Encouraging innovation and the use of health information technology in care delivery

Enhancing medical education and training programs

Establishing a system for distributing and applying knowledge to clinical practice

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In November 2010, the Office of the Inspector General, Department of Health and Human

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Patient Safety and Quality Health Care

In 1999, the Committee on Quality of Health Care in America, Institute of Medicine (IOM) published their first report, *To Err Is Human: Building a Safer Health System*. They concluded that as many as 98,000 die each year from preventable medical errors, a rate exceeding deaths from motor vehicle accidents, breast cancer, and AIDS. Recommended strategies to improve patient safety and quality health care included establishing patient safety and interdisciplinary team training programs for health care workers that incorporated proven methods such as simulation. The second and final report published in 2001, *Crossing the Quality Chasm: A New Health System for the 21st Century*, focused on how the health care delivery system could be redesigned to improve care so processes become patient-centric and care is optimally responsive to the needs of the patient. The Committee recognized that in addition to improved training for health care workers, the health care delivery system itself needed to be transformed. Recommendations included:

- Encouraging innovation and the use of health information technology in care delivery
- Enhancing medical education and training programs
- Establishing a system for distributing and applying knowledge to clinical practice

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Services, issued a report, *Adverse Events in Hospitals: National Incidence Among Medicare Beneficiaries*, that examined the national incidence of adverse events for hospitalized Medicare beneficiaries and estimated associated Medicare costs. Of the nearly 1 million Medicare beneficiaries discharged from hospitals in October 2008, approximately 134,000 patients (13.5%) experienced at least one unexpected adverse event resulting in harm during their hospitalization. Within this group, they further categorized 44% of the adverse events as “clearly or likely preventable.” The calculated Medicare cost associated with these events was estimated to be $324 million for the month of October 2008, equaling 3.5% of Medicare’s total expenditure for inpatient care during October 2008. To extrapolate on an annual basis, roughly 708,000 Medicare inpatients are harmed and 79,000 die from “clearly or likely preventable” adverse events. The additional annual expense spent on the health care associated with treating complications from adverse events was an estimated 3.5% of the $137 billion Medicare inpatient expense for FY2009 or $4.4 billion. They projected the actual cost to be greater since their estimates did not include the cost of outpatient follow-up care after discharge.

Many hospitals have developed targeted internal “quality” and “patient safety” programs that have decreased preventable medical errors. However, there has been little coordination of effort and sharing of best practices especially with respect to the use of new technology and the implementation of standardized training protocols for the health care provider team. As a result, overall progress has been slow towards improving the poor communication and fragmented processes that very often lead to adverse medical events.

The Call for Innovation in Medical Simulation and Information Technology

Medical modeling and simulation training has become integral to patient safety and interdisciplinary team training for health and allied health professionals. The combined complexity of medical knowledge, technical proficiency, communication and teamwork required to deliver safe, quality health care has outpaced the capacity of the traditional health care delivery system and the capability of conventional medical education and training programs. Advances in our ability to treat disease and to develop leading-edge information technology continue to progress at an exponential pace. However, there has been very little organized application of this technology to the efficiency and effectiveness of the health care delivery system. Combined with an enormous influx of technologically savvy health and allied health professionals make it essential that hospitals implement new technology that mirrors the complex requirements of the health care delivery system and medical training employ innovative simulation tools that are strategically incorporated into a standard curriculum.

Conventional medical education and training programs have a number of limitations that can lead to inconsistent quality and outcomes. Many programs have not developed a knowledge management strategy or a structured system to validate, track and archive skill acquisition and performance. Standard core curriculum and training materials either do not exist, or have not been developed according to Instructional Systems Design methodology. The system may lack an enterprise information technology architecture that consolidates performance metrics, multiple educational information sources, and mobile applications. Patient and surgical caseloads are often inconsistent, and attending physicians have various levels of experience, availability, and teaching acumen. Team or individual training is not performed on a repetitive schedule and there is no formal process to integrate lessons learned from sentinel events, near misses or incident reports.

Most medical simulation programs use a combination of sophisticated task trainers,
high-fidelity human patient simulators (HPS), and live patient actors. Nevertheless, many of these programs do not use ISD methodology and a standard curriculum that defines and tracks performance to deliver structured feedback. Quality can be variable based on the degree of instructor subject matter expertise and familiarity with simulation operations and effective debriefing methods. Due to the distance from the work area, simulation training may require a substantial time commitment that may preclude frequent or repetitive training. A high student to instructor ratio can limit individual didactic instruction. Finally, set-up and breakdown time coupled with space availability can limit training throughput.

