

EDITORIAL VIEWS

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Clinical Simulation

Technical Novelty or Innovation in Education

THE recent availability of two commercial patient simulators may stimulate additional interest in a study described in this issue of ANESTHESIOLOGY.¹ The licensing and marketing of these sophisticated simulators has moved this technology from solitary academic prototypes with complicated technical and mechanical design to a standardized commercially available electromechanical manikin with a simple "Windows" user interface. Anesthesia departments who purchase either simulator could implement an educational program similar to the study described by Gaba *et al.* in this issue of ANESTHESIOLOGY.¹

The decision about incorporating clinical simulation into training programs will ultimately be based on how these devices can be used to meet the educational needs of anesthesiologists. In this study, Gaba *et al.*¹ determine that anesthesiologists' technical and behavioral performance in crisis settings can be scored reliably by faculty raters. The ability to reproduce similar scenarios using clinical simulation provided an evaluative technique to measure performance of "teams" of anesthesia providers in similar crisis settings. Not unexpectedly, team performance varied, and correlations among faculty raters were better for technical markers than for behavioral markers of performance.

Some of the practical questions suggested by this research are: Do current simulators match the fidelity of a real clinical setting? Is there a need for clinical simulation in anesthesia education? What are the potential uses of clinical simulation in anesthesia education? What role exists for simulation in medical and health

care education? How can departments meet the capital costs and operating expenses of purchasing a simulator?

Software development and hardware modifications will continue to improve the fidelity of simulators, but advances in technology are not necessary to provide a variety of innovative educational programs. A broad range of physiologic, pharmacologic, and pathophysiologic data provide real time responses to drugs and programmed events. In addition to the cardiorespiratory and pharmacologic models of the "ideal" 70-kg patient, a variety of preprogrammed patients (*e.g.*, mitral and aortic stenosis, intracranial hypertension, obesity) can experience a constellation of cardiorespiratory events such as anaphylaxis, hemorrhage, pneumothorax, and aspiration. Events can be varied to change speed of onset, severity of associated signs, and responses to therapy. New patients or new events also can be created using physiologic and pharmacologic computer-derived parameters.

Is there a need for simulation in anesthesia education? The broad clinical experience provided in an approved residency program remains unchallenged as the foundation for specialty training, but assuring that all trainees get adequate exposure to multiple clinical situations remains a logistic challenge for all training programs. The pragmatic educator might suggest that these constraints always have existed and are effectively met by didactic methods such as lectures, seminars, and journal clubs. These didactic sessions are time-honored, economical formats to provide information, but they have numerous limitations particularly when used to teach and evaluate clinical judgment. Clinical simulation may offer a methodology to apply knowledge and clinical skills in a more realistic setting.

The aviation industry's commitment to simulation and similarities between anesthesia and aviation was a key rationale for developing courses in anesthesia crisis management. If the behavioral and technical concepts taught in crisis management courses generalize from one acute situation to other acute situations, then crisis management courses may need updating—perhaps annually. If concepts taught in crisis training do not generalize among various acute situations, then providing cri-

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sis management training might become a primary education role for simulators.

Crisis management training is resource intensive because a "simulated" scripted crew (faculty) is essential. Crisis management is only one of the potential programs that can be provided using simulation in residency training. The need to recreate an entire operating room environment is not necessary to teach or evaluate clinical judgment in the diagnosis and management of hypotension, hypoxia, cardiac arrhythmias, decreased lung compliance, and myocardial ischemia. The educational options that exist for residency training using clinical simulation are exhaustive and primarily limited by the dedication of faculty to curriculum development. For almost any lecture that teaches a clinical concept, simulation can be used to provide the learning experience in a realistic environment.

One of the most exciting applications of clinical simulation is in medical student education. Simulation provides an opportunity for students in basic science courses to apply this knowledge to clinical settings. Students can explore how baroreceptor reflexes alter heart rate and how reduced preload, decreased contractility, or altered afterload changes blood pressure. Similar experiences can be developed to apply respiratory physiology and anesthetic and cardiovascular pharmacology to simulated clinical settings. In introducing critical care to medical students, simulation can provide a teaching and evaluation environment that closely resembles the acute care setting, whether operating room, intensive care unit, emergency treatment room, or procedure center. Students can evaluate urgent problems, such as a hypotensive or hypoxic patient, during a simulation and initiate a treatment plan and monitor therapy. The immediate feedback provided by the simulated patient's response to therapy is a unique feature of clinical simulation.

Simulation can similarly provide training experiences for nurses, paramedics, and respiratory therapists. Conscious sedation courses for nursing personnel extend the concept of patient monitoring and evaluation beyond pharmacologic "recipes." A variety of special

courses can be developed for health care personnel in radiology departments, cardiac catheterization laboratories, endoscopy suites, or free-standing minor surgical centers (ophthalmic and oral surgery) that include clinical scenarios specific to the special needs of these patient care settings.

A simulation facility that includes appropriate support facilities requires a substantial financial investment. Even in the largest anesthesia departments, anesthesiologists might use a simulation facility only a fraction of every day. The maximum use of this type of resource requires commitments from multiple user groups. The partnership that exists between medical schools and teaching hospitals is a potential source of funding for this type of education facility. Clinical simulation can provide training that meets many of the objectives of continuing nursing and medical education, risk management initiatives, and quality assurance programs. The potential for collaborative education programming across various medical specialties and nursing divisions is a potential benefit of this approach to simulation. In addition to the potential for interdisciplinary training, identically designed simulators that provide standardized reproducible scenarios could be used to teach and evaluate medical students, residents, physicians, nurses, and allied health personnel across the United States. As this study by Gaba *et al.*¹ illustrates, anesthesiology leads in the understanding and application of this technology to health care education. Our specialty will likely determine whether simulation is a technical novelty or innovation in education.

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Reference

1. Gaba DM, Howard SK, Flanagan B, Smith BE, Fish KJ, Botney R: Assessment of clinical performance during simulated crises using both technical and behavioral ratings. *ANESTHESIOLOGY* 1998; 89:8-18