COVID-19 and Virtual Medical Student Education

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INTRODUCTION

On March 17 2020, the Association of American Medical Colleges (AAMC) released guidance strongly advising schools to remove medical students from direct patient care in order to minimize the spread of COVID-19. Within a week, the vast majority of medical students were pulled from their classrooms and clinical rotations. At the same time, course directors were forced to find creative ways to continue medical education on digital platforms. Although students and professors were able to quickly transition to virtual lectures and discussions, other necessary learning experiences including taking patient histories and practicing physical exams were severely limited. The COVID-19 pandemic has posed unique challenges to medical education to adapt and advance their teaching methods. Even though there is no substitute to in-person learning, certain elements of virtual learning will likely remain postpandemic. Thus, the medical education community must learn how to maximize the virtual learning environment for medical students.

STRENGTHS AND WEAKNESSES OF VIRTUAL MEDICAL EDUCATION

Studies show that virtual teaching has advantages, such as accessibility of resources and flexibility. Making physical study materials available online enabled students to access them at the time and place of their preference, which encouraged more self-motivated asynchronous learning. Furthermore, the wide use of virtual meeting platforms accelerated teaching from world-renowned medical specialists, no longer limited by cost and location (1). In addition, increased popularity of social media platforms including YouTube (San Bruno, CA), Twitter (Menlo Park, CA), and Instagram (Menlo Park, CA) Live among medical experts facilitated student knowledge and interest, as well as networking.

Major weaknesses of virtual teaching include technical difficulties and loss of face-to-face interaction. Lack of access to computers, poor internet speed and quality, and technical challenges involving software for virtual learning platforms diminishes the quality and efficiency of learning. More importantly, the loss of bedside or reading room teaching, direct interactions with patients, and feedback from residents or attending physicians may impair students from reaching their full competencies before entering residency (2). The transition from preclinical years to clinical years was negatively impacted due to disrupted teaching of anatomy and basic patient interviewing and physical examination skills (3,4). Furthermore, the intrinsic disadvantages that come with web-based learning exist including difficulty maintaining focus, poor motivation, and reduced communication. Virtual learning may also increase feelings of isolation, anxiety, and stress among medical students (5).

STRATEGIES TO IMPROVE VIRTUAL MEDICAL EDUCATION

Advanced Preparation for Lectures

Virtual meetings should maintain the same professional standards and etiquette as in person meetings. Both presenters and attendees should be conscious of their attire, background, and location to minimize unnecessary distractions. Cameras should be turned on for both presenters and attendees to maximize the resemblance to an in-person meeting. Also, presenters must ensure the quality of their microphone and attendees should double check their audio systems. Logging into the virtual meeting platform a few minutes prior to the meeting can avoid loss of time and attention that may ensue with having technical difficulties. Students may often find themselves lost in a lecture when there is no clear agenda or learning objectives. Prior to starting a presentation, the presenter must properly introduce themselves, set ground rules of how the audience can participate or ask questions, and have a clear outline of the presentation. The presentation should also be adjusted to have minimal text, focused material, and supporting visuals to enhance the educational experience (6). Providing a chance for the audience to ask questions, either directly or anonymously, is crucial in the understanding and retention of information.

Flipped Classroom

One technique to enhance virtual medical education is adoption of flipped classroom learning models, where students

must complete an assignment prior to teaching sessions so that lecture time can be streamlined to analysis and application of higher order knowledge (7). This technique enhances student engagement and promotes active learning that ultimately improves short term student performance and learning of practical skills (8). For example, lecturers may provide students with a peer reviewed journal article or a YouTube (San Bruno, CA) video relevant to the lecture topic to read or watch prior to the session to help students familiarize themselves with the topic. In that way, lecture time can be spent more efficiently answering questions about the topic and understanding applications of the concept through case discussion rather than passive delivery of information. Also, by utilizing Zoom (San Jose, CA) breakout sessions, students may have the opportunity to discuss pre-lecture materials in smaller groups and report back to the larger group.

