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FORUM

Simulation-based Team Training for Patient Safety

Issue Editor: Deborah LaValley, BSN, RN, CPHQ

An Essential Tool for Patient Safety

by John L. Mc Carthy

Jack McCarthy is President of CRICO/RMF.

Part of CRICO/RMF's mission is to protect the assets and reputations of the insured institutions and physicians, and to enable them to practice with the security of a proactive insurance program behind them. Another part is to assist the providers in delivering the safest health care in the world. Indeed, that is what energizes our staff: the idea that the efforts that we make result in increased care quality and safety, and, as a byproduct, lower malpractice claims rates. Toward that end, one of the efforts we have fully embraced is combining simulation-based training and team training—backed by insurance premium discount incentives—to improve skills and reduce preventable errors.

CRICO has been involved in simulation for 15 years, starting when the Center for Medical Simulation (CMS) asked us to help develop some of our malpractice cases into scenarios that CMS would use for team training exercises. Malpractice claims are extremely well documented, providing detailed insight into what clinical and human factor issues emerged, i.e., what really went wrong. As we watched these adverse events played out as team training scenarios (first at CMS and now elsewhere), we recognized the extraordinary value of having clinicians work through crises (sometimes chaos) without any risk to their patients or their careers.

Anesthesia

Our initial foray into simulation targeted anesthesia, not because anesthesiologists had a bad malpractice record, but because they had, in fact, reduced their liability. Aided by some equipment and technique advances, anesthesia was a pioneer specialty in patient safety improvement. But when CRICO/RMF approached the anesthesia chiefs with a sizable premium discount (because of the good trends in malpractice claims) they asked us to redirect our good will (and funds) in the form of an incentive for attending physicians to go through the type of simulator-based training that was already required for residents. We agreed and offered a 10 percent premium discount, about $500 at that time. Despite some concern that $500 might not be overly enticing, it was enough to secure full participation. The anesthesiologists' good malpractice profile got even better. With that in mind, we began to consider how to use simulation-based training in the business plans we develop for other high-risk specialties.

Obstetrics

As is true for most malpractice insurers, obstetrical patient safety is a major concern for CRICO/RMF and the OB/Gyns and certified nurse midwives it covers. Despite relatively low frequency (about one claim per 1,500 births) obstetrics-related claims often represent high severity in terms of both injury and payouts (our average payment is >$1.2 million; several cases have resulted in jury awards above $10 million). In 2003, when CRICO/RMF and the Harvard-affiliated obstetrics chiefs decided to create a premium reduction incentive program, simulation-based team training was the key component. Even with our relatively competitive premium rate for obstetrical providers (OB/Gyns pay about $65,000 per year compared to more than $200,000 in some states), the 10 percent premium discount represented a significant fiscal commitment to the belief that simulation-based team training would have a positive impact on obstetrical patient safety.

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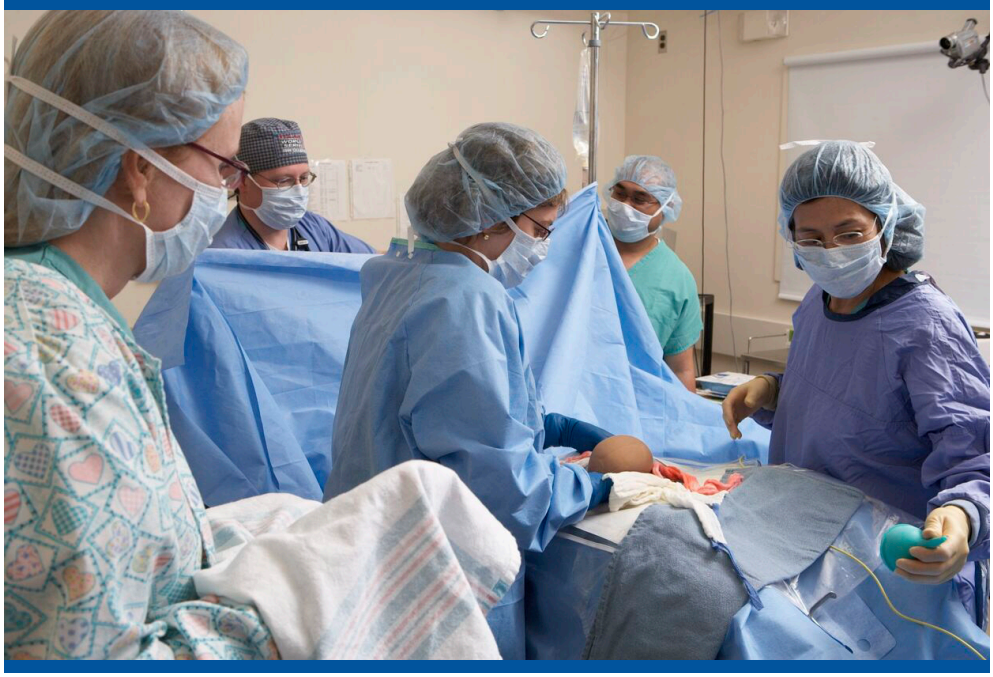
Center for Medical Simulation, Cambridge, MA



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Today, as we pass the five-year mark of our OB incentive program, our actuaries say CRICO/RMF could justify an even larger reduction in the OB/Gyn premium, based on the current experience. Certainly we need to wait for more complete data (there is still some claim lag there), but if those indications hold true we may soon be able to further reduce premiums for a specialty experiencing dramatic increases just about everywhere else in the country.

Obviously, we are very encouraged by the data behind our simulation-based training incentive and, for CRICO/RMF and our insureds, almost nothing moves forward without data and measurement. Our commitment to our board of directors (comprising leadership from the hospitals we insure) is to continuously report back on each of our initiatives with pre- and post-implementation results. In 2003, we asked the Board to commit almost $4 million for the first five years of our OB incentive program with a mutual understanding that its effectiveness might not be clear until those five years had passed. With an average payment of $1.2 million per obstetrics-related case, and extensive legal fees, a reduction of just one case per year would justify the expenditure for the incentive. In a marketplace with higher obstetrics-related claims frequency and equal or greater severity, a similar incentive program would present an even more convincing cost benefit analysis. This is one of the most compelling selling points for anyone attempting to stir up interest in funding simulation-based team training efforts.

