



# Impact of COVID-19 Outbreak on Medical Education and Future Trends

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## ABSTRACT

The coronavirus 2019 pandemic has been a harsh reminder of the immense importance of the healthcare system. Daily life was severely disrupted and widespread effects remain ongoing. War and other circumstances can also lead to sudden disruption and increased demand on medical professionals while creating significant additional challenges. Medical students are an important part of the healthcare delivery structure, and this should be recognized by both the students and the healthcare system, including medical schools. Training should include a broad range of exposure, from contact with patients and families to laboratory work and research techniques, and more in order to provide a comprehensive view and adequate preparation. Medical education has evolved greatly over time and will continue to develop according to needs and conditions. There are numerous influences, both internal and external. The medical community faces many challenges, but provides a vital service. Several portents indicate the need to adapt in order to adequately prepare for the future.

**Keywords:** Education, epidemiology, medical, pandemic, virtual

## INTRODUCTION

The global academic structure is changing rapidly and the coronavirus 2019 (COVID-19) pandemic has accelerated the evolution. According to the Institutes of Science and Development of the Chinese Academy of Sciences report, Research Fronts: Active Fields, Leading Countries, which examined 110 hot research fronts and 61 emerging fronts in 11 broad areas, China ranked first in the Research Leadership Index area of clinical medicine. The United States scored slightly lower, and the United Kingdom was third (1). However, medical education planning must have a comprehensive approach, including basic and clinical science research, basic and clinical medical education, postgraduate education, clinical research studies in hospitals, interaction with other fields, inter/multi/transdisciplinary studies, knowledge of the health system, and patient management (2–7). Medical students are exposed to these and other facets of the profession and should be well prepared to face a complex and changing healthcare environment.

This article is an early reflection on effects of the COVID-19 pandemic and medical education. Since the author has worked in the fields of both health and education, the framework of the review includes an overview of the practices in Turkey and around the world, as well as an evaluation of some recent literature and the future of medical education.

### The Early Days of the Pandemic

Institutions of higher education, like other entities, largely closed in order to control spread of the disease and transitioned to alternative means of continuing at least some of their activity. On March 17, 2020, the Association of American Medical Colleges recommended a temporary suspension of clinical rotations (3, 8). Subsequent additional guidance published on August 14, 2020 recognized the importance of continuing the education of medical students, and suggested that medical schools collaborate with local partners and according to appropriate conditions to provide both training opportunities and a supplement to the overburdened healthcare workforce. The recommendations emphasized the need to ensure sufficient safety precautions, such as adequate training and monitoring, personal protective equipment, and testing for infection with the virus that causes COVID-19 (9). Similarly, in Turkey, following the initial discontinuation of face-to-face instruction on March 13, 2020, guidelines were issued that allowed universities the autonomy to work with their community and implement some in-person activities, according to their capabilities (3, 4, 7).

Many felt that medical students should remain at home, like other students, and various online internship programs were implemented, but given the overburdened healthcare system and the shortage of healthcare personnel, early graduation for medical students was one of the measures adopted by the authorities of various countries. Some

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students were willing to volunteer assistance (5). However, there were many legitimate questions raised about the ability of students to manage in such an exceptional environment. Despite the clear needs of a strained healthcare system, there were various concerns about the appropriateness of such measures. Yet we must accept the reality that the extraordinary conditions led to a different consideration of quality standards. At the same time, students were expected to take more personal responsibility for their education (2).

### Education Must Continue

COVID-19 has had an effect on nearly every sector throughout the world, including higher education and medical education (7). Existing distance education efforts were expanded, including by senior academics who had never before participated in or conducted an online meeting of any kind. The need to adjust to online meetings that could still provide an interactive experience became a priority. (10). This adjustment was considerable for a variety of reasons, and providing an appropriate, secure, interactive environment online proved complicated for various reasons, for both students and instructors. It should be noted, however, that it also offered some opportunities for a new connection between generations. Zoom video conferencing (Zoom Video Communications, Inc., San Jose, CA, USA) was widely adopted, but emergency solutions were often inadequate. Students were required to attend online classes for hours and physicians dealing with extraordinary hospital conditions were also teaching in a new format to an audience they could not always see or interact with. A new phenomenon of “Zoom fatigue,” a form of mental exhaustion resulting from lengthy and repeated video conferencing, was widespread, and burnout became a significant problem. Both physical and psychological effects were common (10–14).

