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Medical Education During the Coronavirus Disease-2019 Pandemic: Learning From a Distance



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As paradigms of clinical care delivery have been significantly impacted by the novel coronavirus disease-2019 pandemic, so has the structure, delivery, and future of medical education. Both undergraduate and graduate medical education have seen disruptions ranging from fully virtual delivery of educational content and limited clinical care for medical students to increased clinical demands with redeployment for residents and fellows. Adherence to social distancing has led to the adoption and implementation of already available technologies in medical education, including video conferencing softwares and social media platforms. Efficient and effective use of these technologies requires an understanding not only of these platforms and their features but also of their inherent limitations. During a time of uncertainty and increased clinical demands, the approach to medical education must be thoughtful with attention to wellness of both the educator and learner. In this review, we discuss the influence of the pandemic on the existing medical education landscape, outline existing and proposed adaptations to social distancing, and describe challenges that lie ahead.

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The novel coronavirus disease-2019 (COVID-19) pandemic has disrupted and challenged the well-established, traditional structure of both undergraduate and graduate medical education – whose backbone has been in-person teaching. Even for medical students who may be accustomed to viewing prerecorded content from the comfort of their homes, in-person sessions exist to strengthen concepts and prepare them for the rigors of clinical training. While many medical students have been removed from patient care areas to minimize exposures and preserve personal protective equipment, those who have graduated early from medical school have been assigned to previously unfamiliar clinical environments.¹ Some medical schools have graduated students earlier than scheduled to contribute additional trainees to a strained workforce.² Growing clinical and administrative demands as well as illness have redirected faculty time and energy away from medical education, impacting their availability for trainees. Many questions remain for the future of medicine and, particularly, medical educa-

tion. Here, we describe the disruptive impact of the pandemic on the current medical education landscape, existing and proposed adaptations to social distancing, the balance between learning and wellness during this time, and challenges that lie ahead.

CURRENT LANDSCAPE MEDICAL EDUCATION AND DISRUPTIVE IMPACT OF THE COVID-19 PANDEMIC

Undergraduate Medical Education

For medical students in the preclinical months of training, the COVID-19 pandemic has had a gentler impact on the day-to-day routine compared with the clinical years. The percentage of preclinical scheduled activities that are lecture based varies by medical school, with some schools conducting the majority of teaching in lectures, whereas others use the lecture format as little as 20% of the time.³ Over the last decade, in-person attendance to lectures has declined. A 2017 American Association of Medical Colleges survey found that fewer than 50% of second-year medical students attended lectures either “most of the time” or “often,” likely as they perceive viewing of prerecorded material to be more efficient.^{4,5} Adherence to social distancing has eliminated in-person small group sessions and workshops during which students discuss concepts with peers and faculty, with some being replaced by video conferencing sessions. Learning and study spaces such as libraries and anatomy laboratories have been shut down.⁶ Basic clinical training experiences during the preclinical years (eg, history taking, physical examination) have also been affected, raising concern for inadequate preparation of students beginning clinical rotations.

Although most preclinical experiences can be substituted with prerecorded lectures and video conferencing sessions, such replacements do not exist for in-person, clinical training. William Osler once said, “Medicine is learned by the bedside and not in the classroom.”⁷ During the clinical years, students join multidisciplinary teams and practice

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newly learned clinical skills, while seeing firsthand how the healthcare system functions. These early experiences likely influence their ultimate specialty selection. During the pandemic, medical students have evacuated inpatient and outpatient arenas in an effort to reduce viral transmission, mitigate personal protective equipment shortages, and lower the risk for student infection – a measure supported by an American Association of Medical Colleges recommendation that advises that they be removed from direct patient care activities “unless there is a critical healthcare workforce need.”^{8,9} Some have suggested that this strategy undermines medical professionalism and sidelines individuals willing to provide patient care.^{10,11} Although having optional clinical experiences has been proposed, this strategy may be perceived as inequitable to those students not electing to participate.¹¹ As the 2020-2021 academic year begins, medical students beginning their final year of medical school may not have completed necessary requirements to participate in senior year rotations.

Graduate Medical Education

In the 2018-2019 academic year, more than 140,500 medical residents and fellows were enrolled in Accreditation Council for Graduate Medical Education (ACGME)-accredited training programs and make up about 14% of active physicians in the United States.¹² In anticipation of the pandemic peak, the ACGME implemented 3 stages of graduate medical education: stage 1, “business as usual” (no significant disruption of educational activities); stage 2, increased clinical demand (some residents/fellows shifted to patient care, some educational activities suspended); and stage 3, pandemic emergency status (majority of residents/fellows shifted to patient care and most educational activities suspended).¹³ Many house staff in the hardest hit areas were redeployed from their specialties to the front lines in emergency departments, hospital wards, and intensive care units.

