Research Article

Effectiveness of Simulation-Based Training on Knowledge and Practice of Basic Life Support among Nursing Students

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ABSTRACT

Background: Basic Life Support (BLS) is an essential emergency care skill for nursing professionals, who are often among the first responders during cardiac arrest and other life-threatening situations. Adequate knowledge and practical competence in BLS are therefore important components of nursing education. Simulation-based training provides a structured and realistic learning environment in which students can practise resuscitation procedures and improve their clinical preparedness.

Aim: To evaluate the effectiveness of simulation-based training on knowledge and practice of Basic Life Support among nursing students.

Materials and Methods: A true experimental research design was adopted among first-year General Nursing and Midwifery students from selected nursing colleges in Nainital. A total of 124 students were included and divided into an experimental group and a control group, with 62 students in each group. Participants were selected using simple random sampling. Knowledge was assessed using a self-structured questionnaire, while practical BLS skills were evaluated using an observation checklist. The experimental group received simulation-based BLS training consisting of theoretical instruction and practical demonstration using mannequins. Pre-test and post-test assessments were conducted to evaluate changes in knowledge and practice.

Results: In the experimental group, the mean knowledge score increased from 10.17±2.61 in the pre-test to 21.00±4.04 in the post-test, while the mean percentage increased from 33.89% to 70.00%. Similarly, the mean practice score increased from 9.50±2.63 to 14.00±1.63, with the mean percentage rising from 47.50% to 70.00%. These findings demonstrated marked improvement in both knowledge and practical BLS skills following simulation-based training.

Conclusion: Simulation-based training was effective in improving knowledge and practical skills related to BLS among nursing students. Incorporating structured simulation into nursing education may enhance students' preparedness and competence in managing emergency situations.

Keywords: Basic Life Support, Simulation-Based Training, Nursing Students, Knowledge, Practice.

INTRODUCTION

Basic Life Support (BLS) is a fundamental component of emergency care and represents the immediate response required when a person develops cardiac arrest, respiratory arrest, or another life-threatening event in which circulation or breathing is compromised. BLS includes early recognition of cardiac arrest, activation of the emergency response system, high-quality cardiopulmonary resuscitation (CPR), and prompt use of an automated external defibrillator when indicated. The effectiveness of these actions depends not only on theoretical knowledge but also on the ability of the rescuer to perform each step correctly and rapidly. Current resuscitation guidelines therefore emphasize structured education, repeated practice, feedback, and competency-based learning for healthcare providers.[1,2]

Nurses have an important role in the early recognition and initial management of clinical deterioration because they remain in close contact with patients in most healthcare settings. During sudden deterioration or cardiac arrest, nurses may be among the first healthcare professionals expected to identify the emergency, call for assistance, initiate chest compressions, provide ventilation, and support defibrillation. BLS competence is therefore an essential element of professional nursing preparation. Nursing students should develop this competence before assuming independent clinical responsibilities so that classroom knowledge can be translated into timely and coordinated action during emergencies.[3]

Teaching BLS to nursing students is challenging because resuscitation requires the integration of cognitive, psychomotor, and behavioral abilities. Students must understand airway, breathing, and circulation while learning chest-compression technique, ventilation, automated external defibrillator use, communication, teamwork, and

rapid decision-making. Conventional classroom teaching is useful for explaining concepts, algorithms, indications, and sequence of actions, but lecture-based instruction alone may provide limited opportunity to rehearse the physical and behavioral components of resuscitation. Effective BLS education therefore requires methods that allow learners to apply knowledge in situations resembling actual clinical emergencies.[2,3]

Simulation-based training provides such an approach by creating a controlled clinical environment in which learners can practice emergency responses without exposing real patients to risk. Depending on available resources, simulation may involve CPR manikins, task trainers, high-fidelity patient simulators, standardized scenarios, audiovisual technology, or virtual learning components. A simulated cardiac-arrest scenario allows students to move beyond memorization of an algorithm and actively perform assessment, chest compressions, ventilation, defibrillator use, communication, and team coordination. Simulation also permits standardization of learning so that students can experience important emergencies that may occur unpredictably during routine clinical placements.[4,5]

An important strength of simulation-based education is the opportunity for deliberate and repeated practice. Resuscitation skills are technically demanding and may deteriorate when they are not reinforced. Repetition enables students to refine compression technique, sequence of actions, equipment use, and coordination with other team members. Immediate feedback helps learners identify incorrect techniques and make corrections during the learning process. Contemporary resuscitation-education guidance supports approaches that combine active practice with feedback and reinforcement rather than relying exclusively on one-time instruction.[2,3]

