

**GROWTH OF A SIMULATION LAB:
ENGAGING THE LEARNER IS KEY TO SUCCESS**

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Abstract:

High-fidelity simulation (HFS) is increasingly utilized for Emergency Medicine education. The Accreditation Council for Graduate Medical Education (ACGME) Residency Review Committee for Emergency Medicine indicates that simulation may serve as an adjunct for the documentation of competencies. As simulation technology matures, institutions will be investing increasing resources to develop simulation centers at their own hospitals and universities. A focused well-defined approach using basic teaching concepts in any educational forum is essential in the initial set-up of a simulation center. The areas we examined for our success at Evanston Northwestern Healthcare were: 1) the physical plant, 2) the simulation equipment, 3) the curriculum, and 4) our teaching methodology. Engaging the learner to want to return is truly the success of our program. This is the critical launching point for anyone interested in developing a simulation lab as it will drive volume, generate financial support, and foster academic production. The academic discussions and the nuances of the machines were only meaningful when this most basic requirement was met, making people want to return. We provide a brief review of high fidelity simulation, and the key elements that led to growth and operational success of our center.

Introduction:

High-fidelity simulation (HFS) is a fundamental tool for teaching healthcare workers. Currently the American College of Surgeons has created a multilevel certification of educational centers.¹ The American Society of Anesthesiologists Workgroup on Simulation Education has begun to characterize simulation centers for the purposes of “approval” as a site to provide continuing medical education credits.² The Accreditation Council for Graduate Medical Education ACGME Residency Review Committee [RRC] for Emergency Medicine has determined that simulation may serve as an adjunct for the documentation of competencies.³ Use of HFS is becoming increasingly integrated into undergraduate and graduate medical educational curricula.⁴

The primary benefit of utilizing HFS as an educational and evaluative tool is that learners can practice medical decision-making and procedural skills on simulated patients in an environment where the risk of error will not harm an actual patient.⁵ These technologies were developed to practice skills without incurring risk: in the military for war games exercises, in the aerospace industry for flight training of pilots and astronauts, and in the nuclear power industry to train personnel.⁶ Bridging the gap between other industries and medicine, Gaba et al. pioneered the use of simulation in anesthesia in order to train anesthesiologists.⁷

Simulation has also received favorable reviews as an effective model for teaching medicine.^{8,9} The attractiveness of HFS as a method of teaching stems from its

ability to allow learners of all levels to “practice” medicine in an environment without risk to actual patients and to provide an environment that bridges basic science and clinical medicine.^{10, 11} Gordon et al write, “Consider the issue of patient safety, and imagine a practitioner who makes a clinical mistake; immediately after realizing the error, he or she will experience an emotional reaction that is powerfully instructive – but only for the next patient. What if educators could . . . [allow] trainees to “live through” a compendium of important cases in a fraction of real-time?” Emotional involvement allows students to integrate and understand information at a deeper cognitive level.¹² As “learning by doing” becomes less acceptable to the general public, simulation exercises, done well, provide learners with meaningful repetition, reinforcement of concepts in the debriefing session, and self-reflection that is critical to improved learning so that residents may “. . . see one, *simulate many*, do one *competently*, and teach *everyone*.”¹³

There is a growing body of Emergency Medicine literature describing the use of HFS in the educational curriculum. Its adaptability to a wide array of educational situations makes it a particularly useful tool for enhancing educational objectives. Educators are documenting their applications of HFS to address core competencies,^{14, 15} low incidence but high stakes procedures,¹⁶ crisis resource management,¹⁷ team training,^{18, 19, 20} IV access,²¹ resident professionalism in ethical dilemmas,²² cognitive forcing strategies,²³ bioterrorism,²⁴ disaster training,^{25, 26} flight crew airway management,²⁷ multiple patient encounters for error reduction,²⁸ comparative evaluation of resident performance,^{29, 30} systems-based modular residency curriculum,³¹ and medical student education.^{32, 33, 34, 35} The significant literature and successful implementation around the country is driving demand for HFS training and proliferation

of training facilities will necessarily follow.

