In Crisis: Medical Students in the COVID-19 Pandemic

Deena Khamees, MD[1], Charles A. Brown, MD[1], Miguel Arribas, MD[1], Annie C. Murphey, BA[2], Mary R. C. Haas, MD[1], and Joseph B. House, MD[1]

The coronavirus (COVID-19) pandemic has sent shock waves through the house of medicine, generating uncertainty, fear, and questions about the role of the medical student during the times of public health crises. On March 17, 2020, the Association of American Medical Colleges, in a joint statement with the Liaison Committee on Medical Education (LCME), recommended that medical schools adopt at least a "two-week suspension on their medical students' participation in any activities that involve patient contact . . . [to allow time] to develop appropriate educational strategies and alternative clinical experiences to best assure safe, meaningful clinical learning for students."[1] While this article focuses on the impact of such a statement on medical students rotating through the emergency department (ED), many of the concepts and strategies detailed herein also apply more broadly to medical students in any clinical environment.

Historical Context

The historical record provides two pertinent examples of how a pandemic can impact medical students. In the first example from the 1918 Spanish influenza epidemic, medical students were asked to replace physicians lost to infection and deployed to areas in need across Spain.[2] As the disease spread to the United States, the Secretary of the Minnesota State Board of Health collaborated with the dean of the University of Minnesota Medical School to recruit senior medical students to fill the void closer to home.[3] Similarly, in Philadelphia, third- and fourth-year students from the University of Pennsylvania School of Medicine staffed an emergency hospital with minimal to no supervision, after receiving a single lecture on the disease.[4] These examples represent an aggressive expansion of responsibility for medical students in a time of crisis.

In contrast to the critical role of medical students providing direct patient care, more recently in 2003 during the severe acute respiratory syndrome (SARS) outbreak, medical student exposure to patients was sharply curtailed. That year, the Faculty of Medicine at the Chinese University of Hong Kong suspended clinical teaching of medical students after 17 students contracted the SARS coronavirus from an index patient while on the wards.[5] Similarly, the University of Toronto restricted clinical activity for their medical students during the same outbreak.[6]

Prior to the AAMC recommendations, the decision of whether medical students should continue clinical work remained controversial and varied. Public health advisors to the government in both the United Kingdom and Canada have suggested engaging medical students in the workforce to combat COVID-19[7] as was deemed necessary in 1918. In Italy, one of the countries most profoundly impacted by the COVID-19 pandemic, medical students have already been "promoted" early.[7,8] The government has waived their

From the [1]Department of Emergency Medicine; [2]Michigan Medicine, University of Michigan, Ann Arbor, MI.
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Supervising Editor: Wendy Coates,, MD.
Address for correspondence and reprints: Deena Khamees, MD; e-mail: dkhamees@med.umich.edu.
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standard qualifying examinations and will bypass their standard 8- to 9-month graduation and credentialing process, resulting in about 10,000 medical school graduates joining the existing Italian physician workforce in clinics and retirement homes.[8]

Medical education leaders may benefit from studying the different approaches used globally to inform approaches at their own sites. This article presents perspectives of a panel of local undergraduate and graduate medical education experts, residents, and medical students regarding the benefits and risks associated with medical student clinical involvement during a pandemic and provides potential alternatives to augment students' contributions and education while minimizing undue risk.

BENEFITS OF STUDENT INVOLVEMENT IN CLINICAL EXPERIENCES

True Value of the Educational Experience and Future Practice Patterns

A valuable emergency medicine (EM) clerkship requires more than the simple presence of students in the ED.[9] Active contribution to patient care enhances medical student learning.[10] Students report feeling ill-prepared for residency with shadowing-only experiences that do not allow for clinical decision-making practice and express a desire for active involvement.[11,12] The phenomenon of "scutwork," defined as the "non-clinical yet essential tasks that do not require a doctor's degree or expertise" also impacts the student's experience.[13] Although the traditional definition of scutwork mainly refers to nonclinical tasks, the definition is subjective and can also refer to service-related clinical tasks traditionally outsourced to other ancillary staff, such as transporting patients to the radiology suite. Nonetheless, limiting hands-on, direct patient care may naturally increase the amount of scutwork performed by medical students.

