Surgical Simulation
A Vital Part of Our Future

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In this issue of the *Annals*, Moorthy and colleagues from Imperial College in London present basic foundational work on the concept of a simulated operating room and provide preliminary evidence regarding its utility. In so doing, they have developed initial assessment measures that can be used in this environment and have presented some basic psychometric data regarding reliability and validity of these competency measures.

Without question, there is an urgent need to augment our efforts in surgical simulation. There are dramatic forces affecting the surgical training milieu that make change a necessity. Academic surgeons throughout the world are acutely aware of the ramifications of a reduction in work hours.[1,2] The issues surrounding reduction of medical error and patient safety are on every hospital's agenda. This is appropriate, but it is having a major impact on opportunities for training. Our teaching hospitals are increasingly populated by the most complex of patients. Although this is appropriate, it has resulted in fewer opportunities for technical learning. Finally, there are major economic drivers that are governing the way in which our operating rooms function. Helping a resident operate takes longer, and this is becoming increasingly problematic in our hospital milieus where financial drivers are paramount.

All of the factors mentioned above would seem to indicate that we need additional strategies to assist our trainees in climbing the learning curve of procedural learning. The days of a slow ascent to competence, through trial and error on real patients, will not be part of our future educational heuristics. In this context, the development and validation of simulated environments, such as are described in this paper, are critical. It is important, however, to emphasize that learning on simulators or in a simulated environment should always be considered an adjunct to, not a replacement for, learning in the actual operating room.

Ara Darzi's group from the Imperial College has worked hard over the last several years to develop a state-of-the-art simulated operating room. This setting is outfitted with sophisticated data capture equipment, leading to the capabilities of assessing a variety of skills, including technical, communicative, and team competencies.

The authors deployed this setting, which has much the feel of a real operating room, to study a variety of dimensions. The first was to determine if the simulated environment was reliable for assessing technical skills and, in addition, to determine its construct validity, that is, the extent to which it the assessment tool can discriminate between different levels of trainees. This affirms that the test measures the trait it purports to measure, in this case, technical skills. The reliability of the technical test was high. This is encouraging and implies that, as is, the test can be used for relatively high stakes assessment. With regards to the element of validity, the assessment showed differences between very junior and midlevel trainees, but not between midlevel and senior trainees. This is a common finding in technical skill simulations and implies that these forms of assessment are best to assess the beginning phases of technical learning, but as

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yet, are not sophisticated enough in the simulations to discriminate between the competent and the expert.

The study also addressed what may be considered some of the "softer elements" of the technical aspects of the operation, for example, prepping and draping, attention to aseptic technique, and checking on the sponge count. Their data show that there were no differences between levels of trainees in these skills, implying that either the measures were not picking up these competencies or that all residents were equally skilled in these basic issues.

The authors also explored elements of team communication in the operating room. This is likely to prove to be a very important area of study for the future, as initial work in this area has confirmed that there is a high incidence of tension in our operating rooms, tension that often results from communicative failures.[3] The authors' initial approach to exploring this element was fairly basic in that they measured "utterance frequencies," basically, a raw score of the amount of dialogue as opposed to exploring the richness of what was said. What they found was that there was no difference in utterance frequency across different levels of trainees. They also found that surgeons communicated more frequently with surgical assistants and scrub nurses than they did with anesthetists.

Finally, the authors did fairly extensive debriefing of participants' opinions about the efficacy and fidelity of the simulator. Encouragingly, the overwhelming majority of trainees felt this was a good environment to learn both technical and nontechnical skills.

This information is important because it may well be true that trainee engagement in simulated environments will be proportional to the realism of that environment. For example, our group has shown that while there is equivalence in learning between low-fidelity and high-fidelity simulation environments, enthusiasm for the exercise is much greater in high fidelity simulations.[4]

This study is important for 3 reasons. First, the development of a sophisticated simulation of an operating room, with the ability to capture an array of data, is a bold step in the right direction. This is a very expensive enterprise but underscores the importance of the realization that there are significant costs of training a surgeon, and these costs are going to rise in the future. As governments and academic health science centers look to the future, there will have to be a profound change in the concepts of the way in which education is funded, if we are to be true to our desires of training the next generation of surgeons to be at least as skilled as the last. The second important aspect of this study has attempted to develop assessment metrics and taken the obligate step of making sure those metrics are reliable and valid. Without such basic psychometric analyses, we cannot be sure that the measures of competence have any real meaning. While the results of these analyses in these studies were mixed, it points us in the direction of where further work needs to be done and where work to date has been of value. Third, this study underscores the concept that surgery is a "team sport." As such, we need to start focusing on communication skills, the use of cockpit style checklists, and the analysis of sources of tension in our operating rooms. This study addresses some of these important aspects of what will likely become routine forms of operating room conduct in the future.

Many can legitimately argue that we are currently graduating surgeons who have the skills and knowledge to practice competently. Nonetheless, the challenges that are facing the academic surgical community are such that we need more studies that will critically analyze the validity and effectiveness of skills labs, as theses venues are undoubtedly going to be a major part of our future.

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