

# EVIDENCE FOR DESIGN OF SIMULATION CENTERS IN NURSING SCHOOLS

## RELEVANT CADRE RESEARCH:

Title:	<b>Patient Room Handedness: An Empirical Examination</b>
Funds:	Academy of Architecture for Health Foundation (AAHF) Research Grant Herman Miller Grant
Period:	December 2007 to May 2009
Collaborator:	University of Texas Arlington School of Nursing
Location:	University of Texas Arlington, Smart Hospital™
Findings:	Standardized same-handed configurations may not contribute to process and workflow standardization, any more than standardized mirror-image configurations in acute medical-surgical settings. Further, a global view of the patient care environment upon entry is the most sought-after familiarization factor to reduce cognitive load.

## RESEARCH ARTICLES

### CADRE Publications

Pati, D., et al. (2012). "The biomechanics of patient room standardization." [Health Environments Research & Design Journal](#), **5**(2): 29-45.

Background: The prevailing focus on cognitive load reduction in healthcare environment standardization excludes a domain of healthcare delivery that could contribute significantly to safety and efficiency through standardization, but it has escaped discussion in the context of the biomechanics of care delivery. Inappropriate biomechanics not only can harm caregivers but compromise care delivery. Little, however, is known regarding the biomechanics of patient care and the way it interacts with the configurational issues typically targeted in healthcare environment standardization.

Objectives: Examine the types of potentially harmful or stressful actions exhibited by nurses during patient care delivery in an acute medical/surgical setting. Examine the sources influencing unsafe actions. Method: Twenty nurses provided three types of simulated care in an experimental setting involving nine care configurations that were systematically manipulated. A kinesiology expert coded 80 simulation segments representing two types of task and two levels of environmental challenge to identify potentially stressful and harmful actions. Exploratory and regression analyses were conducted on the data.

Results: Analysis suggests that a considerable proportion of potentially harmful and stressful actions are associated with the design of the physical elements as opposed to the configurational factors typically

addressed in standardization. Both of these factors interact to produce work-arounds that result in unsafe actions.

Conclusion: The standardization of healthcare environments needs a larger framework to address both cognitive lapses and the biomechanics of care delivery.

Pati, D., et al. (2010). "An Empirical Examination of Patient Room Handedness in Acute Medical-Surgical Settings." Health Environments Research & Design Journal, **4**(1): 11-33.

Objective: The study objective was to examine whether standardized same-handed room configurations contribute more to operational performance in comparison to standardized mirror image room configurations. Based on Framework that physical environment standardization supports process workflow standardization, thus contributing to safety and efficiency, the study examined the comparative effectiveness of the standardized same-handed configuration and the standardized mirror-image configuration.

Background: Patient room handedness has emerged as an important issues in inpatient unit design, with many hospitals adopting the standardized same-handed room concept at all levels of patient acuity. Although it is argued that standardized same-handed rooms offer greater levels of safety and efficiency in comparison to standardized mirror-image rooms, there is little empirical evidence either to support or refute these contentions.

Method: An experimental setting was developed where elements of the physical environment and approach to the caregiver zone were systematically manipulated. Twenty registered nurses (10 left-handed and 10 right-handed) provided three types of care to patient-actor across nine physical design configurations which were videotaped in 540 separate segments. Structured interviews of the subjects were conducted at the end of each individual set of simulation runs to obtain triangulation data. Video segments were coded by nursing experts. Statistical and content analyses of the data were conducted.

Results: Study data showed that standardized same-handed configurations may not contribute to the process and workflow standardization- hence, to safety and efficiency- any more than standardized mirror-image configurations in acute medical-surgical settings. Data suggest that a global view of patient care environment upon entry is the most sought-after familiarization factor to reduce cognitive load.

## INDUSTRY PUBLICATIONS

### CADRE Publications

Pati, D., Harvey, Y., Evans, J., and Cason, C. (2010). "Room Handedness: Patient Room Layout in Acute Inpatient Care." World Health Design.

This US study asks whether standardized same-handed patient rooms contribute any more to process and workflow standardization than standardized mirror image rooms in acute medical-surgical settings.

## RESEARCH ARTICLES

### Non-CADRE Publications

#### **DESIGN**

Murray, J. S. (2010). "Walter Reed National Military Medical Center: Simulation on the Cutting Edge." Military Medicine **175**(9): 659-663.

Walter Reed National Military Medical Center is implementing state-of-the-art technologies in the National Capital Region. In partnership with local and federal entities, advanced simulation and web-based computer training for a broad spectrum of military healthcare professionals will improve healthcare delivery and patient safety for service members and their families. This article describes the evolving formation of simulation technology under Joint Task Force National Capital Region Medical.

