

Is a Video Worth a Thousand Words? Educating Preclinical Medical Students on Sterile Scrubbing, Gowning, and Gloving Virtually and In-Person

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ABSTRACT

Introduction. Programs that offer early exposure to surgery for medical students foster interest in and positive perceptions of surgery. The COVID-19 pandemic led to suspension of these activities at our institution, the University of Kansas School of Medicine. In response to the lack of virtual alternatives, a pilot virtual surgery enrichment program was implemented for first-year students in place of in-person surgical exposure. The aim of this study was to compare the efficacy of in-person and virtual-based surgical education programs to expose preclinical medical students about the surgical realm of medicine.

Methods. First-year medical students participated in either a virtual (Group A) or in-person (Group B) week-long surgical enrichment program. Group assignments were dictated by COVID restrictions on each of our three medical school campuses: Salina, Wichita, and Kansas City. Pre- and post-surveys with a 14-question multiple-choice assessment of surgical knowledge were distributed to participants. Paired Wilcoxon Signed Rank tests and Mann-Whitney-U tests were used for statistical analysis.

Results. There were 14 participants in Group A and 7 participants in Group B. Both groups improved significantly from pre- to post-assessment score. (Group A, $p = 0.01$; Group B, $p = 0.04$). There was no difference between groups in the magnitude of score improvement from pre- to post-assessment ($p = 0.59$).

Conclusions. This pilot program demonstrated that virtual platforms can be a method to provide meaningful clinical experiences in surgery to preclinical medical students restricted from clinical activities. Further development of mentorship in virtual surgical programs and assessment of subjective experience is needed. *Kans J Med* 2021;14:265-268

INTRODUCTION

The first two years of medical school, termed “preclinical years”, are traditionally didactic based. Many schools offer structured programs for students to participate in clinical areas of interest early in their training to facilitate career exploration. In surgery, early exposure to positive experiences and mentorship are important influences on the decision to pursue surgery as a career.^{1,2} Also, early clinical participation in surgery

improves surgical knowledge and performance in the operating room (OR) during surgery clerkships.³

Unfortunately, the coronavirus pandemic led to suspension of clinical activities for students who were deemed non-essential personnel.⁴ While clinical activities are core to third and fourth-year medical students completing clinical clerkships, they are lower educational priority for first and second-year students during the didactic portion of their training. However, structured programs facilitating early exposure to surgery have become a part of the standard model of a well-rounded medical education.⁵ To address this gap in preclinical education, a virtual surgical enrichment program (VSEP) was created.

Virtual platforms seemed a far-fetched method to deliver quality surgical education, but have demonstrated successful performance measures in new virtual surgical clerkships, and even generated interest to pursue surgical careers.⁶ The opportunities for preclinical students to participate in surgery remain limited. It is nonetheless critical to provide students with these opportunities. Virtual pilot programs for surgical education, such as the one described in this paper, must be developed and expanded to restore pre-existing standards in medical education.

METHODS

Scholarship, Enrichment, and Remediation (SER) week is a required shadowing program in the pre-existing curriculum of first and second-year students at our institution and occurs at the end of each systems-based academic block (seven total).⁷ Students spend the week immersed in clinical areas of interest with faculty and residents in the specialty of their choosing. One group of first-year medical students (MS-1s) who choose surgical specialties for their SER week in December 2020 were invited to participate in this study. No pre-determined study enrollment goal was set. With the unpredictable changes in clinical activities available to students during the COVID pandemic, the priority was capturing as many students at one point in time instead of enrolling students over multiple months to reach a specific study size, as the former could add unintended confounding bias to our results. A VSEP alternative was created for MS-1s who were restricted from in-person clinical activities. This was designated Group A. Students who participated in-person, as a result of differences in COVID protocols across our three campuses, were designated Group B. This cohort was thought to represent the usual standard of SER week and served as the control for the purposes of this study.

Design of Virtual Platform. The VSEP was designed with three major components. First, Group A students were asked to watch an educational video with technical skills about sterile scrubbing, gowning, and gloving. Second, students joined surgical teams each day for virtual rounds. Third, an intra-operative video stream was assembled for students to observe surgeries in real time with a mechanism to ask questions.

The primary objective of this study was assessment of surgical knowledge after participation in virtual or in-person surgical SER week. Students in Group A primarily gained this knowledge from the educational video on sterile scrubbing, gowning, and gloving. This video was created in collaboration with institutional experts in surgery and medical education, and operating room (OR) staff educators. The video was distributed electronically to preclinical students via a sharable link to the unlisted video on YouTube™ (<https://youtu.be/xy2EwPjgJEA>).