Incorporation of software

Another technique to enhance virtual learning and student engagement is to incorporate software tools in lectures. For example, PollEverywhere (San Francisco, CA) and Slido (Bratislava, Slovakia) are audience response tools that allow the audience to answer polls and multiple choice or open-ended questions on the web, via smartphones or SMS texting. They are helpful not only in encouraging audience participation, but also informing lecturers about their audience's understanding of lecture materials. Slido (Bratislava, Slovakia) also provides the additional benefit of anonymizing responses so medical students do not feel shy or too intimidated to ask a question.

Pacsbin (Baltimore, MD), a radiologist-developed cloud-based application which can be integrated into an institution's Picture Archiving and Communication System (PACS), allows seamless single click transfer of anonymized scrollable cases to the cloud. Cases uploaded to Pacsbin (Baltimore, MD) are easily accessible on the internet and can be reviewed within the application's Digital Imaging and Communications in Medicine (DICOM) viewer, which can simulate a PACS workstation with functionality such as window level and zoom. By reviewing the cases on Pacsbin (Baltimore, MD) through Zoom readout sessions, it may serve as a valuable distance-learning platform for both residents and medical students (9).

In addition, numerous mobile applications have been developed to facilitate student-driven learning on their mobile devices. UBC Radiology Teaching Apps (Vancouver, British Columbia, Canada) is one example that was designed for medical trainees and medical professionals to help increase their confidence in identifying normal anatomic structures and common pathology on images, as well as choosing the most appropriate imaging test. It is free to download on an iOS iPhone, iPad, and Android. The preclinical section includes high quality and appropriately labeled images for anatomy and ultrasound subdivisions, both of which incorporate a quizzing format for immediate feedback. The clinical section is subdivided into a multiple choice quizzing section, which prompts users to choose the best imaging test to order,

and a clinical cases section, which allows individuals to work through their differential diagnosis. Such open-access, portable learning tools may be more readily utilized as an adjunct to radiology medical student curriculum to promote retention of anatomy knowledge through positive reinforcement and self-motivated critical thinking (10).

Increased Simulation Learning

The development of interactive virtual clinical training is one of the most effective forms of virtual medical education. Hofmann et al. discussed the case of virtual ward rounds that allowed medical students to observe and interact with patients with COVID-19 (11). From student feedback, 92.9% of the students recommended such a form of interactive learning. Some institutions utilized virtual morning reports to practice presenting patients on the wards, improve communication skills and receive feedback from attendings. In another case, Chandra et al. (12) explored the use of virtual callbacks conducted by medical students for patients who had recently been evaluated in the emergency department as a part of virtual emergency medicine clerkship. Student feedback was overwhelmingly positive and they believed that this form of teaching enhanced their clinical reasoning and communication skills.

With the expansion of Artificial Intelligence (AI) in healthcare, there is rising interest in AI-augmented medical education. Cheng et al. developed an AI-augmented teaching program for medical students in detecting hip fractures and found significantly higher postlearning accuracy in the AI-assisted learning group than a control learning group (13). AI-assisted teaching platforms may serve as a valuable teaching method that allows delivery of personalized education and 24-hour supervised tutoring that benefits both trainees and trainers.

At Yale School of Medicine, an online virtual tele simulation curriculum was developed, which consisted of simulated clinical scenarios that included live patient actors, facilitator interactions, and real-time assessment of vital signs, laboratory results and imaging tests. To improve physical exam skills, the "think-aloud" protocol was utilized. For example, when a student was doing an abdominal exam, instead of speaking to the patient "I am palpating your abdomen," they must verbalize the specific findings they are looking for by saying "I am palpating in the left upper quadrant for any firmness, guarding or rebound." In addition, photographic images depicting gross deformities, skin, or key physical exam findings were shown as a part of the physical exam when cued by students. Following each simulation scenario, students were expected to derive diagnoses and update patients on treatment plans. Interactive debriefings were facilitated by attendings to review key concepts in patient history, physical exam, and management steps. Such use of virtual patients has the potential to be a significant learning tool in improving clinical reasoning and physical exam skills especially for preclinical students (14).

CONCLUSION

COVID–19 has caused considerable interruption in medical student education. However, changes to the medical education curriculum may lead to unimaginable innovation of the traditional learning experience (15). Therefore, thinking outside of the box to maximize student motivation to learn through various teaching modalities and engagement with patients, real or virtual, to simulate in–person clerkships is an important responsibility of course directors.

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