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Evaluation of a technical and nontechnical skills curriculum for students entering surgery



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ABSTRACT

Background: Prior interventions to address declining interest in surgical careers have focused on creating early exposure and fostering mentorship at the preclinical medical student level. Navigating the surgical environment can be challenging, however, and preclinical students may be more likely to pursue a surgical career if they are given the tools to function optimally.

Materials and methods: We designed a 10-wk technical and nontechnical skills curriculum to provide preclinical students with knowledge and skills necessary to successfully navigate the surgical learning environment, followed by placement in high-fidelity surgical simulations and scrubbing in on operative cases with attending surgeons. We administered pre-post surveys to assess student confidence levels in operative skills, self-perceptions of having a mentor, overall course efficacy, and interest in a career in surgery.

Results: The overall response rates presurvey and postsurvey were 100% (30 of 30) and 93.3% (28 of 30), respectively. Confidence levels across all operative skills increased significantly after completing the course. Faculty mentorship increased significantly from 30.0% before to 61.5% after the course. Overall effectiveness of the course was 4.00 of 5 (4 = “very effective”), and although insignificant, overall interest in a career in surgery increased at the completion of the course from 3.77 (standard deviation = 1.01) to 4.17 (standard deviation = 0.94).

Conclusions: Our curriculum was effective in teaching the skills necessary to enjoy positive experiences in planned early exposure and mentorship activities. Further study is warranted to determine if this intervention leads to an increase in students who formally commit to a career in surgery.

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Introduction

The overall trend of declining interest among US medical school graduates toward careers in general surgery is well

known. In 1984, 13.5% of US medical school graduates matched to general surgery residency programs; in 2016, that number decreased to 7.6%.^{1,2} This trend is paralleled by an increasing shortage of general surgeons in the work force relative to the

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growing population, with a 25.9% decline in the overall number of surgeons per 100,000 individuals observed from 1981 to 2005.³ Despite efforts by organizations involved in graduate medical education to increase the number of general surgery residency positions, economic modeling suggests that the trend will continue well into the next decade.⁴

Efforts by surgeon educators to combat this problem are not new. In part, these interventions have been driven by the observation that with the increased emphasis of primary care in medical school curricula and the concomitant decrease in time spent by students during the clinical years on surgical rotations, surgeons have fewer opportunities to impact the career choices of students in a meaningful way.^{5,6} These interventions have also been informed by data suggesting that most medical students commit to a career discipline before the clinical clerkship years.^{7,8}

Accordingly, a number of interventions have taken the form of structured outreach programs to medical students during their preclinical years. Many of these programs have shown that early clinical exposure alone, even as brief as a single hour session, can increase student interest in surgical careers.⁹⁻²³ Similarly, early simulation experience has a positive impact on student interest in surgery.^{24,25} Other programs, building on the body of scholarship testifying to the importance of mentorship in career planning,²⁶⁻³⁴ have included a formal mentorship component.³⁵⁻⁴⁰ Although these initiatives have resulted in increased student interest in surgery, however, continuing low application rates among US medical students into general surgery residencies suggest that increased awareness and contact with the profession alone are not sufficient to show a measurable impact.

A major barrier to maximizing the utility of an early exposure experience is a suboptimal learning environment. Especially for preclinical medical students, the operating room foists students into a setting that is unlike any they are likely to have encountered previously. An overall positive experience in this setting is critical to nurturing interest in a surgical career.⁴¹ Similarly, a prior observational study has suggested that clerkship students who develop active strategies to manage the unique challenges of this environment and find a place on the team are better prepared to extract valuable experiences in the operating room.⁴² The knowledge, attitudes, and behaviors underlying these strategies represent a major gap not addressed by prior curricula in the literature. We hypothesize that a curriculum to teach preclinical medical students the technical and nontechnical skills needed to gain confidence in performing in the operating room environment, followed by a series of early immersive operative experiences, will facilitate the positive contact with the profession needed to cement an interest in a surgical career. The purpose of this study was to evaluate how well this curriculum achieved its primary goals of increasing confidence to perform in the operating room environment, to find mentors in the surgical field, and to increase interest in a career in surgery.

Materials and methods

The institutional review board at our institution determined that this study did not meet the federal definition of human

subjects research and was exempt from the review. All pre-clinical medical students at our institution ($n = 183$) had the opportunity to enroll in an elective course offered through our department of surgery. Due to space limitations, enrollment was capped at 30 students.

The design of the course was informed by a formal needs assessment in which prior learners and faculty were surveyed. Specifically, we emailed a survey to all prior learners and faculty who participated in the course over the previous 3 y. After categorizing the responses, the most common reason for taking the course, cited by 59% of learners, was to be exposed to technical skills before the surgery clerkship. By comparison, only 37% of learners enrolled in the course chose the course for reasons related to pursuing a career in surgery. The 10-wk course consisted of early technical and nontechnical skills training to prepare students for the operating room environment. Technical skills training included knot-tying, basic suturing, laparoscopy, cardiothoracic skills, and proper scrub technique and orientation to the physical operating room workspace. Nontechnical skills training included review of situation awareness, decision-making, and communication, and team work strategies adapted for medical students from the Non-Technical Skills for Surgeons (NOTSS) System Handbook version 1.2.⁴³ Based on our needs assessment, we deliberately chose not to train to or assess for skills proficiency. Students subsequently completed three high-fidelity operating room experiences on animal and human cadaver models alongside attending surgeons. All sessions were taught by two surgical education fellows and at least one surgical faculty, allowing for small group teaching with a minimum student:instructor ratio of 10:1. Students who desired more training or mentored practice at the completion of the sessions were offered individual appointments with the surgical education fellows.

Students were then paired with a faculty mentor who had been oriented to the curriculum. Specifically, faculty mentors were informed of the skills taught to the students, and they were encouraged to allow students to apply these skills in the operating room. Faculty mentors were also encouraged to discuss their career choice and to help answer any student questions about careers in surgery. The students were required to scrub into at least one live operative case with their mentor during the 10-wk period. The overview of the curriculum is summarized in [Figure 1](#).

The research team designed a pre-post survey study to evaluate how well the course achieved its three stated objectives. The survey questions were initially formulated in alignment with these objectives. Surveys were piloted with resident, faculty, and educational doctoral members of the research team ($n = 5$), and then with medical students ($n = 3$). Before the course, all students who enrolled were invited to complete a voluntary anonymous “pre” survey asking them to rate their confidence levels in the five technical skills listed previously and their overall level of comfort in the operating room environment. Students were asked to respond using a five-point Likert scale ranging from “1 = not at all” to “5 = extremely.” Students were also asked whether they had a faculty mentor in surgery before the course using a “yes” or “no” response. Finally, students were asked to rate their overall interest in a career in surgery. On completion of the

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