BRITISH JOURNAL OF HOSPITAL MEDICINE

REVIEW

The impact of COVID-19 on medical education and training

Nahil Alrumi[1]

Author details can be found at the end of this article

Correspondence to:
Nahil Alrumi;
Nahil.alrumi@nhs.net

Abstract

The COVID-19 pandemic social isolation policies have accelerated the shift to online teaching for medical students and doctors in training worldwide. Online learning is cost-effective, available, and flexible. However, it can be challenging due to the technical system errors, which results in the disruption of the learning process and social isolation yielding to less satisfaction among students and teachers. The above can have negative consequences on the mental health of medical students and trainees, which is an under-researched area. United Kingdom based medical students and doctors in speciality training encountered disruptions to medical education and training due to the pandemic. Medical school and deaneries had to endorse adjustments to teaching and training delivery methods, examination, and assessments to ensure the continued progression of learning and training. A successful e-learning model depends on motivated and well-prepared medical students and teachers and structured educational materials in supported learning environment and institutions. A blended model is likely to be utilised by medical institutions for medical training in the future, which will need to be researched.

Key words: Medical education; Online learning; COVID-19

Submitted: 30 December 2023; Revised: 26 January 2024; Accepted: 18 February 2024

Introduction

On March 11th 2020, the World Health Organization (WHO) has announced the global pandemic of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) also known as COVID-19, after many cases were reported in most continents (Albouy, 2020). The WHO has expressed concerns due to the spread of the SARS-CoV-2 virus and its severity causing morbidity and mortality among populations (WHO, 2024). This has led governments to declare a state of public health emergency and to contain the virus, national lockdowns were implemented in different communities (Brown et al, 2021). The Lockdown affected medical students and doctors in training. Experiences varied depending on the location of medical students and doctors, resources available, and stage of training. Some medical students and doctors in training expressed satisfaction with their virtual tutorials and webinars, however, others were disappointed as lockdown measures affected their hands-on experiences in laboratories and patient-facing clinical rotations (BMA, 2020). With 13.3 billion SARS-CoV-2 vaccine doses given worldwide, international health organisations have explained that the world can now transition from the public health emergency response to the long-term management of the virus alongside other infections (Wise, 2023). This allows researchers to reflect on the global response of the pandemic and how it affected medical education and training. In this article, I will review the different methods implemented by medical institutions to enable the continuity of teaching in the light of lockdown policies, the advantages and disadvantages of these methods, the impact of the pandemic on mental health in medical education, and the impact of the pandemic on education and training for medical students and doctors in speciality training in the United Kingdom.

Medical education and training disruption during the COVID-19 pandemic

A systemic review and meta-analysis found that 71.1% of healthcare workers perceived their education to be interrupted by the COVID-19 pandemic, with Southeast Asia region

How to cite this article:
Alrumi N. The impact of COVID-19 on medical education and training. Br J Hosp Med. 2024. https://doi.org/10.12968/hmed.2023.0462

experiencing the highest levels of disruptions. It was also concluded that 78% of trainee doctors experienced disruption in their invasive procedure training, and 44.7% needed to prolong their training. Trainee doctors explained that this is mainly due to either the lack of case volume for surgical specialities, or overwhelming case volume for specialities dealing directly with the Pandemic. As a result of the pandemic, 29.2% of trainees experienced redeployment which resulted in disruptions in their training, and it has led to 21.5% of trainees to rethink their career plans. Some institutions resorted to facilitating early graduation for final-year medical students and volunteering for undergraduate medical students to help care for the high influx of unwell patients during the pandemic (Dedeilia et al, 2023).

Medical education and training during COVID-19 pandemic

The Covid-19 pandemic has accelerated the need for educational institutions to implement online learning to mitigate the disruption of face-to-face tutorials, medical teaching, and training (Papapanou et al, 2021). This took forms in both synchronous model (both learner and instructor are online simultaneously to allow instant feedback, interactions, and social and emotional support) and asynchronous model (off-line learning which offers accessibility and flexibility to educational materials). It was suggested that a combination of both models can be used to improve the online-learning process (Deepika et al, 2020).