Residents and Beyond

A third area of concern to CRICO/RMF, and other malpractice insurers that cover teaching programs, is the liability exposure for residents (house officers). Clearly, teaching hospitals, patients—and juries—expect residents to meet the standard of care—while they are in training. But, although a safety net is provided by teaching/supervising attendings (and peers and nurses) residents are, nevertheless, "in training," and thus at risk for finding themselves in unfamiliar situations with dire ramifications.[1] Simulation-based technical and team training offers an opportunity for us to develop a more effective structure for their training needs so that they have a better, safer way of experiencing rare or chaotic events.

The current requirements—baseline training standards—for residents are unclear, inconsistent, and probably inadequate for the realities of modern medicine and teaching environments. To better prepare our physicians of tomorrow, we need to go beyond "see one, do one, teach one." We need to guarantee that every medical school graduate has been introduced to simulation-based training and teamwork training, and to ensure that those training methods are continued and expanded during their post-graduate—and post-residency education. Right now, we do not see that happening, at least not broadly and systematically, and it is unlikely to occur without an infusion of innovative ideas and perspectives like those outlined in this issue by our *Forum* contributors.

Where is this all headed? In the CRICO community, the hospitals and other organizations that sponsor the clinicians we insure have moved simulation-based training from pilot project, to incentive program, toward it becoming a requirement for privileging and credentialing. Anesthesia is likely to be first, but not alone. Last year, CRICO/RMF offered an incentive for surgeons who participated in a simulation-based training for laparoscopy and there is a good chance that that, too, will soon be required for privileging. Obstetrics is likely to follow a similar track in which this training mode becomes part of the work life of a physician, just like it is for a pilot or a nuclear plant operator.

Think about simulation as an investment with a really long term sustainable return. Ten or 15 years from now, as we all look back at this period in simulation from the perspective of a virtual-reality based program, today's methods will look technically primitive, but they will be seen as critically important early steps in the development of health care providers who are thoroughly prepared to deliver the safest health care in the world. ■

Note

1 http://www.boston.com/business/articles/2005/05/11/238m_award_in_childbirth_lawsuit/

CASE STUDY

Poor Crisis Management

by Deborah LaValley, BSN, RN, CPHQ

Ms. LaValley is a Program Directors, Loss Prevention and Patient Safety, for CRICO/RMF.

After indications of fetal distress, a child delivered via vacuum assisted delivery was diagnosed with multiple neurological injuries, including spastic quadriplegia, cerebral palsy, and blindness.

Key Lessons

- Institutional electronic fetal monitoring (EFM) training for all obstetrical staff (physicians, midwives, and nurses) enables clinicians to use the same reference points and terminology when interpreting fetal heart monitoring tracings.
- Communication breakdowns can be minimized through simulation-based training designed to measure, train, and assess a team's ability to integrate knowledge, clinical judgment, and communication.
- Clear, concise, and complete documentation can assist in the defense of a claim or suit by providing critical, relevant information regarding the rationale for proceeding in a particular manner.

Clinical Sequence

A 17-year-old woman, GIPO, 39 weeks gestation, presented to the hospital in early labor about 8:00 a.m. Her prenatal course had been complicated by anemia. She was admitted by her nurse midwife and placed on a fetal heart monitor, which displayed reassuring tracings.

At about 6:00 p.m., the nurse midwife noted that the patient's blood pressure (BP) was slightly elevated (138/86) and decided to watch it closely. By 10:00 p.m., the patient's BP looked better (132/60) and the fetal heart rate (FHR) was in the 130s. The patient was allowed therapeutic rest.

At 4:00 a.m., the patient, still not in active labor, complained of a headache. The nurse midwife consulted the supervising obstetrician, who felt that pregnancy induced hypertension (PIH) or pre-eclampsia toxemia (PET) was unlikely. The FHR tracings continued to be reassuring. In an attempt to move labor forward, an epidural was placed and Pitocin begun (now more than 24 hours after the onset of labor).

Two hours later, it was noted that the patient had previously tested positive for B Strep. She was given the appropriate antibiotic.

By noon, the patient's cervix was 5cm dilated, 100 percent effaced, and the baby was at -1 station and vertex. The FHR ranged from 130–140. At this time, the obstetrician artificially ruptured the membranes (AROM); thick meconium was noted.

By 3:00 p.m., the patient was 6cm dilated, 100 percent effaced, and the baby was at 0 station; FHR was in the 140s; the fetal head had molding noted.

At 6:00 p.m., the patient developed a temperature of 100.6°, BP 160/100, and her urine output decreased to only 20cc in 1.5 hours with 2+ protein. The patient was fully dilated; the FHR was overall reassuring but did have some variable decelerations (sometimes late). The patient's case was presented at rounds and it was felt that she had developed chorioamnionitis as well as PIH and possibly PET. Ampicillin and Gentamycin were begun, as well as magnesium sulfate. Labs were drawn.

The patient, now co-managed by both the obstetrician and nurse midwife, began pushing sometime between 6:00–6:30 p.m. After an hour and a half of pushing, little progress was being made. At 8:00 p.m., the FHR was in the 150s with minimal beat-to-beat variability and some occasional late decelerations. By 8:15 p.m., a fetal scalp electrode had been placed. Given the worrisome FHR and non-imminent delivery, the obstetrician discussed with the patient the need for an assisted delivery (forceps and/or vacuum) and received her (oral) consent. Anesthesia was notified and asked to increase epidural coverage.

Attempts were made to place the forceps but were abandoned secondary to the inability to articulate the blades. Next a vacuum extraction was attempted, popping off twice. The baby was now at 3–4+ station and forceps were again attempted, and again unsuccessful. At this point, the obstetrician discussed with the patient the option of attempting extraction with the vacuum one more time before converting to a cesarean section. The vacuum was placed and a baby boy was successfully delivered at 9:00 p.m.; no meconium was noted below the cords; respirations were depressed, requiring positive pressure ventilation. Apgars were 3/5/7; cord blood pH 7.17–7.19.

The baby was transferred to the NICU and later developed apneic spells and seizures. A head CT, done approximately 12 hours after birth, revealed no intracranial hemorrhage, but did show some basal ganglion changes. These findings, confirmed by MRI, were consistent with hypoxic ischemic injury.

Nursing notes and FHR tracings for the three hours prior to delivery could not be found, nor could the discharge summary, or the placenta.

Disposition

A lawsuit filed against the attending obstetrician and two residents, alleging that they failed to respond appropriately to fetal distress, was settled for more than $1 million.

