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# Perceived challenges and barriers for medical students in the COVID-19 crisis

Mohsen Mohamadi, Tahereh Aghamirzaee<sup>1</sup>, Jamileh Aqatabar Roudbari<sup>2</sup>, Zainab Mohseni Afshar<sup>3</sup>, Maryam Taghvaei Yazdi<sup>4</sup>, Farzan Kheirkhah<sup>5</sup>

*Non-Communicable  
Pediatric Disease  
Research Center, Health  
Research Institute, Babol  
University of Medical  
Sciences, Babol, Iran,  
<sup>1</sup>Faculty of Humanities and  
Management, Mazandaran  
University of Science  
and Technology, Babol,  
Iran, <sup>2</sup>Babol, Iran Health  
Systems Research,  
Health Research Institute,  
Babol University of  
Medical Sciences,  
Babol, Iran, <sup>3</sup>Clinical  
Research Development  
Center, Imam Reza  
Hospital, Kermanshah  
University of Medical  
Sciences, Kermanshah,  
Iran, <sup>4</sup>Department of  
Educational Management,  
Sari Branch, Islamic Azad  
University, Sari, Iran,  
<sup>5</sup>Department of Psychiatry,  
School of Medicine, Social  
Determinants of Health  
Research Center, Babol  
University of Medical  
Sciences, Babol, Iran*

## Address for correspondence:

Dr. Jamileh Aqatabar  
Roudbari,  
Babol University of  
Medical Sciences, Babol,  
Iran.  
E-mail: j.aghatabar@  
yahoo.com

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## Abstract:

**BACKGROUND:** Unpredictable and immediate changes, especially in the clinical and practical fields of medical sciences following the coronavirus disease (COVID-19) epidemic, have posed many challenges for medical students. This study was conducted to identify the experiences and students' understanding of the challenges in the COVID-19 crisis.

**MATERIALS AND METHODS:** The present qualitative research was conducted by performing semi-structured interviews with the students along with holding a student panel. The study population consisted of 30 clinical and basic medical students of Babol, Iran and Kermanshah universities of medical sciences who were selected by purposive sampling method. Data were collected based on students' perceived experiences of challenges, obstacles, and problems in the COVID-19 crisis. The data analysis process was performed by conducting interviews and information obtained from the panel using v10 R150410 software. Finally, the related factors and components were identified.

**RESULTS:** Challenges and perceived obstacles of medical students in the COVID-19 crisis were identified in the form of eight factors including student life factors, interaction and communication, psychological factors, educational technology, factors related to the professors, limitations of educational and research planning, crisis management, and educational evaluation.

**CONCLUSION:** Identifying the challenges of medical education perceived by students in this study and adopting appropriate strategies to overcome existing barriers open new opportunities for expanding the scope of the curriculum, providing education, and promoting community health to universities; moreover, the challenges of medical education and any skill-based discipline, such as medical sciences in the COVID-19 pandemic will require much attention and investigation in cognitive sciences.

## Keywords:

COVID-19, curriculum, education, medical, qualitative research, students

## Introduction

The coronavirus disease (COVID-19) pandemic has endangered the entire structure of university learning, especially medical education. Most institutions have changed their teaching methods from traditional (face-to-face) learning to virtual (online) education.<sup>[1]</sup> Among these, the training of clinical medical students has suffered the most, because face-to-face

training is necessary for every medical trainee.<sup>[2]</sup> At the beginning of the current pandemic, each country has implemented its own policies for the management of medical schools.<sup>[3]</sup> COVID-19 is a highly contagious infection that has forced universities to ban medical students from contaminated hospital environments. In addition, medical students' fear of this terrible infection increases their absence from medical wards and classes.<sup>[4]</sup> Basic medical students have relatively fewer