Common online learning methods and tools used included webinars, virtual classrooms, interactive whiteboards, blogs and e-journals, e-books, and podcasts. Some institutions resorted to using virtual simulations for medical students as a method for online learning. This included virtual laboratories, microscopy, clinical placements, and patients. Few institutions explored the use of social media for learning such as Facebook and WhatsApp groups. This has been embraced by students however had risks of addiction, compromising academic privacy and integrity, and cyber-bullying (Deepika et al, 2020).

The assessments for medical students took place in the form of electronic quizzes of multiple-choice questions, true/false or matching questions using platforms such as Google forms, Poll everywhere, Socrative.com and Quizlize. These tools were useful for formative assessments but were limited for summative assessments. While these methods were helpful in learners' engagement and information retention, there were some concerns regarding the integrity of the tools. For postgraduate trainees, E-portfolios seemed to provide sufficient platform for both summative and formative assessments. It was critical for faculties to use 'Digital learning management system' to facilitate the integration of information and data from instructors and students (Deepika et al, 2020).

Learners and educational institutions have expressed that a blended learning method (face-to-face and online) was the most preferred option, followed by face-to-face and online learning. On assessing outcomes, 75.9% of trainees have expressed satisfactions with the learning methods used during the COVID-19 pandemic (the shift to online learning), this figure was less among faculties and educational institutions (Dedeilia et al, 2023).

Advantages and disadvantages to online learning

For Online learning to be successful, one needs to look at the information communication technology model of CAPS: Current state of knowledge, Area of interest, Potential impact, and Suggestions from experts. It is concluded that online learning is fruitful in the presence of motivated learners and faculty, learning materials with clear objectives that can be both non-interactive (documents, pre-recorded presentations and audio and visual files) and interactive (problem-based learning, workshops, and seminars with live feedback), and good tools, environment, and technology to support the learning process. These factors can lead to successful self-paced and self-regulated electronic learning (Deepika et al, 2020).

It is argued that online learning has some advantages such as flexibility, cost-effectiveness, availability, learning satisfaction and durable access to learning materials. However, it has some disadvantages such as the lack of interactive feedback, social isolation and unpredicted situations resulting in technical errors (Network errors or system crash) which complicates the learning process. Online learning has displayed the gap between the rich

and poor worldwide which has highlighted unresolved issues with educational inequality and inequity (Liu et al, 2022). The disadvantages of online learning have resulted in worsening of teaching quality (Deng et al, 2023). The satisfaction with online learning differed between students and teachers. This was mainly attributed to the differences in both generations' approaches to technology and the preparedness to integrate learning with new electronic tools. The satisfaction with online learning and teaching impacted students' and teachers' perception towards online learning, which can impact the effectiveness of education (Camargo et al, 2020).

Many medical schools post the pandemic still integrate online learning in their curriculums (Mao et al, 2022). It is evident that a student can retain up to 15% of what is read, up to 20% of what is heard and 30% of what is seen in teaching materials. When combining the hearing and watching aspect, a student can achieve up to 50% of materials retained from their tutorials (Prinz, 2005). This favours the use of online learning methods such as interactive virtual classrooms, and virtual simulations. When looking at basic surgical skills online learning outcomes, it was concluded that there was no difference in the efficacy of basic surgical skills learning between video-based learning (interactive) and conventional face-to-face learning. The main advantage for online surgical learning was the ability for students to control the pace of their learning. One disadvantage for online surgical learning was the quality of formal constructive feedback. Inherently, the engagement with teacher to student feedback was more in conventional classroom teaching compared to online teaching. However, it was evident that improving the teacher-to-student ratio in online learning will reflect on an improved student feedback satisfaction (Mao et al, 2022).

