

Virtual Surgical Shadowing for Undergraduate Medical Students: A Pilot Program

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Abstract

Background: Due to the COVID-19 pandemic, in-person physician shadowing has been restricted at many medical schools throughout Canada. We sought to address this gap by introducing a novel virtual shadowing experience to expose medical students to surgical specialties, and to assess possible improvements in the quality of delivering medical education. **Methods:** In compliance with the Health Insurance Portability and Accountability Act, two cameras were placed in an operating room to stream surgical procedures live to medical students. A survey was then distributed after the shadowing experience. **Results:** Ten medical students attended the 2.5-hour virtual surgical shadowing experience and nine provided feedback through a survey. The survey consisted of six Likert scale questions and two short-answer questions. Participants scored an average of 4.6 ± 0.52 for the technology being conducive to

their learning; 4.7 ± 0.50 that the session met their learning objectives; and 4.8 ± 0.44 regarding the knowledge and skills gained being useful for clerkship. Areas of improvement included improved camera quality (n=3) and the provision of case information prior to the sessions (n=4). **Discussion:** The virtual surgical shadowing program enabled students to effectively and reliably observe surgical procedures in real time, whilst engaging and communicating with the surgeons. Encouraging survey responses demonstrated the positive potential for future iterations of similar observerships in other surgical specialties, and as a means of improved medical education. **Conclusion:** Virtual surgical shadowing is a promising and innovative solution to limitations of in-person observerships, providing a secure and accessible way for medical students to explore surgical specialties.

Keywords: COVID-19, medical education, shadowing, surgery, virtual shadowing

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Introduction

The COVID-19 pandemic led to major changes to education for Canadian medical students, limiting in-person teaching and hospital access for students in their pre-clerkship years.¹ During this time, an increasing number of schools opted for virtual learning, leading medical students to report subjective reductions in the quality of their medical education, with 58% having noted that virtual teaching is both less efficient and inferior to in-person classes.²

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One notable educational challenge during the pandemic was imposed limitations on in-person clinical shadowing. Physician shadowing represents an important component of pre-clerkship studies.³ Shadowing provides students with a unique opportunity for direct career exploration, networking, improvement of students' diagnostic acumen, and development of bedside manner, which helps prepare students with practical knowledge for their clinical clerkship.^{1, 3-5}

At the University of Toronto, there were no virtual shadowing experience that allowed students to

observe surgical operations in real-time, an experience that would help inform students' decision to pursue a surgical specialty. To help bridge this gap, our study aimed to: 1) generate and pilot a virtual surgical shadowing experience for pre-clerkship medical students; 2) evaluate whether this program could be used to meet students' observership learning objectives; 3) utilize virtual teaching in a surgical setting to help prepare students for their clerkship studies; and 4) evaluate the efficacy of live video-conferencing technology to capture surgical procedures. In this study, we present one of the first uses of surgical livestreaming as a source of virtual shadowing for medical students amidst COVID-19 restrictions, which may be adapted to supplement medical school curriculum permanently.

Methods

Technology

In compliance with the Health Insurance Portability and Accountability Act, two video cameras were placed in an operating room at Queensway site of Trillium Health Partners (THP) in Etobicoke, Canada. One stationary video camera allowed surgeons to directly interact with students, while the second camera was attached to a mobile surgical light, and was used to capture the surgical procedures. The procedures were streamed live, through Zoom for Healthcare, and were not recorded—to maximize patient privacy and replicate a true observership experience.

Patient Participation

No financial incentives were provided to patients for their involvement. Patients were asked to complete a Live Streaming of Surgical Procedure Patient Consent Form. Patients were given the opportunity to withdraw at any time and made aware that declining to participate would have no impact on their level of care.

Student Participation

First- and second-year University of Toronto medical students were given the opportunity to engage in the virtual shadowing program, with a maximum of five students per shadowing session. Students were required to sign a confidentiality agreement and review privacy training slides prior to the session.

Session Content and Organization

Two sessions were organized, each including procedures for commonly presenting plastic surgery

cases, such as skin cancer resections with subsequent flap reconstruction, and carpal tunnel release surgeries. Each session included approximately five separate cases, separated by question-and-answer periods with the team.

Session Survey

To evaluate the impact of this novel initiative, a survey (SurveyMonkey®) was distributed to students. The anonymous survey consisted of two components: 1) six five-point Likert-type scale responses which ranged from strongly disagree to strongly agree; and 2) open-ended questions for areas of improvement, and an opportunity for students to add additional comments.

Data Analysis

Data was exported from SurveyMonkey® to Microsoft Excel (Version 2207 Build 16.0.15427.20182). Descriptive statistics were employed within Microsoft Excel to analyze the data.