Only students in Group A had access to this digital content. Students in Group B acquired surgical knowledge from in-person OR experiences with faculty, residents, and staff on their respective surgical specialties.

Pre- and Post-Survey. A pre- and post-survey was distributed before and after surgical SER week in December 2020. Both surveys included an identical 14-question multiple choice assessment of surgical knowledge that was created by the authors in collaboration with institutional experts. Each multiple choice item was associated with an image demonstrating proper or improper sterile technique. Additional data collected in the surveys were age, gender, previous OR experience and education, and interest in surgical careers before and after SER week. Informed consent for this study was obtained when the pre-survey was distributed to participants. Participants were informed of the study purpose, main outcomes, anticipated benefits, and lack of risks of participation.

The primary outcome of this study was assessment of surgical knowledge, as measured by the 14-question multiple choice assessment in the pre- and post-survey. The secondary outcome was interest level in surgery, as measured in the pre- and post-survey.

Statistical Analysis. Chi-square and two-tailed t-test were performed to analyze categorical and continuous variables, respectively. Paired Wilcoxon Signed Rank Test was used to determine improvement of assessment score from pre- to post-survey in each group. The Mann-Whitney U Test was used to compare pre- and post-assessment scores across groups, and assess differences in magnitude of change in pre- and post-scores between groups. A p value of < 0.05 was determined to be statistically significant. The data were analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp, Armonk, New York). Approval to conduct this study was obtained from our institutional review board and declared exempt from human subject review.

RESULTS

There were 65 MS-1s who participated in surgical SER week in December 2020. There were 14 respondents (28%) of the 50 students who participated in the pilot VSEP, this was designated Group A. There were 7 respondents (46.7%) of the 15 students who participated in-person, this was designated Group B. The overall response rate was 21/65 (32.3%).

Respondent characteristics are displayed in Table 1. There were no significant differences in demographics or previous OR experiences. Exposure to prior OR education was not different between groups, including attendance at surgical skills workshops (p = 0.16) or specific training in sterile scrubbing, gowning, and gloving (p = 0.47). Interest to pursue surgical careers was not statistically significant between groups before (p = 0.40) or after (p = 0.19) participation in SER week.

Score improvement from pre- to post-assessment of surgical knowledge is displayed in Table 2. The assessment scores of all study respondents improved significantly after participation in surgical SER week (95% CI: 11-29; p = 0.001). Additionally, assessment scores of respondents in Group A (95% CI: 7.1-29; p = 0.01) and Group B (95% CI: 20-39; p = 0.04) improved significantly from pre- to post-assessment.

Comparison of pre- and post-assessment of surgical knowledge between Group A and Group B is displayed in Table 3. There was no statistically significant difference in either the pre-assessment score

between Group A and Group B (p = 0.44) or the post-assessment score between Group A and Group B (p = 0.13). There was no statistically significant difference in the magnitude of score improvement between groups (p = 0.59).

Table 1. Characteristics of 21 respondents in surgical SER week in December 2020.

	Group A n = 14	Group B n = 7	p value ^a
	n (%)		
Age (years) ^b	23 [23 - 24]	24 [23 - 28]	0.30
Female	8 (57)	4 (57)	1.00
Attended surgical education workshops	6 (43)	6 (86)	0.16
Number of previous OR experiences ^b	3 [0 - 6.25]	3 [0 - 8]	0.79
Previously scrubbed into a surgery	2 (14)	0	0.28
Previously educated on sterile scrubbing, gowning, and gloving			0.47
Yes	6 (43)	3 (43)	
No	3 (21)	3 (43)	
Unsure	5 (36)	1 (14)	
Interest in pursuing surgical careers at the beginning of this surgical experience			0.40
Very interested	8 (57)	6 (86)	
Somewhat interested	5 (36)	1 (14)	
Not interested	1 (7.1)	0	
Interest in pursuing a surgical career at the conclusion of this surgical experience			0.19
Very interested	9 (64)	7 (100)	
Somewhat interested	3 (21)	0	
Not interested	2 (14)	0	

Abbreviations: SER, Scholarship, Enrichment, and Remediation; OR, operating room.

^ap < 0.05 statistically significant

^bMedian [interquartile range]

Table 2. Pre- and post-assessment scores in 14 virtual and 7 in-person SER week respondents in December 2020.

