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**Ingrid Philibert**  
Editor

**David C. Leach, MD**  
Consultant

515 North State Street  
Suite 2000  
Chicago, Illinois 60610-4322

Phone 312.755.5003  
Fax 312.755.7498  
Web: [www.acgme.org](http://www.acgme.org)

## Simulation and Rehearsal

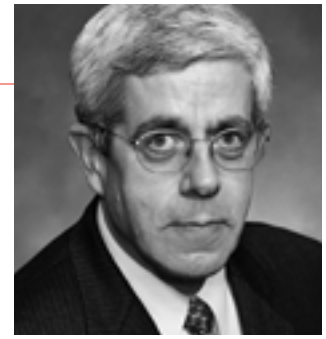
### Practice Makes Perfect

In the "Editor's Occasional Column" in the September issue of the *Bulletin*, I noted that practice, without meaningful feedback to clearly highlight positive and negative aspects of performance, may result in more deeply ingrained behaviors and responses; that practice makes "permanent," but it does not necessarily make perfect. This issue of the *Bulletin* is devoted to simulation, and its less often explicitly discussed companion -- rehearsal. The medical community has begun to see the value of simulation, in moving aspects of learning that may carry risk for patients to a venue remote from the bedside. In contrast, the term rehearsal may seem foreign. At the same time, budding and experienced musicians, actors, lawyers giving closing arguments, clergy preparing sermons would not consider engaging in these activities without some form of rehearsal, either as an explicit trial of the activity in a "low-stakes" setting, or at least

**"...musicians, actors, lawyers giving closing arguments, clergy preparing sermons would not consider engaging in these activities without some form of rehearsal, either as an explicit trial of the activity in a "low-stakes" setting, or at least as a deliberate "mental walk-through" of all the steps that will go into the actual performance."**

as a deliberate "mental walk-through" of all the steps that will go into the actual performance. At the 2004 fall meeting of the American Board of Medical Specialties, Richard K. Reznick, MD, MEd, Professor and Chair, University of Toronto Department of Surgery, drew attention to the role of rehearsal, using the example of his son, a hockey goalie, and the percentage of total pucks shot at him in one-on-one practice, inter-team scrimmage and "high-stakes" games. Solo practice and one-on-one deflection of pucks are rehearsal. The inter-team scrimmage also could be termed "simulated game."

The domains of simulation and rehearsal in medicine encompasses non-computer-dependent modalities such as human cadavers, animal models and standardized patients, along with various forms that rely on electronic technology to create situations and scenarios. They range from simple electronic models and mannequins, personal computer screen-based approaches to high-technology, high-fidelity interactive patient simulators for individuals and teams of participants. Simulation scenarios can encompass procedural tasks, crisis resource management,<sup>1</sup> and introduction of learners to clinical situations. Despite this plethora of simulation options, medicine as a whole is a relative



## Simulation: It's About Respect

David C. Leach, MD

newcomer to simulation, when compared with domains such as aviation and one medical specialty – anesthesiology. Yet in the span of a few years, robust evidence of its benefits has moved simulation from the vanguard to the cutting edge of validated practice in medical education and the professional development of practicing physicians.

This issue of the Bulletin presents some new and exciting developments of simulation in educating residents and improving clinical care in teaching settings. Several articles highlight the benefits of simulation to the advancement of learning in the six general competencies. Simulation facilitates the application of the competencies in two important ways: 1) it broadens the educational curriculum and the evaluation of learners to all six competencies, and 2) it moves education and evaluation “higher” on Millers pyramid, by enabling learning to occur from evaluations of performance in realistic,

**“...it moves education and evaluation “higher” on Millers pyramid, by enabling learning to occur from evaluations of performance in realistic, holistic scenarios that represent the “shows how” level near its apex.”**

holistic scenarios that represent the “shows how” level near its apex. Collectively, the articles in this issue make the case for simulation in facilitating the re-design of graduate medical education, and in enhancing focus on educational outcomes, and in creating necessary conditions in which practice can “make perfect.” ■

<sup>1</sup> Howard SK, Gaba DM, Fish KJ, Yang G, Sarnquist FH. Anesthesia crisis resource management training: teaching anesthesiologists to handle critical incidents. *Aviat Space Environ Med.* 1992 Sep;63(9):763-70.

### Courage

- To reveal your passion through action  
with no guarantee of success;
- To base your passion in a truth  
that may not be acknowledged by all;
- To accept criticism openly and personally  
without wavering in your commitment to the truth;
- To watch others' creative passion bloom  
knowing you've planted that seed;
- To trust others to pursue your passion, and
- To know that the fruits of their work  
will exceed the boundaries of your own imagination.  
~ Alison Clay, MD, September 23, 2005

Alison Clay, MD, is a fellow in critical care medicine at Duke University Medical Center.

*“Dr. Paul Batalden, Director, Health Care Improvement Leadership Development, Dartmouth Medical School and I were having a private conversation. Suddenly he blurted out, ‘Clinical skills should be learned as far away from the patient as possible; it’s about respect.’”*

*At the American Board of Internal Medicine Forum retreat in August 2005 Jordan Cohen, MD, President of the Association of American Medical Colleges, said, ‘People have said that the graduate educational system is broken, but it’s actually outmoded. It was designed for an earlier era and worked well for its time. The task before us is not repair, but redesign.’”*

Dr. Cohen is right – the current system of graduate medical education is outmoded. While many aspects are done well, remain relevant, and can and should be dragged into the world of the future, others need to be radically redesigned. The combination of changes in health care delivery, shortened hospital stays, more home and ambulatory care, variations in care not explained by science, declining reimbursements and, above all, the inexorable and visible failure of the current system to deliver safe care has been described as the “perfect storm.” Safer and more predictable care is needed. Paul O’Neill has said that he knows of no other industry that accepts a 38% reimbursement on amounts billed. Beth McGlynn has said that we deliver care known to be best only 54% of the time. These numbers may be related.

Simulation enhances both safety and predictability; and it will be part of the new system of graduate medical education. Every patient deserves a competent physician every time. Every resident deserves competent teachers and an excellent

**“Every patient deserves a competent physician every time. Every resident deserves competent teachers and an excellent learning environment. Simulation serves both of these core principles.”**

learning environment. Simulation serves both of these core principles. Some reasons why medical educators should routinely use simulation:

1. Clinical skills should be learned as far away from the patient as possible. Dr. Batalden is right – respect for the patient who is to undergo the procedure demands

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that the residents who have not done a given procedure do it for the first time away from the patient whenever possible. Practice should be conducted elsewhere and for the patient's benefit. Respect for residents demands that they be as fully informed and practiced as possible; that they not be asked to do something they are not yet prepared to do. People who have honed a skill in a microsurgery lab don't want to do without one. The routine use of ACLS and ATLS simulation enhances confidence and skill. Residents who have sweated at the bedside deserve more structured and supported learning.

2. Health care is one of the few high risk industries that does not conduct routine rehearsals and debriefings. Simulation allows actions to be planned, studied and debriefed – it enables safer care. Simulation is not the same as simulators. Simple rehearsals help. Complex surgeries are frequently rehearsed. Deb Simpson's team at the Medical College of Wisconsin has produced a series of CDs with embedded video clips. They focus on clinical problems in geriatrics and the cases are very realistic. The technology allows assessment of residents after each 40-60 second video clip. In a brief period of time residents become familiar with some major issues they will encounter on a geriatric service; they have conversations about what they will do; they rehearse.
3. Simulation can be used as a formative tool for resident development. Students and residents, who have heard themselves interview a patient on an audiotape, or seen themselves on a videotape, know the formative power of these technologies. Standardized patients, OSCEs, and role playing have been used in medical student education for a long time now; it is time to extend these methods into residency.
4. Simulation can be used to expose mastery of both rules and values. Familiarity with protocols becomes clear during simulations. At the same time, it also is possible to require improvisation as the learner manages emerging situations. Rules are either demonstrated or not; improvisation calls forth adaptive expertise. Improvisation exposes values. It is an efficient and safe way to explore competence.
5. Simulation can determine how residents respond in different contexts. The acquisition of competence proceeds along a continuum. Simulated cases can be made more or less complex in order to test the resident's abilities in different contexts. There are times when disciplined behavior is needed and other times when discretionary judgment is called upon. Simulation can accommodate both.
6. Simulation can be used to populate a portfolio of assessed experiences that enable residents to demonstrate their abilities. Learning portfolios have been in wide use in grade and high schools since the early 1990s. They are used by many college students and are beginning to appear in some medical schools and residency programs. Portfolios serve three purposes: reflection on experience; assessment of experiences against predetermined criteria; and a collection of evidence that can be presented to others for job interviews or for credentialing purposes. Videotaped simulations offer compelling evidence of competence.
7. Residents can intentionally make mistakes and learn about their consequences during simulations. We learn much from mistakes. Simulations allow for a wide range of responses to a given situation. Dentists have used simulation for years to refine fine motor skills of learners and to demonstrate the consequences of exceeding certain parameters.
8. Simulation offers a controlled way to learn systems-based practice. Simulations can be constructed that involve multiple interdependent variables. The simplest version of this may be "Friday night in the ED," a simulation that involves an overwhelmed emergency room, needs for inpatient and intensive care beds, nursing shortages, and transportation issues. The behavior of individuals assigned to manage each of the units determines whether the larger system can optimally manage the patient overflow.
9. Simulation can document how residents think, as well as what they think. Usha Satish, PhD, a psychologist in Syracuse, New York, has been studying residents in psychiatry, emergency medicine, and surgery at Syracuse and at Stanford. Her four-hour cognitive simulation (described in this issue of the *Bulletin*) requires the resident to manage a number of non-medical emergencies. Strategy, tactics, recovery from emergency situations, and integrative functions expose how residents approach the problems. She has found that residents in different disciplines approach the problem differently. Further, residents do not change how they think during residency. Dr. Satish's work reveals a major opportunity for residents – broadening their repertoire of options in various situations.
10. Simulation is a concrete expression of respect. The main reason to foster simulation remains respect. ACGME's Committee on Innovation in the Learning Environment (CILE) has said: "A high quality learning environment enables resident physicians to learn the art and science of medicine and to apply that learning in a monitored and mentored setting within an institution committed to: competency-based education and practice; support for professional and personal development of learners, faculty and staff; educational and clinical excellence through continuous quality improvement and innovation." Finally, a high quality learning environment is about respect. Simulation will be part of the redesign of GME. ■

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# An Overview of Simulation-Based Training at Washington University, St. Louis

David Murray, MD

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**D**uring the last decade, an increasing number of reports have suggested that simulation training could be used to enhance the skill and competence of residents. The full-scale standardized, electromechanical mannequin is a recent addition to medical training. Independent teams of anesthesiologists introduced prototypes for the current generation of full-scale simulators less than 25 years ago. The success of cockpit simulators in training airline crews and its impact in reducing pilot error stimulated simulation-based research for health care professionals. The

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similarities between anesthesia and aviation, in part, explain why anesthesiologists were the primary architects of these high fidelity devices. Not surprisingly, companies active in the manufacture of cockpit simulators licensed and marketed the first electromechanical mannequins for medical training.

At Washington University in St Louis, we purchased one of the first full scale, interactive human patient simulators in 1996. Our simulation center includes two electromechanical mannequins, a functional operating room, an adjacent control room, conference area and ‘debriefing’ room. Audio-video equipment, monitors, infusion pumps, anesthesia machines, ventilator and defibrillator are used to provide the center with the equipment needed to recreate and record realistic critical events for training. The Department of Anesthesiology operates the simulation center, but the education programs are offered to many Washington University/B-JH/SLCH Consortium residency programs. The center’s location in the ‘heart’ of clinical activity in Barnes Hospital provides easy access for residents in various clinical departments.

A simplistic view of the various full scale mannequin models is that the more sophisticated (and expensive) electromechanical simulators require fewer programming steps to create an event, are more responsive to resident actions and need less ‘real time’ input by an operator during a simulation exercise. Once a pre-programmed event is selected and modified for use, instructors are able to concentrate on resident performance rather than continuously updating the mannequin’s parameters. At the conclusion of the scenario, the simulator’s ‘condition’ offers evidence of the resident’s patient management

skill and is an essential part of the feedback. In contrast, mannequins with less complex hardware and software design require more extensive instructor programming and input to create and conduct training exercises.

Curriculum development for simulation has been a high priority for the last decade. Many of our ongoing training activities include curriculum specifically designed for ‘transition periods’ in medical student and resident education. These medical and graduate medical education transitions include 1) early clinical rotations of third year medical students; 2) the end of medical school (medical education) to intern ‘on call’ (graduate medical education); 3) the beginning of specialty training following internship; and 4) the transition to independent patient care responsibility. Time set aside for orientation and preparation of medical students and residents for these periods offers a simulation-based training opportunity. This training prepares physicians for the increased patient care responsibility. It also alleviates some of the uneasiness and apprehension that young physicians associate with their training transition. The majority of training exercises are directed to the skill domain required to manage critical events. In clinical settings, these acute situations are often associated with adverse patient outcomes.

For medical students who have mastered the skill of the interactive one-on-one patient visit, simulation training adds experiences in evaluating various emergencies. Simulated ‘patients’ with myocardial ischemia, acute abdominal pain and trauma are examples of training exercises. The trauma survey and unconscious patient evaluation are some of the skills practiced by medical students in the simulation laboratory. The simulation exercises require students to perform tasks and actions that require a coordinated team effort and are used to introduce students in early clinical training to skills in the ‘directed’ history and physical, interpreting monitoring, team work and communication. A similar, but more abbreviated curriculum utilizes the mannequin to educate medical students in psychomotor skills for airway management. This course combines psychomotor skills with exercises in managing hypoxic and unconscious ‘patients’.

In contrast to ‘passive’ didactic lectures that stress knowledge, simulation training, with its emphasis on active learning, may be better suited to individuals in graduate medical education.<sup>1</sup> Early in resident education, small groups of residents manage conditions and encounter complications related to underlying disease, invasive procedures and medical or surgical management. This offers instruction in managing events that require higher order clinical reasoning skills, teamwork and communication. Half-day sessions are subdivided into broad categories of events (airway, respiratory, cardiovascular and anesthesia equipment). During the simulation sessions, residents prioritize diagnosis and management, enlist help from members of a health care team, complete various tasks and skills in a sequential manner, interpret clinical findings and then implement a course of action.