Analysis

1. When deciding to continue to labor, proceed with an assisted delivery, or perform a cesarean section, multiple components deserved consideration: a long labor (40 hours of Stage I, three hours of Stage II); extended period (75 minutes) of non-reassuring fetal heart patterns; position of the baby's head (asynclitic); meconium staining at the time of AROM—and the mother's choriamnionitis, group B strep, PIH, and possible PET.

   Patients benefit most when their multiple caregivers work together to interpret data, consider options, and reach decisions—especially when the course of events gets bumpy. Crisis management can be practiced safely via simulation-based team training, and then transported into ad hoc team situations.

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ABOUT FORUM

FORUM provides in-depth analyses of specific medical malpractice cases and issues along with practical loss prevention advice and case abstracts.

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2. Possible misinterpretation of EFM tracings, or disagreement as to their indications, may have inappropriately led providers to allow the patient to labor longer than was prudent.

   Interpretation of electronic fetal monitoring tracings can vary widely among clinicians. Patients are better served when all clinicians in a given setting share a common understanding, e.g., reference points and terminology, when interpreting fetal heart monitoring tracings.

3. The defense of this case was hindered by a lack of or loss of documentation (EFM tracings, progress notes, nursing notes, nursing flowsheets, and discharge summary) and clinical specimens (placenta). The plaintiff alleged that this information may have contained critical material and relevant information concerning the condition of the fetus prior to delivery.

   Although the saying "if its not written down, it didn't happen" or in this case "did happen," is not entirely true, the lack of evidence does make it more difficult to defend in a court of law. Clear, concise and complete documentation can assist in the defense of a claim or suit by providing critical, relevant information regarding the rationale for proceeding in a particular manner.

   Reliable documentation systems can assist in the reconciling of surgical specimens and identify potential retained foreign bodies.

4. This case demonstrates the "Swiss cheese" effect of system failure, in which the holes (systems failures) in multiple stages of care align for an unfortunate outcome. A chaotic atmosphere, short staffing, employee breaks, small environment, poorly planned multiple separate surgical set-ups, and the lack of communication unfortunately all went wrong and set this patient up for an unnecessary adverse event.

   Simulation-based team training is a no-risk method that can be used to measure, train, and assess a team's ability to integrate knowledge, clinical judgment, and communication. When multiple things do go wrong, teamwork skills can help caregivers address the individual errors before they align and open an opportunity for patient harm.

Chaos in the OR

by Deborah LaValley, BSN, RN, CPHQ

Ms. LaValley is a Program Directors, Loss Prevention and Patient Safety, for CRICO/RMF.

Surgical specimens of breast tissue were lost during or after prophylactic bilateral mastectomies.

CASE STUDY

Key Lessons

- Pre-op huddles/meetings with all staff involved in a surgical case can assist in aligning everyone's expectations (timing of steps in the procedure, equipment/supply availability) as well as decrease anxiety and chaos.
- Clear communication during surgical staff turnovers is imperative.
- Reliable documentation systems can assist in the reconciling of surgical specimens and in identifying potential retained foreign bodies.

Clinical Sequence

A 31-year-old female at risk for breast cancer opted to have prophylactic bilateral mastectomies with immediate reconstruction. On the day of surgery, the OR staffing was sub-optimal and the room assigned to this patient was small. As the first mastectomy was being completed, the surgeon handed off to a nurse, the tissue specimen that was to be sent to Pathology. She wrapped the specimen in a blue surgical towel and put it down on the table.

As the oncology surgeon began work on excising the second breast, a plastic surgeon entered to begin work on reconstructing the first breast. Due to the small room size, the oncology surgeon asked the plastic surgeon to wait until both breasts had been removed. The plastic surgeon decided to stay in the OR and work on his computer. While waiting, he asked the nurse to get Alloderm (a tissue type used to support the implant) from the refrigerator, as he was going to need it for his portion of the surgery. When the nurse checked the refrigerator, Alloderm was not present and another nurse had to travel to another building to retrieve some.

Simultaneously, the surgical technician received a phone call, then had to depart for a family emergency, leaving the OR team short staffed for more than a half hour until a replacement arrived. Other staffing changes also occurred during this operation to cover for staff breaks and lunches.

At the close of the surgery, no final surgical counts were done and the surgeons did not ask for them. There were two nurses in the OR at this time: the original circulating nurse and a nurse who had stayed in the OR after covering for the original nurse's lunch break. Each assumed that the other had performed the surgical count, but did not confirm it had been done. The two breast tissue specimens, which had been wrapped in blue surgical towels, may have been inadvertently disposed of when the room was cleaned and turned over.

Ten days post-op Pathology noted that the specimens never made it to the department. The patient underwent an axillary node biopsy for reassurance that that she did not have cancer. The patient sued the oncology surgeon, both nurses, and the institution for failing to retain her breast tissue specimens, necessitating the subsequent biopsy which gives her an increased risk for lymphedema.

Disposition

This case was settled in the mid range (<$499,000).

Analysis

1. Clearly, the surgical team did not discuss the logistics of this case in advance, leaving unresolved the need for a larger room, the sequence of the procedures, and the necessary supplies.

   A pre-op huddle or meeting to discuss expectations can minimize surprises in the OR.

2. Only three, of what should have been five, surgical counts were conducted during this procedure; all were intra-operative, none was done at the close of the procedure.

   While nurses invariably conduct the counts, the surgeon is also responsible for asking and confirming that they have been conducted. Multiple staff turnovers may dictate the need for multiple counts…and some formal exchange of information.

3. The medical record lacked clear documentation regarding specimens being sent to Pathology, specimen reconciliation, staff time-in and out of the OR suite, and surgical counts.

   Reliable documentation systems can assist in the reconciling of surgical specimens and identify potential retained foreign bodies.

4. This case demonstrates the "Swiss cheese" effect of system failure, in which the holes (systems failures) in multiple stages of care align for an unfortunate outcome. A chaotic atmosphere, short staffing, employee breaks, small environment, poorly planned multiple separate surgical set-ups, and the lack of communication unfortunately all went wrong and set this patient up for an unnecessary adverse event.

   Simulation-based team training is a no-risk method that can be used to measure, train, and assess a team's ability to integrate knowledge, clinical judgment, and communication. When multiple things do go wrong, teamwork skills can help caregivers address the individual errors before they align and open an opportunity for patient harm.