	Median pre-assessment score (%)	Median post-assessment score (%)	p value ^a	95% confidence interval
	Median [interquartile range]			
Both groups (n = 21)	50 [39 - 61]	71 [64 - 79]	0.001	11 - 29
Group A (n = 14)	50 [36 - 59]	68 [57 - 73]	0.01	7 - 29
Group B (n = 7)	57 [43 - 64]	71 [64 - 86]	0.04	20 - 39

Abbreviations: SER, Scholarship, Enrichment, and Remediation.

^ap < 0.05 statistically significant

Table 3. Differences between pre- and post-assessment scores in virtual vs. in-person SER week respondents in December 2020.

	Group A (n = 14)	Group B (n = 7)	p value ^a
	Median [interquartile range]		
Median pre-assessment score (%)	50 [36 - 59]	57 [43 - 64]	0.44
Median post-assessment score (%)	68 [57 - 73]	71 [64 - 86]	0.13
Median difference between pre- and post-assessment scores (%)	+21 [5.4 - 29]	+29 [0 - 36]	0.59

Abbreviations: SER, Scholarship, Enrichment, and Remediation.

^ap < 0.05 statistically significant

DISCUSSION

The virtual platform was effective in teaching surgical knowledge, similar to what was found in virtual surgery clerkships.⁶ The interest in surgery did not change or differ between groups. Therefore, neither experience was superior to the other for the primary and secondary outcomes of this study. The lack of change in interest level was reported by other in-person surgical immersion programs from the literature.⁸⁻¹⁰ One such reason may be the selection bias introduced by students choosing to participate likely are interested in surgery already. Interestingly, more students who were not interested in surgery participated virtually. This suggested that the easy accessibility and low-pressure nature of virtual platforms may attract wider audiences.

This study did not explore the subjective experience of the students or the perception of mentorship. Mentorship is a key aspect of early clinical experiences. Multiple strategies are available to enhance mentorship in the virtual setting, including allocating time for student and resident “hangouts” for questions and advice.⁶ Incorporation of a mentorship focus in virtual-based surgical education should be a goal of these modalities and warrants further attention.

This study was limited by a small sample of 21 participants over a short, one-week surgical experience. However, varying local restrictions of the three campuses at the study institution created a pragmatic opportunity to compare a virtual pilot program to an in-person experience. Although it appeared that virtual-based surgical educational experiences may be reliable methods of education of select surgical competencies, further studies are needed to explore this trend with larger groups, and thus, higher statistical power.

This study was the first known to have assessed preclinical students’ ability to learn basic surgical competencies through in-person or virtually based surgical education experiences using an objective measure of competency assessment. While not validated, the objective knowledge assessment in this study was constructed carefully with input from expert surgeons, surgical educators, and medical educators. This new measure was superior to gauging knowledge merely on participant self-reported confidence in their knowledge of this topic. Assessing procedural skills, such as sterile scrubbing, gowning, and gloving techniques, with an assessment based on images of individuals demonstrating proper or improper technique, was preferred over

assessing a procedural skill with text alone. This added tremendous value to the visually based assessment tool used in this study. While it would have been beneficial to perform an in-person assessment of these procedural skills instead of a picture-based assessment, that was not possible due to pandemic related infection control measures, such as limited in-person exposures and social distancing in the clinical learning environment.

The generalizability of this study was limited by a small sample of 21 participants over a short period of time. However, the authors intended the study design to be completed with a single cohort of as many participants as possible. This was because of the evolving pandemic and changing student restrictions introduced bias into including future cohorts after December 2020. Despite this, the sample size of this study was sufficient to address the primary and secondary study aims adequately. The overall response rate was low and unequally distributed among groups. The fact that virtual learners were less likely to participate may allude to a lower motivation to acquire technical skills that lack immediate relevance. It was possible that in-person learners felt a stronger desire to be prepared for their performance in the OR. The addition of in-person skills assessment to virtual learning should be explored to improve motivation.

CONCLUSIONS

The use of readily available video-based technology can be applied through programs such as described in this paper to facilitate experiential participation of students in different areas of medicine. A virtual surgical education program to teach scrubbing, gowning, and gloving for students was as effective as an in-person educational program as measured by the study’s knowledge assessment. This study demonstrated a virtual surgical education program can provide a quality educational experience for students without access to in-person programs due to resource limitations caused by financial constraints, limited local expertise, or a pandemic. In addition, these results showed that some clinical content can be taught effectively prior to an in-person educational session, thus allowing in-person education to build more on foundational concepts and focus on application in clinical settings.

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