Medical Simulators: Room for Improvement

Where do they fall short?

BY BARRY T. KATZEN, MD

Interventionists are taking a lesson from the respected success of flight simulators and are exploring the application of medical simulators as a training and accreditation tool for intervention. Certainly, successful application of medical simulation will be an important advance in the education of physicians, but some limitations remain.

SIMULATOR CAVEATS

Currently, one major problem with medical simulation is that optimal experience requires one-on-one interaction between the faculty member and the student and it is done outside the context of patient care. Today, education is being accomplished through the normal conduct of patient care (ie, traditional learning methods)—a resident learns a procedure by being in and around a patient. The compensation structure for teaching that individual is built into the payment for patient care. Based on my personal experience, having an experienced proctor take time away from clinical practice solely for one-on-one teaching can be difficult to achieve.

Although medical simulation companies offer some level of training, the question is whether one would want to learn interventional procedures from a nonclinical instructor or a clinical proctor. Fundamentally, there are issues regarding training, oversight, and compensation for medical simulation, and achieving successful and accurate implementation. But more pressing than who will pay for the simulator and its upkeep is the need for skilled proctors to oversee the successful use of this training tool.

Simulators require one-on-one interaction; if an individual undergoes independent simulator training with no proctor, the result is going to be of relatively limited value. One of the critical elements of success is the fact that you need a skilled interventionist to commit time to teach. It has become clear that the simulation experience from the student's point of view is very heavily dependent on the quality of the supervision received. This hurdle, among others, must be dealt with before medical simulation can proceed.

Technological Hurdles

Glitches occasionally occur when using simulators. There are instances in which devices freeze, catheters do not move smoothly, or there are not a sufficient number of catheter shapes available, and image quality is sometimes less than realistic. If the technology and experience of flight simulation are used as the gold standard against which we compare medical simulation, we fall short in recreating the entire experience. That goal is to make the recreated experience one in which the operator feels that he is actually working on a patient.

Less Pressure

Frequently, the time factor (the pressure of success within a given amount of time) is not accurately replicated, if at all, in current medical simulator training sessions. The fact that students can work at a more leisurely pace, although helpful for teaching the mechanics of a procedure, does not accurately reflect the conditions and pressure experienced when actually working on a live patient.

Another aspect in which simulators fall short is the ability to present the trainee with emergent complications. For example, a carotid stenting procedure might take 1.5 hours to complete. However, it is unlikely that the carotid artery is going to thrombose while the trainee is working on a simulator. The thrombosis, spasm, the reaction of the vessel, and the environmental changes that can occur have not yet been successfully incorporated into simulation technology. The technology itself is far from being able to accurately simulate the entire interventional environment.

Simulators are currently unable to accurately re-create the complications a trainee might experience when performing an interventional procedure. Simulators will allow for "perfect-world" training, in which there are no complications, but the simulators themselves do not re-create "real-world" situations due to the lack of complications protocols and programming. To some extent it is a function of interactivity. The trainee interacts with the computer, but the computer does not reciprocate. The simulator is not going to throw a curveball at the trainee. Some simulator companies have identified the goal of creating the complete environment, one in which the trainee can be surprised and will encounter emergent complications. From the standpoint of training people at the medical student, residency, and even fellowship levels, the maximum value of simulator technology will be possible once we can simulate the entire interventional environment.

Interface Problems

Some of the haptics and tactile sensation remain relatively crude. Occasionally, the operator must learn to compensate for the simulator because it does not accurately translate the movement and/or orientation data. There is frequently a lack of one-to-one movement between the operator's physical manipulation and what is observed on the monitor. There is variation among simulators in providing physiologic data. Some simulators are more oriented toward learning how to use a specific device rather than how to perform a specific procedure. From a medical education perspective, it is hard to separate those two concepts.

Although much progress has been made, the interface is still a little rough around the edges. One example is when the simulated catheter jumps as you advance it, even though you are advancing it smoothly. The educational process is also slowed when the computer freezes up or must be rebooted.

Maintaining the Educational Value

Ensuring the success of a simulator as a training tool requires the establishment of educational training protocols on simulators, the costs of which must be accounted for within each institution that embarks on establishing simulators training.

One way to keep the educational process going is to ensure that consequences and/or a grade are attached to the simulation training process. Currently, simulators are not being used to grade or measure performance. I think a situation analogous to obtaining a pilot's license, in which competency can be demonstrated through the successful completion of a graded simulator course, is not an unreasonable goal. Some type of performance parameters, or recertification in a specialty board or recredentialing at the hospital, would allow simulators to be taken more seriously.

This might be accomplished at the hospital level. Eventually, maybe one hospital will require, for recredentialing in the cardiovascular arena, a certain number of cases to be successfully performed in a simulation environment. I believe we are a long way from that point, but I think the real value of simulators is not just on the training side, but also on the performance side, which is an area of opportunity but it is also an area in which we have fallen short. There have been some attempts at randomized trials designed to document the advantages of simulation, but the ability to measure performance is a huge potential asset that has not yet been tapped.

It is intuitive to envision medical simulators in use at medical schools, but the business model and the costs have still not been resolved. Currently, even if a simulator were given to a facility for free, there are certain associated operating costs. The question comes down to who is going to pay for this. In order to resolve the potential reimbursement issues, a trial must be conducted to procure data on the benefits, if any, realized from implementing medical simulation training. It will be necessary to prove value before any third party is going to pay for it.

CONCLUSION

We are in an early stage of simulator technology, and there are a lot of challenges ahead. Clearly, there has been significant advancement in simulator technology. Specifically, medical simulation has had a tremendous impact on industry with regard to training for specific devices. They have had less success in being adopted into the mainstream of medical education. ■

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