### What is Missing When Education is Virtual?

How were conditions different for medical students during the pandemic? As one part of their education, normally, they are expected to observe a variety of practices during their first clinical rotations and internships, and they progress toward supervised practice. Experiential learning provides the opportunity to observe the important variety of circumstances. For example, vascular access or intubation cannot always be achieved in the same way, understanding and accurately reading variations in an electrocardiogram, and awareness that a patient with a headache may be having a heart attack and a patient with chest pain may just have reflux. Patient-centered care is exemplified in the Hippocratic aphorism: “There is no disease but the patient.” What about in the virtual world?

Given the circumstances of the pandemic, virtual educational experiences and web-based courses were developed and used more widely. Feedback from students and academics was and continues to enrich these valuable, yet different, teaching tools. Hilburg et al. (14) noted that “educators and students are navigating new educational systems and adapting existing teaching and learning methods to the evolving educational environment.”

Although it may be thought that preclinical courses were less affected, this was not exactly the case. We know that online anatomy dissection opportunities, for example, provided for a continuation of the program, but can a virtual experience really replace the conventional method? (15) We will see. Many areas, such as clinical skills, communication, professionalism, interpretation of tests, and objec-

**Table 1.** Are you ready for an online lesson?

#### Academics

- Embedded analytics
- Flipped learning
- Engaging visuals
- Discussion environment
- Video applications
- Pre and post assessments, instant Q&A (Kahoot!, etc.)
- Creative uses of video conferencing software
- Social media platforms
- Open access medical education tools

#### Students

- Is the video on?
- Mentally ready?
- Study environment
- Preliminary study
- Notes/records
- Homework

tive structured clinical examination (OSCE) skills, are more difficult to teach and to attain in an online environment. It is important to ensure student participation and engagement using interactive applications and integrating games, such as those based on popular TV game shows, like Jeopardy! and The Weakest Link, and quiz formats, such as Kahoot! (Kahoot! ASA, Oslo, Norway) (Table 1).

Hao et al. (16) noted in their review that the results of distance education for medical and nursing students were promising. The authors evaluated 5 databases: PubMed, Embase, MEDLINE (Ovid), CINAHL (Cumulative Index to Nursing and Allied Health Literature), and the Cochrane Library. After eliminating 4596 studies, they examined 16 and said, “We found that the standalone digital education modalities were as effective as conventional learning for knowledge and practice. Different educational technologies have different effects on the knowledge and practice of interns.” They also stated that “Virtual simulation platforms such as i-Human® and Body Interact™ were sufficiently utilized for case-based learning to present students with an interactive medical patient experience.” (16, 17).

### In-person Clinical Experience

How can in-person clinical experience be replicated virtually? What should medical schools do about the different training experience of those now joining the healthcare workforce? And of course, it should not be forgotten that not all students have access to devices and network capabilities for online education.

The pandemic forced a detailed examination of the approach to medical education. While traditional classroom instruction is still relevant, there is a growing emphasis on evaluating just how things need to be done and the possibilities of alternative methods. These include the reasons for actually going to the campus, shifting campus studies to hands-on education and online learning, and competency-based training. During the peak of the pandemic, basic science courses, for example, were often conducted online. Small group discussions were also held online. Flipped learning and asyn-

chronous training techniques were also used. The outcomes, both good and bad, will be seen in the coming years.

