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Review

An overview of research priorities in surgical simulation: what the literature shows has been achieved during the 21st century and what remains

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Abstract

BACKGROUND: Key research priorities for surgical simulation have been identified in recent years. The aim of this study was to establish the progress that has been made within each research priority and what still remains to be achieved.

METHODS: Members of the Association for Surgical Education Simulation Committee conducted individualized literature reviews for each research priority that were brought together by an expert panel.

RESULTS: Excellent progress has been made in the assessment of individual and teamwork skills in simulation. The best methods of feedback and debriefing have not yet been established. Progress in answering more complex questions related to competence and transfer of training is slower than other questions. A link between simulation training and patient outcomes remains elusive.

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CONCLUSIONS: Progress has been made in skills assessment, curricula development, debriefing and decision making in surgery. The impact of simulation training on patient outcomes represents the focus of simulation research in the years to come.

Since the turn of the century, simulation-based education and training has become an important topic of research and study. Since 2000, the 10 highest impact surgical journals have published more than 350 articles in which simulation is a major methodology. This large volume of research has contributed significantly to the field of surgery, leading to advances in surgeon's operative,[1] crisis management,[2] and critical care[3] skills. In addition, it has lead to important breakthroughs in surgery and simulation-based science.

This explosion of surgical simulation research, however, has taken place in an uncoordinated fashion. As a result, the progress made in the different areas of surgical simulation research is uneven and remains relatively unknown. To bring a degree of focus and direction to this important area of research, the Association for Surgical Education (ASE) Simulation Committee applied a systematic approach (ie, a Delphi process) to identify the most important research priorities in surgical simulation.[4] With this article, the ASE Simulation Committee aims to report on the progress made since the turn of the century in each research priority for surgical simulation and to identify prime areas for ongoing research.

Methods

Participants and identification of relevant literature

Select members of the ASE Simulation Committee conducted individualized narrative literature reviews for each of the 10 most important research priorities identified in the previous Delphi study.[4] An expert panel then collated the results to give a comprehensive overview of the current landscape for each priority.

Assimilation of literature into progress reports

The ASE Simulation Committee meets bi-annually. Each investigator presented a summary of the literature they had reviewed when answering their research priority before the Committee to ensure that important publications and reports had not been missed. Once the Committee had approved all reviews, a core team of investigators collated the results of each review into the following report.

Results

Each research priority is listed subsequently as a question and answered according to the findings identified in the published literature (see Table 1).

How should a simulator curriculum be designed and evaluated?

A curriculum for training an individual, a predefined group, or all the staff within a hospital system should be founded on 2 key aspects. The first is to perform a needs analysis to determine where the delta lies for improvement, who the learners would be, in which setting they should be taught, and when (ie, to what level) the curriculum should be offered.[5] The second aspect is to then define the learning objectives for the curriculum, which provide a measure of its efficacy. A curriculum may be based around a simple task, such as removal of an abdominal drain, a complex set of tasks related to the management of the complex trauma patient, or an entire skills curriculum.[6] It is an absolute must that the curriculum sets out the knowledge, skills, and attitudes that the learner will achieve. The curriculum can be a single event, lasting for 1 to 2 hours (the so-called "little c" curriculum) or it can be delivered over a period of many years (the "big C" curriculum).[7,8]

With regard to a simulator curriculum, the process should be as follows:[9]

1. Planning—the purpose of the curriculum should be stated, including its links and appropriateness to other stages of the learner's education, for example, to learn basic colonoscopy skills before a rotation on the colorectal service.
2. Content—the curriculum must set out the general, professional, and specialty-specific content to be mastered, for example, to learn the knowledge, skills, and behaviors required to safely perform a colonoscopy on a patient.
3. Delivery—indication should be given of how curriculum implementation will be managed and assured locally, for example, through standardization of a colonoscopy curriculum across a region, learners and trainers can travel across geographical boundaries to participate in the curriculum.
4. Outcomes—robust assessment against transparent criteria must be undertaken, with relevant feedback to trainees, which feeds into standards for classification and documentation, for example, the colonoscopy training curriculum has an end point, which relates to expansion of one's clinical activities.
5. Review—plans for curriculum evaluation and monitoring must be set out, with resources identified to support trainee learning and assessment, for example, the effectiveness of the colonoscopy curriculum should be measured through predefined outcomes, such as cecal intubation rates, and anyone who has the ability and wishes to learn basic colonoscopy should have the opportunity to engage in the curriculum.