Debriefing is another central component of well-designed simulation. After completing a scenario, students can review their actions, discuss the reasoning behind their decisions, identify missed steps, and consider alternative responses. This process encourages reflective learning and helps connect theoretical knowledge with clinical performance. It may also strengthen communication, situational awareness, role clarity, and teamwork, which are important during resuscitation. Simulation can therefore develop not only technical skills but also broader clinical behaviors needed for an organized emergency response.[4,5]

The educational value of simulation is especially relevant in undergraduate nursing programs, where students may have limited opportunities to participate directly in real cardiac-arrest events. Learning exclusively from actual emergencies is neither predictable nor educationally consistent, and novice participation may be restricted because patient safety must remain the primary concern. Simulation provides a safe alternative in which students can experience the urgency and complexity of resuscitation while being able to repeat procedures, receive guidance, and learn from errors. Recent nursing-education literature supports simulation as a useful approach for developing BLS-related knowledge, practical competence, confidence, and readiness for clinical practice.[5,6,7]

Because nursing students will eventually be expected to respond to emergencies, educational programs must ensure that BLS teaching produces both sound knowledge and observable practical ability. Evaluation of knowledge alone may not represent a learner's capacity to perform resuscitation, while skills practice without adequate conceptual understanding may limit appropriate decision-making. Assessing both domains before and after a structured simulation-based intervention can provide a more comprehensive picture of learning. Therefore, evaluating the effectiveness of simulation-based training on knowledge and practice of Basic Life Support among nursing students is important for determining whether this educational strategy can strengthen preparedness for emergency care and support the development of competent future nurses.

MATERIALS AND METHODS

Study Design and Setting

The study employed a true experimental research design to evaluate the effectiveness of simulation-based training on knowledge and practice of Basic Life Support (BLS) among nursing students. The study was conducted in selected nursing colleges in Nainital. First-year General Nursing and Midwifery (GNM) students constituted the study population.

Sample Size and Sampling Technique

A total of 124 nursing students were included in the study. The participants were divided into two groups, with 62 students in the experimental group and 62 students in the control group. Simple random sampling technique was used for selection of the participants, providing an equal opportunity for eligible students to participate in the study.

Data Collection Tools, Validity and Reliability

Data were collected using three sections. Section A consisted of socio-demographic variables such as age, gender, residence, and previous knowledge of BLS. Section B consisted of a self-structured questionnaire for assessment of knowledge regarding BLS, while Section C consisted of an observation checklist for assessment of practical BLS skills, including chest compressions and use of an Automated External Defibrillator (AED). Content validity of the tools was established through review by experts from nursing education, emergency care, and research methodology. Necessary modifications were made according to their suggestions. Reliability of the knowledge questionnaire was assessed using Cronbach's alpha coefficient, with a value greater than 0.70 considered acceptable.

Intervention and Data Collection Procedure

Pre-test assessment of knowledge and practice was conducted in both groups before the intervention. Students in the experimental group received simulation-based BLS training consisting of theoretical instruction and practical demonstration using mannequins. The training included recognition of cardiac arrest, activation of the emergency response system, high-quality chest compressions, rescue breathing, and use of an AED. The control group did not receive the structured simulation-based training. Following the intervention, post-test assessments were conducted to evaluate changes in knowledge and practical BLS skills.

Ethical Considerations

Approval was obtained from the Institutional Ethical Committee of the concerned institution before initiation of the study. Official permission was also obtained from the authorities of the selected nursing colleges. The purpose and objectives of the study were explained to all participants, and written informed consent was obtained before data collection. Confidentiality and privacy of the participants were maintained throughout the study.

RESULTS

Table 1. Comparison of Knowledge Scores in Experimental Group

Test	Mean Score	Standard Deviation	Mean Percentage
Pre-Test	10.17	2.61	33.89%
Post-Test	21.00	4.04	70.00%

The mean pre-test knowledge score in the experimental group was 10.17 with a standard deviation of 2.61 and a mean percentage of 33.89%. After simulation-based training, the mean post-test knowledge score increased to 21.00 with a standard deviation of 4.04 and a mean percentage of 70.00%. The findings showed a marked improvement in the knowledge of Basic Life Support among nursing students following the simulation-based training.

Table 2. Comparison of Practice Scores in Experimental Group

Test	Mean Score	Standard Deviation	Mean Percentage
Pre-Test	9.50	2.63	47.50%
Post-Test	14.00	1.63	70.00%

The mean pre-test practice score in the experimental group was 9.50 with a standard deviation of 2.63 and a mean percentage of 47.50%. Following the simulation-based intervention, the mean post-test practice score increased to 14.00 with a standard deviation of 1.63 and a mean percentage of 70.00%. The findings indicated improvement in the practical Basic Life Support skills of nursing students after simulation-based training.

