SIMULATION IN NURSING EDUCATION: IMPLICATIONS FOR NURSE EDUCATORS AND NURSING PRACTICE

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ABSTRACT: *Technological advancement in health care and increase awareness of patients about their rights call for nursing training and nursing care to adopt a method of training that mimics full life situation. Simulations in nursing education are indispensable. Faculty of nursing training programs should therefore embrace patient simulation as an instructional strategy and seek its effective implementation in nursing education programs.*

KEYWORDS: Technological Advancement, Instructional Strategy, Nursing Education, Nursing Practice, Simulation

INTRODUCTION

Need for increase knowledge and skills needed for taken care of simple and complex patients in this era of highly sophisticated technology, changing healthcare and increase awareness of patients about their rights cannot be overlooked. Nurses among other healthcare providers cannot afford to handle their patients anyhow on the ground of training for fear of litigation. Nursing education programs are faced with increased pressure to produce graduates who are capable of providing efficient and safe patient care.

The instructional strategies utilized in both didactic and clinical components of nursing education courses are highly influential in determining critical thinking and clinical decision-making ability as well as in developing the psychomotor skill performance of new graduates (Durham and Alden, 2008). In recent years, high-fidelity simulation in nursing education has become an increasingly popular educational tool (Sanford, 2010).

Simulation is a technique or device that attempts to create characteristics of the real-world situation. Simulation allows the educator to control the learning environment through scheduling of practice, providing feedback, and minimizing or introducing environmental distractions. In health care, simulation may refer to a device representing a simulated patient or part of a patient; such a device can respond to and interact with the actions of the learner. Simulation also refers to activities that mimic the reality of a clinical environment and that are designed for use in demonstrating procedures and promoting decision making and critical thinking. In health care education, simulation can take many forms, from relatively simple to highly complex.

The use of simulation in nursing education is not new as this has been used to impact knowledge on some nursing procedures and critical teaching skills. This has been done through the use of models of anatomic parts and whole-body mannequins. The uses of these

have been contributing immensely to the training of professional nurses both in the past and presently. However, the recent advancement in the body of knowledge and the need to meet up with technological advancement has called for more in-depth development of nursing knowledge to keep pace with the changes in healthcare advancement. Current interest in simulation as a clinical teaching tool has largely been enhanced by development of the human patient simulator.

The advances in health care development call for nurse educators taking a lead in the training of learners in order to meet this technological advancement challenges. There is need for the use of patient simulation in nursing education programs to meet the technological and professional learning needs of nursing students.

This seminar paper is prepared to acquaint us with the various types of simulation, its use as an instructional strategy, evidence supporting the use of patient simulation in nursing education, relevance of patient simulation to nursing education and practice, implication of patient simulation to nurse education and practice.

Simulation

According to Webster's (2003) to simulate is to look or act like. Simulation is a technique or device that attempts to create characteristics of the real world (Alden and Durham, 2008). Simulation allows the educator to control the learning environment through scheduling of practice, providing feedback, and minimizing or introducing environmental distractions (Beaubien and Baker 2004). In health care, simulation may refer to a *device* representing a simulated patient or part of a patient; such a device can respond to and interact with the actions of the learner (Gaba, 2004). Simulation also refers to *activities* that mimic the reality of a clinical environment and that are designed for use in demonstrating procedures and promoting decision making and critical thinking (Jeffries, 2005). In health care education, simulation can take many forms, from relatively simple to highly complex. This is what is called fidelity of simulation.

Simulator Fidelity

According to Maran and Glavin (2003) fidelity can be defined as the degree to which the appearance and capabilities of the simulator resemble the appearance and function of the simulated system. Fidelity can be low or high. Human patient simulators, therefore, are generally categorized as low, intermediate, or high fidelity.

Low-Fidelity

Low-fidelity mannequins provide anatomical representations only. It does not offer realistic physiological or vocal feedback. Example is the Brad™ CPR. The low-fidelity mannequin was simply the relevant portion of the torso for the procedure being trained—a nonreactive head and chest model that allowed for a tube to be inserted for the nasogastric procedure and a lower torso catheterization model that allowed for a tube to be inserted for the urinary catheter insertion procedure. (Grady, Kehrer, Trusty, Entin, Entin, and Brunye, 2008)

High-Fidelity Mannequins

High-fidelity mannequins complement anatomical representations with human-like physiological and vocal responsiveness. Example of this is the Laerdal SimMan Universal

Patient Simulator which has realistic weight distribution and joint articulation; realistic heart, lung, and bowel sounds; vocalization; realistic airway and pulmonary mechanics; and carotid, femoral, brachial, and radial pulses (Grady et al, 2008). Sole and Guimond (2010) described high fidelity mannequins as the ones that uses computer technology to provide physiological data to the learner, such as heart rate, blood pressure, and pulse. The computer can be programmed to demonstrate clinical conditions, such as childbirth or shock, and responds to treatments that are delivered during the simulation activity, such as medication administration.