In general, excessive time devoted to scutwork contributes to trainee burnout without significantly enhancing education.[14] Student contribution to the team, however, enhances a sense of importance which in turn further improves student contribution.[15] Components of traditional scutwork may still represent value-added activities, especially during an international emergency that impacts the standard balance of student education and patient care.[16]

Pandemics and other critical incidents may offer valuable and relatively rare educational experiences to learners. The informal but practical curriculum of ethics, policy development, and resource allocation are critical points of learning for providers.[17,18] Such crises may increase in frequency with emerging infectious diseases and natural disasters on the rise.[19,20] Today's trainees may face another pandemic, or similar crises, in their career as practicing EM physicians. First-hand knowledge of the current system's response to threats such as COVID-19 can increase the awareness of systemic problems. In turn, this may inspire trainees to spearhead future disaster-preparedness, public health, and related endeavors in local and national arenas.

The Student–Medical School Financial Agreement

In the event of a pandemic, suspending student clinical experiences without replacement activities for a prolonged period may result in extended student enrollment time or lost vacation time or threaten enrollment eligibility entirely. When students enroll in medical school, they assume considerable financial burden and risk by delaying or abandoning full- and part-time work to completely devote themselves to 4 years of expensive training. An unanticipated suspension could jeopardize student eligibility for loans and financial aid, increase the amount borrowed, lengthen the time period over which money is borrowed, or some combination of these.

Residency Applications and Preparedness

An interruption to medical student education could have lasting effects on trainee competitiveness for residency applications and preparedness for intern year. Many EM applicants rotate through their home or away EDs during their late third year and early fourth year, the timing of which has coincided directly with the COVID-19 pandemic. The EM application process all but requires that students have performed their home rotation and received letters from one or two additional away rotations. A suspension or loss of home or away EM rotations could have a major impact on student schedules and application competitiveness and deprive students of the chance to evaluate residency programs of interest. Not surprisingly, this can only lead to increased confusion, frustration, and anxiety for students. While the Council of Residency Directors in Emergency Medicine (CORD) Advising Students Committee in Emergency Medicine (ASC-EM) has already begun the hard work of addressing the downstream effects of canceled away rotations on

residency applicants, note that this is still effort and time diverted from other important, student-centric tasks.[21]

Should medical students be removed from clinical duties, those students nearing the end of their training may not complete required clerkships in time, including EM rotations at many schools. These students risk delayed graduation or substandard preparation for their next year as an intern, the downstream effects of which residency programs will have to overcome.

Medical Students' Professional Identities

The physician's professional identity, which Wilson et al.[22] have defined as "how a doctor thinks of himself or herself as a doctor," begins in earnest in medical education. The typical, non–COVID-charged medical school rotation allows the student to develop a professional identity through contribution to patient care, argued by some as the *only* way to do so.[15] When we consider that one's professional identity is intricately connected to wellness and professional relationships with teammates, peers, and patients, the significance of its development grows.[23] The clinical experience fosters such development in a variety of ways.

Contributing to patient care results in a sense of ownership and responsibility to and for patients, perhaps most deeply felt when mistakes are made.[15] Additionally, those mistakes can highlight the importance of one's professional reputation.[15] Direct patient care also fosters a realization of expectations, limits, and privileges as the student compares his or her own abilities to that of a resident or attending on the team.[15,24] That team, and the student's active role on it, serves to illustrate the medical student's importance and perception of such.[15] Furthermore, in the times of crisis, contributing to patient care may provide an enhanced sense of satisfaction and purpose. In that sense, the loss of the clinical experience is more palpably felt. Additionally, releasing students from their clinical duties at a time of crisis could signal the perception that they are more learners than they are members of the health care team. This is not entirely unreasonable but should be considered.