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problems because lectures and theory lessons can be held with social distance; however, taking the history and physical examination, which are essential components of pre-clinical education and are the basis of clinical decision-making and patient management, had been stopped, so little practical medical experience would be expected in graduate students.<sup>[5]</sup> Shortage of personal protective equipment (PPE) was one of the most important reasons for keeping medical students away from hospital wards.<sup>[6]</sup> Although video conferencing sessions, virtual morning reports, online courses, and journal clubs help to compensate for the COVID-19 training deficit, “medicine is learned beside the bed, not in the classroom,” and online methods and theoretical sessions can never replace hospital-based learning.<sup>[7]</sup> Face-to-face training based on educational activities such as performing rounds on patients is an important component of comprehensive medical education that has been ceased in this pandemic. Clinical students are banned from direct contact with patients, which puts them further away from effective medical education.<sup>[8]</sup> Daily outpatient clinic visits have been minimized due to community fears of infection in crowded places. This has further disrupted the medical education. Although remote health has helped all people maintain social distance and has reduced unnecessary or unauthorized physician visits, students have lost many practical skills in dealing with out-of-hospital patients.<sup>[9]</sup> Disadvantages and potential problems in online education include difficulties in uploading or downloading educational files, unsuitable space for online study, slow internet speed, and tedious sessions with the inability to interact in conversations.<sup>[10]</sup> Conventional teaching methods use strategies such as body language and instructor voice for comprehensive instruction, while “voice” is the only effective tool in virtual techniques.<sup>[11]</sup> Another disadvantage of virtual classrooms is the emergence of incompetent students who have no interest or desire to overtake each other and therefore progress is less likely. In addition, another shortcoming in the quarantine period and social distance would be the cancelation of exams, which are the most important routes of student evaluation.<sup>[12]</sup> Other problems include a shortage of healthcare staff, which may force medical schools to involve students in managing patients. In addition, some elementary students may be obliged to work in clinical wards earlier than expected so that they can assist and overcome the absence of staff in hospitals.<sup>[6]</sup> On the other hand, isolation and social distancing have increased psychological disturbances such as stress, anxiety, and depression in all populations, including medical students, who have extra concerns about getting insufficient skills and becoming inexperienced doctors.<sup>[13]</sup> In a study by Gismalla *et al.*<sup>[14]</sup> in 2021, the majority of students agreed that the closure of the universities has been a fundamental decision to control the spread of severe acute respiratory

syndrome coronavirus 2 (SARS-CoV-2) infection. Nearly two-thirds of the students believed that e-learning was the best solution during the COVID-19 quarantine. The level of medical students (pre-clerkship and clerkship) and place of residence had a significant relationship with the medical students’ opinions about starting e-learning ( $P$ -value  $<0.05$ ). Internet bandwidth and connection limitations, unfamiliarity with the e-learning system, limited technical support and time flexibility in case of technical problems in online exams, and lack of face-to-face interaction were among the factors that were considered as disadvantages of e-learning by medical students. Baticulon *et al.*<sup>[15]</sup> showed that medical students in the Philippines faced several obstacles (getting adjusted to learning styles, doing homework, and poor communication between faculty and students) in adapting to online learning. Oladipo *et al.*<sup>[16]</sup> showed that training Nigerian medical students during the coronavirus pandemic has been confronted with multiple challenges, which are as follows: lack of interaction with the patients, inability to communicate to create empathy, compassion, and teamwork in medical students, lack of access to appropriate infrastructures and the presence of socially vulnerable students as the main barriers to online learning, poor online educational content, high internet costs, unreliable internet-based services, teachers’ inability to use digital operating systems, lack of access to e-learning systems, lack of technical support, lack of knowledge and technical support. Farooq *et al.*<sup>[17]</sup> have discussed the challenges of training medical students during the COVID-19 pandemic in Pakistan in 2021. Lack of previous experience in online teaching, lack of training in technical information support by faculty members, difficulties in recording lectures by faculty members at home, absence of students for online assessment, inability to maintain a balance between professional and personal life in female faculty members working at home, too many heavy lectures (e.g., live/video conferences) to be downloaded by the students living in rural areas, absence of educational programs, frequent power outages, school’s reluctance to adopt new educational strategies and cultural/social norms, lack of specific guidelines for online medical education had been among the most important challenges suggested by the Pakistan Medical and Dental Council or the Pakistan Higher Education Commission in developing an e-learning plan. Tuma *et al.*<sup>[18]</sup> in 2021 showed that less than half of students and teachers consider online learning to be equal to or superior to traditional learning methods. Most students and teachers mentioned the disadvantages of current technologies, such as unreliable internet connection and getting bored when listening to online lectures as the main problems of e-learning. Armstrong-Mensah *et al.*<sup>[19]</sup> reported the following issues as the main training challenges in the COVID pandemic: absence of alternative options for students to choose online or offline courses,