Results

Generation of a Virtual Surgical Shadowing Program

Zoom for Healthcare was utilized, and webcams were connected to separate computers, which would allow students to view both camera angles at the same time. During the session, students were instructed to keep their cameras on, ensuring that no one other than the pre-approved individuals were observing the procedures.

A total of ten students participated in the pilot virtual surgical shadowing experience. Each session included five students and lasted approximately 2.5 hours.

Program Learning Outcomes and Preparation for Clerkship

Likert-type questions were used to evaluate the students' experience (Table 1). Nine students (n=9) responded to the survey. Overall, participants felt that their observership learning objectives were met throughout the session, rating an average of 4.57 ± 0.47 on the 5-point Likert scale. Students also felt that the knowledge and skills they gained from this experience would be useful during the clerkship component of medical school (4.78 ± 0.42) and every student felt that the preceptors enhanced their learning (50 ± 0).

Feedback on the Use of Videoconferencing Software and Program Organization

Students scored the 2.5--hour time component of the teaching experience at 4.78±0.42. When asked whether the technological platform was conducive to their learning, students scored an average of 4.56±0.5.

Eight students provided responses to the open-ended question about areas of improvement for the program (Table 2). The two areas for improvement included improved camera equipment/angles and the provision of case information prior to the program.

Discussion

Streaming technology has been utilized worldwide to facilitate surgical education, but the utilization of this technique for surgical shadowing is so far low, and the utility of surgical livestreaming is yet to be widely accepted.⁶⁻⁸ As a result, we feel that our study presents an important solution to limitations of in-person learning, both in the context of COVID-19, but also as a means to improve medical education in low-resource settings.

Ultimately, two separate shadowing sessions were run, and the efficacy of the sessions was reflected in students' positive survey responses, scoring our questions highly in the context of learning objectives, shadowing experience, and experience with the technology.

Individualized student feedback identified two noted areas for improvement: 1) the provision of case information prior to the session; and 2)

improvements in camera quality/positioning. In our pilot, patients were consented on the day of the procedure, which prevented the organizers from distributing patient information to the observership attendees. To address this issue, prospective patients could have been consented earlier—allowing students to prepare prior to the sessions.

The second area of feedback included improved camera quality and angles. In our study, two separate webcams were used, each transmitting video at the same time. Certain procedures, such as carpal tunnel release surgeries, presented specific video difficulties, as they are performed through small incisions and require narrow fields of view to complete. Additionally, in our pilot, the surgical lights were often too bright for the exposure settings of our cameras. An alternative solution could include the use of a fixed DSLR or mirrorless camera with the ability to adjust exposure directly on the device.

Within the literature, video quality has been noted to be one of the most common barriers to effectively implementing surgical streaming technology.⁸ Various forms of video capture have been used in practice, including smart glasses like Google Glass as well as GoPro cameras.⁸ Smart glasses best replicate the surgeon's perspective within the procedure, but image quality is often dependent on the speed of the user's network and the inherent

Table 1: Students' experiences to the virtual surgical shadowing program pilot

Question	Mean±SD
My learning objectives of the observership experience were met	4.67±0.47
The knowledge and skills I gained from this experience will be useful during my clerkship year	4.78±0.42
I felt engaged throughout the experience	4.89±0.31
My learning was enhanced by the information shared by the preceptor	5±0
I found the timing and length of the experience to be effective	4.78±0.42
I found the technology/platform used for this experience was conducive to my learning	4.56±0.50

Each question used Likert-type questions with ratings from strongly disagree (1) to strongly agree (5). Mean Likert scores are shown±SD. SD: Standard deviation

Table 2: Themed responses with examples for positive feedback and areas of improvement for the virtual surgical shadowing program

Areas of improvement	Positive student feedback
<u>Improved camera setup</u> “...the resolution of the overhead camera made it difficult to see the details” “Possibly a better camera” “Camera angles and zoom”	“...this was a great experience” “...got me excited for my plastics sub-rotation... “staff were so friendly and engaging”
<u>Case details prior to the session</u> “Perhaps a little bit more information about the patient’s condition/indications for surgery... knowing what procedures we were going to observe beforehand” “...it would be beneficial to have an idea about the cases before the session” “...ability to read up on the type of cases we would see beforehand” “...details of the case before the session”	“...this was my first direct exposure to shadowing surgery and I felt very engaged in each of the sessions... has made me even more excited to explore the surgical specialties” “Overall great experience” “...I hope all students can attend”

quality of the camera.⁸ Additionally, battery life and lighting are generally poor in these cameras.⁸ GoPro cameras have also been utilized to capture surgeries as they offer high video quality, but they may also experience battery drain.⁹

Although our virtual shadowing initiative occurred as a result of the COVID-19 pandemic, we feel that there are several important ongoing implications of virtual surgical education for medical students. This technology could be utilized to provide shadowing experiences for students in settings where specific surgical specialties are not offered, as well as to facilitate global surgical education initiatives to medical students, and residents in lower resource settings. Similar programs have been created and tested, such as one described by McCullough *et al.*, to stream surgical procedures in Mozambique to a plastic surgeon in the United States.¹⁰ Thus, as a purely educational tool, this technology has shown promising results in global surgical education initiatives, and we feel our approach could help both supplement medical education locally and bolster global access to surgical education.

