FACT SHEET

Improving Patient Safety Through Simulation Research: Funded Projects

The mission of AHRQ is to improve the quality, safety, efficiency, and effectiveness of health care by:

- Using evidence to improve health care.
- Improving health care outcomes through research.
- Transforming research into practice.

Introduction

Simulation in health care creates a safe learning environment that allows researchers and practitioners to test new clinical processes and enhance individual and team skills before encountering patients. Many simulation applications involve mannequins that present with symptoms and respond to the simulated treatment, analogous to flight simulators used by pilots.

The Agency for Healthcare Research and Quality (AHRQ) supports simulation research through the Agency's patient safety program. In 2011, AHRQ funded 11 multi-year demonstration grants to evaluate the use and effectiveness of various simulation approaches and the role they can play in improving the safety and quality of health care delivery. This fact sheet briefly summarizes these new projects; each summary includes the project title, principal investigator and organization, AHRQ grant number, project start and end dates, and a description of the focus and goals of the project.

> Simulation allows health care practitioners to acquire the skills and valuable experience they need safely, in a variety of clinical settings, without putting patients at risk.

Simulation has the potential to improve the safety of health care by allowing health care practitioners to acquire valuable experience, in a variety of clinical settings, without putting patients at risk. These newly funded projects will inform providers, health educators, payers, policymakers, patients, and the public about the effective use of simulation in improving patient safety.

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Project Descriptions

Immersive Simulation for Design and Evaluation of an Emergency Department IT

Principal Investigator: Ann Bisantz, PhD, State University of New York at Buffalo

AHRQ grant HS20433; Project period April 1, 2011 – March 31, 2014

Emergency departments can be noisy and confusing places where keeping track of patients can be a challenge. The goal of this project is to design and test a prototype emergency department information system with the potential to track ED patients and improve efficiency and safety, decrease ED wait times, and decrease preventable injuries to patients. The research team will use simulation and cognitive systems engineering methods to design and test prototype ED information systems that are based on an in-depth understanding of the activities of caregivers and staff within the ED. They will use a multi-phase strategy to model key aspects of ED activities, iteratively develop prototypes, and assess prototypes in a simulated clinical environment. Findings from this project will help inform EDs as they implement electronic information systems.

Improving Pediatric Resuscitation: A Simulation Program for the Community ED

Principal Investigator: Linda L. Brown, MD, Rhode Island Hospital, Providence, RI

AHRQ grant HS20286; Project period April 1, 2011 – March 31, 2014

Pediatric emergencies with critical consequences are an infrequent occurrence in community hospitals, and because they are rare, medical teams in these hospitals have very few opportunities to perfect their skill in pediatric resuscitation. This research team will use in situ medical simulation to assess the ability of Rhode Island's community emergency departments (EDs) to perform pediatric resuscitations. They aim to develop a simulation-enhanced educational intervention to improve the skills of ED staff members and optimize the systems required to perform pediatric resuscitations effectively. The project includes the implementation of a statewide, simulation-enhanced, evidence-based education intervention and an evaluation of the effectiveness and sustainability of the intervention through ongoing assessments and review of actual patient care.

Improved Patient Safety by Simulator-Based Training in Cardiac Surgery

Principal Investigator: Richard H. Feins, MD, University of North Carolina at Chapel Hill

AHRQ grant HS20451; Project period May 1, 2011 – April 30, 2014

In today's high-stakes operating room, there often is insufficient time for residents to learn surgical techniques by apprenticeship, practice their skills, and learn how to deal with adverse events. The focus of this project is to demonstrate that training in cardiac surgery techniques can be improved by combining cardiac surgery simulation technology with a rigorous, simulation-based curriculum. The researchers will assess the effectiveness of using simulator-based training in component tasks of cardiac surgery and overall procedures based on six modules: three types of cardiac surgery and three significant adverse events that can occur during cardiac surgery. They will employ a computer-controlled, tissue-based cardiac surgery simulator that has been shown to realistically duplicate an actual patient undergoing cardiac surgery. Eight institutions will participate in the study. While the project focuses on cardiac surgery residents, the results potentially could apply across a broad spectrum of surgical practice.

Improving Patient Safety Through Leadership and Team Performance in Simulations

Principal Investigator: Rosemarie Fernandez, MD, University of Washington, Seattle, WA

AHRQ grant HS20295; Project period July 1, 2011 – June 30, 2014

Team leadership and team composition are two important mediators of medical emergency team performance that have not been studied in patient safety research. This project uses a 2 x 2 (unfamiliar vs. familiar teams and leadership training vs. control) research design to evaluate the impact of leadership training and team composition on ad hoc medical emergency team performance. Ad hoc medical emergency teams will comprise emergency department nurses and physicians from multiple hospitals. The primary outcome measure is team performance, which will be assessed using a validated simulation-based research platform (scenario + team process measures + patient care measures).

Acceleration to Expertise: Simulation as a Tool to Improve the Recognition of Sepsis

Principal Investigator: Gary L. Geis, MD, Children's Hospital Medical Center, Cincinnati, OH

AHRQ grant HS20455; Project period April 1, 2011 – March 31, 2014

Sepsis is a diagnostic challenge and a leading cause of death worldwide. Failure to recognize the early signs and symptoms of sepsis and institute aggressive management significantly increases the risk of death for children

and adults. The central hypothesis of this project is that simulation-based training can accelerate the development of expertise needed by novice clinicians to quickly and accurately recognize sepsis. By identifying the unique elements of the expert's approach to sepsis, an effective, simulation-based approach might become possible. Specifically, the research team will: (1) determine the behaviors that characterize and differentiate the expert from the novice in the recognition of sepsis at the bedside and (2) develop and implement simulation-based learning interventions that accelerate the development of expertise in relation to sepsis recognition.