Medical school administrations intentionally and appropriately message to students that they are an asset to the health care team, but as the AAMC pauses students' clinical experiences, students may be questioning the legitimacy of these claims. A teaching hospital remains such even when under duress. That said, higher patient volumes, new COVID-19–related protocols, and other crisis-specific issues may limit faculty members' practical ability to teach. Continued, if modified, clinical experiences accommodate these constraints and may preserve students' sense of belonging and importance. There are subtle lessons and values imparted on our medical students when we continue or suspend their clinical experiences.

Medicine as Service

The Hippocratic oath embodies the promise that today's physician "... will remember that [he or she] remain[s] a member of society, with special obligations to all [his or her] fellow human beings."[25] This idea of "special obligations," of the same cloth from which the sentiment of a "noble profession" is cut, speaks to a sense of duty experienced by physicians that exceeds that of the typical employee. Indeed, society tends to hold the medical profession in such great esteem because of high professional and ethical standards and the physician's commitment to patients.[26]

As with soldiers in battle, a call to action may eclipse training restrictions—otherwise known as a "field promotion." Losing members of the health care team to quarantine or illness increases the need for health care personnel. Italy responded to this very problem with accelerated graduation for senior medical students who can now practice as general practitioners against COVID-19.[8] When asked to "step up to the plate," medical trainees may feel more prepared if they have remained on the frontlines up to that point. In this regard, students may advocate for a choice in the matter. Before the world saw influenza H1N1, more than half of students surveyed at University of Alberta believed that medical students have an *obligation* to be involved in influenza pandemics.[27] When surveyed at University of Michigan in the aftermath of the H1N1 pandemic, 88% students preferred to be formally involved.[28] Naturally, these students may have feelings of frustration and isolation when instructed to go home.

RISKS OF STUDENT INVOLVEMENT IN CLINICAL EXPERIENCES

Transmission of Disease

Consider the notion of "flattening the curve." This refers to the concept of spreading the incidence of a disease across a longer period of time to avoid a spike of cases that subsequently depletes resources, such as

ventilators, N95 masks, extracorporeal membrane oxygenation (ECMO) machines, and hospital beds.[29] The World Health Organization (WHO) has recommended strategic social distancing of the general population and quarantine and isolation of infected persons to slow the spread of the disease.[30]

Limiting provider exposure to patients under investigation (PUI) reduces unnecessary risk of the transmission of disease. Inherently then, increasing the number of providers who interact with a COVID-19–infected patient by even one creates a potential exponential increase in the number of exposures. Maintaining traditional clinical involvement in the ED results in medical students becoming that one extra provider.

Data from China show that a large population may asymptomatically carry COVID-19, and 86% of COVID-19–diagnosed patients obtained the disease from asymptomatic carriers.[31] Thus, exposed medical students who become asymptomatic carriers could unknowingly aid in spread of the disease to family and friends, thereby worsening the pandemic.

In light of this concern, many EDs enacted policies to prevent students from participating in the care of potential COVID-19 patients, even prior to the AAMC statement. This does not, however, decrease their interaction with other providers in the ED who have been exposed to such patients. Moreover, medical students share workspaces, chairs, and computers with those who are caring for PUI. Thus, restricting care of patients diagnosed with COVID-19 alone would not entirely eliminate contact with fomites on workspaces or with possibly infected staff.

Student Safety

Continued medical student exposure also increases the likelihood of medical students becoming *symptomatically* affected themselves. While older age has been linked to increased likelihood of developing ARDS and death from COVID-19, emerging and evolving data illustrate that young, healthy patients may have a higher risk of severe illness than previously assumed.[32] Data from the Centers for Disease Control and Prevention (CDC), at the time of this writing, show that 38% of the patients hospitalized in the United States are between the ages of 20 and 54 years.[33] Twelve percent of those admitted to intensive care units (ICU) were between the ages of 20 and 44.[33]

Regardless, a lower relative risk does not exclude nor totally protect medical students from such an outcome. Many of the tasks that medical students perform in the ED must be duplicated by a resident physician or an attending, such that we should be mindful of what we ask students compared to what we gain by doing so.[34] In that vein, medical students may be viewed as nonessential providers, which may be regarded as lending flexibility and safety to students while they train.

