Association for Surgical Education

American College of Surgeons/Association for Surgical Education medical student simulation-based surgical skills curriculum needs assessment

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Abstract

BACKGROUND: Simulation can enhance learning effectiveness, efficiency, and patient safety and is engaging for learners.

METHODS: A survey was conducted of surgical clerkship directors nationally and medical students at 5 medical schools to rank and stratify simulation-based educational topics. Students applying to surgery were compared with others using Wilcoxon’s rank-sum tests.

RESULTS: Seventy-three of 163 clerkship directors (45%) and 231 of 872 students (26.5%) completed the survey. Of students, 28.6% were applying for surgical residency training. Clerkship directors and students generally agreed on the importance and timing of specific educational topics. Clerkship directors tended to rank basic skills, such as examination skills, higher than medical students. Students ranked procedural skills, such as lumbar puncture, more highly than clerkship directors.

CONCLUSIONS: Surgery clerkship directors and 4th-year medical students agree substantially about the content of a simulation-based curriculum, although 4th-year medical students recommended that some topics be taught earlier than the clerkship directors recommended. Students planning to apply to surgical residencies did not differ significantly in their scoring from students pursuing nonsurgical specialties.

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High-fidelity simulation has been credited with allowing students to practice medicine “without risk” to actual patients. This presents a somewhat unique opportunity to allow students to “care” for acutely ill patients before they are confronted with similar situations as interns, at which point real patients’ lives are at stake and mistakes could have grave consequences.1

Students expressed high enthusiasm for simulation training. In a study at the Bonshoff School of Medicine in Ohio that looked at 90 randomized students, subjects preferred simulation to problem-based learning using a group discussion format.2 Studies that have examined students’ responses to human patient simulation have found high levels of satisfaction.1,3–5

Learners benefited significantly from simulation on several different outcome measures. A randomized controlled trial of 31 4th-year medical students at the University of California, Los Angeles, found that students “who learn critical assessment and management skills using full-scale, high fidelity simulation perform better than students who acquire similar skills in an interactive problem-based learning format.”6 A 2005 study demonstrated that “simulation-based rapid-response team training [in the emergency department] correlated with improved team functioning and adherence to American Heart Association guidelines in real in hospital emergencies.”7 A 2006 study by Morgan et al8 of 299 4th-year medical students showed statistically significant improvement in written and simulation-based examination scores after participation in experiential learning.

Simulation is now a well-recognized means of assessing competency in surgical education. It is being used in various forms in the new movement in surgical education toward boot-camp courses to help prepare 4th-year medical students for surgical internships. These courses use task trainers to teach technical skills such as chest tube placement, cadavers to teach basic incisions and surgical techniques, and standardized patients to teach skills such as communication.9 These courses have been shown to increase students’ confidence before and during their internships.10,11 Researchers at Stanford University have shown that competency measures at the beginning of the intern year for chest tube insertion and central line placement are greater for interns who participate in a surgical skills boot camp before the beginning of internship.12 Tremendous research has been done into the appropriate elements of a simulation curriculum for 4th-year medical students, and the American College of Surgeons (ACS) and Association of Program Directors in Surgery national skills curriculum has provided a very useful template for the training of residents, but no such comprehensive, standardized, simulation-based curriculum exists for medical students in years 1 to 3.13 The ACS and the Association for Surgical Education (ASE) are creating this curriculum for students, with planned widespread dissemination, such that educators and learners both may benefit. The curriculum focuses on basic surgical procedural and exam skills thought to be relevant to the education of medical students in years 1 to 3 pursuing any subsequent career area. The members of the ACS/ASE committee tasked with this project believe that the input and opinions of learners as well as surgery clerkship directors involved in assessing medical students are important considerations in the development of this curriculum.

The curriculum will be Web based and will be housed in the public domain, where it can be used by medical schools throughout the United States and beyond. Each module contains both information for training as well as recommendations for performance assessment. The objective of this study is to conduct a needs assessment of clerkship directors and medical students to aid in the determination of the content of a simulation curriculum for medical students in years 1 to 3, in addition to which year in medical school survey respondents thought the modules should be taught.

Methods

Questionnaire development

These 2 surveys were developed by the ACS and the ASE committee for simulation. This committee is made up of approximately 20 educators in academic surgery across the nation. These educators are clerkship directors, directors of simulation centers, and researchers in surgical education. This expert panel created a list of basic surgical and examination skills that could potentially be included in a simulation-based medical student curriculum. This list was discussed at the meetings of the ACS and ASE committee for simulation until unanimous consensus was obtained by this expert panel of surgical educators. Forty-two curricular elements were listed for potential inclusion in the final curriculum. The surveys were identical, except that medical students were additionally asked what medical schools they attended and whether they intended to apply for surgical specialties. A 5-point, Likert-type scale was used to determine respondents’ opinions about whether the topic should be included in the curriculum. If a respondent answered in the affirmative, he or she was then asked to indicate in which year of medical school the topic should be incorporated. Both clerkship directors and students were given space to include any further comments they might have. Clerkship directors were surveyed in December 2010 and students in March 2011. The surveys were hosted on SurveyMonkey.com. This study was done with institutional review board approval.