For more advanced residents, a two hour individual session is used to evaluate their skills in managing a range of events. Eight scenarios are randomly selected from an inventory of 20-30 events that include airway and respiratory events



(pneumothorax, failed airway management, pulmonary aspiration, endotracheal tube obstruction, asthma, bronchial intubation); cardiovascular exercises (arrhythmias, anaphylaxis, hemothorax, pericardial tamponade, hypovolemia, septic and cardiogenic shock); metabolic events (metabolic acidosis, hyperkalemia, diabetic ketoacidosis, malignant hyperthermia); and various drug and equipment problems (ventilator malfunction, oxygen failure, narcotic overdose).<sup>2,3</sup> This training and associated assessment is ideally suited for providing instruction in critical patient care settings that require trainees to demonstrate higher order clinical reasoning skills.

Simulation is often cited as a training modality that could improve patient safety.<sup>4,5</sup> The most obvious benefit of simulation training, from a patient safety perspective, is that physicians develop skill and experience in various management strategies without endangering the health and life of a human patient. The cognitive, psychomotor, inferential, deductive and communicative skills that physicians use to manage acute events are effectively duplicated during simulation training. If a

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simulation-based evaluation could be applied to assess these skills, these competence domains could be measured in an objective, quantitative manner. The long-term goal is to develop simulation-based training that results in improved ability, more effective acquisition of essential practice skills domains and eventually an elevated standard of specialty practice. Ultimately, this higher practice standard will contribute to reduced patient morbidity and mortality and safer patient care. ■

*David Murray, MD is the Director of the Clinical Simulation Center at Washington University School of Medicine and the Program Director of the Pediatric Anesthesiology Fellowship at Washington University/BJH/SLCH Consortium in St Louis.*

<sup>1</sup> Williams, G. C., Saizow, R. B., Ryan, R. M. The importance of self determination theory for medical education. *Academic Medicine* 1999; 74; 992-5.

<sup>2</sup> Boulet, J. R., Murray, D. J., Kras, J., Woodhouse, J., McAllister, J. D., Ziv, A. Assessing the Acute-Care Skills of Medical Students and Recent Graduates: Reliability and Validity of Patient Simulator Scores. *Anesthesiology* 99:1270-80, 2003.

<sup>3</sup> Murray, D. J., Boulet, J., Kras, J. F., et al. Acute Care Skills in Anesthesia Practice: A Simulation-based Resident Performance Assessment. *Anesthesiology* 2004; 101, 1085-94.

<sup>4</sup> Jha, A. K., Duncan, B. W., Bates, D. W. Simulator-based training and patient safety, making health care safer: A critical analysis of patient safety practices (Evidence report/technology assessment No. 43. AHRQ publication 01-E058). Shojania, K. G. et al. (Eds); Rockville, Agency for Health care Research and Quality. 2001; 510-7.

<sup>5</sup> Gaba, D. M. What makes a Good Anesthesiologist. *Anesthesiology*; 2004;101:1061-63

## The Language of Aviation Simulation Training: Relevance for Medical Education

*Captain William Hamman, MD, PhD  
and Captain William Rutherford, MD*

The one-on-one responsibility for another human's welfare is a heavy moral burden, and our society has made it a heavy legal one as well. It thus seems paradoxical that as medical learners advance from the lecture and lab into actual care delivery in clinical settings, they are less and less likely to encounter simulation. When the stakes get high, medicine has traditionally abandoned simulation for the “see one, do one, teach one” paradigm.

In “To Err Is Human: Building a Safer Health System” the Institute of Medicine encouraged the medical community to reach out boldly to other domains for insight and inspiration for different models of performance and teaching.<sup>1</sup> Simulation in aviation is one of them, and for good reason. Effective use of simulation is a substantial contributor to making commercial air transportation the safest available mode of travel.

The culture of simulation in aviation has been integrated over our history to improve human performance in a complex operational environment. This improvement has linked the repetitive technical skills practice that simulation provides with human team performance in the operational environment. Like all simulations, these activities enhance skills, including team skills, in potentially dangerous situations through a process of learning and practice in a safe setting.

The complexities of simulation training require a multifunctional “systems” approach. This moves beyond training of individuals to dynamic team training that crosses divisions within the organization and allows communication,

**“The complexities of simulation training require a multifunctional “systems” approach. This moves beyond training of individuals to dynamic team training that crosses divisions within the organization and allows communication, accountability, and the development and maintenance of interdisciplinary teams.”**

accountability, and the development and maintenance of interdisciplinary teams. Commercial aviation has created a multi-functional system based on three principles that health care could emulate: transparency, standardization, and use of simulation.

To understand how simulation developed into the powerful tool it has become, one must understand how it is woven into

the fiber of the aviation industry. Synthetic training devices were first used extensively in training the huge number of pilots required to fight World War II. The devices were crude and relatively inexpensive, but effective. High fidelity simulation technology developed next, and for several decades it was used to teach technical skills that were too hazardous to practice in actual flight. Many of these maneuvers are difficult and must be done correctly the first – and every – time. Flight simulators are more forgiving. As the size and cost of airliners increased, and the added training pilots received made them more difficult to replace, training curricula incorporated more and more simulation and progressively less airplane time. By the early 1980s a newly qualified airline pilot's first flight in an actual plane would be in revenue service with passengers aboard.

As flight, navigation, and facilities technology advanced, accident investigations revealed the human operator to be the most fallible component of the safety equation. Seventy to eighty percent of serious incidents and accidents were attributed to “pilot error.” “Human factors” emerged as a formal discipline out of fellow pilots’ insistence on complete explanations for conditions and circumstances that could have caused skilled, seasoned colleagues to make their fatal mistake.

Human error is routinely blamed for disasters in the air, on the railways, in complex surgery, and in health care generally.<sup>2</sup> While one action or omission may be the immediate cause of an incident, closer analysis usually reveals a series of events and departures from safe practice; each influenced by the working environment and the wider

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organizational context. Understanding the characteristics of a safe and high performing system, therefore, requires research of the context, the development and maintenance of individual skills, the role of high technology, the impact of working conditions on team performance, and the nature of high performance teams. Simulation is an essential tool in the learning and understanding of high performing systems. Safety in these high reliability organizations (HROs) is ultimately understood as a characteristic of the system – the sum total of all the parts and their interactions.

This cultural evolution required the creation of a continuous improvement process. This process includes:

- An event reporting system that processes data into meaningful knowledge, creating opportunity for meaningful change within an organization.
- Simulations to study systems and to implement changes within an organization.

The importance of effective teamwork in aviation is critical to safety. The failure of a flight crew team may lead to a loss of life. Hackman notes that “it is the team, not the aircraft or the individual pilot, that is at the root of most accidents and incidents.”<sup>3</sup>

Traditionally, pilot training concentrated mainly on the development of the technical skills and performance of the individual pilot. Indeed, both researchers and practitioners suggest that more emphasis should be placed on the performance of the *crew* as a team and on factors that affect crew coordination and teamwork.<sup>3,4</sup> Ideally, team skills and the principles of Crew Resource Management (CRM) need to be introduced earlier and continuously reinforced and reviewed during flight training.<sup>5</sup> Finally, “if we want pilots to perform as a crew – as team members – we should train them as a crew throughout their course of professional preparation.”<sup>4</sup>

Human beings make mistakes. Until crew performance was studied in simulation, the captain was God in the cockpit; his crew disagreed with him at their peril. In this tradition or “culture” the airplane, passengers, and crew were exposed to the captain’s potential errors while deprived of the knowledge and skill that resided among the remaining members of the crew. Simulation studies demonstrated that airplanes could be more safely and reliably operated if the knowledge and skills of the entire crew were applied to the flight tasks. Techniques and procedures were developed in simulation that preserve and enhance the captain’s authority and effectiveness by enhancing the flow of information among the entire crew.

Contemporary airline safety is in significant measure the product of this loop of operational reporting, analysis in simulation, and training in simulation. State-of-the-art airline crew training, the Advanced Qualification Program, emerged out of simulation studies during which reported actual events were recreated in simulation. AQP identified specific team skills that enhance safety through effective use of all available resources – human, hardware, and information. The process achieved a greater degree of integration of the team skills in part because AQP team training and practice increases awareness of human and system error and provides techniques and skills that will minimize their effects. This is accomplished through awareness of crew member attitudes and behavior and the use of practical management skills.

Simulation in health care offers many of the same opportunities. The advanced medical simulator would be a wonderful tool for training the team human factor skills that are required by medical teams to function at optimum levels of performance in situations that require a broad set of skills, including crisis management. Cross-cultural training would

## An Example from Aviation

*In aviation we have learned the need to train across disciplines using simulation. On March 9, 1989, an Air Ontario Fokker F-27 was getting ready for takeoff from a small airport in Northern Ontario. There were 2 pilots, 2 flight attendants and 64 passengers on board including 2 commercial pilots traveling with their families. Takeoff was delayed as the tower waited for a small private aircraft to land. It was lost in the spring snowstorm. While the jet waited for takeoff clearance, several passengers took note of the accumulation of snow on the wings. One of them brought it to the attention of the In-Charge Flight Attendant who assured him that there was nothing to worry about. The flight attendants thought it appropriate not to say anything to the operating pilots. The aircraft took off and crashed in a wooded area just beyond the runway because of the snow on the wings. There were 24 fatalities including the 2 operating pilots and 1 flight attendant. When asked about this during the course of the investigation and subsequent public inquiry, the one surviving crew member, a flight attendant, stated that she did not feel it was her job to inform the pilots of a potential problem. She had never been trained to question an area that in her mind was clearly a pilot responsibility.*

bring together the individual technical skills of different medical disciplines to work together and build medical team concepts. The end level concept would be a cross-cultural understanding of medical teams and how each group can establish a symbiotic relationship with the others and as a team demonstrate a higher level of performance.

These processes have been very effective in making the improbable come true—high speed, high altitude, high density air travel is the safest mode of travel. Some of the fundamental elements, including the critical human element, have close analogues in health care. Literal cut-and-paste copies of aviation solutions are unlikely to produce lasting benefit in health care, but application of the same principles and processes to the unique conditions in health care offers great probability of substantial improvement in health care reliability and safety. Simulation will be an integral part of this process. ■

*Captain William Hamman MD, PhD and Captain William Rutherford, MD co-direct the Center of Excellence for Human Performance and Simulation Research at Western Michigan University.*

<sup>1</sup> Kohn, L., Corrigan, J., Donaldson, M. (eds.), *To Err is Human: Building a Safer Health System*; 2000; Washington, DC: National Academy Press, page 146.

<sup>2</sup> Reason, J. *Human Error*. 1990. New York: Cambridge University Press.

<sup>3</sup> Hackman, R.J. Teams, leaders, and organizations: new directions for crew-oriented flight training. In E. Wiener, B Kanki, R. Helmreich (Eds.) *Cockpit Resource Management* (pp. 47-70); 1993; San Diego, CA: Academic Press.

<sup>4</sup> Johnston, N., Integrating human factors training into airline pilot curricula. *ICAO Journal*, 1993; 48(7), 14-7.

<sup>5</sup> Diehl, A. E.; Cockpit decision making. *FAA Aviation Safety Journal*, 1(4), 14-16; 1991; Washington, DC.

## Simulation Training in an Emergency Medicine Residency

*Steven A. Godwin, MD, David Caro, MD, Ann Harwood-Nuss, MD*

**“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.” David Gaba, MD<sup>1</sup>**

As medical schools and ACGME-approved residency programs move toward competency-based curricula, questions have arisen as to the best method to train and evaluate essential educational experiences. Simulation training provides an opportunity for training multiple competencies, and is rapidly becoming a vital component of the medical education process. Education using simulation encompasses a variety of technologies that promote teamwork and critical decision making in patient care.<sup>2</sup> It does this by incorporating realistic patient scenarios in a controlled environment; ensuring a reproducible curriculum for all trainees; as well as improvements in psychomotor skills.

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Two of the more frequently studied technologies include virtual reality and high-fidelity patient simulation (HFS).<sup>3,4</sup> Human simulation allows educators to bridge the gap between the classroom and the “real-life” experience by challenging the student to make critical decisions and then allowing them to witness the results of those decisions in a controlled, observed and patient-safe environment with faculty and peer feedback.<sup>5</sup>

### Use of Simulation in Emergency Medicine

The ACGME Outcome Project and many of the RRCs have stimulated growth in simulation by adopting these tools as accepted modalities for training and assessing competencies. In addition to the competencies, there are clear benefits in patient safety and medical error reduction.<sup>6</sup> Further benefits of simulation training include team communication and crisis management skills that can be taught and assessed in a simulated environment.<sup>7</sup> This concept borrows heavily from the pioneering work performed in the field of military and



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civilian aviation. Our colleagues in aviation have successfully demonstrated that pilots can significantly improve performance, learn how to avoid critical mistakes, and how to execute necessary maneuvers key for a successful recovery without having to crash land a real plane. Flight-simulator-based educational tools are used to instruct flight crews in leadership and teamwork skills necessary for successful operation in complex and rapidly evolving situations.

### **Simulation at the University of Florida Jacksonville**

In 1999, the University of Florida Health Science Center/Jacksonville Department of Emergency Medicine participated in the Department of Defense MedTeams Project, which resulted in the appreciation of the value of simulation training as applied to team training exercises.<sup>8</sup> It rapidly expanded to include teaching residents problem solving and critical decision making skills. In 2002, Emergency Medicine formally integrated high fidelity simulation into its residency training, and in July 2004, the simulation training moved to a dedicated area on campus. The location enabled the residency to explore a variety of training scenarios, including mass casualty events and multiple patient encounters. The University of Florida Jacksonville currently employs simulation training using advanced resuscitation and medications in multiple treatment settings, including triage, communication and resuscitation rooms. In July 2005, the program increased simulation based training to 50% of the residents' monthly didactic time, and developed an instructor checklist of the critical action skills to be taught or evaluated. Instructors utilize review of video-taped performance during debriefing sessions to more completely assess performance. Videotaping further provides an opportunity for self-reflection and small-group discussion, with immediate suggestions for performance improvement. High fidelity simulation (HFS) allows the course of events created by a participant's decisions to dictate the scenario, including both positive and negative consequences of a participant's choices. There is significant educational value in allowing a participant to make an error, recognize it, adapt to the consequences and work through the remainder of the scenario. We have found that the teaching moments for both the participant and the observers are long lasting.