Conservation of Limited Resources

There is a growing conversation about resource conservation, with hospitals reporting limited supply and access to personal protective equipment (PPE) and other vital supplies.[35–38] In fact, President Trump recently signed an executive order activating the Defense Production Act, which was last enacted during the Cold War Era but could now serve to increase the production of crucial supplies and equipment.[38] Regardless of the success of attempts to "flatten the curve," the need to maintain supplies over the course of the pandemic will persist. Students utilizing already scarce supplies in the performance of a task that may require duplication by a senior provider may represent a poor allocation of resources.

Medical Students as a Vulnerable Population Within the Hierarchy of Medicine

Even in the absence of a pandemic, medical students may lack comfort with voicing or otherwise reporting their comments, questions, and concerns.[39,40] This may be heightened during a pandemic or other health care crisis, where there may be concern that other priorities far exceed the students' worries or needs. An inherent power differential exists for medical trainees given the hierarchical nature of academic medicine and the importance of learner assessments for future career options.[41] Students may fear repercussions from those responsible for their clinical experiences and grades when voicing unpopular opinions, which may include a concern for their own safety.[39,41]

Loss of Educational Value

As the number of PUI grows in departments restricting medical students from evaluating PUI, fewer patients remain safe and appropriate for medical students to see. In preparation for residency, the fourth-year curriculum should provide students with opportunities for independent patient care as appropriate. Without patients to care for, a clinical rotation loses its essential educational value.[42,43]

Table 1
Summary of Alternatives to Traditional Rotation or Clerkship for Medical Students

Internet-based Substitutions for Clinical Experiences	Alternatives to Clinical Experiences That Serve the Crisis
• Videotaped vignettes[46] • High-fidelity simulation[47] • Webcasting and online forums[48] • Teleconferencing for in-person didactics[49] • Prepared online modules[50,51] • Problem-based learning with educators available remotely as expert "consultants"[52]	• Staff a screening hotline for patients concerned about exposure[53] • Provide updates, return precautions, and anticipatory guidance via telephone outside the patient's hospital room • Serve as expert researchers to obtain the most up to date information on protocols and recommendations • Assist with public health awareness initiatives • Call discharged patients with positive COVID-19 tests • Call patients to set up virtual visits • Scribe
Optional Ideas for Students Interested	
• Tutoring junior medical students • Pairing with clinical researchers • Childcare and other supportive assistance for health care providers[54,55]	

In such a time of crisis, attendings and senior residents who typically teach students may shift their full focus to managing COVID-19–related issues during shifts. In addition to patient volume and severity of illness, which serve as barriers to education even outside of pandemics, new and unfamiliar protocols may additionally burden clinician-educators.[44,45] In this scenario, the medical student may not receive adequate attention or teaching even if suitable patients exist for them to see.

ALTERNATIVES TO THE TRADITIONAL CLINICAL EXPERIENCE

Undoubtedly, a pandemic brings about unique challenges in providing undergraduate medical education. Instead of choosing between patient and student safety and students' education, we advocate for a consideration of alternatives to the traditional EM clinical rotation and clerkship. If we consider direct patient care as the criterion standard, how can we modify it to accommodate a pandemic?[42] What possible surrogates can we provide our learners in place of direct patient care? Below, we present a number of creative solutions which delicately balance minimized risk with maximized experience (summarized in Table 1).