Limitations

Limitations of our shadowing model include the limited number of students per shadowing experience as well as the challenge of coordinating the high staffing requirements necessary for this program. In future iterations of this program, we believe we could include one to two medical student volunteers available to help prepare the patients and facilitate the technological component of the shadowing experience to help reduce costs and improve efficiency.

Conclusion

To overcome in-person limitations stemming from the COVID-19 pandemic, our pilot project allowed students to shadow plastic surgeons and observe common surgical procedures in a virtual setting. Through survey responses, students confirmed that our virtual surgical shadowing initiative provided an engaging and educational experience that met their learning objectives. As a result, we feel that virtual surgical shadowing represents a promising and innovative solution to facilitating surgical education, and career exploration for medical students in a variety of contexts, and an innovative way to improve the quality of medical education.

References

1. Li MK, Pieris D, Xu G, Law M. In the shadows: medical student clinical observerships and career exploration in the face of COVID-19. *Canadian Medical Education Journal*. 2021 Jun 30;12(3):179-181. <https://doi.org/10.36834/cmej.71523>. PMID: 34249210; PMCID: PMC8263046.
2. ElHawary H, Salimi A, Barone N, Alam P, Thibaudeau S. The effect of COVID-19 on medical students' education and wellbeing: a cross-sectional survey. *Canadian Medical Education Journal*. 2021 Jun 30;12(3):92-99. <https://doi.org/10.36834/cmej.71261>. PMID: 34249194; PMCID: PMC8263044.
3. Soo J, Brett-MacLean P, Cave MT, Oswald A. At the precipice: a prospective exploration of medical students' expectations of the pre-clerkship to clerkship transition. *Advances in Health Sciences Education Theory and Practice*. 2016 Mar;21(1):141-162. <https://doi.org/10.1007/s10459-015-9620-2>. Epub 2015 Jul 12. PMID: 26164285.
4. Haut AG, Haut ER. COVID19 Limits on physician shadowing harm undergraduate students' futures. *Journal of Surgical Education*. 2022 Jul 4:S1931-7204(22)00159-3. <https://doi.org/10.1016/j.jsurg.2022.06.014>. Epub ahead of print. PMID: 35882609; PMCID: PMC9250889.
5. Dhillon J, Salimi A, ElHawary H. Impact of COVID-19 on Canadian medical education: pre-clerkship and clerkship students affected differently. *Journal of Medical Education and Curricular Development*. 2020 Oct 14; 7:2382120520965247. <https://doi.org/10.1177/2382120520965247>. PMID: 33134548; PMCID: PMC7576927.
6. Dangen J, Hsueh Y S, Lau S YC, Nagra S, Watters D, Guest GD. Live-streaming surgery during COVID-19 using a 3D printed camera. *ANZ Journal of Surgery*. 2021 Jun;91(6):1056-1058. <https://doi.org/10.1111/ans.16797>. PMID: 34121283; PMCID: PMC8420233.

7. Jack MM, Gattozzi DA, Camarata PJ, Shah KJ. Live-streaming surgery for medical student education - educational solutions in neurosurgery during the COVID-19 pandemic. *Journal of Surgical Education*. 2021 Jan-Feb;78(1):99-103. <https://doi.org/10.1016/j.jsurg.2020.07.005>. Epub 2020 Jul 31. PMID: 32747320.
8. Abu-Rmaileh M, Osborn T, Gonzalez SR, Yuen JC. The use of live streaming technologies in surgery: a review of the literature. *Annals of Plastic Surgery*. 2022 Jan 1;88(1):122-127. <https://doi.org/10.1097/SAP.0000000000002909>. PMID: 34270473.
9. Bizzotto N, Sandri A, Lavini F, Dall'Oca C, Regis D. Video in operating room: GoPro HERO3 camera on surgeon's head to film operations--a test. *Surgical Innovation*. 2014 Jun;21(3):338-340. <https://doi.org/10.1177/1553350613513514>. Epub 2013 Dec 19. PMID: 24363275.
10. McCullough MC, Kulber L, Sammons P, Santos P, Kulber DA. Google Glass for remote surgical tele-proctoring in low- and middle-income countries: a feasibility study from Mozambique. *Plastic and Reconstructive Surgery Global Open*. 2018 Dec 5;6(12):e1999. <https://doi.org/10.1097/GOX.0000000000001999>. PMID: 30656104; PMCID: PMC6326622.