Some medical schools offered students an early graduation and an opportunity to volunteer during the crisis. The Icahn Medical School at Mount Sinai in New York created a medical corps program for the new doctors to provide needed assistance to the overburdened healthcare system; they assisted with tasks like entering orders, giving updates to patients' families, and facilitating discharge planning (6). Others also found innovative and creative approaches. Yale University used the flipped classroom model for anesthesia residency training, and in the UK, models such as The SAVEd (Self-Isolating Virtual Education) project were implemented as a means of providing ongoing training for anesthetists (18).

### Mental Health

Residents also faced particular difficulties during the pandemic. Residents work in a difficult learning environment at the best of times, and were now under intense pressure and often only saw COVID-19 patients. Doctors and other staff had to come to the hospital as long as they could stand, even if they were sick with other diseases. The stress on the medical system was such that they worked until they had to be hospitalized in order not to endanger patients and their colleagues. The total number of active health personnel decreased. In addition to infection with COVID-19 in some cases, fatigue, insomnia, and other effects were widespread. According to a report published by the Royal College of Anesthetists in 2017, prior to the pandemic, 61% of anesthesiology residents reported that their job negatively affected their mental health, and 85% of anaesthetists in training were at higher risk of burnout. The extreme conditions of pandemic naturally exacerbated already existing problems (12, 19).

Environmental factors that adversely affected student and residency education during the pandemic included:

#### Physical changes

- Difficulty accessing hospitals/limited public transportation
- Restricted mobility and access to dormitories/classrooms/libraries/restaurants
- Limited participation in clinical ward rounds
- Community checkpoints (fever, vaccination history, electronic tracking codes, etc.)
- Limited patient acceptance
- Limited surgeries
- Use of masks/respirators for extended periods

#### Social Isolation

- Separation from loved ones
- No social gatherings for lunch, etc.
- Closure/restricted hours at restaurants/social venues that were not suited to medical staff hours
- Virtual learning
- Virtual patient examination
- Virtual ward rounds

Chu et al. (13) examined stressors and other influences affecting anesthesiology residents during the COVID pandemic and emphasized the need to remember and acknowledge the role of Maslow's hierarchy. Foundational needs, such as adequate sleep and safety must be met in order to achieve higher levels of learning and self-actualization. The inability to consistently meet basic physiological needs, such as providing personal protective equipment, was a challenge faced all over the world and a cause of additional stress for healthcare workers. Along with mentoring and peer support, family support is often important to preserving mental health and navigating stress, anxiety, and depression. During the pandemic, however, in order to protect their loved ones, many medical personnel remained separated from their families. This isolation, oftentimes including separation from children and elderly parents needing care, contributed to anxiety in trainees (12, 13).

Among many examples of solidarity and support during the pandemic, ophthalmology residents in the city of Boston in the USA participated in shared virtual lectures with colleagues beyond the institution. Furthermore, the Boston residents sent t-shirts to their New York City counterparts to demonstrate solidarity (20).

The support found in spiritual foundations is also important. Adeli et al. (21) listed some examples of spiritual competencies to be fostered among medical professionals in a new research center for spiritual health and a school of health and religion in Iran:

- Respecting patients' spiritual beliefs
- Ability to start and continue a spiritual conversation with patients
- Ability to use spiritual solutions to help calm a patient (prayer, appealing to God, etc.)
- Using one's religiosity to facilitate healing process
- Identifying the spiritual needs of patients
- Trying to meet the identified religious and spiritual needs of patients and clients
- Demonstration of moral attributes in personal and professional behavior (empathy, honesty, piety, compassion, altruism)
- Trying to fulfill professional duties in line with religious criteria

### Renewed Discussion of Medical Education

Medical education has evolved over time (22, 23). Standardization became a priority following studies such as the Flexner Report, published in 1910, which suggested various reforms and standards that became well established. Since then, there have been calls for additional progress. In 2010, a Carnegie Foundation study suggested new reforms. The recommendations were grouped under the following main headings (23):

- Standardizing outcomes and individualizing the learning process
- Integration
- Reinforcing habits of excellence
- Focus on personal growth and professional identity

In recent years, there have been efforts to promote an active, team-facilitated, and self-directed learning approach that incorporates individualized learning and interprofessional education (2, 23). Examples include integrating clinical sciences into basic sciences, considering functional anatomy rather than simply conventional anatomy, and supporting competency-based learning using small groups. Physical presence in the healthcare setting, however, is crucial. Although technology-based applications and simulations make a significant contribution, students must have the opportunity to experience the complex environment of outpatient and inpatient treatment services. There is no substitute for learning through seeing, touching, and doing, including participating in the most brutal and miraculous aspects of life and death.