Residency and fellowship programs exist to train physicians through hands-on clinical experience and teaching. In the pre-COVID-19 era, trainees and attending physicians traditionally rounded together to see patients at the bedside and discuss teaching points. In light of social distancing and increased patient care demands, these established teaching and learning opportunities, as well as didactic conferences, largely dissolved.¹⁴

On the wards, direct patient contact was often limited to more senior individuals, and supervised procedural training was reduced. Despite the emergency

pandemic declaration, the ACGME mandated that trainees continue to receive adequate supervision and training while adhering to duty hours.¹⁵ At Mount Sinai Hospital in New York City, the Department of Medicine established a 3-tier system led by a hospitalist who supervised a team of individuals, some of which may not have had internal medicine training.^{16,17}

Many trainees were immersed in telehealth patient encounters as in-person clinic visits were canceled.¹⁸ With appropriate attending supervision via an additional mobile device, these telehealth encounters can approximate lessons learned in person at the bedside but lack opportunities to practice direct patient interaction and physical examination skills.

Although trainees continued to staff inpatient services, they were unable to participate in prescheduled electives and other required rotations that may be important for subspecialty decisions and fulfill graduation requirements. Of note, accreditation bodies have given flexibility to program directors around the assessment of trainees’

readiness for unsupervised practice.¹⁹ With the limitations on elective surgeries, residents and fellows in surgical specialties may have struggled to perform procedures required by accreditation bodies for licensure and independent practice. The implication of these shortfalls remain uncertain, but there is concern for the possibility of inadequate training of proceduralists.²⁰

As this academic year comes to a close and new trainees enter the workforce, in-person orientation sessions will be condensed into virtual programs. Likewise, residency and fellowship interviews will be

transitioned to a virtual format.

ADAPTATIONS AND RECOMMENDATIONS TO OPTIMIZE EDUCATION DURING SOCIAL DISTANCING

The COVID-19 pandemic has necessitated adoption and implementation of already available technologies in medical education. In many institutions, Zoom and similar video conferencing platforms like BlueJeans and Microsoft Teams have now replaced the in-person lecture-style and small group meetings.²⁰⁻²³ Of note, these platforms are not new and have been a prevalent resource that allowed learners to attend lectures remotely. The pandemic has significantly expanded users of these softwares, with Zoom users growing from 10 million to 300 million users from December 2019 to April 2020.²⁴

Zoom features important tools useful in education such as shared screens, whiteboard, polling, breakout rooms,

CLINICAL SUMMARY

- The novel coronavirus disease-2019 pandemic has challenged the structure and delivery of undergraduate and graduate medical education.
- Adaptations to social distancing in medical education include creative uses of video conferencing softwares, social media platforms, and Free Open Access Medical education tools
- In-person clinical experiences are difficult to replicate virtually, and missed experiences present challenges for the training of those preparing to join the healthcare workforce
- Challenges to medical education during the coronavirus disease-2019 era include engagement over video conferencing and social media platforms, balancing of home and work life, and heightened concerns for provider burnout.

Table 1. Summary of Video Conference Features and Descriptions With Examples

Feature	Description	Example
Screenshare	Allows either the meeting host or participants to share their device screen with other participants	A lecture with slides on basics of glomerular disease.
Whiteboard	Host/participant can create a white canvas seen by all participants. Can be used to draw with various colors, pens, or text. Drawings can be saved at the end of the meeting.	A “chalk talk” on acute kidney injury.
Polling	Host can write 255 character multiple choice questions (single or multiple answer) with 10 choices that can be shared with the group. Each poll can be launched/cleared as needed.	A nephrology board review session during which participants answer practice questions.
Breakout rooms	The host can separate the group into smaller groups for a specific period of time before recovering as a larger group. Each group can communicate with the host to ask them to join their group to answer questions or discuss.	A medical student session during which they solve acid-base disorder problems in small groups of 4 students.
Annotation	Participants may use the same tools that are available to draw on the whiteboard to annotate on any screen that is shared.	A learner circles the basement membrane deposits on a pathology slide shared from the pathologist’s microscope.
Chat and file share	Similar to instant messaging, participants can share messages with the whole group or individual participants.	Learners pose questions during a lecture on nephrolithiasis. After the lecture, a file with slides is shared with all participants.
Nonverbal feedback	Participants can communicate with the host using preset reactions (eg, yes, no, and raise hand)	A medical student raises their hand to ask a question about hyponatremia.
Virtual background	The user uploads a photo or uses existing images (eg, outer space) to change their own background.	Create an ice breaker by asking learners to use a background of their favorite place.
Recording	The session is recorded and stored to either the host’s computer or Zoom Cloud account. If the screen sharing is used, the screen is recorded with a thumbnail of the speaker in the corner. Chat sessions and an audio transcript of the session are also saved.	A nephrology fellow on night float misses a board review session and then views the session the following week.

and annotation to facilitate interaction. The option to change one’s background to a photo of their choice creates a playful, light-hearted environment. The whiteboard, helpful for those accustomed to “chalk talks” allows both the educator and learner to draw on a blank screen. Breakout groups facilitate small group work or discussion. Polling features mimic audience response systems, and the chat feature provides another venue of conversation. [Table 1](#) summarizes video conferencing features and provides examples of their use.