Beyond the Bells and Whistles: When Simulation-based Team Training Works Best

by Eduardo Salas, PhD, and Michael A. Rosen

Dr. Salas is University Trustee Chair and Pegasus Professor of Psychology at the University of Central Florida (UCF). Michael Rosen is a PhD candidate in Psychology at UCF.

As the use of simulation-based training (SBT) to improve teamwork and safety within health care proliferates, the issues of sound, scientifically rooted practice deserve close attention. A fundamental lesson, learned the hard way in other domains, is that simulation by itself does not equate to learning. That is, task exposure does not guarantee that the trainee will learn. Simulation is just a training delivery method that must include sound instructional features to be effective. Practice, in the absence of sound pedagogy and training design, will not lead to the desired learning, increased team performance, or safety. In order to be effective, SBT for teamwork must apply what we know from the science of team training, teamwork, and simulation-based training.

Key Definitions

The primary purpose of SBT for teamwork in health care is to improve team interaction (e.g., communication and coordination) which subsequently leads to improved patient outcomes. This chain relies on individual staff members learning the relevant teamwork language and behaviors.

Learning is stable change in knowledge or performance capacity rooted in experience.[1] However, experience alone is not enough to ensure that the "right" lessons are learned.

Training is the systematic acquisition of the competencies (knowledge, skills, and attitudes; KSAs) underlying effective performance.[2] Training ensures that learning is focused on the competencies that matter.

Simulation for the purposes of training is a representation of a task or working environment that can be used for practice activities.[3] It is a means by which experience can be engineered to produce the desired learning.

Simulation-based training is a method or strategy of training that involves the use of several scientific, theory-based approaches to training, and includes information, demonstration, and practice-based methods.[4] It is an approach to training that seeks to accelerate the development of expertise by systematically designing opportunities to practice that result in the desired learning.

Finally, **team training** is a set of tools and methods designed to build teamwork competencies in a systematic manner.[5] The principles that follow are intended to serve as a guiding framework for designing SBT that effectively builds teamwork competencies.

Seven Principles for Effective SBT for Teams

Clear and precise learning outcomes

Focus on uncovering the team-based competencies. In order to be systematic, a training program should clearly articulate its purpose. That is, the changes the training is supposed to produce in the learner should be explicitly specified. In the context of SBT for teamwork, learning outcomes should be focused on the teamwork competencies: the knowledge, skills, and attitudes that underlie effective teamwork. There are general listings of teamwork competencies that can help guide the development of learning objectives.[6] However, these lists are abstract and must be contextualized for a given application.

Carefully crafted scenarios

Embed opportunities to perform. SBT must provide opportunities to practice these teamwork competencies or learning will not result. In this sense, the scenario is the curriculum in SBT.[4] Scenarios should be designed so that trigger events are embedded within the scenarios. These trigger events should require the team members to perform the targeted competencies. For example, a trigger event for the teamwork competency of mutual support could involve one team member becoming over taxed. This situation would require other team members to step in and help out. The degree to which this happens is an indicator of the level of this competency within the team.

Diagnostic measures

Seek to diagnose KSA deficiencies. The old adage of "you get what you measure" rings true in the context of SBT for teamwork.[7] In order to systematically change behavior, knowledge, and attitudes, SBT should incorporate sound performance measurement practices.[8] To this end, performance measurement tools should diagnose performance; that is, they should provide information about the causes of effective and ineffective performance.[9] Diagnostic measurement is key to providing constructive feedback for correcting deficiencies in competencies. In the example of the trigger event discussed above, a measurement tool capturing the mutual support behaviors after the team member workload imbalance occurred can be linked to the competency of mutual support and be used to drive feedback.

Robust observation protocols

Develop multi-level performance assessment tools. A key component of the preceding issue of performance measurement is the use of observational protocols. These protocols should capture individual and team level performance.[10,11] This is necessary in order to provide feedback at the appropriate level (i.e., to correct individual or team competency deficiencies).

Team performance is a function of both how well the individuals perform their tasks as well as how the team members interact interdependently.[6] Observational protocols should be sensitive enough to separate individual task work from interdependent teamwork.

Feedback

Provide constructive and team-based feedback. In order to change behavior, information must be provided to teams based upon their performance in the simulation. This is a fundamental component of learning and has been shown to be a critical factor in the success in SBT.[12-13] In order to facilitate team performance increases, feedback should be focused at the team level. This feedback process should be timely and follow the science of debriefing.[14]

An Organized Pedagogical System

Apply sound instructional design principles. A comprehensive training program should not rely exclusively on the use of simulation, especially when addressing skill development across a broad spectrum of expertise. SBT should include the use of information provision methods (e.g., lectures, reading materials), demonstration techniques (e.g., visualizations and examples of teamwork behaviors), practice-based methods, and provide feedback based on performance.

Thinking about what happens before, during, and after SBT

Adopt a systems approach to SBT. Training does not occur in a vacuum. The design and delivery of effective SBT for teams must consider factors at work well beyond the boundaries of the actual practice activity. In order to achieve the end goal of transfer of what is learned in SBT to the actual job environment, a broader perspective must be taken. This includes creating an organizational climate that values SBT and aligns policies and procedures so that what is learned in SBT can be practiced on the job.

The promise of SBT for increasing teamwork can only be delivered on when scientifically based principles of learning and teamwork are applied. This means moving beyond the "bells and whistles" of simulation as a technology and understanding simulation as part of a training delivery method. ■

Principle	Tips
Focus on uncovering the team based competencies	■ Develop learning outcomes to serve as a guide ■ Train teamwork competencies, not tasks ■ Define teamwork requirements ■ Conduct a Cognitive Task Analysis; uncover covert aspects of the job
Embed opportunities to perform	■ Create opportunities to demonstrate competencies (triggers) ■ Embed metrics (and instructional features) ■ Link 'triggers' to competencies and learning outcomes
Seek to diagnose KSA deficiencies	■ Ensure metrics are diagnostic of performance for after-action review ■ Reinforce desired behaviors ■ Focus on process measures ■ Design event-based measurement protocols
Develop multi-level performance assessment tools	■ Train the observers ■ Focus on both the individual and team level ■ Focus on four to five key performance dimensions
Provide constructive and team-based feedback	■ Make it timely ■ Provide diagnostic and developmental feedback ■ Focus on both individual and team level feedback ■ Create a discipline of debriefing
Apply sound instructional design principles	■ Provide information… trainees build declarative knowledge of teamwork competencies ■ Demonstrate behaviors… trainees learn "rough approximation" of teamwork behaviors through observational learning ■ Create practice opportunities… trainees learn by doing; good performance is reinforced, poor performance is corrected ■ Provide feedback and remediation… trainees refine teamwork competencies (deficiencies in KSAs are identified and addressed with corrective feedback and additional targeted training)
Adopt a systems approach to Simulation-based Training (SBT)	■ Sound positive messages about SBT & safety ■ Make sure you involve top-level support ■ Make sure key players are on board ■ Prepare organizational climate ■ Create opportunities to practice (after SBT) ■ Show management support (after SBT) ■ Ensure trainee motivation ■ Promote self-efficacy ■ Reinforce desired behaviors (after SBT) ■ Provide incentives

