An Economic Model for Clinical Simulation in Prelicensure Nursing Programs

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This article describes the costs that nursing education leaders should consider when planning to integrate clinical simulation into prelicensure nursing curricula. This descriptive analysis demonstrates the cost calculation for simulation experiences, debriefing sessions, and evaluations of student performance. Calculations are based on resources needed to conduct simulations in two of ten schools that participated in the National Council of State Board of Nursing multisite study. The techniques and standards used to create the model of costs can be applied for comparison with the costs of clinical education and for planning to ensure that the program is financially sustainable.

Simulation programs for the clinical education of prelicensure and graduate nursing students and other health care professionals are increasing. Clinical simulation facilitates experiential learning activities, including the technical and cognitive skills involved in caring for patients across the lifespan. Educators and researchers have found that clinical simulation provides a safe, nonthreatening environment, giving students the opportunity to use clinical reasoning and problem-solving skills that can be transferred to the clinical setting without the risk of harm to patients. Experience in these settings has been shown to develop the clinical skills that can be synthesized, retained, and applied in clinical practice.

Despite the apparent advantages, limited information is available on the overall cost associated with implementing and maintaining a simulation program. If the setup, operational, and maintenance costs are too high, the financial viability of integrating clinical simulations into health professional curricula as a substitute for real clinical time may be limited. The economic efficiency may vary with the characteristics of implementation, including the dose, particularly if expensive equipment is procured to provide a low dose of simulation to a small number of students.

Using the National Council of State Boards of Nursing (NCSBN) study data, including the simulation resources, faculty hours, and equipment costs, this descriptive study discusses a model created to determine the costs of integrating clinical simulations at varying doses across seven different clinical courses in a nursing prelicensure curriculum. The objective is to discuss an exemplar (one clinical course at two schools), while providing a framework for nursing educators to consider the efficiency of substituting simulation for real clinical time.

Background

Simulations have been incorporated in nursing education programs for many years. Recently, simulation use has escalated in nursing education programs as well as clinical practice institutions, which use it for the interview process, orientation, and annual competency review. A 2010 national survey of prelicensure nursing programs found 87% of respondents (n = 917) reported using high- or medium-fidelity simulation (Hayden, 2010), and 69% reported they do substitute or have on occasion substituted simulation for traditional clinical experiences. Substitution most frequently occurred in basic and advanced medical-surgical, obstetric and pediatric, and nursing foundations courses.

The use of clinical simulations in nursing education is increasing not only as a response to shortages of educators and limited access to clinical sites but as a means of improving patient safety. At the University of California San Francisco's Kanbar Center for Simulation, Clinical Skills and Telemedicine Education, a basic precept is "First, do no harm." The center offers students a safe, realistic learning environment where they practice clinical and procedural skills on trained actors or manikins (Vu, 2010). Health professionals are training and using simulation-based curricula to promote safe, quality patient-care environments. Evidence on the differences in outcomes produced by medical residents educated in a simulation-based curriculum as opposed to those produced by residents not exposed to clinical simulation has recently begun to appear in the literature (Singer et al., 2013).

Given the national clinical faculty shortage, educators must be used strategically and efficiently. Simulation consortiums are forming across several states that facilitate faculty development in simulation education to integrate simulation into the health professional curricula (Florida Healthcare Simulation Alliance, 2014;

Oregon Consortium for Nursing Education, 2014). Recently, to prepare health professionals and to set standards for simulation educators, the Society for Simulation in Healthcare (2014) developed, tested, and implemented a certification program as a Certified Healthcare Simulation Educator (CHSE™) for both basic and advanced health care educators.

The clinical site shortage, the lack of quality clinical sites, and low census counts are also driving the increased use of simulation to replace real clinical time (Rothgeb, 2008). The clinical simulation experiences can be set up to offset the lack of opportunities in real clinics and provide standardized critical experiences for all students (Medley & Horne, 2005).