The high-fidelity mannequin was a full, anatomically correct simulator reactive to various examination interactions (e.g., pulse, breath sounds with chest movement, heart sounds). When the tube was inserted for the nasogastric procedure, the mannequin gagged when the tube reached the nasopharynx and coughed if it was inserted incorrectly; simulated urine was obtained when the urinary catheter insertion procedure was performed. In addition, the high-fidelity mannequin was able to say "yes" or "no" in response to questions and could say "ouch" in response to the student's questions or actions (Grady et al 2008). High-fidelity simulation is a relatively new area in nursing education and utilizes high technology simulation monitors and computers. This technology offers new avenues for teaching student nurses' scenarios as well as critical thinking and reflection on lived experience and practice. (Sanford, 2010)

The History of Simulation as a Teaching Strategy in Nursing Education

Nightingale model of nursing training use an apprenticeship approach to prepare students for clinical practice. This model remains the dominant approach until nursing education moved from hospital-based programmes to institution of higher education. Since that change, nurse educators teaching clinical courses have provided students with clinical instruction and practice in skills laboratories (Billings and Halstead, 2009).

Nurse educators have used low-fidelity for decades such as mannequins, role plays, case studies, anatomical models, oranges (to learn how to give intramuscular injection), use of foams (to learn how to stitch the layers of the skin) etc. The introduction of high-fidelity simulation, in the form of affordable, potable and versatile human patient simulators in the late 1990s transformed health care education and appears to be one of the technologies of the future. Using simulation in nursing education as an instructional strategy is supported not only by constructivist approach to education but also by lessons learned from those preparing pilot, military special forces teams, and students preparing for administering anaesthesia or performing surgery (Billings and Halstead,2009).

Types of Simulation

There are various types of simulation available for clinical teaching in nursing profession. These include:

Part Task Trainers

Part task trainers, also known as low-tech or static task trainers, are designed to replicate only a portion of the body or the environment. Many of these represent selected anatomical areas of the human body and are used to teach basic psychomotor skills and procedures. They range in complexity from an item as simple as an orange that is used to teach injection

technique to an arm for teaching venepuncture or a mannequin for teaching cardiopulmonary resuscitation (CPR). These simulation tools are relatively inexpensive, and multiple models are often available for use within the same institution, allowing for larger numbers of learners to practice simultaneously.

Simulated Patients/ Standardized patients

Simulating patients through role play between learners and educators is commonly used in medical and nursing education. Physical assessment skills, history taking, and communication techniques are often taught using student pairs. Trained simulated patients can be used to simulate psychiatric interactions where the learners can try out appropriate interventions. Live female pelvic and male prostate models/teachers provide a dual role of allowing students to refine their exam techniques on the model while receiving real-time feedback about the pelvic or prostate exam.

According to Sole and Guimond (2010) in standardized patient, individuals act out various situations and scenarios. Allow for interaction of the learner with an actual patient. Standardized patients can be used in a wide variety of learning activities, such as practicing interview techniques and physical examination skills. A well-trained standardized patient with a good script is very effective at suspending disbelief in the scenario and creating a valuable learning simulation. Expense and scheduling are challenges for this type of simulation.

Screen-Based Computer Simulators

Screen-based computer simulators are designed to model various aspects of human physiology or specific tasks or environments. Through a variety of computer programs, learners use information to make clinical decisions and observe the results in action. There is often feedback during and after the interaction. Computer-assisted instruction programs or Web-based programs are relatively inexpensive and reusable and can be used individually or in groups. According to Albertson (2012) screen-based or PC-based simulations are human computer interactions that allow students to experience a variety of medical skills and procedures. This is best used with entry-level students. They can practice with basic skills at their own pace. The cost is relatively inexpensive--a computer and a CD. However, the simulation is low fidelity, meaning not very lifelike. It should not take the place of more realistic simulations or patient-student interactions.

