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Review Article

Simulation in pediatric nursing education: Are there enough evidence for future practice?

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ABSTRACT

Introduction : Research on simulation is still a developing field in nursing and simulation-based learning is gaining momentum with its application over the past two decades in nursing education. Simulation is utilized as a method of training, by helping the learners for competent practice and to improve patient safety, but not much evidence is available for its application in pediatric nursing education.

Objectives : This study aimed to (1) describe the application of simulation in teaching pediatric nursing education and (2) explore the evidence for its application in developing clinical competencies and skills in nursing students taking pediatric courses.

Materials and Methods: A literature search was conducted in Google Scholar, PubMed, Medline, Science Direct & ProQuest for the relevant articles available on the internet. Descriptive, experimental, and systematic reviews concerning simulation in pediatric nursing were included.

Results : Mixed results were cited in studies about imparting the knowledge concerning the applicability of simulation in pediatric nursing courses. Available evidence shows that simulation can improve the competency of students in clinical practice and in improving patient care outcomes and communication skills. There is a paucity of studies about the applicability of simulation in pediatric nursing education.

Conclusion : Simulation is found to be a useful strategy in providing a near-to-real experience for the students to practice high-risk, rare procedural skills in pediatric nursing education. However, further, evidence is required to replace clinical practice experience with simulation, for sustained improvement in patient care outcomes, and in critical thinking and knowledge retention in nursing students.

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1. Introduction

There has been an upsurge in the application of simulation and simulation-based learning in nursing education over the past two decades.¹ Simulation is identified as an active methodology in learning courses with a clinical component such as nursing, with clinical simulation having a problem-based learning approach (PBL).² The Bachelor of Nursing programs in India requires that students complete their clinical experience in pediatric nursing during their third

year of the course. Hustle for placement in the clinical site and obtaining permission for nursing students to complete their skills can frequently become a concern of cooperating facilities and can pose a challenge for nursing programs.³ Many a time, these clinical sites may only permit a limited number of students per day, limiting the experiences of the nursing students to develop their required professional and critical reasoning skills in caring for patients with specific needs and conditions, restricting the scope of practice.⁴ Nurse educators have utilized simulation as a method of training to improve health care education, practice, and patient safety, by helping the learners to acquire knowledge

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and essential skills and to enhance teamwork and to achieve competence without jeopardizing patients at risk.⁵

Providing a learning experience for the nursing students by rotation in the simulation laboratory can be incorporated as an effective strategy in providing specialty clinical practice and supplementing learning needs in acute nursing for children, by providing a near-to-real practice environment for mastering dexterity in nursing care and procedures.⁶ Simulation has gained significant attention and momentum for experiential learning especially in the time of COVID-19 where there was a lack of pediatric inpatients to provide enough training in nursing as well as in other health professions.⁷ It had been suggested that simulation, especially high-fidelity simulation, allows students to practice needed nursing care and clinical skills and by building self-confidence and positively impacting knowledge.^{8,9} Moreover, simulation has the advantage of reproducing the procedures repeatedly, without putting the patient at risk, which makes them feel safe during clinical practice.^{10–12}

Simulation can be defined as ‘activities that mimic the reality of a clinical environment’ and are designed to demonstrate procedures, decision-making, and critical thinking through techniques such as role-playing and the use of devices such as interactive videos or mannequins.^{6,13} Gaba¹⁴ defines, “*Simulation is a technique, not a technology, to replace or amplify real experiences with guided experiences often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion*”. The simulation had been used as an effective method to provide the learning outcomes concerning skills and knowledge of the patients with acute, critical, and chronic illness as well as to improve communication and interaction with such patients and their relatives, and can be especially practical in situations where there is a paucity of children’s ward and to improve the patient safety culture.¹⁵ Simulation has three phases: pre-briefing and briefing, scenario (or simulation), and debriefing, during which feelings are shared by the participants and possible improvements for situations given in the scenario are suggested.¹⁶ Simulation can take various forms, such as using standardized patients, role-playing, use of physical or virtual reality part-task-trainers, computer patients (screen-based virtual world) or electronic patients. Fidelity refers to describing simulation products, and the precision of reproduction of real life.¹⁷ Simulation attempts to achieve a level of fidelity that resembles situations encountered in real life. There are three levels of fidelity in simulation, with each simulator having a specific purpose in teaching and validating clinical competencies.¹⁸ Low fidelity simulators, or task or skill trainers, are useful for introducing and practicing psychomotor skills before performing them on real patients (e.g. insertion of a urinary catheter). Moderate-fidelity