Impact of the pandemic on mental health in medical education

Mental health is an essential factor that impacts the effectiveness of medical education. Historically, mental health outcomes were poorer among medical students compared to non-medical students (Peng et al, 2023). During the COVID-19 pandemic, it was noted that medical students experienced higher prevalence of depression, anxiety, stress, and suicidal ideation when compared to pre-COVID-19 pandemic period. Many mental health problems seemed to persist even after the peak of the infection waves globally, which illustrated a lasting impact of the pandemic on medical students' mental health. It was also noted that the severity of mental health problems correlated with the severity of the infection spread and the community's ability to control the disease. When exploring risk factors for deteriorating mental health among medical students during the pandemic, it was concluded that online learning complications and education and training disruptions contributed to worsening mental health. Other factors included stress from the consequences of getting the infection, social isolation and being pre-clinical or junior medical student (Rich et al, 2023). Positively, the enhanced awareness of mental health problems among medical students during the pandemic has resulted in removing the stigma of 'Prevention' and "Help-seeking" behaviors regarding mental health problems and improved signposting to mental health services. In addition, many medical institutions have demonstrated flexibility towards assessments and academic requirements during the pandemic, which mitigated one important risk factors that contributed to the deteriorating of mental health among medical students during the pandemic (Peng et al, 2023).

As for medical doctors in speciality training, it was noted that the high workload during the COVID-19 pandemic resulted in an increased physical and emotional stress, which has led to the higher rates of burnout. Burnout correlated negatively with the quality of patient care. It also contributed to the progression of issues such as substance use, depression, and suicide ideation. Some evidence showed that burnout can stem from early stages in medical school and junior medical training. Unresolved burnout can then develop to anxiety disorder, depression, and sleep disorder. The mental health of medical trainees directly impacted their performance and engagement in training needs and assessments (Alkhamees et al, 2023). Risk factors that can contribute to worsening mental health among healthcare workers during the pandemic included fear of being infected with the virus, fear of passing the virus to other patients, co-workers or family members, not meeting their

clinical obligations to care for patients, lack of Personal Protection Equipment (PPE), and lack of psychological and social support. Other synergistic factors to worsening mental health among healthcare workers during the pandemic included underlying physical health comorbidities and existing pre-pandemic mental health problems (Sanghera et al, 2020) (Ching et al, 2021). While healthcare workers in training (like doctors in training) experienced high prevalence of mental health consequences during the pandemic, little intervention was done to address risk factors and provide mental health support. A mixed method study done by the University of Nottingham looked at introducing digital mental wellbeing packages during the pandemic. These packages used positive psychology, which amplified elements within individuals and communities to flourish to achieve mental wellbeing. It enabled capacity building, motivation, and resilience among individuals and organisations. In addition, it provided a safe space for trainees to express their concerns and reflect on their experiences during the pandemic with other trainees in small groups (Blake et al, 2021). There was incomplete evidence to address which groups among healthcare workers needed the most mental health support during the pandemic. It was also evident that healthcare-related mental health interventions were not investigated during COVID-19 pandemic (De Kock et al, 2021).

The impact of COVID-19 on medical students and doctors in speciality training in the United Kingdom

The COVID-19 pandemic has impacted medical students from pre-clinical years to final years including students who were intercalating in a Bachelor of Science (BSc) or Master of Science (MSc) degrees. It has resulted in the cancellation of clinical attachments, rotations, objective structured clinical examinations exams, participation in lab-based research and audits, and external clinical electives. Abiding by the government regulations on social distancing, many medical schools in the United Kingdom (UK) have switched to online learning and assessments, in the form of online seminars, lectures, and open-book e-assessments. Furthermore, the pandemic has created an opportunity for British-based medical students to volunteer within the National Health Service (NHS) in primary and secondary care. The General Medical Council (GMC) has detailed its guidance on monitoring the standard for online learning among medical schools and the policy for medical students opting to volunteer in the NHS (GMC, 2021). Volunteering responsibilities varied depending on the level of training of medical students. It ranged from delivering medicines to the wards, taking bloods, siting cannulas, inserting urinary catheters, and monitoring vital signs. The volunteering of medical students in the NHS has aided in the improvement of the workforce shortage and has served as a good alternative to develop clinical skills among medical students. However, there were risks associated with medical students volunteering in the NHS such as the lack of sufficient Personal Protection Equipment (PPE) training, the overwhelming workload and death toll, and the anxiety around being exposed to the virus. These risks have led to the worsening of medical students' mental health and wellbeing (Rainbow and Dorji, 2020). In a study that surveyed final year medical students from 32 medical school in the UK during the COVID-19 pandemic, the curriculum changes have resulted in students feeling less prepared for their future roles as foundation year 1 doctors. This lack of preparedness was mitigated by volunteering in hospitals (descripted as assistantships). This highlights the need for medical schools to implement safe changes for medical curriculums to empower medical students without the disruptions of the learning process (Choi et al, 2020).