Using Simulation for Teaching Femoral Arterial Access: A Multi-Centric Collaborative Approach

Principal Investigator: Hitinder S. Gurm, MD, University of Michigan at Ann Arbor

AHRQ grant HS20447; Project period April 1, 2011 – March 31, 2014

Vascular complications occur in approximately 3 percent of patients undergoing coronary intervention and are associated with significant morbidity and mortality. An increase in vascular complications corresponds with the beginning of the academic cycle, and trainees have more complications in their first few procedures than later when they are more experienced. This research team will develop and implement a simulator to teach femoral artery access using a three-step approach: (1) development of a valid simulation model that provides realistic training for obtaining femoral arterial access, (2) creation of a program to incorporate the simulation model in the educational curricula of cardiology fellowships at four major institutions, and (3) collection of followup data to assess changes in complication rates across the institutions.

Improving Physician and Nurse Communication with Serious Gaming

Principal Investigator: Mary E. Mancini, PhD, University of Texas, Arlington

AHRQ grant HS20416; Project period April 1, 2011 – March 31, 2014

Communication between physicians and nurses often is less effective than it could be, and ineffective interpersonal communication has been identified as a leading contributor to preventable adverse events. Physicians and nurses traditionally receive little if any direct experiential training in communicating effectively with each other, and traditional methods for teaching communication skills often are both time-consuming and ineffective. These researchers will develop and evaluate a "serious" game to improve the communication skills of practicing physicians and nurses by increasing their understanding about the impact of ineffective interpersonal and inter-professional communication. The game will allow users to experiment with and learn more effective communication skills and behaviors through practice and feedback.

Improving Cancer Care Patient Safety Through Pathology Training Simulation

Principal Investigator: Stephen S. Raab, MD, University of Washington, Seattle, WA

AHRQ grant HS20339; Project period May 1, 2011 – April 30, 2014

Uncontrolled variability in diagnostic testing contributes to high rates of error and increased costs. The incorporation of simulation training in pathology residency holds promise for reducing variability. This research will determine whether a simulation-based anatomic pathology education combined with Lean methods of quality improvement is better than a traditional apprenticeship for reducing errors in formulating pathology diagnoses of cancer in major solid organs. The research team will conduct a double cohort case-control study in a single institution by separating residents on the university hospital anatomic pathology rotation into two groups: (1) an integrated Lean-simulation-based anatomic pathology education track and (2) a traditional apprenticeship track. They will compare resident performance and patient safety outcomes in oncology for the two tracks over a 3-year period.

Improving Patient Safety Related to Medication Infusion Pump Technology Using Systems Engineering

Principal Investigator: Alan D. Ravitz, MS, Johns Hopkins University, Baltimore, MD

AHRQ grant HS20460; Project period May 1, 2011 – April 30, 2014

Clinicians are well aware of the difficulties of using medication infusion pumps and the associated threats to patient safety, and they often adapt their activities to the cumbersome design of the infusion pump, rather than having access to machines designed to meet their needs. To address these shortcomings, this research team will: (1) define clinician requirements in the use of medication infusion pumps and develop measures of effectiveness and performance, (2) develop a rapid prototype environment to test the safety/usability of simulated infusion pumps and develop prototypes based on clinician requirements using systems engineering best practices, and (3) measure the safety and usability profile of infusion pump designs in a simulated intensive care unit setting.

A Secondary Task for Measuring Laparoscopic Skill

Principal Investigator: Mark W. Scerbo, PhD, Old Dominion University, Norfolk, VA

AHRQ grant HS20386; Project period September 30, 2011 – September 29, 2013

Laparoscopic surgery imposes significant visual-motor and attentional challenges on the surgeon, potentially putting patients at serious risk. Although clinicians can use simulators to practice their skills outside the operating room, there is no standard method to determine whether a surgeon has achieved or maintained laparoscopic proficiency. The objective of this project is to validate a new secondary task that targets the spatial skills needed to mentally translate 2-D display images into the 3-D operational space. The researchers will use laparoscopic simulators, porcine models, and fresh cadavers to demonstrate that the secondary task can be used to measure characteristics of laparoscopic skill. Successful demonstration of the hardware/software system and objective assessment methods hold good potential for coupling to any spatial task where surgeons use a video display to monitor their activities.

Creating Simulation-Based Performance Assessment Tools for Practicing Physicians

Principal Investigator: Matthew B. Weinger, MD, Vanderbilt University, Nashville, TN

AHRQ grant HS20415; Project period April 1, 2011 – March 31, 2014

Assurance of physicians' ability to detect and manage uncommon but potentially lethal events is an area of particular concern for which simulation-based performance assessment may be ideally suited. To test this approach, the researchers will: (1) develop standardized, generalizable simulation scenarios and associated tools to conduct simulation-based assessment of board-certified anesthesiologists, (2) demonstrate that simulation-based clinical assessment can be reliably delivered across multiple national sites to evaluate board-certified physicians seeking recertification, (3) describe the distribution of clinical performance during simulation, and (4) begin to address the remaining challenges and questions related to reliable and valid simulation-based assessment of practicing physicians' clinical competency.

More Information

For more information about the Agency for Healthcare Research and Quality, please visit the AHRQ Web site at http://www.ahrq.gov. For more specific information on AHRQ's research priorities and funding opportunities, please visit http://www.ahrq.gov/fund/.

For specific programmatic questions about simulation research and other patient safety topics, please contact:

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