simulators assist in developing competencies with the integration of computer technology and are useful for developing an in-depth understanding of specific, complex subject matter and competencies (e.g. various heart sounds, bowel sounds, initiation of IV therapy, administration of IM injections). High-fidelity simulators, or human patient simulators, can provide the most realistic simulated patient experiences. These computerized mannequins can provide situation-based changes following students’ interventions and decisions, and allow them to practice psychomotor skills and various observational responses to physical and pharmacological interventions. Palpable pulses, alteration of heart rate based on pharmacotherapy, pulse oximetry, vocal sounds, etc. are examples of features in such simulators.¹⁷

Nursing is a profession in which nurses work in highly demanding environments and care for increasingly complex patients. It is imperative that experiences are provided for training and developing new and complex skills in nursing, or to enhance their experience with rare events, and to empower nurses with the competencies for their practice.¹⁹ Simulation training and education can help nurses to develop competency in technical skills, as well as to integrate cognitive and psychomotor skills into patient care and to enhance the communication skills with the patients. It is predicted that simulation can become an inseparable part of nursing education and career to develop and enhance core nursing competencies and for learning the procedural and clinical skills, as well as for the application of such skills in the clinical setting.²⁰ Providing quality of such training will become a coherent part of the individual and team performance to improve self-confidence, critical thinking, and problem-solving capabilities.¹⁹ This is inherently important while dealing with at-risk or subjects such as children and their families, to give proper family-centered care in a collaborative work environment.²

1.1. Purpose of the study

This article describes the application of simulation in teaching pediatric nursing education and explores the pieces of evidence for its application in developing clinical competencies and skills in nursing students taking the pediatric course.

2. Materials and Methods

A literature search was conducted in Google Scholar, PubMed, Medline, Science Direct & ProQuest for the relevant articles. The search terms included, “*Simulation in Pediatrics*”, “*Pediatric nursing skill with simulation*”, “*Pediatric nursing skills*”, “*High fidelity simulation*”, “*Pediatric nursing procedural skill development*”, “*Competency development in child health using mannequin*” etc. Studies included consisted of

observational, systematic reviews, and experimental designs.

3. Results

Fourteen studies were found to be related to the study objectives and were able to be retrieved from the web search and included in this section. The findings are summarized under the following subheadings.

3.1. Simulation for developing critical thinking and providing competencies for practice

Taylor and colleagues⁵ used an ‘unfolding case study approach of simulation experience, to enhance student engagement and to build critical reasoning skills, for students enrolled in pediatric and maternity clinical courses using simulation manikin. The concepts applied were relevant to the clinical courses and essential in meeting critical clinical competencies. The simulation process was followed by debriefing, facilitated by simulation expert, which was a reflective discussion covering objectives of the scenarios provided, assessment techniques used and should have performed and the findings occurred during the scenario, that and were followed by an exam related to the topics covered on the simulation. The study had found that the use of an unfolding case provides students with a chance to critically think, and get a meaningful clinical experience, as well as enhances students’ engagement and communication.

Another study was conducted among nursing students in South Korea by Kyung-Ah Kang,²⁰ to compare changes in the knowledge of patient care for children with bronchiolitis, confidence in skill performance (CSP), and satisfaction resulting from training in educational modalities. The various learning modalities were problem-based learning (PBL) (*Experimental group 1, E1*), simulation with PBL (*Experimental group 2, E2*), and the control group with lecture-based instruction (*C group*). Significant differences were found in the mean scores of the students in the post-test knowledge of the students in three groups, with higher scores among the group of combined simulation with PBL, whereas a higher level of satisfaction was obtained in the group who had a PBL, including lectures and a clinical practicum (E1) compared to students who had PBL with simulation (E2). Also, the mean CSP and satisfaction scores were lower in the E2 group compared to E1 group.

A pilot study was conducted by McKeon et al.²¹ to compare required resources and student learning outcomes for traditional versus computer-based simulation. The competency scores of computer-based simulation showed significant improvement compared to the traditional group on their evaluation of learning outcomes.