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Experiential Learning: Why Immersive Simulation Has Become So Important

James A. Gordon, MD, MPA

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Imagine a new doctor and nurse, both fresh out of school, who are working on-call in the hospital for the very first time. They are caring for an elderly man with excruciating flank pain from a large kidney stone, and decide to administer a bolus dose of morphine for comfort. Shortly after administration, the patient becomes overly-sedated and appears quite ill. Surprised and alarmed, the young practitioners call a "code." Amid great anxiety and a flurry of activity, the backup team arrives to revive the patient with a simple reversal dose of nalaxone.

Now consider, in that moment, what has happened in the mind of these two young practitioners almost *instantaneously:* for the rest of their lives, they will remember the simple step of narcotic reversal…forever.

Traditionally, such a powerful lesson could only be learned on real patients. Today however, scenarios like these can be safely replicated in the simulator lab, helping trainees develop expertise through the kind of "deliberate practice" required in any field of high performance.[1,2] Animated full-body patient simulators—robot-mannequins that can recreate the clinical encounter—are unique in complementing traditional methods of medical education. In particular, simulation can add value in helping to achieve three longstanding pedagogical objectives: safety, standardization, and efficiency.

Safety

In the pre-simulator era, supervised apprenticeship was viewed as the safest and most effective form of training, providing dedicated oversight and real-world experience. Inherent in this model is an orchestrated transition to independent practice, during which time the judgment of a relative novice will substitute for the expert. Layers of oversight reduce the risk of error, but such risk is always present in a "live" training environment. Although simulation is used to mitigate such risk in other high-risk training environments (aviation, military, nuclear power), health care has only recently begun to explore simulation-based risk-reduction strategies and peer review.[3]

Standardization

In the pre-simulator era, pathology presented to trainees only by "time and chance." If a young doctor or nurse happened to be in the hospital or clinic when a certain patient presented, then he or she had the chance to remember and classify that patient as part of a personal "case repository" of clinical experience. This is how medical expertise was developed and honed. But if such a person/disease never crossed a trainee's path, then he or she would simply "hope" to adequately handle future such patients by dint of intellect and training.

Such uncertainty has historically been managed by progressively expanding the length of training (internship, residency, fellowship)—effectively mitigating the inherent variability of patient presentation. However, we cannot simply "add another year" *ad infinitum* onto already-lengthy training programs. Moreover, available time to "teach and learn" has been notably diminished in recent years, not only because of new house-officer work hour restrictions, but also because many patients previously treated in a teaching hospital are now treated effectively with brief outpatient visits. Simulation offers a unique opportunity to offer exposure to important disease entities that may not otherwise be encountered in sufficient quantity by the trainee.

Efficiency

How can a safe and complete training cycle continue to be maintained in the face of the growing mismatch between the volume of new medical knowledge and the available training time? Simulation, like real patient care, is efficient in fostering instant and enduring learning. Because experience in the simulator can be dynamic yet controlled, educators may be able to accelerate the acquisition of medical expertise through careful curricular planning.[4] Based on work done with colleagues at the Institute for Medical Simulation,[5] I believe that simulation reliably catalyzes a level of emotional activation that is critical in the development of expertise; and that such emotional activation is hard to routinely achieve outside of the integrated clinical environment (real or simulated).

Core educational goals of safety, standardization, and efficiency in health care education can no longer be maximized through traditional methods alone. Immersive full-body simulation is unique in allowing the trainee to experience a transformational level of emotion and cognition previously accessible only through real-world patient care. Such a platform promises "on-demand"[6] access to instantaneous and indelible learning for the safest possible health care.

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Simulation-based Performance Assessment: Scenarios, Raters, and Scoring

David J. Murray, MD

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Health care educators, certification boards, hospital credential panels, and patient safety organizations agree that increasing the skill and competence of health care professionals is the key to long-term and lasting advances in patient safety.[1-5] In order to accomplish this goal, health care educators must develop strategies that assure that professionals acquire and maintain skills expected in patient management settings. Increasingly, simulation is cited as a modality capable of accomplishing many of these objectives.[5,6] A simulation-based curriculum can be used to measure, train, and assess a professional's ability to integrate knowledge, clinical judgment, communication, and teamwork in high-fidelity practice settings.

Current approaches to assess physicians stress knowledge, but under-emphasize other competency domains required in patient care settings. A physician's ability in skills that are directly relevant to patient care must be assessed to assure competence in managing conditions, particularly those conditions where delayed diagnosis and inadequate treatment contribute to an adverse patient outcome. The components required for designing and implementing a simulation-based training and assessment program include the scenarios, the scoring systems, raters, and the analysis of the participant scores obtained during the training session (Table 1).

Table 1

Steps in Design, Implementation, and Analysis of a Scenario and Simulation-based Assessment

Scenarios
Defining the skills and choosing the appropriate tasks
Content and context of scenario
Construct of scenario
Diagnostic features, clinical findings, urgency, progression of signs/symptoms, anticipated sequence of actions
Fidelity, standardization, reproducibility of scenario (props, verbal cues etc.)
Administration (preliminary data (H&P) and presenting findings)
Instructions and comments to participants during scenario
Scoring
Pilot and expert management
Observation and review of pilot
Scoring metrics (diagnostic and therapeutic actions, sequence, time, mannequin outcome)
Ratings (key actions, time, checklist, global)
Raters
"Hawks" and "Doves" (defining performance expectations)
Training and consensus on scoring actions by the raters
Setting performance standards
Analysis of Scores
Difficulty of scenarios
Consistency of each participant scores across scenarios (discrimination)
Variation among raters (rater versus rater, rater versus participant, rater versus scenario)

Scenarios

Scenarios and the associated debriefing are the essential components for achieving the curriculum goals for simulation-based training. The three general principles used to select and design a simulation exercise are 1) the relevance of events to training goals, 2) the fidelity of exercises to modeled clinical environments, and 3) whether the scenarios afford trainees an effective opportunity to manage the event.