Complex Task Trainers

Complex task trainers involve virtual reality and haptic systems, representing the highest level of computer-based technology. Haptic refers to technology that can sense where touch occurs as well as the amount of pressure being applied. This type of technology is particularly useful in learning environments where the faculty cannot clearly see where the student is assessing the patient. For example, during a pelvic exam, it is difficult for the faculty to determine if the learner is doing a thorough exam. With haptic technology, sensors are placed inside a pelvic model to provide feedback to the learner about areas assessed with touch and the amount of pressure applied. Complex task trainers are often combined with part task trainers so that a physical interaction can occur within the virtual environment. This type of simulation is gaining popularity for training practitioners in surgical techniques such as laparoscopy. While such technology is reusable, it can also be relatively expensive.

Integrated Simulators

Integrated simulators combine computer technology and part or whole-body mannequins to provide a more realistic learning experience. The degree of sophistication of the mannequin and the computer that drives it determine the degree of engineering fidelity of the system.

Virtual Reality

A computer-generated environment that provides multi-sensory experiences for the learner; immerses the learner in a simulated environment. For example, virtual online hospitals and communities are being developed where student avatars can interact in real time with patient avatars. Virtual reality can be designed for the learner to experience clinical conditions, such as decreased vision or impaired mobility (Sole and Guimond, 2010).

Human patient simulators

According to Albertson, (2012) human patient simulators are among the most recent technologic advances in instructional methodologies for medical and nursing education. These interactive mannequins are capable of realistic physiologic responses, including respiration, pulses, heart sounds, breath sounds, urinary output, and pupil reaction. Additionally, the more advanced models can communicate with the student, responding to questions posed by the learner in real time during the simulation exercise.

The authors are most familiar with the Human Patient Simulator by Medical Education Technologies Incorporated (METI®) and SimMan™ by Laerdal™. Each company has a variety of portable simulators representing different patient ages to meet the educational needs of the learners at all levels. Both vendors have models with realistic anatomy and clinical functionality.

The METI HPS represents the latest in state-of-the-art simulation technology. Physiological and pharmacological models are used as the operating platform, allowing the simulator to react like a live human. These unique integrated models imitate the human response in a multilayered, real-time manner, providing a realistic clinical presentation (METI 2006). The HPS has a data recorder that records the learner's actions, allowing precise accounts for review and debriefing. Additionally, the HPS interfaces with a patient monitor like those used in most hospitals (Albertson, 2012).

Laerdal's SimMan operates using personal computer (PC) software. The simulator displays patient physiologic parameters on a PC screen that emulates a patient care monitor. The SimMan software includes the first Integrated Video Debriefing System. The video Web camera records video and audio that is synchronized with the event log, providing a valuable tool for debriefing. Laerdal's software allows ease of management of patient parameters during scenarios (Laerdal, 2006).

The simulators have interchangeable genitalia so that the mannequin can present as a male or female. It is possible to adapt the appearance of the mannequin to represent a range of ages from young adulthood to geriatric. Additionally, with the aid of a wig, makeup, and female clothing, the realism can be enhanced as the male mannequin is transformed into a female patient. The mannequin can also be successfully outfitted to present as a pregnant female with the appropriate props (Albertson, 2012).

According to Alden and Durham, (2008) human patient simulation is a relatively new teaching strategy that allows learners to develop, refine, and apply knowledge and skills in a realistic clinical situation as they participate in interactive learning experiences designed to meet their educational needs. Learners participate in simulated patient care scenarios within a specific clinical environment, gaining experience, learning and refining skills and developing competencies; all this is accomplished without fear of harm to a live patient. The use of simulation as a teaching strategy can contribute to patient safety and optimize outcomes of care, providing learners with opportunities to experience scenarios and intervene in clinical situations within a safe, supervised setting without posing a risk to a patient.

Examples of Human Simulators used in Nursing

- Advanced baby manikin, infant nursing simulator
- Advanced nursing manikin, nursing simulator
- Buttocks intramuscular injection simulator
- Advanced electronic elbow joint intracavitary injection simulator
- Bone marrow puncture and femoral venipuncture simulator
- Upper-arm intramuscular injection simulator
- Advanced electronic shoulder joint intracavitary injection simulator.
- Peritoneal dialysis simulator
- Male Urethral Catheterization Simulator
- Ostomy Care Simulator (Medical Model)
- Iso Mechanism of Labor, Delivery Course, Childbirth Simulator, Simulator For Health
- Advanced nasogastric tube and trachea nursing model
- Trauma Nursing Care Manikin
- Mother and Child First Aid Simulation System
- Advanced Medical Patient Care Simulator with Ostomy