Discussion:

As our center reached its four-year mark, we reflected on the key areas that fostered our growth. Our simulation education involves local and national training curricula of emergency medicine residents, nurses, medical students and pre-hospital care programs. A brief review of the growth of our center is presented along with key elements for expansion.

The HFS center at our community-based academic center was conceived with the following goals: to provide medical education utilizing HFS technology, to provide a safe learning environment, and, with an open-minded approach, to determine just what HFS could achieve. Like many centers, ours had a very modest start. An internal grant provided funding for an adult HFS device, but we did not have a dedicated space to begin this training. A small 3.048m x 4.572m conference room was the beginning of our project, with the caveat that after we were done “playing” we had to “put away our toys” and return the conference room to its original state. Ten medical residents were the first group to participate in this new technology. Our first cases were a few cardiac arrests emphasizing Advanced Cardiac Life Support (ACLS) skills. Our control room was separated from our simulation area by an accordion screen. Our debriefing style was personal and supportive, but not standardized. We stood around the mannequin and talked about how we could improve our management of the simulated cases.

In four years our center has grown tremendously, not just in physical size and technical sophistication, but in the expansion of our applications of and research about

HFS. We have served over 2000 participants per year, utilizing two dedicated HFS Centers with a combined 464.52 square meters. Our faculty has developed approximately 100 well-described and reproducible cases for a variety of learners including emergency medicine residents, medical students, nurses, internal medicine residents, obstetrics and gynecology residents, paramedics, emergency medical technicians, and community programs for mass casualty events. We offer a broad variety of courses [Table 1] with numerous participants. Research projects are numerous, with residents participating in a variety of research involving simulation. Two Federally funded research projects are currently underway.

Staff:

To accommodate the growth of the lab, the increasing trainee load, and our emerging academic endeavors, protected time for physicians was developed for this type of education. Initially the center's director (and the main provider of simulation training) was provided with time out of the clinical schedule for training events only. As the number and variety of course offerings increased, and the clinical research developed, a variety of physicians' clinical responsibilities were reduced. This educational and academic endeavor could only take place with the commitment of the administration in the Emergency Medicine Division. In addition to physician time, critical support staff was required. The hospital became intrigued with our critical communication course for nurses and provided significant funding that supported a full time emergency department nurse and computer technician to run the simulator software specific to the cases and learners.

Equipment:

Our simulation equipment was acquired by a variety of methods. State and federal grants for disaster planning and pre-hospital education drove the acquisition of a number of devices. The need for filling educational gaps in Emergency Medicine residency programs with critically ill pediatric patients led to our partnering with Children's Memorial Hospital in Chicago, Illinois for the development of a pediatric curriculum utilizing simulation. A pediatric simulator was purchased to meet this national need. The "trauma man" simulator was acquired through our Level 1 trauma program and the Hospital's commitment to nursing and resident education.

Review of Our Growth:

Our core group of physicians-educators reviewed each step of the expansion in an attempt to identify the key components that fostered the successful development of our center. The areas we examined were: 1) the physical plant, 2) the simulation equipment, 3) the curriculum, and 4) our teaching methodology.

We looked at each of these critical issues but could not attribute our expansion solely to the physical plant, the equipment, or even a robust curriculum. Clearly, each of these factors added to our armamentarium for teaching but did not contribute to the true expansion of the program. Identifying the driving force behind this expansion required a reflective analysis of the events that emerged from the 3.048m x 4.572m room where all of this started.

The initial instruction provided to our residents utilizing this new technology was met with interest, at least with respect to the computerized patient simulator, but the first series of cases were of limited success. The technology was great, the physiology

of the simulator provided a realistic response to the learner's input and it seemed all of the critical components were in place during the initial phase to provide a tremendous experience for the participants. Instead, our initial attempts elicited minimal interest from the learner. They perceived the simulator as a novelty, rather than a robust instructional tool.

After this initial foray into resident education, the task of "engaging the learner" became the priority for our center. We relegated the technology of the simulator – the blinking of the eyes, the respiratory sounds, and the heart sounds – in other words, the "bells and whistles," to a secondary role and focused on developing what we felt was the key missing ingredient – connecting the teacher and the learner.