### **Critical Procedures**

It is often difficult to ensure adequate exposure for all residents to life-saving procedures that are infrequently encountered in the clinical setting, such as cricothyrotomy. Simulation training allows residents to receive training and assessment on these procedures. In addition, HFS allows for integration and evaluation of the decision to perform the procedure based on the patient's condition, with assessment of not only the procedure itself but knowledge of timing and indications. For example, "Was the patient allowed to desaturate to an unacceptable level prior to intubation?" or "Not only was the thoracostomy performed correctly but was it performed in a timely manner?" Training of rapid sequence intubation, a critical emergency medicine skill, is enhanced as the resident

works through decisions in difficult airway management prior to performing the actual procedure. A variety of other systems exist that aid in core procedural training, including ultrasound, birthing, and pediatric simulators. Skill training for technically demanding procedures such as laparoscopy, bronchoscopy, arthroscopy, and angiography are also available through simulation. Our Simulation Center currently uses a variety of simulation equipment including: Sim Man (Laerdal) full-size simulators; Air Man (Laerdal) advanced airway simulators; ultrasound simulator with ABD, OB/Gyn and FAST capabilities (Ultrasim); Central Line Man and Trauma Man (SimuLab) for procedural training; and Sim Baby (Laerdal) for HFS child/infant training.

### **Critical patient encounters**

Conventional training may not always provide the optimal number of clinical contacts for the individual learner to obtain adequate competency in all learning objectives. For example, pediatric emergencies constitute approximately 30% of all patients seen by emergency physicians. Even in busy emergency departments, pediatric resuscitations are far less frequently encountered than resuscitations for adults. New, high-fidelity pediatric simulators provide opportunities for residents to test their patient and team management skills that are vital when encountering a sick or injured child. These simulators can ensure that the participants are exposed to low-frequency but high-acuity events that they might not otherwise encounter during their training period. These educational benefits are shared across all specialties that provide pediatric care.

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**"Conventional training may not always provide the optimal number of clinical contacts for the individual learner to obtain adequate competency in all learning objectives."**

### **Teamwork**

Simulation instruction is not limited to resuscitative procedures and airway management. The benefits from team training exercises are generalizable across many clinical specialties. Beyond simple team communication skills, crisis management can be taught and assessed in a simulated environment. Topics including professionalism and communications, along with patient care, can all be formatted into these learning scenarios.

### **Other Current Offerings**

Starting a simulation training program requires institutional commitment. In 2005, the University of Florida Jacksonville Dean's Office and the Shands Jacksonville Hospital agreed to provide the organizational and financial support for the expansion of the Simulation Center, including funding for a Medical Director, a Center Manager and a Technician. The academic leadership established a broad coalition of educators



to promote quality patient care, expand patient safety initiatives, and enhance multidisciplinary health care, education, and teamwork through simulation and goal-directed training. At present, the College of Medicine, Nursing and other Allied Health are actively involved in the Simulation Center activities. All specialties, including emergency medicine, anesthesia, internal medicine, surgery, pediatrics, radiology, cardiology, orthopedics and obstetrics/gynecology have

**“The benefits from team training exercises are generalizable across many clinical specialties.”**

identified educational benefits to simulation training. The Simulation Center currently offers a yearly introduction to basic airway management and rapid sequence intubation conference for medical students, nurses, residents, fellows and pre-hospital personnel from the surrounding counties. The simulation center also hosts a number of ACLS and PALS courses, as well as ultrasound training workshops. To date, a wide variety of campus providers, as well as pre-hospital personnel, military Special Operation medics, and local and regional health care providers have participated in simulation training. We believe this cooperative and collaborative multi-specialty effort in our simulation center will allow for greater utilization of resources and the realization of common educational goals. ■

*Steven A. Godwin, MD is the Program Director and David Caro, MD is the Associate Program Director of the Emergency Medicine Residency Program, and Ann Harwood-Nuss, MD is the Associate Dean for Educational Affairs and Designated Institutional Official, all at the University of Florida College of Medicine at Jacksonville.*

<sup>1</sup> Gaba D. The future vision of simulation in health care. *Quality Safety Health Care.* 2004; 13 (suppl. 1): i2-i10.

<sup>2</sup> Bond, W., Spillane, L. The use of simulation for emergency medicine simulation. *Academic Emergency Medicine.* 2002; Nov; 9(11):1295-9.

<sup>3</sup> Reznick, M., Harter, P., Krummel, T. Virtual reality and simulation: training the future emergency physician. *Academic Emergency Medicine.* 2002; Aug;9(1):78-87.

<sup>4</sup> Gisondi, M. A., Smith-Coggins, R., Harter, P. M., et al. Assessment of resident professionalism using high-fidelity simulation of ethical dilemmas. *Academic Emergency Medicine.* 2004; Sep;(9):931-7.

<sup>5</sup> Bond, W., Deitrick, L., Arnold, D., et al. Using simulation to instruct emergency medicine residents in cognitive forcing strategies. *Academic Medicine.* 2004; May;79(5):438-46.

<sup>6</sup> McLaughlin, S., Doezema, D., Sklar, D., Human simulation in emergency medicine training: a model curriculum. *Academic Emergency Medicine.* 2002; Nov; 9(11):1310-8.

<sup>7</sup> Reznick, M., Smith-Coggins, R., Howard, S. et al. Emergency medicine crisis resource management (EMCRM): pilot study of a simulation-based crisis management course for emergency medicine. *Academic Emergency Medicine.* 2003; Apr;10(4):386-9.

<sup>8</sup> Morey, J., Simon, R., Jay, G. et al. Error reduction and performance improvement in the emergency department through formal teamwork training: evaluation results of the MedTeams project. *Health Services Research.* 2002; 37(6):1553-81.

## Doc-U-Drama: Using Dramatic Simulation to Teach About Patient Safety

*Margaret Kirkegaard, MD, MPH, FAAFP*

“Experience is the best teacher.” This adage has been a traditional tenet of medical education. Yet when it comes to medical errors and patient safety, experience may not be the best teacher. Research has shown that resident physicians who are involved in medical errors experience considerable stress, anger and guilt. They often respond with dysfunctional coping mechanisms that include distancing (this does not happen on my service), denial (not my fault) and discounting (the patient was doing poorly anyway).<sup>1</sup> This negative emotional response significantly impedes the ability to learn from the event.

Traditionally, the Morbidity and Mortality Conference has been the didactic mechanism where medical students and residents are expected to learn from negative experiences. However, when Pierluissi et al. observed 332 M and M conferences at four academic hospitals, they concluded, “In both medicine and surgery conferences, errors were infrequently discussed explicitly, and leaders infrequently acknowledged ever having made an error.”<sup>2</sup> Even when errors are explicitly discussed, the complex context surrounding the event is lost so learners are able to apply the ‘retrospectroscope’ of hindsight bias and discount the event (I wouldn’t have done it that way...). Orlander, in an overview of attributes of the M and M conference, summarizes the paradox of learning from error like this, “Reconciling educational goals with the confrontation of mistakes presents a particular challenge: education is more effective when enjoyable, not painful, and adult learning occurs best through collaboration, not prescription.”<sup>3</sup>

How then can we create an experiential learning opportunity that is real, enjoyable and still focuses the discussion on making mistakes? One solution that we developed is using dramatic simulation of medical events involving an error or multiple errors. Dubbing this technique “Doc-U-Drama,” we have written scripts dramatizing real events involving adverse outcomes as the result of a medical error.<sup>4</sup> The scripts portray the complexity of modern medical care by including roles for multiple health care providers such as the residents, attending physicians, nurses, lab technicians, receptionists, and patients across multiple settings where health care is provided such as the bedside, clinic, hospital ward, and residents’ lounge. The scripts not only convey the words and actions of the individuals but also the feelings of the characters. Here is a small example from one of the scripts that was written based on a real incident reported to the Agency for Health care Research and Quality (AHRQ) website for case discussions.<sup>5</sup>

**Float Nurse:** ...Dr. Cardio was here earlier and wrote this order for Mrs. Hill that I can't read. Can you look at it? (*hands Resident the chart*)

**Resident:** That's Dr. Cardio alright. It looks like something "K (kay)". You better page him. He's pretty fussy about his orders. How is Mrs. Hill today?

**Float Nurse:** She's still in a fib according to the signouts but stable. Well, I already tried to page Dr. Cardio. He's in the cath lab. The tech said that he would call back in a bit. I just thought maybe you would be able to read the order. (*later on...*)

**Ward secretary:** (*to the nurse*) Dr. Cardio called back. He says the order reads, "forty of K (kay)." He called from his car. He's on the way to the office now.

**Float Nurse:** "Forty of K (kay)?" I guess that probably means forty milligrams of Vitamin K. That just doesn't sound right. I should probably check it out. Can you page him again?

**Ward secretary:** Why don't you call the resident instead of paging him. You know that he really doesn't like to be paged with this kind of stuff.

This interaction and the many others that are included in the Doc-U-Drama scripts allow the participants to role-play the seemingly benign, everyday interactions that eventually allow errors to occur. As the participants "act out" the scripts, the complicated context, or what has been labeled the "second story"<sup>6</sup> in patient safety theory, unfolds for the participants. Often there is cognitive 'buy-in' from participants and comments like, "Yes, that's how it happens" or "We had a case exactly like that."

The scripts are performed by attendees and followed by a discussion of the scenario. The discussion often starts with an attempt to assign blame to one person or service involved in the scenario. Interestingly, however, participants often disagree on who is actually to blame. This discussion leads to a great illustration of the "Swiss cheese" theory of error – that small, routine "errors" that occur daily can momentarily line-up, like holes in layers of Swiss cheese, to allow a catastrophic event to happen.<sup>7</sup>

The scripts are performed unrehearsed and participation requires no preparation. Each script typically takes about 15 minutes to perform and workshops can last from one hour to three hours. Although the optimal size group is 10 to 15 learners to facilitate discussion, Doc-U-Drama has been used with groups as small as 8 learners and as large as 180 learners. If attending physicians or other health professionals participate, then dramatic roles are assigned that do not match the participants' professional roles.

In addition to being used by the authors in multiple settings, Doc-U-Drama has been adopted by the National Center for Patient Safety (Veterans' Administration) and used in several training sessions. The scripts and discussion questions are available for use on the NCPS website <[www.patientsafety.gov/psc/pscurric.html](http://www.patientsafety.gov/psc/pscurric.html)>.

The anecdotal feedback from multiple users is highly positive. Learners often describe the sessions as "fun," "realistic" and "energizing." Doc-U-Drama has not been subjected to any long-term outcomes analysis to assess the impact on residents' attitudes, knowledge or skills but the immediate results have been successful in engaging learners about systems-theory in medicine. In feedback surveys, 95% to 97% of respondents strongly agreed or agreed that Doc-U-Drama was an effective way to learn about medical errors, that it promoted systems thinking and that it created an emotionally safe environment.

A consistent criticism of Doc-U-Drama is that the scripts don't illustrate potential solutions to the medical errors. Consequently, we recommend that Doc-U-Dramas should be coupled with additional didactic and interactive workshops discussing human factors engineering, communication and team training as solutions to improving patient safety.

The use of Doc-U-Drama as a simulation technique for teaching patient safety has several advantages. One, it engages the learner to see the complexity of the situation as it unfolds in real time and removes the tendency to hindsight bias. Two, it provides an emotionally safe environment to 'experience' a medical error. The drama is emotionally engaging but also non-threatening. Three, it illustrates the systems-theory or Swiss cheese paradigm of medical errors. The unfolding story of Doc-U-Drama places the medical errors in context and stimulates creative thinking about system redesign. And lastly, it is an enjoyable learning experience. Learners consistently report that these sessions are "fun" and "feel real". We recommend Doc-U-Drama as a promising simulation tool for teaching residents and medical students about patient safety. ■

*Dr. Margaret Kirkegaard is an assistant clinical professor at Northwestern University/Chicago College of Osteopathic Medicine. She has also been a faculty member at Hinsdale Family Medicine Residency since 1992.*

<sup>1</sup> Mizrah, T. Managing medical mistakes: ideology, insularity and accountability among internists-in-training. *Soc Sci Med* 1984;19:135-46.

<sup>2</sup> Pierluissi, E., Fischer, M. A., Campbell, A. R., Landefeld, C. S. Discussion of medical errors in morbidity and mortality conferences. *Journal of the American Medical Association*. 2003;290:2838-42.

<sup>3</sup> Orlander, J. D., Barber, T. W., Fincke, B.G. The morbidity and mortality conference: the delicate nature of learning from error. *Academic Medicine*. 2002; 77:1001-6.

<sup>4</sup> Kirkegaard, M. A., Fish, J. Doc-U-Drama: using drama to teach about patient safety. *Family Medicine* 2004;36(9):628-30.

<sup>5</sup> <http://www.webmm.ahrq.gov/>

<sup>6</sup> The "first story" refers to identifying an individual to blame for an adverse outcome. The "second story" involves analyzing the event and finding all the contributing factors such as work overload, poor communication, poorly designed workspaces, malfunctioning equipment, etc.

<sup>7</sup> Reason, J. *Managing the Risks of Organizational Accidents*. Burlington, VT: Ashgate Publishing Company; 2000.

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# The Center for Medical Education and Innovation at Riverside Methodist Hospital

*Pamela J. Boyers, PhD and Edward T. Bope, MD*

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In June 2005, Riverside Methodist Hospital opened a simulation facility for residents and attending physicians. In addition to housing multiple opportunities for clinical simulation under one roof, the Center for Medical Education and Innovation™ (CME+I™) also houses a Virtual Care Unit™ (VCU™). Riverside Methodist Hospital's graduate medical education committee (GMEC) believes that in this virtual hospital setting, the management of complex cases and the hand-over of care from one level to another can be improved through practice.

Simulation has been used in several industries for some time, but it has been slow to find application in medical education. While “See one, Do one, Teach one” is familiar to everyone in medicine, the new mantra could be “See one, Practice some, Do one competently, Teach one”. With the

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**“While ‘See one, Do one, Teach one’ is familiar to everyone in medicine, the new mantra could be ‘See one, Practice some, Do one competently, Teach one.’”**

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recent development and availability of sophisticated clinical simulation models, the GMEC felt that the opportunity now existed to create an environment where residents and practicing physicians could safely practice procedures and demonstrate competencies.