One of the first considerations is the length and number of scenarios needed to address the training or assessment goals. On the one hand, a single prolonged scenario that poses multiple additive challenges may offer more opportunity for a physician to demonstrate many of the advanced skills and behaviors expected in practice, but scoring of these scenarios is often challenging. Scoring issues such as reproducibility, scoring rubrics, timeliness, reliability, and availability of expert raters often limit the application of this type of scenario. Scenarios that are to the point (5–10 minutes) can include relatively well-defined scoring actions and offer a more concise debriefing strategy. Each scenario measures a defined, targeted management issue and a set of scenarios offers a method to evaluate a range of skills.

Scoring

To measure the skills expected in advanced stages of training, experts are needed to define performance expectations. This expert input is often needed through multiple iterations of the scoring system. Comprehensive checklists are often used, as well as global, or holistic, scoring. All of these scoring methods have strengths and weaknesses. One of the primary considerations is whether the scoring systems align with how an expert would manage the scenario. For many scenarios that require a logical, sequential approach to manage the condition, checklists often are unable to capture sequencing of actions that are fundamental to acute care management. These inclusive checklists also tend to reward thoroughness rather than skill.

Almost all of these scoring systems do require some subjective rater judgments, such as what constitutes completion of a checklist item. The holistic or global evaluation, which includes a single rating of performance, adds more rater variance, but the overall reliability and reproducibility of the global scoring system is often superior to more objective scoring methods. Unlike the other scoring systems, the global assessment allows raters to evaluate all of the actions (correct and incorrect) and

to assess the sequence of actions in assigning an overall score. One of the main concerns with global scores is that rater discrepancies, especially their root causes, is certainly more difficult to resolve when the rating criteria are not as explicit.

Raters

One of the reasons that few studies have tackled the issue of trainee and provider assessment is that more complex skills in advanced training situations require an expert rater and are more difficult to evaluate. A variety of training steps are needed to assure that similar criteria are applied by the raters. This includes the need for agreeing on the skill set expected of the participant, defining the expectations for each scoring item, 'pilot' scoring, and setting standards for skill sets.

Analysis of Participant Scores

Recent simulation studies have concentrated on psychometrics of performance assessment.[7-10] This type of analysis of the resulting participant scores provides a "check" on the efficacy of the scenario design, content, construct, scoring methodology as well as the raters. An analysis of scenario scores indicates whether scenarios are of equal difficulty, and whether scenario discriminations (the correlation between individual scenario scores and total scenario scores) are positive. A positive result would confirm that scenarios are evaluating related content. In analyzing participant scores, participants who receive a higher score on a scenario would be expected to receive a greater overall score and, conversely, failure to recognize any scenario would be expected to correlate with lower cumulative scores. This analysis often provides information about whether changes are needed in the design or content of the exercise as well as to indicate which practice domains might require more attention and emphasis during and following training. An analysis of rater differences in scoring each exercise provides information about how different evaluators interpret case scoring actions and whether they score the end-points of each action similarly.

Conclusion

A number of specialties are designing and implementing simulation-based credentialing and recertification programs. Studies that establish the reliability and validity of this credentialing approach will need to be accomplished prior to the implementation of these programs. Certification and recertification using a simulation-based assessment has the potential to enhance professional skill, elevate practice standards', and ultimately improve the safety of patient care. ■

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Communication with Patients and Families in the Aftermath of Adverse Events and Medical Error

by Robert D. Truog, MD, and David M. Browning, MD

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Over the past two years, the Institute for Professionalism and Ethical Practice at Children's Hospital has partnered with CRICO/RMF to develop and produce a workshop devoted to supporting clinicians in their communication with patients and families in the aftermath of adverse events and medical error. While the workshop employs some of the same strategies used in simulation and team training, it incorporates some unique differences as well.

The "Coaching for Disclosure" workshop has been constructed around the National Quality Forum (NQF) standard on "Disclosure of Serious Unanticipated Outcomes," one of the 30 Safe Practice Guidelines[1] developed by this organization that form the metric for the pay-for-performance programs endorsed by the Leapfrog Group[2] and other payers. The model is premised on the assumption that it is simply not feasible to train all of the clinicians in a health care institution to be highly knowledgeable about and proficient in the disclosure of adverse events and medical error, but rather that hospitals should develop systems to assure the availability of "coaches" who can provide the necessary just-in-time training and support to clinicians on a 24/7 basis. The goal of our workshop, therefore, is to train a cohort of coaches to fill this role at each of the CRICO-insured institutions.[3]

The primary role of the coach is to guide the clinicians in the immediate aftermath of an adverse event, starting with the initial conversation or conversations that the clinical team has with the patient and family. These conversations are critical—data show that decisions to file lawsuits against clinicians and hospitals correlate poorly with whether the event was due to an error or even the seriousness of the error, but instead are driven largely by failures of the clinicians to treat patients and family members with honesty, openness, respect, and compassion. As Hillary Clinton and Barack Obama recently wrote in the *New England Journal of Medicine,* "Studies show that the most important factor in people's decisions to file lawsuits is not negligence, but ineffective communication between patients and providers."[4]

One section of the workshop is devoted to detailed exploration of a case scenario, using live enactments with workshop participants and professional actors portraying a middle-aged patient and her husband. The patient has just had abdominal surgery, and as a result of faulty communication between the surgical intern and the bedside nurse, receives a morphine infusion 10 times greater than the intended dose. She suffers a respiratory arrest, but is quickly resuscitated and restored to her baseline health without any evidence of lasting harm from the error.

Participants from the audience are selected to play the various roles in the event—the surgical attending, surgical intern, bedside nurse, nurse manager, social worker or chaplain, and the coach. With the goal of primarily emphasizing the coaching process, the enactment is performed in two parts. First, we simulate the team huddle that occurs between the coach and the clinicians to prepare for the conversation with the patient and her spouse; then we have the clinicians engage in the actual conversation with the patient and husband.