Nursing Procedures that can be carried out on simulators

- Hair and face washing, hair combing (with artificial hair)
- Eye and ear washing and administering
- Mouth cavity and artificial teeth care
- Endotracheal intubation
- Sputum suction
- Oxygen inhaling
- Oral and nasal feeding
- Gastric lavage
- Breast care and inspection
- Venepuncture, injection, blood transfusion (Arm)
- Deltoid subcutaneous injection

- Vastus lateralis injection
- Thoracic cavity, abdominal cavity, liver, bone marrow and lumbar puncture
- Enema
- Female urethral catheterization
- Female bladder irrigation
- Ostomy care
- Buttocks intramuscular injection
- Holistic nursing care: sponge bath, replacing clothes, cold and heat therapy.
- Limbs joints: bend, rotation and upper or lower movement
- Advanced Medical Patient Care Simulator with Ostomy

Features of Human Patient Simulations

The following describes some of the features of the simulation mannequins:

Full Scale Adult/Infant Patient Simulators - these allow the learner to perform relevant pediatric emergency skills and scenarios.

Interactive Manikins - they provide immediate feedback regarding interventions.

Simulators Software – these generate automatic debriefing based on the event log synchronized with video pictures, provides immediate, detailed feedback on performance to learners.

Realistic Airway System - allows accurate simulation of all relevant difficult airway management and patient care scenarios. Realistic breathing patterns and complications bring realism to the simulation experience.

Justification for the Need of Patient Simulation

There has been existence of shortage of manpower resources in nursing both in the clinical and nursing training institutions. Many individuals are interested in nursing as a career but many could not be trained because of the inability to overstretch the enrolment capacity. In Nigeria for example most of basic training institutions could not admit more than 50 students at a time because of lack of adequate facilities to cope with their training.

Lack of sites for clinical training is a major barrier to increasing enrolment in nursing programs. Another barrier to increasing enrolment is a lack of funds to hire additional faculty members to accommodate higher enrolment. In order to explore possible solutions to the shortage, the state of Florida permits the use of simulation to substitute for up to 25 percent of the clinical practice hours in a basic nursing education program. Knowledge of issues, barriers, and effective strategies related to use of simulation is critical in designing best practices for using simulation to address nursing workforce issues (Durham and Alden 2008).

Relevance of Patient Simulation to Nursing Education and Practice

The use of patient simulator as an in instructional tool in nursing is of immense importance to both education and practice.

The followings are some of the benefits of simulation to Nursing education:

Promotion of Patient Safety and Prevent Errors - Simulation allows students to learn and practice nursing skills in less risky environment. The patient safety has been enhanced through simulation. According to Durham and Alden, (2008) incorporating medication administration into patient simulation scenarios offers numerous learning opportunities and benefits to students. Understanding of the rationale for medication use is enhanced as students are able to see how medications fit into the treatment of selected conditions. They have an opportunity to identify the appropriate drugs, determine safe dosages, calculate dosages, properly identify the patient, administer medications by a variety of routes, observe for side effects, and evaluate the effectiveness of medications.

Promotion of critical thinking and Decision-Making skills

The use of simulations prepares students for critical thinking and self reflection as well as preparing them for the complex clinical environment. Through critical effective and quick clinical decisions are made which will enhance the students learning skills and developing competence for future practice.

Promotion of Exposure to Complex and Scarce Learning Experiences

Some nursing learning experiences and skills are complex and even scarce to come across during training. Examples of these are given of intrathecal and intravitreal injection, demonstration of cardiac arrest and host of others. Simulations enable students to gain skills on these kinds of procedures while in training. In addition, simulation can pave the path between formal education and professional practice for experiences that can be difficult to find, but are essential for progressing to the level of competence and beyond (Galloway, 2009).

Promotion of Effective Communication and Collaboration Skills

Effective communication and collaboration are promoted in simulation through team training, implementation of a standardized approach to handover communications, debriefing after a simulation which provides an opportunity for feedback and an avenue to ask and respond to ques

Implication for Nurse Educator

Simulation is a multidimensional concept requiring the educator to examine not only the equipment, but also the environment and the psychological perceptions of the learner and educator (Beaubien and Baker 2004). Educators should acknowledge that the patient simulator is a highly sophisticated, technologically advanced teaching tool hence:

Educators should be innovative, creative, and be ready to learn through active participation in students' teaching using patient simulator.

