demonstrating that simulation enhances understanding, retention, and application of clinical concepts [6].

The increase in skill competency following the intervention may be attributed to experiential learning, repetitive practice, and immediate feedback provided during simulation sessions. Nursing students often experience anxiety while performing invasive procedures in real clinical settings. Simulation-based learning creates a safe environment for practising procedures without risk to patient safety [7,8].

The findings are consistent with studies conducted among nursing professionals and students, indicating that educational interventions significantly improve competency in implanted venous access device care. The present study supports the incorporation of simulation laboratories into nursing education programs to improve psychomotor competency and clinical readiness.

The study also emphasises the importance of structured oncology nursing education. Appropriate training in port-a-cath care can reduce procedural errors, improve infection prevention practices, and enhance patient outcomes.

4. CONCLUSION

Simulation-based education was found to be highly effective in improving knowledge and skill regarding port-a-cath care among fourth-year Basic B.Sc. Nursing students. Students demonstrated enhanced procedural competence, confidence, and understanding following the intervention.

The study highlights the value of simulation as an innovative teaching methodology in nursing education. Integrating simulation-based oncology training into undergraduate nursing curricula may improve patient safety and prepare future nurses for specialised clinical responsibilities.

Implications for Nursing Practice

- Simulation-based learning should be incorporated into undergraduate nursing curricula.
- Oncology nursing procedures should be practised in simulation laboratories before clinical exposure.
- Continuous competency assessment programs should be implemented for nursing students.
- Training on infection prevention and sterile handling of central venous access devices should be emphasised.
- Nursing educators should utilise interactive and skill-oriented teaching strategies.

Limitations

- The study was limited to selected nursing colleges.
- Small sample size reduced generalizability.
- Lack of a control group limited the comparison.
- Long-term retention of knowledge and skill was not assessed.

- Findings were dependent on single institutional settings.

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