In the first conversation, the coach faces a complex set of tasks. In a short period of time, the coach needs to assess the emotional state of those who were involved in the event (Are any of the clinicians too angry or upset to participate? Are they capable of being "team players" in the meeting with the patient and family?). In addition to determining which of the clinicians will meet and speak with the family, the coach must help the team develop an agenda for the conversation and formulate a plan for what the family will be told (What are the facts that we can and should share with the family at this time? Are there areas of uncertainty where we should avoid conjecture and speculation? Is it appropriate to convey expressions of regret or, possibly, apology?). The coach needs to help the team anticipate difficult questions that might be raised by the patient or family member ("Who is going to pay for the extra costs associated with this event?" "What if I don't want that doctor to take care of me anymore?")

Once the coach and the team feel that they are adequately prepared for the conversation, there is a short break while the patient and her husband set the scene for the second conversation, which is now imagined to be the patient's bedside. The patient is in a hospital gown, attached to an IV, with her husband seated beside her. The clinicians then join them, and the initial disclosure conversation takes place. As facilitators, we have been impressed by how these conversations differ from one workshop to another—no two are alike. The response of our talented actors has been consistent and predictable—when they experience the clinicians as honest and caring, they tend to feel reassured and open to trusting the clinicians. When the actors feel the clinicians are "beating around the bush" or hiding what they know, they are likely to become irritable and demanding. In this way, our approach to learning differs markedly from the method employed with "standardized patients," where the actors typically respond within defined scripts. Our approach is more like improvisational theater, where the content of the conversation is created by and emerges naturally from the nature of the interaction itself.

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A Day at CMS

by Thomas Beatty, MD

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My first experience at the Center for Medical Simulation (CMS)[1] was in 2004 with a team of colleagues (physicians, nurse midwives, and nurses) from Newton-Wellesley Hospital (NWH). We were a veteran group, confident in our ability to recognize and manage obstetric emergencies and skeptical that laboratory simulation would provide a realistic setting that could challenge us and teach us something new.

A didactic session reviewed crew resource management (CRM) principals such as situational awareness, assertion, and closed loop communication. The concepts were familiar, but not ones we had formally incorporated into obstetric care. During the session, our group was called urgently into a delivery room to assist in an ongoing obstetric emergency. The other participants watched events unfold through a two-way window. The simulation was realistic, with physiologic monitors producing realistic (and worrying) data. I quickly forgot that I was in a simulation lab and responded as I had been trained to do so many times before.

Later, reviewing the video and listening to feedback from observers was a humbling experience. Though I knew what obstetric/surgical decisions to make, my communication skills often failed to get the desired results. I issued instructions into the air, without directing them to a specific person; I made assumptions regarding the actions of others without confirming them; and I failed to communicate exactly which task I was performing. Our team members each possessed necessary knowledge and skills individually, but our ability to handle the crisis was hampered by our lack of effective teamwork.

Our team improved as the day progressed, as we observed other responders and practiced our own teamwork again. The intensity of the simulation experience taught me the value of CRM principals and teamwork training in a manner that classroom learning cannot. The experiential learning at CMS gave me the opportunity to participate and critique my own behaviors in a crisis, observe the behaviors of others in the same simulated event, and strategize with my hospital team—discussing how we would implement the team training concepts we learned back on our "real" Labor and Delivery unit.

At NWH, we have implemented structured communication (SBAR[2]), briefings and debriefings, closed loop communication, assertion, drills, and other elements of team training. And, we practice them with various obstetrics drills. Over time, all of our Maternal/Child Health staff have become versed in the terminology of patient safety CRM.

The Refresher Course

Prior to my second visit to CMS, in 2007, I had imagined all possible obstetric crises that might be simulated and felt prepared to ace the course. I was concerned that the second time around might not be as valuable a learning experience. I was attending alone, so I would be inserted into a "team" on the spot. The second experience was more intense than my first since I had to quickly establish relationships with strangers and effectively communicate. I may have learned more from this second time.

Observing teams from other hospitals and working with new people forced me to rely on principles and not past experience. Certainly, by the end of the day we were no longer strangers but a team, working effectively together. This second CMS experience re-imprinted principles for me that I continue to carry with me. Obstetric emergencies occur with regularity and require a defined set of clinical skills we can and do master. But our ability to effectively manage these emergencies requires more than the skill of individual providers—this is where the simulation experience was most valuable to me. The intense experience at CMS imprinted concepts along with the value of effective communication and teamwork, practices I employ daily as, for example, I use and request **SBAR** communication. I hold **briefings** before procedures and **debrief** after the event (although to be honest, we don't always debrief the uneventful procedures, but always debrief the eventful ones). Just today, a nurse **asserted** her concern about an aspect of care for one of my patients; we met, along with other team members, until all were comfortable with a plan we developed. **Closed loop communication** has become a requirement with verbal orders and we have extended it to emergencies.

My first simulation experience transformed the way I viewed emergency care in obstetrics. I took the knowledge back home, but could not have utilized it in a vacuum. Fortunately, a critical number of other hospital members obtained the same experience. This along with team training and regular drills allows me to utilize the concepts I learned on a regular basis. My second experience served to advance my understanding of CRM principles, reinforce the concepts in a way that only intense experiential learning can do, and to realize that daily use of team training/CRM principles is the best way to prepare to use them effectively in an emergency.

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1 Center for Medical Simulation www.harvardmedsim.org/cms

2 SBAR (situation, background, assessment, recommendation)

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Following the coaching session and the conversation, we typically spend about 30 minutes debriefing the event. The purpose here is not to criticize or even to focus on how the interaction could have been improved, but instead to respect what we have just observed as simply one of the many ways that these conversations might actually happen. We reflect on the insights we have gained and on what they might teach us about how to be more effective coaches. The actors are part of the debriefing and play an essential and valued role, as they are perceived as authentic understudies for real patients and family members. They are frequently called upon to respond to questions from the participants such as "How did you feel when the attending said he was sorry about what happened?" or "What might have been said differently that would have increased your trust in the team?"

Attendance at a half-day workshop is a big commitment for clinical leaders, yet it is not enough time to fully teach all of the complicated skills that coaches require. Indeed, one of the most frequent comments we receive on our evaluations is that our participants feel this is an excellent *beginning*, but that additional and ongoing training will be necessary before they will feel comfortable taking on the coaching role. To date, we have conducted 12 workshops with more than 250 participants from the physician and nursing leadership of the hospitals; but we recognize that this is only a beginning to meeting the challenge from the NQF to make this model of just-in-time support through coaching a successful reality. ■

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Getting Organized at STRATUS

by Molly Perencevich, MD

Dr. Perencevich is a resident in Internal Medicine at Brigham and Women's Hospital, Boston

Before my first STRATUS session, I reviewed the management of hypotension and hypoxia, as well as ACLS (Advanced Cardiac Life Support) algorithms. I knew that the sessions were intended for us (medicine residents) to practice managing sick patients in code situations in the hospital. And, I knew that a patient mannequin would be the focus of the simulation. However, exactly how the session would work was unclear to me.