## The Call for Change

The changing accreditation standards for graduate medical education are driving curricular reform. With the increasing need to incorporate the six ACGME competencies, and with the ACGME rapidly moving towards outcomes in medical education for the accreditation of residency programs, the GMEC believed that a major shift in paradigm was becoming essential. For the medical staff, the credentialing of physicians with the requirement to demonstrate continued competency was causing some angst. Simultaneously, surgeons were asking for ways to practice minimally invasive techniques and cardiologists were interested in the rapid advancement in interventional skills simulation.

## Space and Financing

Nearly 20,000 square feet of ideal space became available for the Center to be situated directly above the hospital's new Emergency Department. The GMEC moved quickly to

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**“The Executive Committee of the GMEC, (the Residency Program Directors and the DIO) worked with the architects to create a center that was dedicated to supporting the proposed paradigm shift in medical education. In this center, health professionals would practice procedures, learn and demonstrate the ACGME competencies, practice case management, and learn to work as health care teams.”**

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approve the expenditure of \$5M from the Riverside Medical Education Foundation Fund. The fund was established thirty years ago by two visionary physicians to ensure the continued support of Medical Education at Riverside. \$3.1M was for design, construction and equipping the center. \$1M was appropriated for the operation of the center for the first year; and a further \$1M seeded an operational endowment.

## Implementing the Vision

The vision was to create a learning environment that would launch us into the future. The Executive Committee of the GMEC, (the Residency Program Directors and the DIO) worked with the architects to create a center that was dedicated to supporting the proposed paradigm shift in medical education. In this center, health professionals would practice procedures, learn and demonstrate the ACGME competencies, practice case management, and learn to work as health care teams. Special emphasis was to be placed on communication among team members regarding the hand over of patients. Disaster preparedness and the handling of mass casualties were also to be incorporated.

## The Center for Medical Education and Innovation™

The center is divided into three sections: A Conference Center including a Distance Learning Suite; a Clinical Skills Lab section, including a micro vascular lab, a laparoscopy lab, an endovascular suite, and two standardized patient rooms. The third and most unique section is the Virtual Care Unit™ (VCU™).

The VCU™ consists of a central control room with four adjoining rooms: an ICU, a procedure room, a trauma suite, and an OR. Each room is outfitted with the exact equipment as their counterparts in the hospital and also with cameras and microphones so that teaching sessions can be recorded and reviewed.

The walls between each room can be raised to provide maximum flexibility for simulating the hand over of care or for the triaging of mass casualties. Each room has an adult simulator with over 72,000 possible clinical interactions. Each “patient” has vital signs monitored in synchrony with their condition.



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In the control room, medical simulation technicians work to create the scenarios and “drive” the cases. Debriefing rooms are located around the VCU™ to foster critical thinking and evaluation.

### Preparation for the Paradigm Shift

To prepare for this new model for learning, the GMEC formed four groups: Faculty Development, Outcomes Measurement, Fund Raising /Marketing, and Innovation.

These groups started to meet for four months before the opening of the Center. They consisted of physicians from the residency programs, medical staff, administrators, residents and nurses. The leaders of these groups reported monthly to the Executive Committee of the GMEC.

**“Members recognize that outcomes research on the use and effectiveness of simulation technology in medical education is in its early stages. The challenge ahead for the GMEC is to create an infrastructure in the CME+I™, including the virtual hospital, which routinely supports the measurement of skills and the demonstration of competencies.”**

### Establishing the Academic Core

The GMEC at Riverside is deeply committed to contributing to the existing studies on the impact of clinical simulation on educational and clinical outcomes. Members recognize that outcomes research on the use and effectiveness of simulation technology in medical education is in its early stages. The challenge ahead for the GMEC is to create an infrastructure in the CME+I™, including the virtual hospital, which routinely supports the measurement of skills and the demonstration of competencies. Studies will need to be undertaken that will provide evidence that simulation exercises can have a positive impact on important issues such as: the education of health professionals, patient safety, and ultimately on the quality of health care provided. ■

*Pamela J. Boyers, PhD is the Designated Institutional Official and the Director of the Center for Medical Education and Innovation, and Edward T. Bope, MD is the Director of the Family Medicine Residency Program at Riverside Methodist Hospital, Columbus, OH.*

*Other participants in this effort include the following members of the GME Committee: Thomas Boes, MD, Jeffrey Bell, MD, Oscar Ruiz, MD, Kevin Schroeder, MD, Carl Krantz, MD, Louis Unverferth, MD, and Carla Granger, Assistant director, Medical Education.*

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## The “Competent Physician:” A Web Based Training Program to Enhance Health Care Performance through Shared Knowledge of the ACGME Competencies

*Jamie Dickey, PhD, Ross Ungerleider, MD, James Anderson, MD, Dongseok Choi, PhD, Kristen Wessel, PhD, Christopher Komanapalli, MD, Donald Girard, MD*

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### Introduction and Purpose

Applying the concept of Systems-Based Practice as a paradigm for educating faculty, residents, and other health care professionals on the ACGME competencies is an important value. This value has driven an evolving educational process at Oregon Health & Science University (OHSU). The primary goal for developing a web based e-learning program at OHSU was to create shared cognitive schemas among health care professionals for conceptualizing and evaluating physician attitudes and behaviors in the five non-medical ACGME competencies throughout our institution. A description of the web based training course designed to partially fulfill this goal follows.

### Course Objectives:

The design of the e-learning course sought to meet seven objectives:

1. Develop a list of knowledge, skill/behavioral, and attitudinal objectives for each of the competency areas to guide course content, teaching methods, learning activities, and assessment.
2. Provide an engaging educational experience for physicians and other health care professionals throughout the institution, utilizing real world medical situations that demonstrate the learning objectives associated with the competencies.
3. Create a developmental rating scale to diagnose physician performance for each competency area objective.
4. Utilize the rating scale to provide an opportunity for residents and medical faculty to self-assess their performance of the competency areas.
5. Describe to health care professionals, throughout the institution, evaluation criteria for physician competency.
6. Provide an opportunity for physician reflection on practice experiences in order to identify areas for improvement.
7. Offer a course evaluation to allow for continuous course improvement.

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## Methods:

The web-based course was conceptualized as a method to introduce the ACGME competencies, not only to residents and medical faculty, but also to the OHSU institution and the larger health care community.

Course content was adapted from competency descriptors supplied by the ACGME and incorporated in the OHSU Physician Performance Diagnostic Inventory (PPDI). In addition, a developmental rating scale was created that was loosely based on the “Dreyfus Scale” and influenced by Albert Bandura’s concept of “self efficacy.” OHSU staff involved in

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**“In addition, a developmental rating scale was created that was loosely based on the ‘Dreyfus Scale’ and influenced by Albert Bandura’s concept of ‘self efficacy.’”**

the development of the course initiated a dialogue with *Planet Productions*, a local web based e-learning production company, to create the course. OHSU’s Graduate Medical Education (GME) enterprise and the Division of Cardiothoracic Surgery sponsored the project and offered it as a course to meet two goals: 1) to provide training and evaluation opportunities for residents and medical faculty on the ACGME competencies and, 2) to offer it as a learning opportunity for other health care professionals who work with and evaluate residents.

Before course content could be developed, a course design document was created in collaboration with *Planet Productions*. This document was driven by the competency objectives identified in the PPDI and it provided a template for teaching methods, learning activities, and course access, navigation, and demographic tracking, as well as, assessment methods that would be utilized and tracked for each competency area. After completion of a preliminary course design document, the next step was to organize an advisory board of interested stakeholders with representatives from medicine (faculty and residents), nursing, media, and hospital administration to review the document and move forward with creating course content to support the objectives.

The advisory board, in collaboration with the media company, sought to “bring the competencies to life” by creating a script to provide scenarios. These scenarios would reflect many of the competency concerns presently being addressed throughout our institution, and also to ensure that course content, learning activities, and assessments were relevant to learner experiences. Following completion of course scripts, video production and filming of selected scenarios began. This process involved finding locations and actors to illustrate them. The e-learning course was introduced to OHSU residents, medical faculty, and other health care professionals in June 2005.

## Course Description

The course is divided into several sections:

1. an introduction to the ACGME competencies;
2. a course description, instructions, and overview of the course objectives;
3. learning scenarios and multiple choice questions relying on audiovisuals, videos, and other types of media with illustrated narrative comments explaining consequences of choices as related to the ACGME competencies;
4. seven opportunities for residents to do reflective writing about practice applications in an online journal;
5. a self-assessment tool (OHSU Physician Performance Diagnostic Inventory) with an opportunity to identify areas for future learning;
6. a special section for program directors, but also accessible to all course participants; and
7. a course evaluation.

The course does not move through a linear progress from one section to another. It can be navigated and entered from any point. The course takes approximately 1.5 to 2 hours to complete and may be taken in shorter intervals (approx. 20 minutes). To receive credit, residents must complete 95% of the course work. Only the individual resident and his or her program director have access to an individual’s responses, reflection/journal entries, and self-assessment. Residents taking the course will be tracked by GME for completion and/or time spent on the electronic application.

## Preliminary Conclusions

OHSU recently has piloted this program to teach “competency awareness” at several residency programs around the country, including our own. Our preliminary data show a significant improvement ( $p$ -value  $< 0.01$ ) in the ability of residents (who have taken *The Competent Physician*) to identify the non-medical themes in which they need to learn and become competent, how to determine different levels of competence, and how to apply competency objectives to real life applications. We have not yet determined a way to measure the impact of the reflective journaling pieces, but substantial research in the social sciences clearly document that reflection is the key ingredient towards the development of emotional intelligence<sup>1</sup> and mindfulness<sup>2</sup> – both of which are essential to leadership. ■

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<sup>1</sup> Goleman D, Boyatzis R, McKee A: *Primal Leadership*. Harvard Business School Press. Boston. 2002.

<sup>2</sup> Siegel DJ: *The Developing Mind: How Relationships and The Brain Interact to Shape Who We Are*. Guilford Press. New York. 1999.

# Streamlined and Standardized: Rethinking the Internal Review Process to Improve Compliance Across Specialties

*Edward P. Callahan, MD, MS, Mary Gleason Heffron, PhD,  
Deborah Simpson, PhD, Mahendr Kochar MD, MS, MBA*

Implementing the general competencies, tracking duty hours and achieving maximal accreditation length is challenging within a program. They are even more difficult for an institution that sponsors multiple residencies and fellowships.

**“Although our internal review process provided an established structure for achieving institutional excellence in our residency education programs, implementation of our established protocol led to vague, lengthy, and variable reviews.”**

The internal review process offers an opportunity to apply a centralized approach to addressing all three challenges, but it too must overcome issues associated with limited resources and ineffectiveness. Among the common accreditation citations for institutions, approximately 60% are directly related to the internal review process. Therefore, by revising the internal review process, the Medical College of Wisconsin Affiliated Hospitals has found ways it could systematically improve resident education and compliance with accreditation standards.

## The Challenges: Many Kingdoms

The Medical College of Wisconsin Affiliated Hospitals (MCWAH) is the sponsoring institution for 83 residencies and fellowships, with 650 residents and 80 fellows rotating at 14 affiliated institutions in the Milwaukee region. Similar to other large academic centers, departments tend to operate independently, interpreting the ACGME requirements and general competencies within their programs to varying degrees of compliance. Per ACGME guidelines, the sponsoring institution must ensure that its accredited programs are in substantial compliance with the institutional, common and specialty-specific program requirements.

In 2002 the standards that address general competencies were added to the responsibilities of the sponsoring institutions and their Graduate Medical Education Committees. Thus, MCWAH needed a broad, consistent, and standardized means of ensuring that all of these disparate programs were in compliance with the ACGME requirements.

## The Solution: Revising the Internal Reviews

Recognizing the mandate to institutions to assume responsibility for the performance of all accredited residencies and fellowships, we sought a systematic mechanism to monitor and improve performance in every specialty. Although our internal review process provided an established structure for achieving institutional excellence in our residency education programs, implementation of our established protocol led to vague, lengthy, and variable reviews. For example, while the ACGME language was included in the protocol document, the format of the interviews, program self-review, questions, and report were largely left to the interpretation of the review team leader. Depending on the relationship between the team leader and the program being reviewed, reports ranged from overly glowing to covertly critical, and from in-depth to superficial, while their length varied between 2 and 23 pages.

## Guiding Principles and Development Process

In need of a better system, we first identified specific problems with our process and opportunities for improvement. We developed specific aims for our internal reviews: to improve medical education, ensure compliance with ACGME requirements, and increase accreditation length for all programs across the institution. To inform how we structured our internal review process, we then searched for internal review protocols from other institutions for models or component processes to meet our aims. An internet search yielded 10 accessible internal review protocols. Similar to our own, almost all had included ACGME language verbatim within their protocol. Although some were elegantly written and provided elements that contributed to our final internal review process, others were resource intensive, complex or difficult to implement, and/or did not appear to maximize the internal review process consistent with our aims.

Table 1

### Criteria for Internal Review Process

1. All components of the internal review process must work together seamlessly and synergistically;
2. Maximize use of faculty time as it is precious;
3. Eliminate unnecessary data collection while seeking congruity with commonly required PIF elements;
4. Focus internal review process on 4 target areas: Previous Citations, Program Requirements, Duty Hours, and Outcome Project;
5. Standardize the process and the products (e.g., reports) across all internal reviews;
6. The review process must model an RRC site visit (i.e., at a single site and time, based at the home program's office).

Following our review, we developed six specific criteria for our internal review process, which are presented in **Table 1**.

## Pieces of the Puzzle

The hallmark of our new system is that all component parts serve a purpose. Understanding that faculty time is precious, we wanted minimal waste. Unnecessary questions were



eliminated; the self-review, questionnaires, and team report were aligned so that every answer that was obtained had a place to be documented in the report. Since all program requirements typically include previous citations, duty hours, and outcomes project, these common elements became the foundation for our internal review process.

The most significant change was that the program director must perform a line-by-line assessment of the program requirements, place a checkmark in the margin for each compliant requirement, and note any areas of non-compliance or needing further improvement. This check-marked list is submitted to the internal review team for verification. Although technologically simple, this detailed assessment provides powerful accountability.

Table 2

### Checklist of Self-Review Documents

1. Response to previous citations;
2. Program requirements with check-marks by program director;
3. List of non-compliant requirements with specific action plan;
4. Summary of compliance and description of the method used to measure duty hours;
5. Program definitions and examples of competencies;
6. Program curriculum (goals and objectives) including evidence that residents meet objectives;
7. Measurement tools for competencies (table provided);
8. Evidence of, or plans to, develop dependable outcome measures;
9. Evidence of, or plans to, link outcomes with program improvement;

In addition, each program must submit standardized documentation that matches the ACGME requirements for duty hours and outcomes project. This objective data forces programs to provide quantifiable evidence of progress (Table 2).