Cesario, S. K. (2009). "Designing health care environments: Part I. Basic concepts, principles, and issues related to evidence-based design." *Journal of Continuing Education in Nursing*, **40**(6): 280-288.

A 2001 Institute of Medicine report captured the nation's attention regarding the dangers that can result from the health care environment. This report, fueled by the need for new facilities to be constructed, led to an explosion of research that now links the physical structure and design of health care facilities to the health and well-being of patients, nurses, other health care workers, and visitors. Continuing nursing education that highlights the importance of evidence-based design has been associated with measurable improvement in health care facilities' clinical outcomes, economic performance, employee productivity, customer satisfaction, and cultural congruency. Three major categories of outcomes can be impacted by evidence-based design: stress reduction, safety, and overall health care quality and ecology. In this article, Part I of a two-part series, the basic concepts, principles, and issues related to evidence-based design are introduced. Part II will describe continuing education programs available for nurses.

Cesario, S. K. and J. Stichler (2009). "Designing health care environments: Part II. Preparing nurses to be design team members." *Journal of Continuing Education in Nursing*, **40**(7): 324-328.

Significant renovation, expansion, and new construction of health care facilities is expected during the next several years. Nurse leaders must expand their knowledge of the design process and evidence of design features that enhance safety, efficiency, and healing. In this article, the authors discuss the development of a graduate-level nursing course that provides nurse leaders with knowledge and competencies in health care design and enables them to engage in effective interdisciplinary communication during the design process. Part I of this two-part series, which was published last month, discussed the basic concepts, principles, and issues related to evidence-based design (Cesario, 2009).

Stichler, J. F. (2008). "Finding evidence to support facility design decisions." *Journal of Nursing Administration*, **38**(4): 153-156.

Nearly \$200 billion of healthcare construction is expected by the year 2015, and nurse leaders must expand their knowledge and capabilities in healthcare design. The goal of this bimonthly department is to prepare the nurse leader in using the evidence-based design process to ensure that new, expanded, and renovated hospitals facilitate optimal patient outcomes, enhance the work environment for healthcare providers, and improve organizational performance. In this article, the author provides nurse leaders with examples of where to find data to guide decisions about the efficacy of specific design features in achieving desired outcomes.

## **NURSE EDUCATION-SIMULATION**

Cant, R. P. and S. J. Cooper (2010). "Simulation-based learning in nurse education: systematic review." *Journal of Advanced Nursing* **66**(1): 3-15.

**Aim.** This paper is a report of a review of the quantitative evidence for medium to high fidelity simulation using manikins in nursing, in comparison to other educational strategies.

**Background.** Human simulation is an educational process that can replicate clinical practices in a safe environment. Although endorsed in nursing curricula, its effectiveness is largely unknown.

**Review methods.** A systematic review of quantitative studies published between 1999 and January 2009 was undertaken using the following databases: CINAHL Plus, ERIC, Embase, Medline, SCOPUS, ProQuest and ProQuest Dissertation and Theses Database. The primary search terms were 'simulation' and 'human simulation'. Reference lists from relevant papers and the websites of relevant nursing organizations were also searched. The quality of the included studies was appraised using the Critical Appraisal Skills Programme criteria.

**Results.** Twelve studies were included in the review. These used experimental or quasi-experimental designs. All reported simulation as a valid teaching/learning strategy. Six of the studies showed additional gains in knowledge, critical thinking ability, satisfaction or confidence compared with a control group (range 7-11%). The validity and reliability of the studies varied due to differences in design and assessment methods.

**Conclusion.** Medium and/or high fidelity simulation using manikins is an effective teaching and learning method when best practice guidelines are adhered to. Simulation may have some advantage over other teaching methods, depending on the context, topic and method. Further exploration is needed to

determine the effect of team size on learning and to develop a universal method of outcome measurement.

Sanford, P. G. (2010). "Simulation in nursing education: A review of the research." *The Qualitative Report* **15**(4): 1006-1011.

Simulation in education has been used at least since the time of World War II. Simulation in nursing education in the form of static manikins, role playing, CPR manikins, and other techniques has also been utilized as a teaching modality for quite some time. 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. However, the outcome research in the area of high-fidelity simulation in nursing education is limited at this time. This article focuses on the qualitative and quantitative research currently available in this area.

Decker, S., et al. (2008). "The evolution of simulation and its contribution to competency." *Journal of Continuing Education in Nursing*, **39**(2): 74-80.