Analysis of Alternatives

The competing missions of war, beneficiary care, homeland security, natural disaster and pandemic response training have put inordinate demands on the Military Health Service. Both military and civilian medical training opportunities fall short in offering adequate preparation for battlefield trauma due to the very dissimilar nature of traumatic injury patterns (motor vehicle accident versus improvised explosive device) and the low volume of civilian trauma cases. Medical training programs have utilized a combination of cadavers, live animals and simulation. Each modality has advantages and disadvantages. The animal model is recognized as the gold-standard for battlefield trauma training based on recent extensive experience in combat casualty care and After Action Reports. Validation of training transfer of critical skills learned from using live tissue has been established on the battlefield anecdotally and is reflected in improved survivability rates, but targeted research has not been accomplished. Nevertheless, hemorrhage from injured extremities continues to be one of the leading causes of preventable death on the battlefield and the correct application of a tourniquet, trained using live animals, has been the single most important intervention for saving lives on the battlefield.4,5,6 Live animal models provide realistic training in key areas: Hemorrhage control, intrathoracic and intraabdominal procedures, tissue handling, and multi-system physiologic response to therapeutic and procedural interventions. In addition to strong ethical concerns, the disadvantages to using live animal models include the variation from human anatomy and anatomic landmarks, the inability to perform repetitive procedures and the high degree of laboratory and veterinary support. Cadavers have anatomic fidelity but lack physiologic responses of live animals and the tissue characteristics are not optimal for surgical training. The disadvantages of both of these models also include cost and availability.

Medical Technology for the 21st Century

Transforming medical training and health care delivery first require a transformation in organizational culture. Health care provider and team training must be comprehensively embedded into an enterprise knowledge management strategy that employs innovative technology that sets training goals and tracks

performance. Repetitive training cycles must utilize a standard ISD curriculum template that integrates patient safety and process deficiencies. Fundamental to this strategy is a centralized program office and an enterprise “cloud” information technology architecture which serve as the hub for identifying training requirements, developing curriculum, facilitating communication, collaboration, sharing of best practices and the strategic insertion of innovative technology. The development of a secure web-based portal for patients can provide 24/7/365 access to:

- Asynchronous or synchronous online access to a health care provider team member
- Telemedicine and remote patient monitoring devices
- Accurate medical information and knowledge resources
- Disease management tools that set personal treatment goals
- Mobile applications and personal reminders that improve compliance
- Solutions for gathering and tracking medical or laboratory data
- Collaboration with other patients and the health care provider team
- Healthy behaviors and prevention

This level of active patient participation is absolutely vital to achieving and maintaining overall health in today’s medical environment.

**In Summary**

Medical simulation training is an effective vehicle for improving medical education and training and health care delivery. To achieve maximum efficacy, training programs should provide qualified instructors and subject matter experts for didactic instruction, facilitation and mentoring. The use of standard curriculum using Instructional Systems Design methodology and performance data capture should become the foundation for structured feedback sessions that comprehensively summarize the results of the event and provide analysis-based recommendations. Programs should incorporate leading-edge technology such as virtual reality environments, medical gaming simulations with and without haptics, synthetic tissue models, and mobile applications. An enterprise “cloud” information technology architecture should serve as the foundation for promoting communication, collaboration, and the distribution of standardized tools that track and analyze performance. Innovative technology can also be used to facilitate provider-patient communication, track treatment outcomes and provide patients access to accurate health information, accountable disease management solutions and mobile applications that empower them to take an active role in the management of their disease.
About the Author

Dr. Deborah Burgess has more than 30 years of experience and leadership in the military medical community. A retired U.S. Air Force colonel, physician, and fellow in the American College of Physicians, she designed, implemented, and led the Air Force’s medical modeling and simulation program. Built from the ground up in less than three years, the program was designated the Department of Defense (DoD) Center of Excellence for Medical Modeling and Simulation. Her expertise in the areas of battlefield trauma, disaster medicine, advanced medical simulation, medical technology development, and health care learning transfer make her a dynamic leader who contributes her expertise in expanding the capabilities of ICF’s already robust and leading-edge modeling and simulation capabilities. She is also working to strengthen the work of DoD, Department of Veterans Affairs, and other agencies in order to create a strong continuum of care and support for military personnel and families before, during, and after active duty.

Dr. Burgess holds a medical degree from the Uniformed Services University of the Health Sciences and a nephrology fellowship degree from Stanford University Medical Center. She is dual board certified in internal medicine and nephrology and holds multiple medical licenses and memberships in several professional and scientific societies.

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