On the day of the session, prior to the simulation, one of the staff physicians introduced us to STRATUS. He explained that the mannequin could speak and answer our questions. The mannequin also has physical exam findings such as pulses, heart sounds, and lung sounds. A cardiac monitor would provide continuous data. An ECG, chest X-ray, and lab tests could be obtained by request. For treatment, there was oxygen, tools for intubation, materials to put in IVs (which could actually be performed on the patient), medications, and other items to perform a variety of procedures if needed. The session would begin with us being given the symptoms or abnormal vital signs that brought us, the medical team, to the bedside. It was then our job to evaluate and treat the patient. Afterwards we would discuss how things went.

"This is a 74-year-old man who was admitted two days ago with shortness of breath. He has been doing OK, but now his BP is 93/45 and his oxygen saturation is 84 percent on five liters of oxygen."

Upon entering the room the mannequin was moaning and saying, "I cannot breath." The six of us approached the patient somewhat timidly, not sure what to do first. Somebody talked to the patient and reviewed the chart. Someone else started to monitor his vital signs, but then got distracted by looking at the ECGs. And someone else examined him, but did not tell anyone else what he found. There was a lot of confusion and it was not always clear what we had determined and what needed to be done. We eventually arrived at the most likely diagnosis of flash pulmonary edema. We wanted to give Lasix, but there was no IV in place. Then, a staff member came into the room to discuss how things went.

The discussion was focused on not just the diagnosis and treatment, but also about how we managed the situation. Our approach had been disorganized. The staff physician recommended that we have a leader who stood at the end of the bed and kept the group organized. He or she would give jobs to

people and keep track of the relevant information obtained. We decided ahead of time that Samara would be the team leader. We were then given another scenario.

"This is a 74-year-old man who was admitted two days ago with shortness of breath. He has been doing OK, but now his BP is 93/45 and his oxygen saturation is 84 percent on five liters of oxygen."

Samara stepped to the head of the bed and helped coordinate our evaluation and treatment of the patient. Each of us had a clear task: to obtain the history, evaluate and manage the airway, monitor the vital signs, start an IV, and obtain data such as ECG and labs. We quickly learned that he had had a thoracentesis the day before for a pleural effusion, and our exam confirmed a right-sided pneumothorax. His blood pressure was dropping, so we performed a needle thoracostomy to release the pressurized air.

These simulations are valuable for many reasons. They are a great opportunity to review diagnosis and management of conditions such as flash pulmonary edema, tension pneumothorax, and cardiac arrest. Procedure training, such as needle thoracostomy, is also a benefit. The more unique part of these experiences, however, is a chance to practice these things in a real-time manner. If you asked any of us in the classroom what we would do when dealing with a situation like those above, we would calmly describe the process of evaluation and treatment. However, in reality, situations like these are often not calm and it can be difficult to focus when a patient is in distress and there are many people involved. In urgent situations, such as the evaluation of acute hypoxia or a cardiac arrest, it is important to be able to work together to thoroughly and efficiently evaluate and treat the patient. The STRATUS simulation sessions provide this opportunity in practical education.

Not a Moment to Lose: Shapiro Simulation Center

by Steven D. Schwaitzberg, MD, FACS

Dr. Schwaitzberg is Chief of Surgery, Cambridge Health Alliance; Visiting Associate Professor, Harvard Medical School

Surgical training in the 1980s and early 1990s was a trial by fire: see one, do one, teach one. Ironically, it was said back then that the problem with every-other-night call was that you missed half of the action. Somehow though, the system worked since master surgeons were produced by the score.

That was a different era and much has changed. Everything from work-hour restrictions to competency-based education is different and we are not going back. Only the patients have not changed. They still come in the same flavors, hypotensive, septic, or perhaps bleeding from time to time; but no longer is there the luxury of large house office teams responding to crisis after crisis garnering experience through long hours of trial and (substantial) error.

In order to save lives in the Emergency Department (ED) or the Operating Room (OR), we will need to develop training strategies to hone the efficiency and competency of the modern multidisciplinary team of surgeons, anesthesiologists, ED physicians, nurses, physicians assistants, and medical technicians. In the era of restricted work hours, these individuals will mix and match with regularity.

Thirty years ago, I sat in a room with the famous surgeon centenarian Michael DeBakey who told a group of wide-eyed medical students, "You can't learn to play the piano by reading the sheet music." He was right and that was the justification later for a whole lot of every-other-night (and two months of every night) call for me in the hospital. His message is still right, but the methods have to change.

Last year, I participated in a research study designed to simulate a surgical emergency in a mock operating room with a full surgical team in the Shapiro Simulation Center at Beth Israel Deaconess Medical Center. I was prepared for disappointment. After all, I had trained on the real thing. To my utter amazement, when the simulated *you know what* hit the fan, I found myself in that same zone of slowed down reality and problem solving that occurs for me in "real" crisis scenarios. In fact, it took a few moments for it to sink in when the simulation was actually over. Reality had been successfully suspended. I realized we were onto something.

The full impact of the value of simulation in the OR crisis scenario didn't hit me until a month or two later when I was called to one of our operating rooms in full blown chaos. CPR was underway and a young surgeon was sweating with a big problem: an elective surgery patient with no blood pressure. There is no replacement for experience, but the closest surrogate is good training and this surgeon had neither when it came to this scenario. The story had a happy ending, a near miss instead of a terrible tragedy.

Later, when I could reflect upon it, I came to appreciate just how valuable team simulation will be, not only to tomorrow's surgeons, but today's as well. The broad fields of surgery must fully embrace this type of training. We, and our patients, have not a moment to lose.

Additional Reading

by Judith Jaffe, MSLIS
Ms. Jaffe is Knowledge Manager for CRICO/RMF.

The following additional resources related to Simulation and Team Training were selected from the PubMed (Medline) database of indexed biomedical literature published from 2000 through March 2008. Links are provided to abstracts and full text, where available.

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