Nurse educators are challenged to implement teaching strategies that promote learners' clinical competency and critical-thinking skills. Additionally, these educators are asked to base their curriculum decisions, teaching practices, and evaluation methods on current research findings. Simulation offers a unique mode for experiential learning and evaluation, but the appropriate use of the spectrum of simulation typology requires strategic planning. Although simulation provides educators with new educational opportunities, the potential use of simulation in competency testing cannot be achieved until educators and researchers acquire the knowledge and skills needed to use this education strategy, develop realistic case scenarios, and design and validate standardized and reliable testing methods. Numerous pressures exist for clinical settings to document the competencies of their employees. Simulation could be used in the practice environment to promote and validate the clinical judgment and competency of nurses.

Hughes, R. G., et al. (2008). Enhancing patient safety in nursing education through patient simulation. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*, R. G. Hughes. Rockville, MD, Agency for Healthcare Research and Quality, USA.

The focus of this chapter is on the use of patient simulation in nursing education programs. A review of the various types of simulation is presented, followed by detailed information about the human patient simulator and its use as an instructional strategy. Specific information is provided about use of patient simulation in relation to prevention of medication errors, developing critical thinking and clinical decision-making skills, use of effective communication skills, and the importance of teamwork. The use of the METI® Human Patient Simulator (HPS) in a university nursing program is described, and an example of a patient care simulation that is used with undergraduate students is given.

Gaba, D. M. (2007). "The Future Vision of Simulation in Healthcare." *Simulation in Healthcare*, **2**(2): 126-135.

Simulation is a technique—not a technology—to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner. The diverse applications of simulation in healthcare can be categorized by 11 dimensions: aims and purposes of the simulation activity; unit of participation; experience level of participants; healthcare domain; professional discipline of participants; type of knowledge, skill, attitudes, or behaviors addressed; the simulated patient's age; technology applicable or required; site of simulation; extent of direct participation; and method of feedback used. Using simulation to improve safety will require full integration of its applications into the routine structures and practices of healthcare. The costs and benefits of simulation are difficult to determine, especially for the most challenging applications, where long-term use may be required. Various driving forces and implementation mechanisms can be expected to propel simulation forward, including professional societies, liability insurers, healthcare payers, and ultimately the public. The future of simulation in healthcare depends on the commitment and ingenuity of the healthcare simulation community to see that improved patient safety using this tool becomes a reality.

Bremner, M. N., et al. (2006). "The Use of Human Patient Simulators: Best Practices with Novice Nursing Students." *Nurse Educator*, **31**(4): 170-174.

Only recently have nursing educators begun to consider the enormous implications of using high-fidelity human patient simulation in general nursing education. As a first step in exploring the potential of this new technology with novice nursing students, faculty conducted a quantitative and qualitative analysis of students' reactions to a simulation. In addition, from the analysis and the review of literature, the faculty identified specific best practices for using this educational methodology with novice nursing students.

Parr, M. B. and N. M. Sweeney (2006). "Use of Human Patient Simulation in an Undergraduate Critical Care Course." Critical Care Nursing Quarterly, **29**(3): 188-198.

Human patient simulation provides students with experiences and skills they might not otherwise encounter in a clinical rotation. It also offers an experience during which the time is suspended, thus affording students time to think critically, make decisions, and act, as opposed to the fast-paced hospital environment where students may have neither a clear picture of the situation nor adequate time to act. This article presents the design of a simulation center within a school of nursing along with several areas of considerations for successful implementation of the laboratory. A simulation scenario focusing on the acute coronary syndrome used during a final semester critical care nursing course is described and student evaluation of the experience analyzed. The evaluation includes student assessment of the simulation process for the development of necessary patient care skills and the ability to test decision-making and critical thinking skills. The experience with the initial integration of simulation into the nursing curriculum is discussed, inclusive of opportunities for improvement.

Ziv, A., et al. (2006). "The Israel Center for Medical Simulation: A Paradigm for Cultural Change in Medical Education." Academic Medicine **81**(12): 1091-1097.

Simulation-based medical education (SBME) is a rapidly growing field, as is illustrated by the increased development of simulation centers worldwide. SBME is becoming a powerful force in addressing the need to increase patient safety through quality-care training. Recognizing the benefits of SBME, increasing numbers of bodies involved in medical and health care education and training are establishing simulation centers worldwide. The general model of most facilities focuses on a single simulation modality or a specific branch of medicine or health care, limiting their overall impact on patient safety and quality of care across the health care systems. MSR, the Israel Center for Medical Simulation, is a comprehensive, national, multimodality, multidisciplinary medical simulation center dedicated to enhancing hands-on medical education, performance assessment, patient safety, and quality of care by improving clinical and communication skills. The center uses an "error-driven" educational approach, which recognizes that errors provide an opportunity to create a unique beneficial learning experience. The authors present the Israeli experience as an alternative model, and describe the impact of the MSR model on the Israeli medical community during four years of activity. They also describe the opportunities this model has opened towards changing the culture of medical education and patient safety within Israel. Although this model may require modification when implemented in other medical systems, it highlights important lessons regarding the power of SBME in triggering and bringing about cultural changes in traditional medical education.