Free Open Access Medical education (eg, blogs, websites, and videos) and social media platforms (eg, WhatsApp, Twitter, Instagram, Slack) that had served as adjuncts to core curricula have now come to the forefront. In nephrology, these resources have grown over the last decade.²⁵ Anecdotally, preexisting Web-based resources such as NephSIM²⁶ have been adapted to develop virtual elective experiences in nephrology, radiology, and

dermatology. In nephrology specifically, learners have had opportunities to join virtual educational experiences shared on social media including the online game NephMadness,²⁷ NephSIM Live,²⁸ Live Arkana Nephropathology sessions, NephroTalk,²⁹ and national and international conferences.³⁰ [Table 2](#) summarizes examples of other virtual educational activities.

As medical students were removed from essentially all clinical care venues, some institutions continued efforts to develop interpersonal skills by encouraging students to provide virtual patient updates to family and friends. Institutions may provide opportunities for students to join clinical teaching sessions (eg, morning report) via video conferencing platforms. Motivated medical students wasted no time finding other avenues to be active within the medical community after the suspension of inpatient clinical rotations. Some have continued participation in mentored research projects. Others have mobilized to

Table 2. Virtual Education Activities

Activity	Platform
Journal club	VCS, Twitter, Slack
Case or pathology conference	VCS
Review of practice questions for board exam preparation	VCS, Slack, WhatsApp
Telehealth precepting	VCS, WhatsApp
Standardized patient encounter	VCS
Regular communications with clinical questions and relevant articles	E-mail, Slack, WhatsApp
Research discussions or meeting	VCS, Slack, WhatsApp

Abbreviation: VCS, video conferencing software.

form response teams to serve as activists, advocates, and educators in their communities.^{31,32} At the Icahn School of Medicine at Mount Sinai, a Medical Corps program was developed to allow students who had matched at the Icahn School of Medicine at Mount Sinai for residency to assist with tasks such as entering orders, scribing, relaying updates to patients’ families, and facilitating discharge planning.³³

CHALLENGES

Anecdotal reports suggest that conference attendance has improved with the adoption of video conferencing, presumably because of availability of computers and mobile devices. However, this accelerated implementation of virtual educational content delivery has challenges. In **Table 3**, we summarize strategies and tips to optimize effectiveness and efficacy of virtual medical education. First, effective participation in video conferencing platforms requires a quiet environment with minimal disruptions and a stable internet connection. In addition, faculty accustomed to “chalk talks,” where pictures are traditionally drawn on a whiteboard to illustrate a concept, is now expected to create content to convey the same points through video conferencing.

In an era where clinical and administrative responsibilities encroach on educational time, creating images using presentation programs can be time consuming. Development of new educational content may be particularly cumbersome in such a time of uncertainty and increased clinical demands. In person, educators rely on audience interaction to guide content and topic emphasis based on apparent knowledge gaps. Interaction is possible with video conferencing, though gauging audience understanding and identifying knowledge gaps can be a challenge, particularly for those who may be using conferencing softwares for the first time. Finally, there remains a population of faculty who may be reticent to or uncomfortable with the adoption of virtual educational platforms. Motivated learners and educators will be tasked with providing technological support for those less savvy to overcome these barriers. Faculty development geared toward these technologies will be required effectively use virtual platforms to address learners needs,

Table 3. Strategies and Tips to Optimize Virtual Medical Education

Strategies and Tips to Optimize Virtual Medical Education
Adjust your camera to the eye level and find a quiet area
Encourage learners to connect to both audio and video
To minimize background noise, mute participant,s and encourage them to unmute as needed
If hosting a video conferencing session, start the session a few minutes early. Enable the “waiting room” as needed and admit participants once the speaker is ready
Orient learners to all different options to interact (eg, chat, nonverbal feedback, unmute)
Schedule faculty development or orientation sessions for educators to review use of software before teaching sessions
Place the chat window in a visible location on the screen while teaching, or designate a chat moderator to consolidate and verbalize questions
Set up an “ice breaker” poll and introduce participants to software features
Consider the use of standardized patients via video conferencing platforms
If internet connectivity is poor, consider assigning a cohort to ensure that the meeting remains active
In a setting like “Grand Rounds,” consider unmuting all participants at the end of a session to allow for applause
Consider sharing meeting links privately to minimize intrusion by unwanted participants. If shared more publicly, adjust security settings (eg, limit chat, unmuting) to avoid disruptions.
For recurring sessions with the same group, consider using 1 meeting link