Subjects and selection criteria

All surgery clerkship directors in the United States were invited via e-mail to participate in the survey via an e-mailed link. Then 4th-year medical students from 5 medical schools in different geographic regions—Harvard Medical School, the University of California, San Francisco, School
of Medicine, the University of Minnesota Medical School, the University of Pennsylvania School of Medicine, and the University of Texas Southwestern Medical School—were invited via e-mails sent to their class lists to answer the same questions in a student needs assessment survey. Two reminders were sent via e-mail to the students.

**Statistical analysis**

Stata statistical software (StataCorp LP, College Station, TX) was used for the statistical analysis of these data. Response percentages were calculated for each item on the survey. These percentages were used to locate the mode for each response on both the clerkship directors’ and students’ surveys. Topics that had response frequencies for “absolutely” or “probably” of two-thirds or greater by both students and clerkship directors will be included in the curriculum. A Wilcoxon’s rank-sum test was run on the Likert-type scale topic inclusion question to compare the responses of clerkship directors and students. A Wilcoxon’s rank-sum test was run on the Likert-type scale topic inclusion question to compare the responses of students who planned to apply in surgery or surgical subspecialties and those who plan to apply to nonsurgical residencies. The comments were reviewed by 2 reviewers to identify common themes and trends, and no unifying themes were identified.

**Results**

**Respondents’ characteristics**

Of 163 surgical clerkship directors invited to participate, 66 responded, for a response rate of 45%. The student needs assessment had an overall response rate of 26.5% (231 of 872), ranging from 17.0% to 49.3% at different medical schools. Of the medical students responding, 29.9% were from Harvard, 20.3% from the University of California, San Francisco, 22.1% from the University of Minnesota, 13.0% from the University of Pennsylvania, and 14.7% from the University of Texas Southwestern. Of the student respondents, 28.6% indicated that they would be applying for residency training in surgery or surgical subspecialties, 67.5% indicated that they would not be, and 3.9% were unsure.

**Topics for inclusion**

The ASC/ASE committee decided on the following inclusion criteria for the simulation-based curriculum: two-thirds of both the clerkship directors and the students needed to respond that the topic should “absolutely” or “probably” be included in the curriculum. Table 1 provides a list of topics that met the outlined criteria.

**Comparing clerkship directors’ and students’ responses**

Clerkship directors and medical students as groups responded differently to the question of what should be included in the curriculum. Wilcoxon–Mann-Whitney rank-sum tests were used to detect statistically significant differences between students’ and clerkship directors’ responses. Clerkship directors ranked universal precautions, the basic vascular examination, male groin and digital examination, digital rectal examination, breast examination, bladder catheterization, intermediate vascular examination, communication, effective surgical presentation, and intermediate suturing higher than did medical students. Students ranked using local anesthetics, basic ultrasound, central venous catheter placement, paracentesis, chest tube placement and removal, basic surgical procedures, lumbar puncture, joint aspiration, packing for epistaxis, casts and splints, basic laparoscopy, and basic flexible endoscopy more highly than did the clerkship directors.

Of the 42 items on the survey, clerkship directors and medical students had different mode responses to the year the topic should be included on 16 (38%) items, 13 of which were cases in which medical students’ mode responses were earlier years than clerkship directors’.

**Comparing the responses of students applying in surgery with those not applying**

The responses of students applying for surgery or surgical subspecialties differed slightly from those of students not applying for surgery. Wilcoxon–Mann-Whitney rank-sum test were used to detect statistically significant differences between the responses of students applying for surgery and those not applying. Students applying for surgery ranked intermediate knot tying, intermediate suturing, chest tube placement and removal, and basic laparoscopy higher than did medical students who were not applying for surgery. Students applying for nonsurgical residency programs ranked the female pelvic examination and using local anesthetics higher than students applying for surgery.

**Comments**

The ACS/ASE simulation curriculum needs assessment found that both surgery clerkship directors and 4th-year medical students are for the most part in agreement about the content that should be covered in a simulation-based curriculum. In the topic areas where they differed, it appears that clerkship directors placed a higher priority on basic skills, such as communication and basic exam skills, and medical students were eager to also learn more advanced skills such as laparoscopy and chest tube placement. This study did not have the capacity to evaluate why this discrepancy exists, but it might reflect medical students’ eagerness to learn skills to
which they have less exposure in the preclinical years. Further research might tease out this distinction to help us better understand how educators and learners view the role of the simulation center in medical education. This might provide more clarity about how to address the needs identified by both these parties.

