Simulation: The New Teaching Tool

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SEE RELATED ARTICLE, P. 495.

Throughout the past decade, emergency medicine educators have wrestled, perhaps with some apprehension, information essential to the practice of our specialty grow exponentially in breadth and depth. New developments are rapidly layered on top of an already thick strata of knowledge: new laboratory and imaging tests that must be interpreted and incorporated into increasingly complex decisionmaking; new drugs with indications, interactions, and toxicities; new procedural skills; more guidelines and protocols; mandated programs in professionalism and other competencies; and complicated, ever-expanding systems, from computerized hospitals to evolving government agencies. The educator’s task is to ensure that resident physicians acquire most of the new and existing knowledge, skills, and attitudes of emergency medicine in the restricted duration of a residency. And that has become an insurmountable challenge.

Residents learn primarily from the apprenticeship model of treating patients under supervision, from reading, and from didactic programs consisting mostly of lectures. Patient contact is now somewhat limited by work hour rules. Reading provides necessary foundational knowledge, but it does not always translate into clinical skills and judgment. The duration of emergency medicine residency training has not been (and perhaps cannot be) extended beyond 3 or 4 years, unchanged from when residencies began. It does not seem practical to divide our burgeoning knowledge base into manageable portions through specialization. Consequently, either educators must find more efficient and effective training methods or residents must acquire more of their knowledge and skills after graduation.

The traditional lecture is a favorite educational tool because an instructor can convey a concentrated parcel of information to a large audience in a short time. Unfortunately, if it is not repeated, used promptly, or somehow processed, most of the information is forgotten. Is there a better way? In this issue of Annals, Binstadt et al1 offer simulation as an answer to the educator’s dilemma. Although the authors haven’t completely abandoned the traditional lecture and group discussion methods of teaching, they have transformed a substantial amount of their didactic program by integrating a form of experiential learning—simulations—into modular sessions throughout the academic year. The authors initially define medical simulation as “the use of a device, or series of devices, to emulate a real patient situation.” This is a reasonable definition of a simulator; however, simulation is more than the use of mannequins and computers. Simulation is the artificial representation of a situation, environment, or event that provides an experience for the purposes of learning, evaluation, or research. In short, simulation is another educational tool.

Binstadt et al1 and others have described some innovative uses of simulators in emergency medicine, but educators have only begun to realize the potential of simulation.2-10 Computer-controlled, full-body mannequins, or “high-fidelity simulators,” are generating most of the excitement as technologic advances and decreased costs make these devices more widely available. Existing high-fidelity simulators imitate cardiovascular and pulmonary physiology well and allow verbal interactions with a patient, but they have rudimentary anatomic features. Partial task trainers, such as IV trainers and lumbar puncture models, are better at simulating regional anatomy. Simulators, like other tools, are specialized.

It is clear that simulation animates the curriculum. It allows learners to try out and operationalize new knowledge, turning general concepts into practical skills and management strategies. It imparts an emotional component to the experience for most learners, thereby firmly implanting new information into memory. It allows resident physicians to make mistakes without causing harm to real patients and to correct their mistakes immediately. It provides residents with standardized experiences in managing common and rare clinical conditions under closer supervision than is available in the emergency department.11 However, there is a cost. Many faculty who use simulation find it to be one of the most time-intensive teaching methods.

Although Binstadt et al1 report that the time required for simulation course development is “substantial,” they have probably understated the time commitment, especially when content is customized to various levels of training. High-quality clinical simulation programs are expensive because they require not only high-fidelity mannequins but also simulation (technical) professionals, medical content experts, adept instructors, and a facility in which to conduct the simulations and store equipment.9,12 The amount of effort required to create a new simulation varies with the needs and training level of the learners. Brief, impromptu simulation sessions can effectively demonstrate a few teaching points. However, as the
novelty of the new technology fades, advanced learners demand more realism and complexity in their simulation exercises. Simulation works best when it allows the learner to reflect on the experience and self-evaluate, which is time-consuming when done well.

How real, dramatic, or “immersive” does a simulated experience need to be? A simulation should imitate and approximate, but not necessarily duplicate, reality. Simulations should reproduce only the important elements of the working environment. The level of realism or “fidelity” of simulation lies on a continuum based in part on technology, ranging from immersive virtual reality laboratories and full-body, automated, “high-fidelity” mannequins situated in hospital environments on the high end, to intermediate-fidelity interactive, computer (screen)-based programs, partial task trainers, and standardized patient assessments, to homemade procedure models and written, cognitive exercises using clinical vignettes on the low end.5,13,14 Kyle12 draws parallels between high-end medical simulation and theater: “Clinical simulation facilities are theaters where plays of illness and treatment are imagined, written, rehearsed, staged, and criticized . . . [S]imulation scenarios need all the components of “real” theatrical productions: scripts, costumes, lines and action cues for all the participants (including the patient simulator), props, and a rehearsal audience for constructive criticism.”

The fidelity of the simulation is determined by the learning objective. “The goal is always to create the best learning, not necessarily the best simulation.”12

Before redesigning emergency medicine curricula with simulation as extensively as Binstadt et al1 have done, educators might want some proof that it works better than what they are currently doing, relative to the effort expended. Most studies of simulation are merely surveys that report the enthusiastic and appreciative reviews of learners. Wang and Vozenílek10 point out that “there are no data to support the efficacy of simulation in enhancing resident performance and competency with respect to systems-based practice.” True validation studies are needed. On the other hand, demonstrating the educational benefit of every simulation in a randomized, controlled, comparative trial may be too much work for too little benefit while our knowledge base continues to mushroom. Many instructors who use simulation are satisfied with its face validity.9

Simulation has been used in various forms in emergency medicine for years. The American Board of Emergency Medicine oral board examination has used “simulated patient encounters” for assessment since 1981. In this high-stakes examination, the examiner verbally paints a picture of a patient, a setting, and subsequent events for the candidate (examinee) and scores the performance with technically primitive devices: pencil and paper. Nevertheless, the American Board of Emergency Medicine examination is a scientifically validated and highly regarded assessment tool. The “mock codes” in advanced cardiac life support courses and procedure laboratory exercises are simulations using models. In objective structured clinical examinations and role-playing exercises, actors or instructors simulate patients. Disaster drills are multilevel simulations designed to evaluate an entire emergency response system, the triage and transport of multiple simulated “victims” in the field, and the management of individual patients (either actors or mannequins) in hospitals.

Binstadt et al1 have appropriately placed knowledge at the base of their performance pyramid (see their Figure 1a), because “effective clinical performance begins with knowledge.” Inexperienced interns will flounder during a simulation if they do not possess the prerequisite knowledge and decisionmaking skills. High-fidelity simulation is an inefficient method for imparting facts; an instructor can concentrate more information per hour into a lecture or into a few pages of a textbook. Simulation seems to be a more effective method of learning at the higher levels on this pyramid. Simulation may be useful for accelerating the learning curve, but only for a portion of the curriculum. Although usually conducted in artificially controlled laboratory settings, simulations may serve as the stepping stone between lectures and books and the complex, unpredictable experiences of the clinical arena.12

Considering the complexity, cost, and time requirements of developing and implementing high-quality simulations, simulation-based instruction will not completely replace traditional teaching methods. Nevertheless, high-fidelity mannequin- and interactive computer-based simulations are proving to be effective tools for teaching higher-level skills. Faculty will never be able to teach everything that resident physicians must learn, but it helps to have a new tool for the job.

Supervising editor: David T. Overton, MD, MBA

Funding and support: The author reports that this study did not receive any outside funding or support.

Publication dates: Available online December 18, 2006.

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REFERENCES