As for the COVID-19 pandemic impact on doctors in speciality training in the UK, it has resulted in the halt of non-urgent clinics and procedures, face-to-face teaching and conferences, membership exams, leadership opportunities, research opportunities and recruitment interviews. In a way to overcome such challenges, local educators, health boards and policy makers needed to come with alternatives and solutions (MacLeod et al, 2020). The Annual Review of Competency Progression (ARCP) toolkit was adjusted to address the shortcomings of speciality training doctors achieving their competencies due to the COVID-19 pandemic. For example, ARCP for Internal Medicine Training (IMT) reduced the number of clinics required for IMT doctors, and it incorporated telephone clinics in

the curriculum. In addition, teaching events and conferences were changed to an online format using platforms like Microsoft Teams, Zoom and Slido. As for membership exams, the royal college of physicians mitigated this by enabling written papers to be done online from home to abide by the government guidance on social distancing. While the Practical Assessment of Clinical Examination Skills (PACES) format was adjusted to add more time for candidates to encompass donning and doffing of Personal Protection Equipment (PPE). Most academic speciality training doctors were redeployed to clinical roles which resulted in the pause of any non-COVID-19 laboratory research or clinical trials. This extended the training periods for academic speciality training doctors. The COVID-19 pandemic has led to the adjustment to the recruitment process for speciality training by the Physician Specialty Recruitment Office (PSRO). The PSRO opted to cancel evidence and accomplishment verification and interviews following a 'high-trust model'. This has negatively skewed results for candidates and was perceived as an inaccurate method as it does not account for domains such as training in teaching, quality improvement projects and commitment to speciality. Finally, some doctors in speciality training had to shield due to health conditions during the pandemic, these doctors needed adjustments to the ARCP toolkit, and were supported for a stagged return to work by their local deaneries and health boards (Sharrack et al, 2021).

Conclusions

COVID-19 pandemic has resulted in the widespread of online learning to cope with national lockdown and social isolations policies to prevent the spread of the SARS-CoV-2. Online learning can be Synchronous (both learners and teachers are online) and non-synchronous (offline learning). Synchronous online learning provided instant feedback to learners and better emotional and social support. Non-synchronous online learning provided flexibility and accessibility of educational materials to students. Online learning has disadvantages such as social isolation and disruptions in systems technology leading to obstructions in the learning process. This has revealed discrepancies between the poor and rich which highlighted education inequality and inequity concerns. It was noted that online learning during the pandemic was perceived by medical students and trainee doctors to have caused disruptions to medical education and clinical placements, which resulted in the lack of preparedness for future roles for medical trainees. All the above has led to the worsening of mental health outcomes which negatively affected online learning engagement. There was incomplete evidence describing successful interventions used to mitigate mental health wellbeing among medical students and healthcare workers like doctors during the pandemic. British-based medical students and doctors in speciality training experienced disruptions in their education and training during the COVID-19 pandemic. Medical schools, deaneries and health boards opted for some adjustments to maintain progression in training.

Today, post the COVID-19 pandemic, many medical institutions implement online learning in their curriculums. Many medical students and trainee doctors have expressed their satisfaction with a blended model of teaching that involves both online learning and face-to-face teaching.

Key points

- Successful online learning models depend on having self-paced motivated learners, prepared medical institutions, well-constructed educational materials with clear objectives and suitable resources and environment with sufficient technology support.
- The future of medical education and postgraduate training will adopt a blended model with both online and face-to-face learning to achieve cost-effective learning goals.
- Mental health wellbeing among medical students and trainees is an under-researched area and more needs to be done to investigate risk factors and implement interventions looking at preventing mental health deterioration, which directly impacts patient care and engagement with medical learning and assessments.

Author details

[1]General Internal Medicine, Northwick Park Hospital, Harrow, UK

Availability of data and materials

All data included in this study are available upon request by contact with the corresponding author.

Author contributions

NA was the sole author and was responsible for the design of the work, drafting and revision of content, and approval of the version to be published.

Ethics approval and consent to participate

Not applicable.

Acknowledgement

Not applicable.

Funding

This research received no external funding.

Conflict of interest

The author declares no conflict of interest.

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