### Internal Review Team Goals: Review, Verify, Recommend

After the program's self-review is completed and the documents submitted, the internal review team members have three straightforward goals:

- Review all of the documents;
- Verify, through triangulation of data, documents and human sources, that the information is accurate; and
- Recommend specific strategies for the program to achieve educational success and maximum accreditation length.

The internal review team, made up of a program director or associate director as the team leader, faculty member, resident and education professional, receive the documents from MCWAH prior to the review day. The review is scheduled to take place within a one half-day time-frame, with all of the sessions conducted at the host program's office. The team verifies information from the multiple sources, and all of the interviews are designed to feed directly into the team's final report.

**“By providing an objective, transparent accounting of compliance, along with streamlining and standardizing the process of internal reviews, the institution is now able to see the state of residency education and compliance across multiple programs.”**

The team's final report includes the standard list of strengths and areas to improve, but also areas of potential excellence. This allows the team to identify components of the program that are in compliance, but could be further developed and/or refined to maximize educational impact. By adding areas of potential excellence to the final report, the team is specifically directed to think creatively and it challenges and supports each residency program to move beyond compliance toward educational excellence.

### Feedback and the Future

The pilot stage of the new process was recently completed, and feedback has been obtained specific to our three aims: to improve medical education, ensure compliance with ACGME requirements, and increase accreditation length for all programs across the institution. The program directors found completing the self-review challenging, but they appreciate the removal of extraneous questions and the parallel nature of the documentation process to the PIF. The new half-day format has been well received by program directors and review team members alike as it makes effective use of faculty time and simulates a mock RRC site visit. Internal review team leaders have found the process straightforward and thorough. The internal review committee has found that following a consistent report format has allowed for more in-depth discussion and comparison across residencies and specialties.

By providing an objective, transparent accounting of compliance, along with streamlining and standardizing the process of internal reviews, the institution is now able to see the state of residency education and compliance across multiple programs. This dashboard view allows the institution to identify common themes and provide formative feedback to individual programs identifying specific areas for improvement and areas of potential excellence. Over time we intend to measure citations and accreditation length, looking for a widening inverse relationship, and offer educational solutions that cross specialties campus wide. ■

*Edward Callahan, MD is the Chair of the Internal Review Committee for the Medical College of Wisconsin Affiliated Hospitals (MCWAH) and program director of Emergency Medicine. He is an assistant clinical professor at the Medical College of Wisconsin (MCW). Mary Heffron, PhD is a medical education specialist for MCWAH. Deborah Simpson, PhD is an associate dean and professor at MCW in Academic Affairs. Mahendr Kochar, MD is senior associate dean for graduate medical education at MCW and the designated institutional official for MCWAH.*

# An Examination of Clinical Skills in the United States Medical Licensing Examination™ (USMLE™)

Gerard F. Dillon, PhD and Peter V. Scoles, MD

It is widely recognized that clinical skills are important to the safe and effective care of patients. Several organizations, including the Accreditation Council for Graduate Medical Education, have included some form of clinical skills in the competencies deemed important to the education and assessment of physicians practicing in the United States. From the time that the USMLE was first conceptualized, more than 15 years ago, it has been the intent of the National Board of Medical Examiners® and the Federation of State Medical Boards (the organizations that sponsor USMLE) to include clinical skills among the areas assessed as part of the examination program supporting the US medical licensing system. After many years of development, this goal became a reality in June 2004 when the USMLE Step 2 Clinical Skills (CS) exam was

**“The inclusion of the formal assessment of these skills is a milestone in the effort to measure the knowledge and skills necessary for practice of medicine.”**

administered for the first time. The inclusion of the formal assessment of these skills is a milestone in the effort to measure the knowledge and skills necessary for practice of medicine. This new component of USMLE, which includes a live physician-standardized patient encounter as the testing context, reflects the environment in which most physicians apply their knowledge and skills.

Step 2 CS examinees rotate through a series of 12 stations in which they interact with standardized patients (SPs) who are trained to portray real patients. The cases represent a broad spectrum of common and important symptoms and diagnoses. Examinees are assessed on three subcomponents: 1) the Integrated Clinical Encounter (ICE), which includes the ability to take a relevant history, perform a focused physical examination, and clearly summarize findings in a patient note; 2) Communication and Interpersonal Skills (CIS), which includes skills at gathering information, sharing information, and establishing a rapport with the patient; and 3) Spoken English Proficiency (SEP), which requires clear communication within the context of the doctor-patient encounter.

For the ICE subcomponent, history-taking and physical examination skills are assessed by the SP using case-specific checklists, and the patient note is assessed by physicians who are trained in the rating process and in the focus of the specific

**“Scores on all subcomponents are accumulated across cases, and pass/fail determinations are made at the total test level using criterion-based standards established by the Step 2 Committee.”**

case. The SEP and the CIS subcomponents are assessed by the SPs, who provide a global rating of these skills using a series of generic rating scales. Scores on all subcomponents are accumulated across cases, and pass/fail determinations are made at the total test level using criterion-based standards established by the Step 2 Committee. Examinees must pass ICE, CIS, and SEP to obtain an overall pass on Step 2 CS.

The Step 2 CS exam is administered at five regional test centers in Atlanta, Chicago, Houston, Los Angeles, and Philadelphia. The centers have the combined capacity to administer as many as 35,000 Step 2 CS exams per year. During the first year of testing, over 16,000 Step 2 CS examinations were taken by US and Canadian students, and nearly 14,000 by international students. For their first attempt at Step 2 CS, the pass rate was 96% for US/Canadian students and 83% for international students.

Step 2 CS comprises one component of the Step 2 examination; the one-day, Step 2 Clinical Knowledge (multiple-choice) examination is the other. Candidates must pass both components of the Step 2 examination, along with the USMLE Step 1 (multiple-choice) examination, as prerequisites for taking USMLE Step 3 (a multiple-choice and patient simulation examination). Step 1, Step 2 Clinical Knowledge and Step 3 are all computer-delivered examinations. Additional information about the Step examinations can be found at the USMLE website <[www.USMLE.org](http://www.USMLE.org)>. ■

*Gerard F. Dillon, PhD is the Associate Vice President, USMLE, and Peter V. Scoles, MD is the Senior Vice President, Assessment Programs, both at the National Board of Medical Examiners.*

*Patient Care*

## **CALL FOR ABSTRACTS**

**2004 ACGME ANNUAL EDUCATIONAL CONFERENCE**

March 3-5, 2006

The Marvin R. Dunn Poster Session



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### **“Advancing competency in Graduate Medical Education”**

The Accreditation Council for Graduate Medical Education (ACGME) invites proposals for poster presentations at its annual conference on March 3-5, 2006 at the Gaylord Palms Resort and Convention Center in Kissimmee, Florida. Program directors, faculty, administrators and residents interested or involved in graduate medical education (GME) are encouraged to submit proposals.

#### **SUGGESTED TOPICS FOR SUBMISSION**

This year the ACGME welcomes posters that report on successful initiatives to improve graduate medical education related to: 1) teaching and assessing the general competencies (with a special interest in use of portfolios); 2) using assessment results to drive and guide educational improvement; 3) changing the learning environment or redesigning education and patient care (includes approaches for improving patient safety and reducing resident duty hours); and 4) implementing strategies and methods, including faculty development, to facilitate educational improvement at the institutional or program level.

#### **SUBMISSION PROCESS**

To be considered for a presentation, your abstract submission must be received electronically by **January 6, 2006**. All submissions will be reviewed and evaluated by the judging panel for relevance, content and clarity. Notification of acceptance for presentation will be e-mailed by **January 13, 2006**. Poster presenters will be required to prepare a poster for the session and be available from 5:00 pm - 7:00 pm on the evening of Friday, March 4, 2006 to discuss the poster. Accepted abstract submissions will be printed for distribution to program participants as a part of the workshop agenda.

**ALL PRESENTERS ARE REQUIRED TO REGISTER FOR THE WORKSHOP.**

*Systems-Based Practice*

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## FORMATTING INSTRUCTIONS

Abstracts must be submitted as a single-page document typed in Microsoft Word or Word Perfect format. Margins should be 1-inch on all sides. DO NOT use abbreviations in the abstract title. The abstract title should be typed in ALL CAPS. The title should be brief, but clearly indicate the nature of the project or investigation.

The author(s) name(s) and institutional affiliation(s) should be typed in Title Case (upper and lower letters) on the line after the title. The abstract must be sent to <[abstracts@acgme.org](mailto:abstracts@acgme.org)> as an e-mail attachment. The sender of the abstract should be the lead author. All communication will occur with the lead author. Questions regarding the abstracts should also be sent to this electronic address.

NOTE: Simple graphs or tables may be included if they fit on the single page. The text of the abstract must be organized into the sections below (use headings in bold):

1. **Purpose** of investigation or project
2. **Methodology**, including investigation or project design and analysis
3. **Summary of results** (if applicable)
4. **Conclusions**

### Abstract Checklist:

1. The abstract must be typed in 10-pt or 12-pt Arial or Times Roman font style; margins must be 1-inch on all sides.
2. The title should be typed in ALL CAPS.
3. Content of abstract should be single-spaced with double-space only between title and author's names.
4. The abstract must not exceed 300 words and must fit on a single page. Not more than three references may be included. If references are used, they must still fit on the single page.

## SUBMISSION DEADLINE AND NOTIFICATION

All submissions must be received at the ACGME office no later than **January 6, 2006**. Submissions must be sent electronically according to the format outlined above. No substitutions will be accepted. Authors will receive confirmation of their submission upon its receipt in the ACGME office. The first author will be notified by **January 13, 2006** whether the submission has been accepted for poster or oral presentation. Display specifications and communication guidelines will be provided at the time of acceptance.

Abstracts submitted to other national meetings are acceptable provided they have not been accepted for publication in a peer-reviewed journal prior to the meeting date.

**Please note that the ACGME does not endorse any commercial medical education products, and therefore will not accept abstracts promoting the use of these products.**

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# Using Strategic Management Simulation to Evaluate Physician Competence: A Challenge and a Vision

*Usha Satish, PhD, Thomas Krummel, MD, FACS, Tina Foster, MD and Satish Krishnamurthy, MD, MCh*

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In the past, the assessment of medical residents has primarily emphasized factual/technical knowledge and, to a lesser extent, more complex problem solving competencies. Factual knowledge and technical competencies vary widely across specialties, and their assessment must be specific to the particular professional field. At the same time, there are

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**“Generic skills form the substrate upon which specialty specific skills can be executed effectively.”**

important generic underlying capacities that contribute to success, capacities which are common to different fields and specialties. Unfortunately, we often fail to discover these generic capacities when we focus on measuring only factual knowledge or technical competence. Generic skills form the substrate upon which specialty specific skills can be executed effectively.

Overall, competence in medical practice is a habit that engages all human faculties,<sup>1</sup> and involves functioning in health care systems at both a macro and a micro level.<sup>2</sup> How is competence in medicine attained? Leach proposes that medical students progress from novice to advanced beginners. Residents, in turn, progress from advanced beginners to competent.<sup>1</sup> During this development, there is a change in thinking processes from algorithmic or rule-based approaches to a process that is able to take into account a particular patient’s unique needs. This is the skill of knowing which rule to break and how to break it to best serve this particular patient. This movement from rule based to specific (and potentially more complex) context based thought and behavior requires the development of underlying competencies in the realm of thinking processes.

How is competence best measured? Given the need to function in systems at both a macro and a micro level, simultaneous measurement that relates to both micro and macro systems the individual needs to navigate is required to provide clear assessment of underlying competence. This task is best accomplished when the context of measurement closely approximates the information processing skills needed in the real world environment. A successful approximation would help to alleviate some of the problems generated by subjective and sometimes amorphous assessment processes.<sup>3, 4, 5, 6</sup> In addition, a reality oriented assessment system provides

the potential for feed-back and future learning.<sup>7</sup> Measurement could occur in a real-world setting, but just as with the attainment of procedural skills, a simulated environment facilitates both assessment and training.

## **Need for Novel Assessments: Complexity and SMS Simulations**

Several tools are available to assess the many factors necessary to be a competent physician. Tests to measure factual knowledge (multiple choice quizzes, oral exams), clinical skills (Objective Structured Clinical Examinations (OSCEs), Standardized Patient Examination, etc.) and communication and interpersonal skills (evaluation of recorded or live performance, patient surveys and similar measures) are effective in assessing education in these particular domains. These tools assess competencies separately. They may be subject to evaluator bias. In addition, none of these approaches measures how effectively a physician combines these different skills in the real world environment.

The multidimensional aspects of competence make the verification and certification of physician competence an extremely challenging task.<sup>8</sup> This multi-dimensional aspect, and the measurement of competencies under conditions of ambiguity and uncertainty, are addressed by complexity theory.<sup>9, 10</sup> Many writers concerned with instructional technology view the complexity approach as the optimal basis for skill acquisition in today’s environment. As Tennyson

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**“The multi-dimensional aspect of competence, and the measurement of competencies under conditions of ambiguity and uncertainty, are addressed by complexity theory.”**

and Breuer have stated: “Complexity theory provides the needed guide toward training technologies which employ contemporary requirements for cognition based instructional strategy.”<sup>11</sup> Early versions of complexity theory originated in the behavioral and management sciences; later versions encompass all fields of science, including physics, chemistry, economics, medicine and more. Behavioral complexity theory describes characteristic competencies that are needed to deal effectively with complex challenges. It has generated the basis for multiple competency assessment technologies that capture those competencies in a reliable and meaningful fashion. Theory-based assessments allow the holistic, simultaneous interactions among competency components to be assessed, free of evaluator bias, and in a manner that is generic in its applicability to various professions. More important, these assessments set the stage for subsequent feedback and learning. Once the rules of this learning are internalized by the individual it sets the stage for a life-long process of optimal learning.

Complexity theory views competency as the combination of various skills as they interact with the pieces of information a person has, and how the person uses these skills and the available information in relationship to each other. Complexity theory based assessment allows evaluation of individual generic competencies and evaluation of how these competencies interact in solving a problem. Technology for complexity theory-based simulation (SMS) has been developed, tuned, and validated over more than a quarter century. This simulation technique immerses the subject in a real world scenario for a period of time and objectively assesses performance.<sup>9,12</sup> Since many events of a computerized SMS scenario do not change with the responses of the subject, the technique is effective in comparing the performance of different subjects with each other and comparing competency to established criteria of excellence.