Clinical simulation environments provide superior opportunities for training in which team performance can be taught, enhanced, and evaluated. Immersing health professional students, practitioners, and teams in a clinical simulation environment allows them to collaborate and communicate effectively and to refine patient-centered care management and practice (McGaghie, Issenberg, Petrua, & Scalese, 2010). Patient safety, reduction of errors, and health promotion are primary foci in health care and nursing practice. High-fidelity patient simulators are being programmed to respond to errors in medication, clinical judgment, and skill performance and to allow students and practitioners to view and discuss the consequences of their errors (Van Sell, Johnson-Russell, & Kindred, 2006).

Clinical simulation is also being used effectively and efficiently for practitioner and learner remediation. Selected clinical scenarios can be designed to help the learner with a particular challenge master the skills and critical behaviors needed to be a high-functioning, competent practitioner (Greenawalt & Brzycki, 2007). Immersing learners in their scope of practice in the clinical simulations encourages the development of and socialization to their professional role. Simulation also creates a learning environment in which decisions and problems need to be solved and a culture of communication and collaboration needs to be developed (Lasater, 2007; McGaghie et al., 2010).

Value of Simulation

The value of simulation as a pedagogy for clinical experiences is determined by its efficacy and costs; financial sustainability must be considered. Costs include the use of a combination of resources.

The initial capital expense of the construction of the simulation environment tends to be viewed as a capital investment on which an educational institution looks for a return. The cost is fixed if the initial purchase is financed rather than paid in cash. Any maintenance and upkeep has both fixed and variable costs.

Manikins are costly because of the computerized sophistication and the need for personnel to manage them. These considerations are also part of the initial investment and can be handled similarly to the cost of construction. However, there are ongoing maintenance costs. Clearly, manikins have to be replaced more often than a simulation environment. Additionally, manikins can be purchased in a stepwise fashion based on the sophistication needs of the clinical courses. The financing, if not paid in cash, is a fixed cost.

Other costs include task trainers that provide low-fidelity practice, are low cost, and support procedural techniques and practice; development of a standardized patient program as appropriate; and continued faculty development, which is a variable cost that depends on the amount of simulation-based education. Administrative and technical development support is also a variable cost. Overhead costs, such as utility costs, may vary depending on utilization.

Literature Review

As early as 1975, the cost-effectiveness of the Sim One computerized manikin was determined to be beneficial. Hoffman and Abrahamson (1975) evaluated Sim One for training for physicians and nurses in specific tasks and found it effective in learning gained per unit of time, amount of student time required to reach a specified performance level, and investment of faculty time needed for student learning. Since then, there has been an explosion in the use of simulation in health care, yet few studies have examined and standardized the reported costs of simulation-based education. In 2013, Zendejas, Wang, Brydges, Hamstra, and Cook performed a systematic review of the literature focusing on the cost of simulation in comparison with nonsimulation education or training of medical and nursing students and other health professionals. Of the more than 10,000 articles the authors identified, 967 were comparative studies, and 59 of them reported limited cost data. Only 15 reported cost data compared with other instructional methods. The majority of the costs reported related to the cost of the simulator, training materials, and maintenance. Gaps exist in reporting costs associated with information technology, space, staff time, and training.

In a study of the cost-effectiveness of three different simulation-based training programs for intravenous catheterization skills, Isaranuwatchai, Brydges, Carnahan, Backstein, and Dubrowski (2014) combined learning outcome data with cost data. This study compared a low-fidelity simulation (virtual reality computerized program), a high-fidelity simulation (manikin), and a progressive simulation (virtual reality, task trainer, and manikin) The authors compared programs assuming various levels of value for improved outcomes. Though the progressive simulation had the highest total cost, it was most educationally effective (based on the observed gains in learning) and cost-effective at most levels of value assigned to the improved outcomes.

Cohen et al. (2010) evaluated the effectiveness and cost savings of simulation-based education applied to the reduction of patient harm, namely, a decrease in catheter-related bloodstream infections (CRBSIs) in a medical intensive care unit. Medical residents completed simulation training, and CRBSI rates