The development of biomedical research and the transformation of clinical practice into megabusiness opportunities cannot be ignored. It is impossible for medical education not to be affected by these developments. Numerous economic and healthcare management concerns, social expectations, and sociological change affect medical education in many different dimensions. The role of research is vital and is an important part of a professional career, and the growth of telemedicine and other developments are valuable; however, the importance of direct patient care must not be neglected as we examine priorities.

### The Future of Medical Education

There are dozens of articles and opinions on medical education, and the COVID-19 pandemic reinvigorated concerns for the future (24). In 2013, the American Medical Association (AMA) began an initiative to support innovation in medical education. Grants totaling 11\$ million were made to an initial group medical schools to promote the alignment of medical education and training with the changing needs of the healthcare system. They cited the following as targets (22):

- Develop new methods for measuring and assessing key competencies for physicians at all training levels to create more flexible, individualized learning plans
- Promote exemplary methods to achieve patient safety, performance improvement, and patient-centered team care
- Improve understanding of the healthcare system and healthcare financing in medical training
- Optimize the learning environment.

Revisions to curriculum and traditional professional pathways are prominent among the ideas for restructuring and innovation. For example, several of the schools awarded a grant are working on flexible systems of progression that will enable medical students to begin their residency once they demonstrate sufficient competency, rather than after a prescribed period of time. New content and new teaching methods and experiences designed to provide core education and the opportunity for individualization from the very beginning of training are some of the ways forward that are being explored. This new content includes elements such as healthcare system organization and financing, patient safety and quality improvement, medical informatics and clinical decision making, population health management, social determinants of health, team-based care, and chronic disease management. The aim is to design an education and professional experience that provides the full experience necessary to prepare medical students for the healthcare system of the future.

## CONCLUSION

Medical students must understand and participate in the system of healthcare delivery. To this end, exposure to the full spectrum of activities is immensely valuable, including work with patients and families, laboratory testing, and other avenues that will encourage a broad, comprehensive awareness and preparation for their career in medicine.

In order for medical education systems to adequately prepare medical professionals to perform in and meet the needs of the changing healthcare system environment, it is important that training include the following components:

### Medical education

Basic sciences  
Clinical sciences  
Basic medical practices  
Clinical research and ethics  
Epidemiology

### Research culture

Postgraduate and doctoral opportunities  
Opportunities to participate in research and development processes in different positions  
Participation in translational medicine practices

### Personal capacity development

Personal wellbeing  
Coping with stress  
Leadership and self-confidence  
Project management  
21<sup>st</sup> century skills

### Health service delivery

Management of health services  
Patient rights  
Community management and sociological elements  
Health economics  
Health law

### Virtual health care

Terms of virtual patient assessment  
Legal dimension of virtual patient assessment  
Framework of virtual patient consultation

Evolution of longstanding structures in the medical community is a challenge, but a necessary one. Medical schools must examine current and future needs and how medical education might be restructured. While some barriers are formidable, such as lack of resources and regulations, some beneficial innovations are more accessible as we work to achieve larger goals. These include initiatives such as adding a hands-on junior doctorship period where graduates have the opportunity to continue to gain experience, supporting personal capacity development through certificate or other graduate education instead of compulsory courses during medical education, and providing MD-MSc or MD-PhD opportunities for those who want to pursue research.

The pandemic reminded us all of the critical role of the healthcare system. We must address weaknesses and be prepared to meet the future. Change can be difficult. But how would you advise this patient?

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