The SMS technique captures a range of skills and focuses on multiple capabilities that allow flexible and appropriate behaviors, including the development of novel approaches to the solution of difficult challenges. Several writers have described simulation techniques in general, and the SMS simulation in particular, as the optimal means to effectively

**“The SMS simulations have been as useful as other technologies where competence in routine skills is measured, but they are even more and uniquely effective for assessment and training when professional task requirements are multi-faceted and complex.”**

train thinking strategies that are needed today.<sup>13,14</sup> The SMS simulations have been as useful as other technologies where competence in routine skills is measured, but they are even more and uniquely effective for assessment and training when professional task requirements are multi-faceted and complex.

### Description of SMS Simulations

The SMS simulations were developed to provide “multiple competency” measurement in tasks and task situations that are potentially complex and volatile, and that contain ambiguity, uncertainty and delayed feedback. The measurement system allows evaluation of several subtle (sometimes difficult to measure) components of professional functioning, including communication, teamwork, use of knowledge, breadth of approach, integration of knowledge with incoming information, and use of planning and strategy. SMS simulations have been used in North America, Europe, Australia and Asia to assess and train decision makers such as government and private industry executives, lawyers and others.

The wide applicability of the SMS technique to various professions is based on its applicability in multiple settings. It focuses on “how” a person conceives of, utilizes and applies

any technical skills he or she has obtained. The “how” of functioning extends to all of the competencies that are discussed by writers who are concerned with instructional technology. For example, the simulation measures whether a person is capable of developing and applying novel solutions where required, not merely whether some limited specific level of a well-learned problem-solving capacity is utilized in his or her particular job setting. The SMS simulation’s universal approach to the measurement (and training) of competence in complex task settings has been repeatedly demonstrated. The simulation has provided extensive data (published in more than 300 scientific publications) in the fields of management, psychology, pharmacology, rehabilitation and other disciplines.

Measurement via the simulation technique provides both numeric and graphic (computer generated) information on an individual’s competence across a range of responses to task demands. Assessed performance attributes on 25 validated performance indicators vary from “simpler” measures of competency in categories such as “activity” and “timeliness of response,” through categories such as “information orientation,” “information utilization” and “emergency management” to increasingly complex measures in such areas of functioning as “initiative,” “breadth of approach to challenges,” “planning,” and “strategy,” among others. The simulation identifies where a particular person does show competence, and in which areas of thought and resulting action aspects of competence are still limited or inadequate, allowing for focused remediation. In other words, SMS simulations provide a direct metric for improvement.

**“The simulation identifies where a particular person does show competence, and in which areas of thought and resulting action aspects of competence are still limited or inadequate, allowing for focused remediation.”**

### Reliability and Validity

High levels of predictive validity, reliability and applicability of the SMS simulations to real world settings have been repeatedly demonstrated across multiple professions.<sup>14,15,16</sup> Validity data collected in various countries have demonstrated that the SMS simulation consistently predicts decision maker success across professional specialties, cultures and continents (predicting an individual’s achievement and future success level on indicators such as “job level at age,” “income at age,” “promotions” and “number of persons supervised,” etc.). Overall validity coefficients consistently exceed  $r=.6$ . Reliability values range between  $r=.7$  and  $.94$ .

### Conclusions

Physician competency includes specific knowledge domains regarding the patient, the disease and possible management options, as well as specific technical and communication



skills. Beyond that, competency encompasses the ability to acquire and prioritize information and the ability to integrate and synthesize a plan of action that results in the best outcome for the patient. Even more significantly competence in medicine requires the ability to identify the myriad of rules, values and virtues in medicine and distinguish between them. In addition to its use in developing technical skills, simulation can be used to help develop and assess these more complex abilities. The SMS simulations, with their long history of use and validation in many other professions, are a new and exciting tool which can be used for the professional development of residents and physicians. ■

*Usha Satish, PhD, is Associate Professor in the Department of Psychiatry and Behavioral Sciences and Satish Krishnamurthy, MD, MCh is Associate Professor in the Department of Neurosurgery, both at SUNY Upstate Medical University; Thomas Krummel, MD, FACS is Professor and Chair, Department of Surgery at Stanford University School of Medicine; Tina C. Foster, MD is Vice Chair of Obstetrics and Gynecology (check) at Dartmouth Hitchcock Medical Center.*

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## Simulation and Rehearsal with Live Actors: Standardized Patients in Resident Education

*Ingrid Philibert*

In addition to simulation using technology in some form, standardized patients (SPs) and other “actors” are used in the education of residents to ensure comparable learning experiences, rehearse difficult or rare situations, and allow evaluation of clinical and communication skills. Proponents of technology-facilitated simulation using computers and mannequins have emphasized that standardized patients “have no clinical findings.” Supporters of the use of SPs note that living human beings bring realism to the interpersonal and emotional responses that mannequins and computer models cannot equal. The non-exhaustive sampling of the literature on the use of standardized patients that follows highlights the breadth of their application in the education of residents. The majority of articles describing the use of SPs focused on enhancing communication and interpersonal skills related to patient and family encounters.<sup>1,2,3,4,5</sup> A smaller group addressed the use of SPs in the development of both clinical skills and communication skills in residency.<sup>6,7,8</sup>

Yudkowsky et al. piloted an objective structured clinical examination (OSCE) in which SPs rated surgical residents’ communication and interpersonal skills on six challenging communication tasks.<sup>1</sup> In addition to receiving feedback from the SPs at the end of each encounter, residents completed a survey of their experience and their level of comfort with each encounter. Serwint described the use of standardized patients in educating pediatric residents about palliative care, including communicating bad news and understanding the emotions residents and patients’ families may experience.<sup>2</sup> The article also addressed the development of realistic cases that address educational goals, types of SPs and their strengths and weaknesses, and recommendations for resident evaluation. Quest et al. described a one-day educational intervention including SPs examinations to teach residents disclosure of a patient’s death to family members, finding poor agreement between residents’ and faculty’s ratings of resident competence, commenting that this finding has important implications for curriculum design.<sup>3</sup>

Klamen and Yudkowsky used SPs in a nine-week introduction to Psychodynamic Psychotherapy course for first-year psychiatry residents. The SPs provided written feedback to the residents on their simulated psychotherapy sessions. Residents, SPs and faculty rated the experience positively, and the authors found SPs to be a valuable learning modality for the early years of psychotherapy training.<sup>4</sup> Roth et al. described a communications exercise for first-year medicine residents using SPs, with the goals of 1) teaching interviewing skills at the start of residency, 2) assessing resident skills and confidence with specific types

of interview situations, 3) developing faculty teaching and assessment skills, 4) encouraging collegial interaction between faculty and residents, and 5) guiding curriculum development. Scenarios included dealing with an angry family member, providing counseling for smoking cessation, setting agendas for patient encounters and delivering bad news. Performance profiles were created for each resident. Feedback on the program was positive, and the authors plan to repeat the exercise for first-year residents, and develop an expanded version for residents in the second and third year.

Nagoshi et al. used an eight-station SP examination to assess clinical skills related to the care of geriatric patients in medical students, residents and Geriatric Medicine fellows.<sup>6</sup> The exercise had a high reliability score ( $\alpha = .89$ ), and that examinees found it valid and fair. However, scores decreased with the level of training, and the authors suggested that a single format may not be appropriate across the educational continuum. Stratton et al. examined the relationship between emotional intelligence and medical students' clinical skills in a required comprehensive performance examination.<sup>7</sup> It showed that Attention to Feelings, Empathic Concern and Perspective Taking were ( $p = .05$ ) positively correlated with communication skills, but Empathic Concern and Perspective Taking were negatively associated with physical examination skills. Wilson used standardized patients to assess the clinical and interviewing skills of entering internal medicine residents.<sup>8</sup> They found the residents adequately documented history, but did not address pertinent physical findings. They also did not consistently make problem lists, provide a differential diagnosis, or report clinical reasoning. The author noted that the examination facilitated identification of specific deficiencies in the skills for new residents and allowed clinic preceptors to address them. ■

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## Practical Tools to Help You Address Resident Fatigue and Impairment

*Kathryn M. Androlsek, MD*

Since July 2003, the ACGME common program requirements have mandated graduate medical education programs to monitor resident well being and fatigue.<sup>1</sup> In February, it underscored that “Providing residents with...sound didactic and clinical education must be carefully planned and balanced with concerns for patient safety and resident well-being.” The institutional requirements stipulate

**“Providing residents with...sound didactic and clinical education must be carefully planned and balanced with concerns for patient safety and resident well-being.”**

“Formal written policies and procedures governing resident duty hours that support the physical and emotional well being of the resident and...ensure residents participate in an educational program regarding physician impairment.”

Formal efforts to deal with physician impairment began in the late 1950s. Sentinel work, including the Institute of Medicine’s “To Err is Human,” has linked issues physician fatigue with medical error.<sup>2</sup> Physicians, like all individuals, have a risk of developing a mental health disorder at some point in their lives.

North Carolina is the 8th leading state in the nation in the number of residents it trains. Of the 100,000 residents in the US, approximately 2,500 receive their residency education in one of the state’s 13 teaching institutions. These institutions include large academic health centers, military installations, community hospitals, and AHEC and private practice settings.

In early 2003, Duke University and the University of North Carolina joined forces to address this issue. This resulted in convening a team that included representatives from both institutions, the North Carolina Physicians Health Program, and the North Carolina Area Health Education Centers. The effort was endorsed by the North Carolina Medical Board and the Southern Medical Association. The team committed to develop an instructional program to help program directors, faculty and residents prevent, identify, and manage fatigue and impairment.

A needs assessment of North Carolina’s residency programs in 2003 revealed that one-half of them provided no formal education in physician fatigue and impairment. Programs expressed a lack of confidence in their ability to diagnose or successfully manage a resident with impairment

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and/or fatigue. Approximately one third of respondents felt the new limits on duty hours would have no effect on resident fatigue and nearly one half predicted an increase in resident stress due to the duty hour restrictions. Anecdotally, programs expressed concern regarding their ability to fulfill the ACGME expectations.

To respond to this need, the team developed a curriculum to address fatigue and its management. The development of the curriculum is facilitated by a grant from the Josiah Macy, Jr. Foundation. An advisory board was recruited. It included Designated Institutional Officials, program directors, residents, medical students, deans and chancellors, nursing and physician assistant leadership, state medical boards, physicians' health programs, and national "experts" on fatigue, GME legal issues, and physician impairment.

The curriculum is "case based" and covers seven prototypical situations. An 8<sup>th</sup> case outlines how to give balanced performance feedback.

The seven topics include:

- fatigue,
- stress and depression,
- burnout,
- disruptive behavior,
- alcohol and chemical dependency,
- boundary violations,
- other forms of impairments,

The curriculum is available at no charge in two formats: 1) an interactive workshop designed to enhance faculty skills to prevent, identify and manage common situations of resident fatigue and impairment; and 2) a set of CD ROMs and a teachers' guide that includes workshop content and help to facilitate the use of the materials in a given residency program.

Up to six hours of Continuing Medical Education Credit is available to those eligible.

To sample the curriculum; order the CD-ROMs and teachers' guide; and locate upcoming workshops, visit: <[www.lifecurriculum.info](http://www.lifecurriculum.info)>

For questions, contact Kathryn Andolsek, MD, MPH at: [Kathryn.andolsek@duke.edu](mailto:Kathryn.andolsek@duke.edu) ■

*Kathryn Andolsek, MD, MPH, is the Associate Director, Graduate Medical Education and Interim Associate Dean, Continuing Medical Education at Duke University Medical Center. This project was made possible in large part by a grant from the Josiah Macy, Jr. Foundation.*

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<sup>1</sup> ACGME Common Program Requirements for Resident Duty Hours and the Working Environment, <[http://www.acgme.org/acWebsite/dutyHours/dh\\_Lang703.pdf](http://www.acgme.org/acWebsite/dutyHours/dh_Lang703.pdf)>

<sup>2</sup> Kohn, L., Corrigan, J., Donaldson, M. (eds.), *To Err is Human: Building a Safer Health System*; 2000; Washington, DC: National Academy Press, page 146.

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## Competencies in the Press: Simulation in Learning and Assessment

*Deirdre C. Lynch, RhD*

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**M**edical education is changing. Nowhere is this change more dramatic than the growing use of simulation to aid learning and assessment. Simulation exercises range from low-technology activities, such as practicing suturing on oranges, to high technology simulation such as intubating a computer-driven, full-length mannequin. The ethical argument for the use of simulators is based on the belief that patient safety is enhanced when learners practice their skills, especially invasive procedures, on simulators prior to performing these procedures on live patients.<sup>1</sup> There are, however, other good reasons to integrate simulation into medical curricula. Simulation helps to standardize teaching and assessment, thus learners have the

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**"Some high tech simulators record learner performance, thus aiding collection of reliable data and mitigating the need for multiple assessors."**

benefit of similar educational experiences. Some high tech simulators record learner performance, thus aiding collection of reliable data and mitigating the need for multiple assessors. Many simulators provide learners the opportunity to practice skills as often as they want. Simulators can be set up to provide opportunities to rehearse skills needed for rare or unusual cases. Recent advances in simulation technology help simulation scenarios to be more realistic and thus be more effective in engaging learners. Summaries of three articles below show how simulators can be used to teach and assess components of the following general competencies: Professionalism,<sup>2</sup> Systems-based Practice,<sup>3</sup> and Patient Care.<sup>4</sup>

**Gisondi MA, Smith-Coggins R, Harter PM, Soltysik RC, Yarnold PR. Assessment of resident professionalism using high-fidelity simulation of ethical dilemmas. Acad Emerg Med 2004;11:931-7.**

Can simulation be used to assess Professionalism? Based on their work with emergency medicine residents, Gisondi and colleagues would say "yes." They incorporated simulation into an existing course on medical crisis management. They identified Professionalism issues encountered during their



training in the emergency room. The following five areas emerged: patient confidentiality, informed consent, withdrawal of care, practicing procedures on the recently deceased, and use of do-not-attempt-resuscitation orders. The authors then created patient-physician scenarios for each professionalism area that built on the preceding medical crisis. Five assessment tools were developed by determining specific behaviors required to adequately address each scenario. For example, behaviors in the withdrawal of care checklist included “resident determined the surrogate decision-maker” and “resident asked for an advance directive/DNR form.” Each checklist contained at least one critical behavior and had “yes” or “no” scoring options.