CONCLUSION

While this current pandemic presents new challenges, it will not be the last crisis faced by our health care system. Failing to consider our medical students' role now disservices current and future students. Acceptable alternatives to the clinical experience vary by medical school and even by department. Of note, medical schools and students should consider possible ramifications regarding existing power dynamics and differentials in the employment of certain strategies discussed above. These are included to illustrate the full scope of alternatives and are already benefiting several communities during this pandemic. Several additional considerations not explored here exist, including how to navigate residency applications when many students miss rotation experiences due to suspensions and cancellations, how to mitigate the impact of isolation on student mental health, and other items vital to maintaining sound and robust training for our future physicians.

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References

1. Guidance on Medical Students' Clinical Participation: Effective Immediately. Washington, DC: Association of American Medical Colleges, 2020. Available at: https://www.aamc.org/system/files/2020-03/Guidance%20on%20Student%20Clinical%20Participation%203.17.20%20Final.pdf. Accessed Mar 17, 2020.
2. Trilla A, Trilla G, Daer C. The 1918 "Spanish flu" in Spain. Clin Infect Dis 2008;47:668–73.

3. Ott M, Shaw SF, Danila RN, Lynfield R. Lessons learned from the 1918–1919 influenza pandemic in Minneapolis and St. Paul, Minnesota. Public Health Rep 2007;122:803–10.
4. Starr I. Influenza in 1918: recollections of the epidemic in Philadelphia. Ann Intern Med 2006;145:138–40.
5. Patil NG, Yan YCH. SARS and its effect on medical education in Hong Kong. Med Educ 2003;37:1127–8.
6. Clark J. Fear of SARS thwarts medical education in Toronto. BMJ 2003;326:784.
7. Legraien L. Government Is Considering Using Medical Students to Help in Coronavirus Outbreak. London, UK: Pulse Today, 2020. Available at: http://www.pulsetoday.co.uk/clinical/clinical-specialties/infectious-diseases/government-is-considering-using-medical-students-to-help-in-coronavirus-outbreak/20040272.article. Accessed Mar 17, 2020.
8. Amante A, Balmer C. Italy Rushes New Doctors Into Service as Coronavirus Deaths Rise Above 2,500. Rome: Reuters: 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-italy/italy-rushes-to-promote-new-doctors-to-relieve-coronavirus-crisis-idUSKBN214245. Accessed Mar 18, 2020.
9. Manthey DE, Coates WC, Ander DS, et al. Report of the task force on national fourth year medical student emergency medicine curriculum guide. Ann Emerg Med 2006;47:1–7.
10. Lyss-Lerman P, Teherani A, Aagaard E, Loeser H, Cooke M, Harper GM. What training is needed in the fourth year of medical school? Views of residency program directors. Acad Med 2009;84:823–9.
11. McGregor CA, Paton C, Thomson C, Chandratilake M, Scott H. Preparing medical students for clinical decision making: a pilot study exploring how students make decisions and the perceived impact of a clinical decision making teaching intervention. Med Teach 2012;34:508–17.
12. Landmann A, Havron WS, Patel A, Thompson BM, Lees JS. Medical student expectations from surgical education: a two-year institutional experience. Am J Surg 2016;212:1265–9.