3.2. Effect of simulation training on knowledge, skills, and stress levels of students

Hatice and colleagues,²² had performed an experimental study in Turkey, on students who are taking a pediatric nursing course in clinical practice to investigate the effect of simulation training on their knowledge, skills, stress, and anxiety levels. The students in the experimental group had given simulation training on children suffering a respiratory disease and those in the control group were trained with a traditional method. The results showed that students participating in the simulation training had significantly higher levels of stress, anxiety, and clinical skill scores compared to the control group. There were no significant differences between the groups in the knowledge scores. Students in the experimental group were more successful in the actual clinical setting and their clinical skill scores were higher in providing nursing care to a baby with respiratory difficulty.

3.3. Simulation for teaching rare procedural skills in pediatrics

Successful use of simulation to teach rare procedures in acute pediatric emergencies such as neonatal resuscitation, pediatric advanced life support, advanced airway management, procedural skills training, and trauma management have been cited in research.^{7,23} Acquisition of complex procedural skills in pediatrics requires direct observation, frequent practice along appropriate clinical judgment, communication, critical assessment, problem-solving, and decision-making skills, and thus make simulation the best choice to learn and enhance these tasks in nursing.^{24,25}

Luanne Linnard,²⁶ provided high fidelity simulation scenario for student nurses and practicing nurses, to practice and apply the essential safety components of chemotherapy administration and care of the pediatric oncology patient, for safe patient assessment, central line care, and cancer symptom management. High fidelity simulation refers to the use of high-technology lifelike mannequins in a simulated clinical environment.²⁶ The students reported a high level of satisfaction and perceived skill acquisition and reported increased self-confidence with the simulation experience.

3.4. Simulation as a method of competency assessment

Competence includes the ability to integrate knowledge, skills, and values with practice, with functional acceptability.²⁷ Even though observation of staff in real-life patient care situations is regarded as the most accurate method of competency assessment, it is not very practical to perform procedures in a patient care setting for practice and can be expensive, time-consuming, and can be harmful or unethical in certain situations.²⁸

Simulation has thus evolved as a method of evaluation of nursing competence for registered nurses in a structured setting. A systematic review was conducted by Keddington²⁹ to evaluate simulation as a method of assessing nursing competence. It was found that simulation is an effective method of competency assessment of high-risk, low-frequency skills which occur infrequently in wards, that can transform to improved patient outcomes. One such example is a descriptive study evaluating clinical competencies in pediatric health using simulation-based assessment (SBA).³⁰ Simulation scenarios were provided to the participants their performance was assessed using SBA. It was found that SBA can be successfully used for nursing students in assessing clinical skills and competency.

A randomized controlled trial was conducted by Bultas³¹ to compare the effectiveness of high-fidelity simulation with traditional static mannequins as a teaching strategy in pediatric staff nurse education, to assess the knowledge retention, skill performance, and team confidence levels caring for deteriorating patients during the American Heart Association's (AHA) Pediatric Emergency Assessment, Recognition and Stabilization (PEARS) course. The intervention group was assigned to high fidelity simulation and the control group to a traditional static mannequin. Assessments were carried out after a period of six months. It was found that knowledge retention was maintained, skill performance improved, and teamwork ratings of the experimental group increased significantly at six-months follow-up, supporting the use of simulation as an effective teaching modality and competency assessment method in the care of the deteriorating pediatric patient.

3.5. Simulation as a method to improve patient outcomes

A prospective cohort study was carried out in the United Kingdom by Ulf Theilen,³² to evaluate the long-term impact of ongoing regular team training (*pediatric Medical Emergency Team or pMET*) on hospital response to deteriorating ward patients, patient outcome, and financial implications. It was found that deteriorating patients were recognized more promptly after the training and were transferred to high dependency care and more rapidly escalated to intensive care, and contributed to a sustained reduction in the hospital mortality rates and improvement in the savings brought out by reduced bed occupancy rates in the pediatric intensive care unit.

An exploration of the hybrid simulation intervention was provided using a quasi-experimental pre/post study in Canada by Sandra Goldsworthy,³³ to undergraduate nursing students to respond to a deteriorating adult or pediatric patient to prevent adverse patient outcomes. The hybrid approach to simulation combining both high-fidelity and virtual simulation cases (*pediatric sepsis, pediatric asthma, neonatal seizures*) proved effective in improving

confidence and competence in the recognition and response to deteriorating patients, and provide evidence that it can enhance knowledge after simulation intervention.