Bearnson, C. S. and K. M. Wiker (2005). "Human patient simulators: A new face in baccalaureate nursing education at Brigham Young University." Journal of Nursing Education, **44**(9): 421.

Simulation has been used to augment learning in the health care professions. The human patient simulator (TPS) has been used primarily by medical students but is now being used by nursing students, as well. This study explored the benefits and limitations of using an BPS as a patient substitute for one day of actual clinical experience for junior nursing students. Learning outcomes included increased student knowledge, ability, and confidence in medication administration.

Medley, C. F. and C. Horne (2005). "Using simulation technology for undergraduate nursing education." Journal of Nursing Education, **44**(1): 31-34.

As simulation technology is rapidly expanding, nursing programs are making large investments in this technology, which has great potential for undergraduate nursing programs. Unfortunately, this potential is underestimated and underused. With simulation technology, undergraduate students can gain and improve skills in a safe, non-threatening, experiential environment that also provides opportunities for decision making, critical thinking, and team building. This article describes how to use simulation technology to enhance undergraduate nursing education. The process for simulation technology

instruction, leveling content from simple to complex, and faculty resources are discussed. An example of a simulation program is included.

Yaeger, K. A., et al. (2004). "High - Fidelity Simulation - Based Training in Neonatal Nursing." Advances in Neonatal Care, **4**(6): 326-331 310.1016/j.adnc.2004.1009.1009.

Simulation-based training is a novel approach that facilitates the use of higher order thinking skills. Simulation-based training challenges medical professionals to develop cognitive, technical, and behavioral skills through the use of mannequins, working medical equipment, and human colleagues. During scenarios, trainees must make use of their knowledge base, analyze and synthesize factors contributing to the crises, and evaluate the effects of their actions. Feedback indicates that simulation-based training programs are more pertinent to and better accepted by adult learners than traditional programs. The instructional methodologies used in simulation-based training programs are more in line with the tenets of adult learning.

Gaba, D. M. (2004). "The future vision of simulation in health care." Quality and safety in healthcare, **13**: i2-i10.

Simulation is a technique—not a technology—to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner. The diverse applications of simulation in health care can be categorised by 11 dimensions: aims and purposes of the simulation activity; unit of participation; experience level of participants; health care domain; professional discipline of participants; type of knowledge, skill, attitudes, or behaviours addressed; the simulated patient's age; technology applicable or required; site of simulation; extent of direct participation; and method of feedback used. Using simulation to improve safety will require full integration of its applications into the routine structures and practices of health care. The costs and benefits of simulation are difficult to determine, especially for the most challenging applications, where long term use may be required. Various driving forces and implementation mechanisms can be expected to propel simulation forward, including professional societies, liability insurers, health care payers, and ultimately the public. The future of simulation in health care depends on the commitment and ingenuity of the health care simulation community to see that improved patient safety using this tool becomes a reality.

Nehring, W. M. and F. R. Lashley (2004). "Current Use and Opinions Regarding Human Patient Simulators in Nursing Education: An International Survey." Nursing Education Perspectives, **25**(5): 244-248.

The human patient simulator (HPS) has recently been introduced as an adjunct technology in nursing education. An international survey of nursing schools and simulation centers that collaborate with nursing schools and have purchased a Medical Education Technologies, Inc. (METI) HPS™ was undertaken in 2002. Thirty-four schools of nursing (18 based in universities and 16 based in community colleges) and six simulation centers participated in the survey. Information gathered from the survey and reported on in this article includes curricular use, faculty time and use, student opinions, evaluation, and other uses of the HPS, specifically in research and continuing education. The results provide a foundation for early use of the HPS in nursing education at all levels.

Scherer, Y. K., et al. (2003). "Acute Care Nurse Practitioner Education: Enhancing Performance Through the Use of Clinical Simulation." AACN Advanced Critical Care, **14**(3): 331-341.

Full-body patient simulators have been used for a number of years to educate nurse anesthetists and anesthesiologists. These lifelike mannequins operate from a sophisticated computerized system with the ability to generate multiple physiologic events and respond to numerous pharmacologic stimuli. The authors recently integrated the use of the patient simulator into the curriculum to educate their acute care nurse practitioner students. The learning process was divided into three steps: the presimulation experience, the simulation experience, and the postsimulation experience. These steps are described as well as important principles that need to be integrated into each phase of the process. A case scenario on respiratory failure provides an example of the simulation experience. In addition, the advantages and disadvantages of this teaching method, as identified by faculty and students, are discussed.