13. Bell-Masterson S, Swamy L, Worsham C. Opinion: Let's Talk About Residents' Hours – And Their 'Scut' Work Too. Boston, MA: CommonHealth, 2016. Available at: https://www.wbur.org/commonhealth/2016/02/16/residents-hours-scut-work. Accessed Mar 18, 2020.
14. Sindhu K. Scut Work Is Harming Residents and Their Patients. New York: Op-Med Doximity, 2018. Available at: https://opmed.doximity.com/articles/scut-work-is-harming-residents-and-their-patients?_csrf_attempted=yes. Accessed Mar 18, 2020.
15. Smith SE, Tallentire VR, Cameron HS, Wood SM. The effects of contributing to patient care on medical students' workplace learning. Med Educ 2013;47:1184–96.
16. Griffith M, Santen SA, Allan J, et al. Is it learning or scutwork? Medical students adding value in the emergency department. AEM Educ Train 2019;3:101–4.
17. Hafferty FW, Franks R. The hidden curriculum, ethics teaching, and the structure of medical education. Acad Med 1994;69:861–71.
18. Hafferty FW. Beyond curriculum reform: confronting medicine's hidden curriculum. Acad Med 1998;73:403–7.
19. Jones KE, Patel NG, Levy MA, et al. Global trends in emerging infectious diseases. Nature 2008;451:990–3.
20. Parker RS. Hazards of Nature, Risks to Development: An IEG Evaluation of World Bank Assistance for Natural Disasters. The World Bank, 2006. Available at: http://documents.worldbank.org/curated/en/396321468161661084/Hazards-of-nature-risks-to-development-an-IEG-evaluation-of-World-Bank-assistance-for-natural-disasters. Accessed Mar 18, 2020.
21. Consensus Statement Regarding SLOEs and Away Rotations From the CORD Advising Students Committee in Emergency Medicine. Irving, TX: Council of Residency Directors in Emergency Medicine, 2020. Available at: https://www.cordem.org/globalassets/files/consensus-statement-from-the-advising-students-committee-in-emergency-medicine-_-white-paper.pdf. Accessed Mar 19, 2020.
22. Wilson I, Cowin LS, Johnson M, Young H. Professional identity in medical students: pedagogical challenges to medical education. Teach Learn Med 2013;25:369–73.
23. Monrouxe LV. Identity, identification and medical education: why should we care? Med Educ 2010;44:40–9.
24. Sommerlad H. Researching and theorizing the processes of professional identity formation. J Law Soc 2007;34:190–217.
25. Tyson P.The Hippocratic Oath Today. Public Broadcasting Service, 2001. Available at: https://www.pbs.org/wgbh/nova/article/hippocratic-oath-today/. Accessed on Mar 18, 2020.
26. Cruess RL, Cruess SR. Teaching medicine as a profession in the service of healing. Acad Med 1997;72:941–52.
27. Herman B, Rosychuk RJ, Bailey T, Lake R, Yonge O, Marrie TJ. Medical students and pandemic influenza. Emerg Infect Dis 2007;13:1781–3.
28. Waight G, Berhane A, Orton L, et al. The role of the medical students in influenza pandemic response. J Emerg Management 2011;9:60–6.
29. Glass R, Glass L, Beyeler W, Min H. Targeted social distancing designs for pandemic influenza. Emerg Infect Dis 2006;12:1671–81.
30. Coronavirus disease 2019 (COVID-19): Situation Report —53: World Health Organization, 2020. Available at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200313-sitrep-53-covid-19.pdf?sfvrsn=adb3f72_2. Accessed Mar 16, 2020.