DISCUSSION

The present study demonstrated a marked improvement in BLS knowledge among nursing students following simulation-based training. The mean knowledge score increased from 10.17±2.61 (33.89%) in the pre-test to 21.00±4.04 (70.00%) in the post-test**,** showing a considerable gain after the intervention. Similar findings were reported by Saidkhani et al. (2024)**,** who observed that among students receiving scenario-based BLS training, the mean knowledge score increased from 5.73±2.43 before training to 11.06±2.57 after training ($p<0.001$)**,** whereas the control group showed only a small change from 5.60±2.29 to 6.00±1.55. Thus, the improvement observed in the

present study was consistent with their findings and supported the usefulness of active simulation and scenario-based approaches for improving understanding of BLS procedures.[7]

The improvement in knowledge observed in the present study was also comparable with the findings of Abbasi et al. **(**2024). In their randomized study among nursing students, the simulation group had a mean CPR knowledge score of 11.71±1.27 before training, which increased to 16.60±1.42 immediately after training and remained at 16.57±1.21 after one month ($p<0.001$). In the present study, the corresponding knowledge score increased from 10.17±2.61 to 21.00±4.04, while the mean percentage increased from 33.89% to 70.00%. Although the scoring systems differed between the two studies, both demonstrated a clear rise in knowledge following mannequin- or simulation-based instruction, suggesting that active participation in simulated resuscitation scenarios may facilitate acquisition and reinforcement of BLS knowledge.[8]

A similar pattern was reported by El Ougli et al. (2024) in undergraduate nursing students undergoing high-fidelity CPR simulation. Immediately after training, the simulation group achieved a theoretical knowledge score of 16.41±1.73 out of 20, compared with 13.15±1.96 in the control group. At 30 days, knowledge remained higher in the simulation group at 15.60±1.71, compared with 11.38±1.93 in the control group. In the present study, knowledge increased from a pre-test mean of 10.17±2.61 to a post-test mean of 21.00±4.04, with the mean percentage reaching 70.00%. The findings of both studies therefore indicated that incorporating simulation into resuscitation education was associated with better knowledge acquisition, while the findings of El Ougli et al. additionally suggested that much of this knowledge could be retained beyond the immediate training period.[9]

With regard to practical performance, the present study showed improvement in BLS practice scores after simulation-based training. The mean practice score increased from 9.50±2.63 (47.50%) in the pre-test to 14.00±1.63 (70.00%) in the post-test**.** These findings were comparable with those reported by Dharmarajlu et al. (2024) among nursing students receiving simulation-based paediatric CPR training. Their mean CPR skill score increased from 11.4±2.8 before simulation to 44.7±1.2 after training**.** Although the assessment tools and maximum scores differed from those used in the present study, both studies showed substantial post-training improvement in psychomotor performance. This similarity suggests that simulation provides nursing students with an opportunity to repeatedly practise resuscitation procedures and translate theoretical learning into observable clinical skills.[10]

The improvement in practice scores was further supported by Abu-Wardeh et al. (2024)**,** who evaluated simulation-based BLS training among newly employed nurses. In their experimental group, the mean practice score increased from 4.75±1.466 at pre-test to 5.90±1.601 at the second post-test**,** whereas the control group showed only a limited change from 4.62±1.319 to 4.80±1.727**.** The reported effect size for practice in the experimental group was Cohen's d=0.749**.** In comparison, the present study recorded an increase in mean practice score from 9.50±2.63 to 14.00±1.63, accompanied by an increase in mean percentage from 47.50% to 70.00%**.** Despite differences in participant characteristics and scoring methods, both studies demonstrated improvement in practical BLS performance following structured simulation exposure.[11]

The present improvement in practical performance was also in agreement with Mohsenzadeh et al. (2025), who evaluated Basic Cardiac Life Support training among undergraduate nursing students using simulation with feedback. In their experimental group, the mean skill score increased from 3.45±1.23 before training to 20.75±5.04 immediately after training, and subsequently increased to 25.63±4.22 after one week and 26.25±4.27 after one month**.** In the present study, the practice score similarly increased from 9.50±2.63 to 14.00±1.63, with the post-test mean percentage reaching 70.00%**.** These findings indicated that structured simulation, repeated performance, and feedback can contribute to improvement in practical resuscitation skills. Overall, the parallel improvement in both knowledge and practice in the present study supported simulation-based training as an effective educational approach for strengthening BLS preparedness among nursing students.[12]

CONCLUSION

Simulation-based training was effective in improving both the knowledge and practical skills of nursing students regarding Basic Life Support. The marked improvement in post-test knowledge and practice scores demonstrated the value of structured, hands-on learning. Simulation provided students with opportunities to practise essential resuscitation skills in a safe and realistic environment. Incorporating simulation-based BLS training into nursing education can strengthen students' preparedness, confidence, and competence in managing life-threatening emergencies.

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