3.6. Simulation for the care of a child and their family at the end-of-life

Teaching the complex and sensitive needs of a child dying with a terminal illness and their family is challenging, and requires more than mere understanding of the emotions. End-of-life care can create anxiety for nursing students, and effective communication with patients and their families and the members of the professional health team must be required to achieve positive patient outcomes.³⁴ Cole et al.³⁵ developed an instructional model with structured simulated experience to increase the understanding of the undergraduate pediatric nursing students to the role of the nurse, especially symptom management, providing emotional care, and learning communication skills while taking care of a child at end-of-life. The curriculum was introduced to the pediatric nursing students, during the latter half of the semester, after learning baseline information about child health. The simulation mainly covered three main areas: *symptom management in a terminally ill child, communication, and provision of family-centered care*. The end-of-life scenario utilized an unfolding case study format and provided an experience for students in both active and passive roles. The students demonstrated psychomotor skills and knowledge level competency during the simulated experience. The management symptoms at the end of life include providing comfort, coping in a culturally competent environment as well as specific interventions utilized for pain management. Providing emotional care for the patient and the family included providing the family an opportunity to express their feelings openly, identifying the nursing role as an emotional caregiver, and communicating with a family in challenging situations such as facing sadness and grief, identifying spirituality needs, and its assessment. It was identified that the students learned to discover and to be 'realistic' when supporting patient and their families and to be truthful and authentic to deliver empathetic care in such times.

3.7. Simulation as a substitution for actual clinical hours in pre-licensure nursing

An experimental, longitudinal, randomized control trial study was conducted in the United States by Jennifer K Hayden,³⁶ to explore whether traditional clinical experiences can be substituted with simulated clinical learning experiences, and to provide evidence on nursing knowledge, clinical competency, and the transferability of simulation laboratory to the clinical setting in the pre-licensure nursing curriculum. The students were randomized into three groups (control, who had traditional

clinical experiences with no more than 10% spent in simulation; 25% group, where students' 25% of traditional clinical hours were replaced by simulation; 50% group, in which 50% of the traditional clinical hours were replaced by simulation). The results indicated that there were no significant differences among study groups regarding end-of-program nursing knowledge, clinical competency, or overall readiness for practice. Educational outcomes were equivalent, with new graduates obtaining similar ratings in critical thinking, clinical competency, and overall readiness for practice, when up to 50% of traditional clinical experience in the undergraduate nursing program was replaced by simulation.

4. Conclusion

Research on simulation is gaining momentum and has the potential to become a critical part of the entire nursing career.¹⁹ Increased retention of knowledge and skills after simulation-based training had been reported in many studies. Further research and application of simulation in pediatric nursing require improving the currently available simulation curriculums in nursing with the development of validated assessment tools and demonstration of amelioration in patient outcomes after the simulation-based training.⁷ The improvement in simulation experience for the students can be brought by replicating the reality of scenes and conditions available in a nursing facility, with a reflection of the professional role which the student nurses intended to assume in the future.² However, practical challenges exist while adopting simulation as a teaching strategy in terms of expense, time, technical support, and physical space for storing and use of simulation equipment,^{37,38} in addition to establishing/hiring a position of simulation coordinator along with other technical personnel to run and maintain the simulators. It is anticipated that the role of simulation will continue to grow in pediatrics.³⁸ There is a paucity of available studies exploring the role of simulation in pediatric nursing education.³⁹

4.1. Future directions

Simulation research is still a developing field in pediatric nursing education, with not much evidence on actual patient outcomes have been cited. There are still several research gaps to be addressed to optimally use simulation to bring desired outcomes. There is no doubt that simulation can be used primarily to teach pediatric nursing for developing skills especially in acute care settings and to provide a standardized environment for the performance-based assessment in Objective Structured Clinical Examinations (OSCEs).²³ However, the possibility of incorporating simulation for conducting a summative assessment, improving performance and patient outcomes, and provision of cost-effective simulation-based learning

practices are areas that need to be explored further through research. Setting up of a simulation center and faculty, which is resource-intensive should be weighed against the potential benefits associated with it, in particular, with the pediatric outcomes such as preventing death, or reduced hospital stay, or admission to the intensive care unit.

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7. Conflict of Interest

None.


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