31. Li R, Pei S, Chen B, et al. Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV2). Science 2020. https://doi.org/10.1126/science.abb3221
32. Wu C, Chen X, Cai Y, et al. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. JAMA Intern Med 2020. https://doi.org/10.1001/jamainternmed.2020.0994
33. Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States. Atlanta: Centers for Disease Control and Prevention, 2020. Available at: https://www.cdc.gov/mmwr/volumes/69/wr/mm6912e2.htm?s_cid=mm6912e2_w. Accessed Mar 18, 2020.
34. Sokol DK. Virulent epidemics and scope of healthcare workers duty of care. Emerg Infect Dis 2006;12:1238–41.
35. USP Response to Shortages of Garb And Personal Protective Equipment (PPE) for Sterile Compounding During COVID-19 Pandemic. Washington, DC: US Pharmacopeia, 2020. Available at: https://www.usp.org/sites/default/files/usp/document/about/public-policy/usp-covid19-garb-and-ppe.pdf. Accessed Mar 19, 2020.
36. Thielking M. Frustrated and Afraid About Protective Gear Shortages, Health Workers Are Scouring for Masks on Their Own. Boston, MA: STAT News, 2020. Available at: https://www.statnews.com/2020/03/18/ppe-shortages-health-workers-afraid-scouring/. Accessed Mar 19, 2020.
37. Jenco M. CDC Issues Guidance on N95 Respirator Shortages, School Closings During COVID-19 Outbreaks. Itasca, IL: American Academy of Pediatrics News, 2020. Available at: https://www.aappublications.org/news/2020/03/13/coronavirus031320. Accessed Mar 19, 2020.
38. Welna D. Trump Invokes A Cold War Relic, The Defense Production Act, For Coronavirus Shortages. Washington, DC: National Public Radio, 2020. Available at: https://www.npr.org/2020/03/18/818069722/trump-invokes-a-cold-war-relic-the-defense-production-act-for-coronavirus-shorta. Accessed Mar 18, 2020.
39. Dwyer J. Primum non tacere: an ethics of speaking up. Hastings Cent Rep 1994;24:13–8.
40. Liao JM, Thomas EJ, Bell SK. Speaking up about the dangers of the hidden curriculum. Health Aff 2014;33:168–71.
41. Gaufberg EH, Batalden M, Sands R, Bell SK. The hidden curriculum: what can we learn from third-year medical student narrative reflections? Acad Med 2010;85:1709–16.
42. Spencer J, Blackmore D, Heard S, et al. Patient-oriented learning: a review of the role of the patient in the education of medical students. Med Educ 2000;34:851–7.
43. Ward B, Moody G, Mayberry JF. The views of medical students and junior doctors on pre-graduate clinical teaching. Postgrad Med J 1997;73:723–5.
44. Gordon J, Hazlett C, Ten Cate O, et al. Strategic planning in medical education: enhancing the learning environment for students in clinical settings. Med Educ 2000;34:841–50.
45. Bielajs I, Burkle FM, Archer FL, Smith E. Development of prehospital, population-based triage-management protocols for pandemics. Prehosp Disaster Med 2008;23:420–30.
46. Lim EC, Ong BK, Seet RC. Using videotaped vignettes to teach medical students to perform the neurologic examination. J Gen Intern Med 2006;21:101.
47. Abrahamson SD, Canzian S, Brunet F. Using simulation for training and to change protocol during the outbreak of severe acute respiratory syndrome. Crit Care 2006;10:3.
48. Wong ML, Koh D, Phua KH, Lee HP. Teaching community, occupational and family medicine at the National University of Singapore: past, present and future. Ann Acad Med Singap 2005;34:102–7.
49. Augestad KM, Lindsetmo RO. Overcoming distance: video-conferencing as a clinical and educational tool among surgeons. World J Surg 2009;33:1356–65.
50. Kleinpell R, Ely EW, Williams G, Liolios A, Ward N, Tisherman SA. Web-based resources for critical care education. Crit Care Med 2011;39:541–53.
51. Joyce MF, Berg S, Bittner EA. Practical strategies for increasing efficiency and effectiveness in critical care education. World J Crit Care Med 2017;6:1–12.
52. Barrows HS. Problem-based learning in medicine and beyond: a brief overview. New Direct Teach Learn 1996;1996:3–12.
53. Gliha LJ. Medical Students Deploy Across Colorado to Help Combat Coronavirus. Denver, CO: KDVR, 2020. Available at: https://kdvr.com/news/coronavirus/medical-students-deploy-across-colorado-to-help-combat-coronavirus/. Accessed Mar 18 2020.
54. Lee YJ. Medical Students Around the US Are Offering to Babysit for Hospital Workers on the Frontlines of the Coronavirus Pandemic. New York, NY: Business Insider, 2020. Available at: https://www.businessinsider.com/medical-students-babysit-healthcare-workers-covid-19-coronavirus-2020-3. Accessed Mar 17, 2020.
55. Collins J. As Health Care Workers Prepare for COVID-19, Medical Students Pitch in on the Home Front. Minneapolis, MN: MPRnews, 2020. Available at: https://www.mprnews.org/story/2020/03/15/health-care-workers-prepare-for-covid19-medical-students-pitch-in-on-homefront. Accessed Mar 17, 2020.