**“The simulations required residents to integrate their knowledge, attitudes, and skills to address the scenarios unlike many assessments that tend to measure these domains separately.”**

First, second, and third year residents participated in two half-day sessions of the modified crisis management course. The course was conducted in a simulation center that contained high-fidelity patient simulators (computer-driven, full length mannequins). Three physicians directly observed the residents, via a two-way mirror and scored their performances. The observers then compared their scores and resolved disagreements by looking at videotapes of scored performances and coming to a consensus. Residents received feedback after each scenario.

Results indicated that second- and third-year residents completed significantly greater mean numbers of checklist behaviors than the first-year residents. Senior residents were also more likely to complete the critical behaviors for each scenario. These results suggest that residents learn some aspects of professionalism as they progress through training. More revealing to the authors was that this type of assessment could help them to uncover educational needs that traditional assessment approaches, could not. The authors noted that the simulations required residents to integrate their knowledge, attitudes, and skills to address the scenarios unlike many assessments that tend to measure these domains separately.

**Shapiro MJ, Morey JC, Small SD, Langford V, Kaylor CJ, Jagminas L, et al. Simulation based teamwork training for emergency department staff: does it improve clinical team performance when added to an existing didactic teamwork curriculum? *Qual Saf Health Care* 2004;13(6):417-21.**

One component of Systems-based Practice is the ability to engage in effective teamwork. In their study, Shapiro and colleagues describe the use of high tech simulation to foster team skills. Four teams, consisting of one emergency medicine resident, a physician, and three nurses, participated in the study. Two teams participated in the simulation exercises and the others served as comparisons. All participants had previously completed didactic

coursework on emergency team coordination. Shapiro and colleagues created simulation scenarios to help participants apply their knowledge about teamwork.

Three 30-minute scenarios of increasing difficulty were developed. Designed to approximate actual medical crises, the scenarios required the simultaneous engagement of all team members on multiple patients. The scenarios occurred in a medical simulation center that appeared and functioned just like an emergency room. Teams were debriefed after each scenario and their videotaped performances were used to illustrate strong and weak team behaviors. Feedback focused on the following five dimensions of teamwork: maintaining team structure and climate, applying problem-solving strategies, supporting the team with information, executing plans and managing workload, and improving team skills.

The Team Dimensions Rating Form was used to measure team performance. Measurements were conducted by two trained assessors who observed the teams in the emergency room prior to and following the simulation session. Although team performance improved for the two teams who participated in the simulations, the change was not statistically significant. The two comparison teams did not improve. Participants rated the simulation as being an excellent or very good experience and generally agreed that the scenarios were realistic and a good way to practice team skills.

**“This article is helpful because it describes a creative approach to teaching and assessing one component of Systems-based Practice, using high-tech simulation and multi-provider and multi-patient scenarios.”**

This article is helpful because it describes a creative approach to teaching and assessing one component of Systems-based Practice, using high-tech simulation and multi-provider and multi-patient scenarios.

**Clark JA, Volchok JA, Hazy JW, Sadighi PJ, Fanelli RD. Initial Experience Using an Endoscopic Simulator to Train Surgical Residents in Flexible Endoscopy in a Community Medical Center Residency Program. *Curr Surg* 2005;62:59-63.**

High tech simulators are mostly used to teach and assess components of Patient Care, notably, procedural skills. Along this vein, Clark and colleagues describe their experience introducing a simulator to a surgery residency program.

The virtual reality endoscopic simulator provided a three-dimensional model that allowed residents to practice handling an endoscope, provided visual feedback of tissue and auditory feedback on patient comfort, and recorded performance. The system included computerized cases of varying difficulty with accompanying histories, physical examinations and laboratory results that could be reviewed by residents before

each procedure. Cases were designed to teach diagnostic skills by providing realistic presentations of normal and pathological tissue, and to teach therapeutic skills by providing virtual reality experience of polypectomy, injection therapy and other therapeutics. Residents were required to complete ten simulated cases every month and complete a structured clinical rotation in the endoscopy unit. Based on two years of data, eight senior residents demonstrated an average efficiency of 80% in completing endoscopies and five junior residents demonstrated an average efficiency of 59%.

**“Opportunities for multiple practice sessions helped residents to learn endoscopy skills at a quicker pace and allowed them to complete enough endoscopies to meet volume requirements for credentialing. This in turn has helped all graduates who used the simulator to immediately obtain endoscopic privileges upon employment.”**

The authors note many benefits of adding the simulator to their curriculum. First, they believe that it has reduced risks to patients. Second, opportunities for multiple practice sessions helped residents to learn endoscopy skills at a quicker pace and allowed them to complete enough endoscopies to meet volume requirements for credentialing. This in turn has helped all graduates who used the simulator to immediately obtain endoscopic privileges upon employment. Third, residents could practice endoscopies at times convenient for them, which seemed to instill enthusiasm for procedures and the residents began to perform endoscopies earlier in their training and consistently completed assigned cases. Fourth, the surgical endoscopist reported that residents who had mastered the simulator tended to be less anxious when they started the endoscopy unit rotation and had better endoscopy skills with real patients. Finally, the simulator freed up time the GI staff. In sum, the authors believe that the simulator enhanced curriculum effectiveness and efficiency. ■

<sup>1</sup> Ziv A, Wolpe PR, Small SD, Glick S. Simulation-based medical education: an ethical imperative. *Acad Med* 2003;78:783-8.

<sup>2</sup> Gisondi MA, Smith-Coggins R, Harter PM, Soltysik RC, Yarnold PR. Assessment of resident professionalism using high-fidelity simulation of ethical dilemmas. *Acad Emerg Med* 2004;11:931-7.

<sup>3</sup> Shapiro MJ, Morey JC, Small SD, Langford V, Kaylor CJ, Jagminas L, et al. Simulation based teamwork training for emergency department staff: does it improve clinical team performance when added to an existing didactic teamwork curriculum? *Qual Saf Health Care* 2004;13(6):417-21.

<sup>4</sup> Clark JA, Volchok JA, Hazey JW, Sadighi PJ, Fanelli RD. Initial Experience Using an Endoscopic Simulator to Train Surgical Residents in Flexible Endoscopy in a Community Medical Center Residency Program. *Curr Surg* 2005;62:59-63.

## RRC/IRC Column

### ACGME Approves Program Requirements for Resident Education in Four Specialties and Two Subspecialties

At its September 2005 meeting, the ACGME approved revisions to the Program Requirements for General Surgery, and the subspecialty Requirements for Neuroradiology, both effective November 13, 2005. Other requirements that were approved at the September meeting included the Requirements for Ophthalmology, with an effective date of January 1, 2006, and the Requirements for Family Medicine, Physical Medicine and Rehabilitation, and the subspecialty Requirements for Geriatric Medicine (Internal Medicine), all to become effective July 1, 2006. The Council also approved revisions to the Requirements for Nuclear Medicine, to become effective July 1, 2007.

The ACGME approved the following addition to Section C.5.a. of the ACGME Manual of Policies and Procedures:

“(5) If the Institutional Review Committee (IRC) confirms withdrawal of accreditation of a sponsoring institution, all ACGME-accredited programs sponsored by that sponsoring institution will be administratively withdrawn. Once the IRC confirms Probation or Withdrawal of a sponsoring institution, no new program applications for the institution will be accepted.”

## Other News from the September ACGME Meeting

### ACGME Establishes Committee On Bylaws And Policies and Periodic Bylaws Review

The Board approved the establishment of the Committee on Bylaws and Policies, and the appointment of William Hartmann, MD as Chair, and Carol Berkowitz, MD and Mr. Roger Plummer, as members of the committee. The Committee’s charge calls for periodic review of the adequacy of the ACGME Bylaws and the Manual of Policies and Procedures, to occur at least once every two years. In

**“The Committee’s charge calls for periodic review of the adequacy of the ACGME Bylaws and the Manual of Policies and Procedures, to occur at least once every two years.”**

addition, the Committee will coordinate the preparation and submission of any proposed amendments to both the Bylaws and the Manual of Policies and Procedures for review and approval by the Board of Directors. The Committee also will consider and make recommendations on potential amendments to ACGME Bylaws and Manual of Policies and Procedures as directed by the Board of Directors.

### ACGME Approves New Mission, Vision and Value Statements and Continues Work on Strategic Plan

The ACGME approved new ACGME Mission, Vision and Values, shown below, as part of an ongoing strategic planning effort. Mark Kelley, MD, Chair of the Strategic Initiatives Committee, presented the Mission, Vision and Values shown on this page. He also submitted a strategic plan draft that had been refined by the Committee. Work on the ACGME strategic plan will continue at the Executive Committee's November 2005 retreat; results will be presented to the ACGME at its February 2006 meeting.

### ACGME Elects Officers and Directors for 2006

The ACGME Executive Committee for 2006 includes Emmanuel Cassimatis, MD, Chair, William Hartmann, MD, Chair Elect, Mr. Roger Plummer, Treasurer, and Carol Berkowitz, MD, Maximilian Buja, MD and Mr. Mark Laret. The ACGME also reappointed Mr. Paul B. Gardent, Joseph C. Honet, MD and Mr. David Jaffee for a second three-year term, and Mr. Roger L. Plummer for a second two-year term on the ACGME Board of Directors. The ACGME Board also approved the appointment of Timothy Flynn, MD, Associate Dean for Graduate Medical Education, University of Florida at Gainesville, to the Board of Directors, and the appointment of Karen Holbrook, PhD, President, Ohio State University, as a new public member. Both appointments are effective October 1, 2005.

### ACGME Recognitions for Distinguished Service

Dr. Leach thanked Mark Kelley, MD and Vishal Gala, MD, for their dedicated service as ACGME Directors, respectively, as chair of the Committee on Strategic Initiatives and the Council of Review Committee Residents. The Council also recognized Duncan McDonald for his service as a public director and first non-physician chair of the ACGME Monitoring Committee.

Dr. Leach paid special tribute to Nadia Mikhael, MD, the observer for the Royal College of Physicians and Surgeons of Canada, who is retiring from her position, and to Ms. Cynthia Taradejna, who served as the first Executive Director for the Institutional Review Committee from 1996 to 2005. Ms. Taradejna has accepted new responsibilities as co-director of the ACGME Division of Organizational Assessment and Advancement. Patricia Surdyk, PhD, has accepted the position Executive Director of the Institutional Review Committee. ■

### ACGME Mission:

"We improve health care by assessing and advancing the quality of resident physicians' education through accreditation."

### ACGME Vision:

"Exemplary Accreditation"

### ACGME Values:

#### Accountability

Processes and results that are:  
Open and transparent  
Responsive to the educational community  
and the health of the public

#### Professionalism

Actions that are:  
Respectful and collaborative  
Responsive  
Ethical  
Fair

#### Excellence

Accreditation that is:  
Efficient and effective  
Outcomes-based  
Improvement-oriented  
Innovative  
Reliable, valid and consistent



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## ACGME and ABMS Focus on Practice-based Learning and Improvement

*Patricia Surdyk, PhD*

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“Who would have guessed a few years ago that this kind of positive energy would exist around Practice-based Learning and Improvement (PBLI)?” This was the observation voiced in many conversations overheard throughout the ACGME/ABMS joint conference held September 22-23, 2005. During the initial phase of the ACGME Outcome Project dating back to 1999, PBLI was often cited by program directors and faculty as difficult to understand and even more challenging to teach and assess. But no confusion regarding this competency was apparent for the cadre of poster

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**“The presenters enthusiastically and skillfully demonstrated that critical reflection, quality improvement, applying new learning and monitoring its effects, i.e., the basic components of PBLI, can be effectively integrated into the self-learning that should occur at all phases of a physician’s career.”**

presenters and speakers at this recent conference. The presenters enthusiastically and skillfully demonstrated that critical reflection, quality improvement, applying new learning and monitoring its effects, i.e., the basic components of PBLI, can be effectively integrated into the self-learning that should occur at all phases of a physician’s career. Posters and presentations exemplified that PBLI is the driving force behind lifelong learning from medical school through residency and into individual practice, underlying program development, as well as institutional and even national initiatives.

Stephen D. Brookfield, PhD, award-winning author and expert in adult learning, opened the day-long conference by focusing on critical reflection as sine qua non for effective teaching. In his discussion of continuing professional development, Murray Kopelow, MD, Chief Executive of the Accreditation Council for Continuing Medical Education, described how reflection is key to the self assessment essential for achieving and maintaining competence at all stages along the medical education continuum. Darryl G. Kirch, MD, Dean and Senior Vice President for Health Affairs at Penn State College of Medicine, used the challenges faced by his own institution to demonstrate how using critical reflection and learning from practice can likewise improve systems. Specific, practical suggestions were offered by panel discussants: Kevin Rodgers, MD, Co-Program Director for Emergency Medicine at Indiana University, Eugene C. Nelson, DSc, Director,

Quality Education, Measurement, and Research, Dartmouth-Hitchcock Medical Center, and Joel Rosenfeld, MD, Designated Institutional Official and Program Director for Surgery at St. Luke’s Hospital in Bethlehem, Pennsylvania. Concluding the day, Dame Lesley Southgate, Professor of Medical Education at St. George’s Hospital Medical School in London, England, reflected on how self learning throughout her career prepared her for a role in leading the national initiative for authentic assessment of postgraduate training in the United Kingdom.

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**“This year’s conference attendees engaged poster discussants in lively exchange around such topics as describing mortality and morbidity conferences as vehicles for reflection, using quality measures introduced during resident-focused multidisciplinary rounds to help shorten length of stay, and using imaging studies to assess personal practice accuracy.”**

A popular feature of this joint conference series continues to be the poster reception held the evening prior to each conference. As in years past, a wide range of examples from the field demonstrated how far, and relatively fast, medical educators have progressed in incorporating the competencies into their curricula. This year’s conference attendees engaged poster discussants in lively exchange around such topics as describing mortality and morbidity conferences as vehicles for reflection, using quality measures introduced during resident-focused multidisciplinary rounds to help shorten length of stay, and using imaging studies to assess personal practice accuracy. The presentations and abstracts from the conference can be located on the ACGME website at <http://www.acgme.org/outcome/forum/forHome.asp><http://www.acgme.org/outcome/forum/forHome.asp>.> ■

**The fifth in this series of jointly-sponsored conferences will be held on September 21-22, 2006 and will focus on Patient Care.**

## UK Authorizes Medical Education Authority

On September 30, 2005, Britain's Postgraduate Medical Education and Training Board (PMETB) formally assumed oversight of postgraduate medical education across the United Kingdom. Prior to the formation of PMETB, the Specialist Training Authority was responsible for the graduate education of specialists and the Joint Committee on Postgraduate Training in General Practice oversaw the training of general practitioners. PMETB will be responsible for the education of all UK clinical specialists and generalists that follows undergraduate medical education and basic clinical preparation.