Nursing educators should emphasise and teach students critical thinking and reflection skills because this will go a long way in helping them graduate from lower level cognitive skills to higher level, that is, knowledge to synthesis and evaluation. However, the faculty should take up the challenges of training faculty members to enable the educators effectively utilise the simulators.

Plan to Coordinate Simulation Activities and Simulation Team Building

Be developed and supported with this pedagogy. Develop champions and have successes with the pedagogy. Provide an efficient 'delivery' of simulations into the course/curriculum. Embrace learning and adoption of technologies used in simulations. Evaluate learning outcomes when incorporating this pedagogy and obtain the evidence-based reports for inform decision making. Integrate this pedagogy into better practices, better patient outcomes, and improved care and safe environments

Understand how to design a simulation. The nurse educators should go for training on simulation technologies. They are the end users and they will be in the best position to design the simulators in a way that it will suite the purpose

Join organizations and task forces to be involved at the regional and national level to disseminate and help with trends and policies in this area. Serve on national panels, focus groups where nursing education decisions are being made

Conduct simulation research. Send in abstracts to speak, disseminate, and participate in conferences (Jeffries, 2007)

Implication for Nursing Practice

There is increased need for quality nursing care geared towards patient safety therefore the clinicians should embrace this innovative program by developing their ICT skills to enhance their performance on the job. Simulation is increasingly used in continuing and in-service education in healthcare staff-education settings. Staff development educators can create carefully crafted simulations that will assist in developing the expertise needed in a new clinical setting.

Galloway, (2009) opined that because of the increases in patient co-morbidity, acuity, and demand for safety, the healthcare system can no longer be sustained by, or satisfied with nurses who remain at the beginner level. Competent nurses who gain expertise through experience are needed. Nurses routinely have the most frequent and intense contact with patients; and it is the nurse who must be able to recognize changes in patient condition that require early collaboration with other members of the healthcare team. It is not uncommon for the nurse to make the initial decisions regarding a patient whose condition is rapidly deteriorating. Rehearsing and gaining experience through the use of simulation can help the nurse gain confidence and knowledge about how to act in an emergency

Simulation has gained entrance into clinical practice in the following areas:

- Employers are beginning to use simulation as a mechanism to evaluate competence for new nurses.

- They also use simulation for experienced nurses to demonstrate skill competence for complex and/or high-risk skills and procedures.

- Innovative programs use simulation in orientation programs to strengthen clinical and assessment skills, most frequently for specialty areas like critical care or emergency room.

- Simulation has been used to remediate nurses returning to work or retrain nurses wishing to change clinical focus by orienting to their new specialty.

- Simulation is recommended to improve team training, improve interdisciplinary communication, and improve collaborative practice among healthcare providers

In addition, the clinicians should support the educators in enhancing training through simulation especially when using a standardised patient and in the preparation of scripts and scenario to be demonstrated by this standardised patient.

RECOMMENDATION FOR TRAINING INSTITUTIONS AND AUTHORITIES

- Faculty development is needed in several areas such as operating simulation equipment, using and editing clinical scenarios, and identifying best practices for implementing simulation in a nursing education curriculum or a clinical setting. Therefore:
- Each Nursing training institution and authority should develop comprehensive simulation laboratories to enhance the valuable learning and assessment opportunities inherent to the clinical education component of our nursing programs.
- The simulation curriculum should be incorporated into nursing education program
- Encourage the development of a Simulation Development Team. Get a consultant to work with the simulation team to get everyone on board and motivated.
- Develop a champion or two, then train others. Organize workshops in your school for other faculty and clinical partners
- Compile material used, teaching tips, resources, in one location, e.g Web site for easy access by all
- Promote involvement of other faculty members – invite them to see your simulations
- Visit other Schools of nursing and medical centers using high fidelity manikins/ simulators

CONCLUSION

Simulation is a tool for improving teaching clinical skills. The efforts have been on strategies that will ensure provision of quality nursing care with enhanced patient safety. The development of simulation technology and strategies is a step forward to achieving success in the above-mentioned directions. Simulation will ensure development of student nurses and even practicing nurses with the aim of achieving competencies in their specialty areas. Simulation technology can help nursing educators enhance the learning experience of their students without sacrificing quality. Simulation can pave the path between formal education and professional practice for experiences that can be difficult to find, but are essential for progressing to the level of competence and beyond.

Rehearsing and gaining experience through the use of simulation can help develop nurses from novice to expert nurses, allow them to gain confidence and knowledge about how to act in an emergency. Staff development educators can create carefully crafted simulations that will assist in developing the expertise needed to meet the current challenges in nursing and healthcare at large.

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