Topics that had response frequencies for “absolutely” or “probably” of two-thirds or greater by both students and clerkship directors will be included in the curriculum. The curriculum will include information about when medical students wanted to learn the information and when clerkship directors wanted to teach the information so that they can make informed decisions about when they would like to teach the information. Although the survey responses can serve as a guide, it is important that educators be allowed the flexibility to incorporate the modules where they fit into their existing curricula. On average, 4th-year medical students wanted some topics to be taught earlier in medical school than clerkship directors felt necessary. This discrepancy might be handled in a number of ways. It might be appropriate to introduce some topics earlier in medical school, at a more basic level, and then return to these topics later. Alternatively, it might be worthwhile to have optional “open simulation sessions” during which students who are interested in practicing certain skills can participate.

Perhaps one of the most surprising findings of this study is that the responses of students applying for surgical residencies and those not applying did not differ significantly. The groups had statistically significant differences in rankings for only 6 topics. This likely tells us that all students are interested in more exposure and practice with these skills; this enthusiasm is not unique to students interested in surgery. This further argues for the value of a surgical skills curriculum that is widely available to medical educators.

Limitations of this study include a low response rate, leading us to worry about response bias. It is possible that students who responded are more interested in learning procedural skills. Approximately 20% of students who participated in the main residency match applied to general surgery, obstetrics and gynecology, plastic surgery, orthopedic surgery, otolaryngology, or neurosurgery. In our sample, students applying for surgery or surgical subspecialties were slightly overrepresented at 28.6%. Another limitation is that students from only 5 medical schools were asked to participate. Although these medical schools are a mix of public and private and from different geographic

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Topics that met the criteria for inclusion in the simulation-based skills curriculum</th>
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<tr>
<td>Topics to be included</td>
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<tr>
<td>Sterile technique/scrub, gown, and glove properly</td>
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<td>Breast exam</td>
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<td>Basic vascular examination/blood pressure measurements and interpretation/peripheral pulses and auscultation (bruits)</td>
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<td>Digital rectal examination</td>
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<td>Communication: obtaining a patient history and basic patient communication</td>
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<td>Universal precautions</td>
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<td>Basic airway management/airway maneuvers and bag valve masking</td>
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<td>Male groin and genital examination</td>
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<td>Communication: effective surgical case presentation</td>
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<td>Bladder catheterization</td>
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<td>Female pelvic examination</td>
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<td>Communication: safe and effective hand-offs</td>
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<tr>
<td>Basic knot tying/2-handed and instrument tying</td>
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<td>Basic suturing/simple interrupted, interrupted horizontal and vertical mattress, interrupted subcuticular</td>
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<td>Venipuncture and peripheral intravenous insertion</td>
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<td>Sutures, staples, and drains guidelines for care and removal</td>
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<td>Communication: breaking bad news</td>
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<tr>
<td>Communication: mock pages, cardiac arrhythmias, chest pain, shortness of breath, low urine output</td>
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<tr>
<td>Communication: effective communication during codes</td>
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<td>Arterial puncture and arterial blood gas interpretation</td>
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<td>Communication: obtaining consent</td>
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<td>Nasogastric tubes</td>
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<td>Using local anesthetics</td>
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<td>Intermediate airway management/direct laryngoscopy and intubation</td>
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<tr>
<td>Intermediate suturing/simple running, running subcuticular</td>
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<td>Team training: emergency room</td>
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<tr>
<td>Intermediate vascular examination/handheld Doppler, ankle-brachial index</td>
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<td>Thoracentesis</td>
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<td>Casts and splints</td>
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<td>Team training: intensive care unit</td>
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<tr>
<td>Basic surgical procedures/superficial abscess incision and drainage/minor skin lesion excision</td>
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regions, a cross-sectional study of students from more medical schools would be more representative. In addition, it could be argued that the input of residency program directors should have been considered. Future studies might ask program directors from various specialties what they believe should be included in a simulation curriculum.

A 2005 study conducted by Wu et al.\textsuperscript{15} of 3rd-year medical students found that that a majority had never performed essential procedures such as purified protein derivative placement or cardiopulmonary resuscitation, and one-quarter had never performed basic procedures such as peripheral intravenous catheter insertion and phlebotomy. A follow-up study in 2006 of 4th-year medical students found that “a majority reported never having performed cardioversion, thoracentesis, cardiopulmonary resuscitation, blood culture, purified protein derivative placement, or paracentesis. One fifth of students had never performed peripheral intravenous catheter insertion, phlebotomy, or arterial blood sampling.”\textsuperscript{16} This study shows that the 4th year of medical school “cannot be relied upon to provide students with clinically significant additional experience in procedures” in the absence of a curriculum with those goals in mind.\textsuperscript{16} It is well known that although procedural and skills experience is invaluable, it can be hard to obtain in current teaching environments for a variety of reasons, and simulation can be used to supplement resident education. The simulation skills-based curriculum will be widely available and, when implemented, has the potential to help fill the current gap in medical students’ skills training.

Even though on average, students wanted topics to be covered earlier in medical school than did clerkship directors, this study demonstrates substantial agreement between clerkship directors and medical students about the content of the curriculum. Input from both clerkship directors and medical students provides invaluable guidance in selecting appropriate topics for a simulation-based multiyear curriculum for medical students.

Acknowledgments

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References