Two objectives became the primary goals in the remodeling of the educational component. First, was taking the simulation case and identifying the critical teaching points for each learner. Second, was making it an absolute priority to conduct the debriefing review sessions and critique the performance in a non-threatening supportive fashion with emphasis on gearing the key learning objectives for the level of the audience. Subsequent to the implementation of these factors, we discovered that these strategies generated an almost universal response from the learners: "When can I come back for more cases?" By creating a learning environment that was engaging and non-threatening and by providing 3-4 critical teaching points per case with relevance to the learner, we found that it created a powerful experience that made this type of education preferable by students, nurses, paramedics, and residents alike. It also became evident that it was critical to identify clinical educators with the ability to conduct this type of session because these teachers were the most effective at creating the environment we

desired for the learners.

Within our institution, positive feedback spread amongst students and educators, we found that previous participants were actively calling us to schedule time in the lab. We succeeded in engaging our participants such that we were able to provide critical analysis in a way that was never demeaning or condescending. The simple formula of “critical teaching points geared toward the level of the learner and appropriate critiques in a positive non-threatening fashion” was utilized for every participant. Without this formula and the desire of the learner to participate again, the interest and volume could never have been realized. The direct byproduct of this tremendous increase in activity was financial support from the institution as well as from a variety of groups that participated in the lab.

The elements of the presentations in our center were (and still are) reviewed, and continuously updated by having every participant fill out an evaluation of the experience. Our case presentations are a compilation of the techniques and elements we identified that work best to provide a positive educational experience. We discovered that the software was as important as, if not more important than the hardware. The “human factor” –the teaching is what really drives the success of the programs we conduct.

Conclusion:

The concept of “we will build it and they will come” is a difficult hurdle for any institution interested in delving into this new technology. The cost of the machines and software approach \$50,000, with space to accommodate these participants often

requiring significant hospital and/or medical school commitment. The additional costs of nurses, technicians, and a physician can be overwhelming. Unless a large grant or donation drives the initial startup and personnel required, we recommend a strategy that focuses on generating significant interest through positive experience. This process will likely result in increased student volume and institution financial support. In our case, support from nursing, medical schools, and pre-hospital care providers only came when we had a track record with each group. As we increased the volume of teaching sessions for these groups of learners, financial support for teachers and equipment were justified. As the volume grew and more appropriate teachers were identified, we began data collection for our various research projects and actively sought outside funding and grants. Key personnel at our institution with expertise in obtaining financial support focused on this aspect, which allowed the teachers to focus on the lab, the research and the students.

There are other important factors that contribute to a successful center including a clear statement of purpose or vision, thoughtful consideration of logistics (location, space, equipment, and personnel support), continuing quality assurance (assessment and reassessment of the training's effectiveness), a network of like-minded and capable individuals comprised of co-investigators and colleague-educators, significant clinical experience in the simulation environment to develop expertise and leadership in the field, and foremost, institutional support.

Our success was accomplished by engaging the learners with relevant clinical “pearls” geared toward their training level in a supportive environment. This fostered a desire to return and gave our lab the ability to improve and expand this unique

educational experience. We have discovered that the success of a simulation center depends more on the thought and effort put into case development and on the individual interactions between the educators and the learners than on the physical plant or the hardware with all the “bells and whistles.” Failure for growth and limited volume in our program would have continued had we continued to rely on a “technology-driven” educational model. The success of our lab was based on the vision that when you engage the learner, growth will follow

Table 1:

Courses and Participants

Courses	Paramedics	Physicians	Nurses	Community
Pediatric Advanced Life Support	X	X	X	
Community Disaster Life Support	X			X
Advanced Bioterrorism Triage Course	X	X	X	X
Advanced Pediatric Life Support		X	X	
Effective Communication		X	X	
Advanced Cardiac Life Support	X	X	X	
Advanced Airway	X	X		

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² ASA, *ASA Approval of Anesthesiology Simulation Programs*, A. B. o. S. Education, Editor. 2006, American Society of Anesthesiologists.

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