implement learning objectives, and deliver educational content.³⁴

The seemingly greatest challenge is the suboptimal replication of patient encounters experienced during the undergraduate medical education years. Although case simulations and virtual standardized patients can provide some training of skills such as physical examination and clinical reasoning, these activities are generally supplementary rather than a replacement of in-person teaching.³⁵⁻⁴⁰ Moreover, competency-based assessments of student skills through these virtual simulations are limited. Anecdotally, virtual objective structured clinical examinations can be used to evaluate remaining competencies required for graduation, but these techniques have never before served as substitutes for direct patient care.

Finally, educators and students are navigating new educational systems and adapting existing teaching and learning methods to the evolving educational environment. Balancing of home and work life, which now may have minimal physical separation and include child care for some, presents new obstacles. With additional clinical responsibilities, educators may have limited time for content creation and sometimes complete transformation of courses from in person to fully virtual experiences. Course directors may face challenges with educators who may not be familiar with technologies newly applied in medical education.⁴¹

BALANCING LEARNING AND MORALE: WHAT CAN LEARNERS HANDLE?

It is no secret that social distancing has created a rift in our traditional methods of gathering and sense of community. It is well documented that social isolation often negatively impacts psychological health, with increased rates of stress, anxiety, depression, and other negative feelings.⁴² Although similar psychological sequelae have been observed during the COVID-19 pandemic-related isolation, the full impact on mental health remains to be seen. On the other hand, although faculty and trainees alike find themselves physically separated during this imposed isolation, our existing virtual communication platforms enable connection with friends, family, and colleagues as well as social and work-related communities. In nephrology, trainees have anecdotally reported improved communication among 1 another. Chief residents and fellows across specialties have shared experiences of virtually gathering for weekly updates, emotional support, and COVID-19 management tips. This sense of community has even expanded greater than before, with lecture invitations extended beyond individual specialties and institutions. In the heavily affected pandemic areas in Boston, ophthalmology residents are sharing virtual lectures with colleagues beyond the institution and into the community.⁴³ To show their support for 1 another, residents in Boston sent t-shirts to their New York City counterparts.⁴⁴

Trainees were under not just the stress of taking care of patients with this novel and tenuous disease but also their own personal apprehensions.⁴⁵ During the peak of the pandemic, these frontline caregivers were redeployed into unfamiliar departments or even different hospitals. They may have been at high risk for virus exposure and worried about exposing their family members or falling ill themselves. Vacations were shortened, postponed, or canceled all together. Half of trainees surveyed in 1 study expressed concern about overwork and burnout.⁴⁶ More than 24,000 trainees are international medical graduates, many of whom require a visa to work in the United States, anxiously awaiting word from the waiver system. Recognizing these stressors, the American Medical Association wrote guidelines regarding trainee education and safety, including financial and personal well-being. Provider burnout has been a concern before the pandemic and will remain an important area of concern as we move forward.

As programs adapt to an uncertain future, it is difficult to determine the optimal balance between resuming didactic teaching sessions vs allowing trainees time to decompress or attend to responsibilities outside of work. Some nephrology training programs have fully resumed traditional didactic sessions that have been transitioned to virtual platforms, advocating that a return to normalcy will help decrease trainee anxiety.⁴⁷ Others have implemented weekly program director check-ins or other supportive sessions in lieu of didactics. Trainee morale matters not only for current fellows but also for ongoing workforce recruitment. In a large survey about what matters most

in selecting a residency program, medical students ranked resident morale and educational programming as the most important attributes.⁴⁸ It is important that training programs strive to reach a thoughtful balance between return to normal educational activities, with input from their trainees, while being mindful of added demands and stressors in trainee's lives.

CONCLUSIONS

In this uncertain COVID-19 era, we can be certain that medical education will likely never be the same. Both undergraduate and graduate medical education have been significantly disrupted, requiring educators and learners to adapt to learning at a distance while aiming for normalcy. When used optimally and despite their inherent limitations, virtual tools can be used by both learners and educators to achieve a shared goal of providing effective and efficient medical education to train our next generation of physicians. This pandemic has provided educators with an unexpected opportunity to push forward innovations in medication education and rigorously study the impact of this emerging educational paradigm on our trainees.

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