**“PMETB will be responsible for the education of all UK clinical specialists and generalists that follows undergraduate medical education and basic clinical preparation.”**

PMETB is an independent statutory body, responsible for:

- Establishing standards and requirements for postgraduate medical education and training.
- Making sure these standards and requirements are met.
- Developing and promoting postgraduate medical education and training across the country.

PMET aims include: safeguarding the health and well-being of persons using the services of general practitioners or specialists; making certain that the needs of persons undertaking postgraduate medical education and training are met; and ensuring that the needs of employers and those engaging the services of general practitioners and specialists within the National Health Service are met. Specific objectives include, among others 1) to establish standards for postgraduate medical education (PME); 2) to ensure that training of physicians adheres to these standards; 3) to promote and develop PME; 4) to establish outcomes for PME; 5) to consider issues of multi-professionalism as relevant; and 6) to collaborate with other organizations to achieve these objectives.

More information about PMETB's can be found at: [www.pmetb.org.uk](http://www.pmetb.org.uk)

## Teaching Hospitals Seek Clarification of Supervision Costs in Non-Hospital Settings

At the 2005 Annual Meeting of the American Medical Colleges (AAMC) held in early November in Washington, DC, Karen Fisher, JD, Associate Vice President in the Division of Health Care Affairs, summarized the effort of the AAMC to clarify the Medicare rules for payment of costs related to resident supervision in non-hospital training settings. At issue is the method for determining the cost of supervisory faculty in these settings, with the AAMC advocating that the teaching hospital and the non-hospital sites collectively should determine these costs, while the Centers for Medicare and Medicaid propose a formula-based approach.

Under the Medicare rules, supervisory costs that result from supervision during a billable service are not included in the calculation of the costs to be covered by payments from the sponsoring institution to the non-hospital site. The amount of supervision for reimbursement to the non-hospital sites may comprise only the time spent in direct mentoring residents and completing their evaluations. Ms. Fisher expressed the AAMC's concerns that the higher supervisory faculty costs in ambulatory settings, combined with an absence of indirect medical education (IME) payments for residents in ambulatory venues, may have the unintended consequence of discouraging resident education in these sites, which often most closely represent the settings residents will practice in after completion of training. ■

**“The higher supervisory faculty costs in ambulatory settings, combined with an absence of indirect medical education (IME) payments for residents in ambulatory venues, may have the unintended consequence of discouraging resident education in these sites.”**

*Additional information was excerpted from the AAMC letter of April 15, 2005, responding to the CMSS Q and A document on Medicare payments for residency training in non-hospital sites, at: <http://www.aamc.org/advocacy/teachhosp/41505covertoems.pdf>*

# The Role of Simulation-based Team Training to Support a Safety Culture

Paul Barach, MD, MPH, David Mayer, MD

**“We are more likely to act ourselves into new ways of thinking than think ourselves into new ways of acting.”**

Mark Twain

Quality health care and patient safety have emerged as major concerns in society and major drivers for improving the nation’s health and well-being. Historically, adverse events in health were not perceived as a major problem. In his effort to draw attention to medical error, Leape in 1994 noted this was because “adverse events are scattered, most errors do not lead to serious injury, and the culture of health care leads clinicians to deny or conceal errors.”<sup>1</sup> The Institute of Medicine’s “To Err is Human; Building a Safer Health System,” and other reports identified quality and safety as major areas for improvement in the health care system, and in 2005, clinicians know, research findings indicate and recent policy documents describe a present-day system in which care often is not as good or safe as it could be.<sup>2</sup> Recommendations to address this quality and safety deficit include translating lessons learned from other complex, high-risk industries with excellent safety records, such as aviation and nuclear power, with special attention to improving coordination among individuals and human-systems interactions.

The IOM report, *Crossing the Quality Chasm: A New Health System for the 21st Century*, called for a change in medical education to address the problems with quality and safety.<sup>3</sup> Principle 5 of the report, “Create a Learning Environment,” stresses the use of simulations, noting that “health care organizations and teaching institutions should participate in

**“Crew resource management techniques, combined with simulation, have substantially improved aviation safety and can be modified for health care use.”**

the development and use of simulation for training novice practitioners, problem solving, and crisis management, especially when new and potentially hazardous procedures and equipment are introduced. Crew resource management techniques, combined with simulation, have substantially improved aviation safety and can be modified for health care use.” The national Council on Graduate Medical Education (CoGME) and the National Advisory Council on Nursing Education and Practice (NACNEP) co-convened a symposium

entitled *Collaborative Education to Ensure Patient Safety*, which produced these recommendations:

- Promote use of simulations in teaching and evaluation of team performance analogous to practices in the aviation industry. This should be ongoing, beginning early in professional schooling, continuing throughout training, and at intervals during professional practice as part of the continuing education and recertification process. Collaborative team approaches should be stressed in both education and evaluation.
- Professional education and training in clinical settings should require the incorporation of interdisciplinary delivery of care focused on development and implementation of systems to enhance patient safety. Some percentage of interdisciplinary training, simulations, and/or exercises should be mandatory. Initial programs should emphasize interdisciplinary issues (e.g., teamwork, conflict resolution, and use of informatics to promote collaboration in enhancing patient safety).

Clinical care is highly opportunistic in the availability of the entire spectrum of cases, and changes in medical practice and the limits on resident duty hours have accentuated this. The application of the ACGME/ABMS six general competencies is drawing attention to the limits to which real patients in real settings can be used for education (and assessment). Logistical, ethical and economic issues often preclude systematic, contextual, learner-focused deliberate practice with rich immediate feedback – the well-known critical components of attainment of expertise. The ACGME/ABMS Joint Initiative Toolbox refers to Simulations and Models:

**“Residents should be able to demonstrate that they can gather accurate information about the patient, that they know the cognate science of safety, that they can do a root cause analysis in the analysis of errors. They should demonstrate patterns of communication that promote safety, as well as professionalism needed to tell the truth about how safe the system is.”**

“Key attributes of simulations are that: they incorporate a wide array of options resembling reality, allow examinees to make life-threatening errors without hurting a real patient, provide instant feedback so examinees can correct a mistaken action, and rate examinees’ performance on clinical problems that are difficult or impossible to evaluate effectively in other circumstances.”

David Leach, MD, noted that all six of the ACGME competencies relate in some way to patient safety, stating that “Residents should be able to demonstrate that they can gather accurate information about the patient, that they know the cognate science of safety, that they can do a root cause analysis

Figure 1 **Matrix of Simulation Tools and Purpose \***

	<b>Purpose of level</b>	<b>Way of learning</b>
Base level	Introduction to the topic	Reading (books, internet resources, traditional multimedia publications), lectures, observing others and/or video demonstrations of teaching
Level 1	Acquisition of specific skills	Simple simulators (both micro- and macro-simulators)
Level 2	Acquisition of cognitive skills	Complex micro-simulators
Level 3	Integration of a range of psychomotor, cognitive and interpersonal skills	Full-scale, complex macro-simulator

in the analysis of errors. They should demonstrate patterns of communication that promote safety, as well as professionalism needed to tell the truth about how safe the system is. However, it is probable that systems-based practice is the competence in which safety is most prominently featured. It is here that skills can be acquired to design safer systems.<sup>4</sup>

### Developments in medical education

In recent years, the systems of medical education have begun to shift from providing instruction to providing successful learning opportunities for residents and medical students. There are trends towards more case-based teaching, small group learning, standardized-patient encounters, and earlier integration of clinical contexts into the basic sciences. Seven insights can be inferred from this:<sup>6,7</sup>

1. Learners are not receptacles of knowledge, instead they create learning actively and uniquely;
2. Learning is about creating meaning for each individual by establishing and reworking patterns, relationships and connections;
3. Most learning occurs implicitly, arising from interactions with complex situational cues from patients, peers, and mentors;
4. Direct experience decisively shapes individual understanding – the brain’s activity is in direct proportion to engagement with an actively stimulating environment;
5. Learning occurs best in the context of compelling “presenting problems” – when people are confronted with specific, identifiable problems they want to solve that are within their capacity to solve;
6. Learning requires active reflection – high challenges produce major surges in short term neural activity; but building lasting cognitive connections requires considerable periods of reflective activity as well;
7. Learning occurs best in cultural contexts that provide enjoyable interaction and substantial personal support; effective learning is social and interactive.

### Developments in simulation

A variety of approaches to simulation have emerged in the past five years, including growing sophistication of life support training systems, including complex task trainers for endoscopic and catheter based procedures; ultrasound simulators; full length mannequin computer-controlled simulators; surgical devices incorporating touch, audio and visual simulation; and virtual reality devices. *Anesthesia Crisis Resource Management (ACRM)*, an immersive simulation-based training program, was created based on aviation Crew Resource Management and published in the early 1990s.<sup>5</sup> The power of the training resides in realistic, videotaped scenario enactment of operating room incidents followed by rapid cycle facilitated, learner-centered debriefings using the scenario videotapes. These tools have enabled the exploration of new frontiers in training and performance assessment and similar investigations at the level of teams and even systems.

There has been a tendency to see full-scale simulators as the ideal solution for all educational simulation needs, yet all types of simulators have different strengths and weaknesses in achieving educational goals. Recent advances in miniaturization of computerized mannequin simulators have begun to stimulate much more widespread adoption. PC simulators (micro-simulators) are beginning to be seen as a complementary tool to full-scale macro-simulators (simulators with physical dimensions such as mannequin) as they can provide autonomous, cognitive training. They differ from macro-simulators in that they do not need an operator to run the simulations and provide the educational feedback. Today, complex micro-simulators can run and debrief scenarios autonomously. These complex micro-simulators build larger cognitive structures and support development of broader competencies by providing many more options and degrees of freedom for learner decision-making, and richer and more complex, customized feedback.

Micro-simulators have the advantage of accessibility, as most people have access to a PC either at work or at home. The programs are relatively inexpensive (\$80-200) and can be used to practice cognitive problem-solving strategies in many different clinical cases. This allows the more expensive, full-scale simulation training to be focused on broader issues such as interpersonal and team training.



**“By taking a system perspective of safety, clinical risk modification permits us to translate experience and expertise developed in other technologically advanced, hazardous industries and apply those lessons to the medical community.”**

Much of health care is performed by interdisciplinary teams. Like simulation, team training has a long history in aviation, beginning with classic studies which revealed failures of coordination, communication, workload management, loss of group situation awareness and inability to use available resources – all causes implicated in thoroughly investigated plane crashes.

Theories of high reliability organizations (HROs) – institutions that have far less than their expected share of mishaps – suggest that flexible teamwork is a critical element in maintaining safe operations in a complex, risky environment. Extensive reviews have discussed how teams routinely outperform individuals, and are increasingly needed in today’s work arenas where information and resources are becoming more distributed, technology is becoming more complicated, and workload is increasing. This calls for simulation that is able to incorporate training in crew resource management, leadership and communication. The stress of real-life situations cannot be reproduced in micro-simulations, but situations requiring team cognition, communication and decision-making skills can be recreated in a full-scale complex macro-simulation environment, ideally with the ability to debrief and offer feedback to participants.

Health care errors encompass all settings where care is delivered and engage all categories of health care workers. Patient safety improvement requires multi-level system changes, including addressing thorny challenges such as eliminating the prevalent culture of “blame and shame” – singling out individual providers and blaming them for errors. Stand-alone CRM training of medical personnel has had limited effectiveness in this prevalent cultural context. Although individuals and teams trained in CRM may understand the benefits of crew management training, the cultural elements remain in the workplace and insufficient ancillary support and recurrent training are provided. The good results are simply diluted by time and inertia. Although, this model is based on initial work performed in aviation, significant differences require modifications to address the complex and unique issues in medicine.

By taking a system perspective of safety, clinical risk modification permits us to translate experience and expertise developed in other technologically advanced, hazardous industries and apply those lessons to the medical community. We can accomplish this by using the science behind aviation safety, microsystems, human factors, simulation, and team training to provide a conceptual foundation. We have created a clinical risk modification program built on three principles that have made commercial aviation safety a standard for

healthcare to emulate: transparency, standardization, and simulation-based team training. We selected the commercial aviation model as a framework because both aviation and medicine are “professions” with similar traditions, cultures, and values. Both callings require high levels of self-confidence and independent decision-making abilities. Both industries function in high-risk, rapidly changing, technologically driven environments in which task outcomes are dependent on functional teams. Team training has a long history in aviation, beginning with classic simulation studies which revealed failures of coordination, communication, workload management, and loss of group situation awareness.

In conclusion, various levels of simulation are available to address the development of specific haptic and cognitive skills, to advance patient safety for all medical trainees.

**“We have created a clinical risk modification program built on three principles that have made commercial aviation safety a standard for healthcare to emulate: transparency, standardization, and simulation-based team training.”**

Ultimately, the goal is to incorporate the range of available simulation modalities into a rigorous clinical and patient safety curriculum that also includes performance measures to address specific clinical skills and the broader competencies important to achieve safe patient care. ■

*Acknowledgements: Several ideas presented above emerged from conversations with Stephen Small, MD, William McGaghie, MD, and airline captains and physicians William Hamman, MD, PhD, and William Rutherford, MD.*

*Paul Barach, MD, MPH is Associate Professor, Department of Anesthesiology, Medicine and Epidemiology and Associate Dean for Patient Safety and Quality Improvement at University of Miami. David Mayer, MD, is the Associate Dean for Undergraduate Education at the University of Illinois at Chicago.*

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**Editor's Introduction:**  
**Practice Makes Perfect**

**Executive Director's Column:**  
**Simulation: It's About Respect  
Courage**

**An Overview of Simulation-Based Training  
at Washington University**  
**The Language of Aviation Simulation Training:  
Relevance for Medical Education**  
**Simulation Training  
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