lack of access to free hardware, software, and internet services due to social distancing programs, lack of motivation to learn, the increased workload in new courses, compatibility with unknown technologies, distrust on the future, lack of fair access for all students, prolonged time to get prepared for adequate training of faculty members, creating new curricula, and online distribution of the data. Hattar *et al.*<sup>[20]</sup> in 2021 acknowledged that the students have been interested in e-learning in the form of online lectures and discussion sessions. However, they believed that this method could not replace clinical practices and has caused them to lose much of their educational experience. Graduate dentistry students were also prepared for working on their own but their feedback indicated the need to participate in postgraduate training courses. In summary, the COVID-19 pandemic appears to have been a major challenge for education systems worldwide as medical universities shift students from bedside training and university to virtual learning.

Since the unexpected and sudden changes, especially in the practical fields of medical sciences, have brought about many challenges for medical students, and considering that only one or two aspects, mostly educational, of medical students' challenges caused by the COVID-19 pandemic have been assessed in other studies, this study was conducted to investigate and identify medical students' challenges induced by the COVID-19 pandemic in a multi-dimensional manner and with a comprehensive approach.

## Materials and Methods

### Study design and setting

The present qualitative research was conducted by performing semi-structured interviews with clinical and basic medical students.

### Study participants and sampling

In this research, the samples were purposefully selected from clinical and basic medical students of Babol, Iran and Kermanshah universities of medical sciences. The criteria for entering the research included passing at least two semesters during the COVID pandemic. After interviewing the 30<sup>th</sup> person, the information reached theoretical saturation.

### Data collection tool and technique

Data were collected from students by conducting semi-structured interviews according to the objectives of the study. The contents of the interviews were analyzed using the conventional content analysis method. To facilitate data analysis of this study, v10 R150410 software was used. After analyzing the interviews conducted with participant number 30, no new class or topic emerged

in relation to the desired concept, and no extra data was created; therefore, sampling ended due to data saturation. To confirm the correctness of the data, the member check method was used in the initial coding stage, so that the codes and interpretations obtained from the analysis of some interviews were checked with the participants in the supplementary panel to confirm the correctness of the coding by reviewing the panel members. It also tried to use sampling with maximum variability in age, gender, years of study, and field of study for information enrichment. Accordingly, the criterion of verifiability was also covered by the regular collection of data, their constant comparison, accurate recording and writing, and observance of impartiality and agreement of analysts about the classes; moreover, the criterion of reliability of data with a long involvement of researchers with the data and immersion was considered. In the end, the factors and components related to the students' perceived challenges were identified.

### Ethical considerations

The samples voluntarily participated in the interview and were assured that their feedback would be kept strictly confidential and that the data collected would be used solely for the purposes of the research.

## Results

The participants of this study are 30 clinical and basic medical students of Babol university of Medical Sciences, Iran University of Medical Sciences, and Kermanshah University of Medical Sciences. Their data are presented in Table 1.

In this study, approximately 120 initial codes were obtained from the implementation of interviews and panels, which were reduced to 51 codes after removing duplicate ones. Finally, the codes were categorized into 8 classes and 61 subclasses, which are summarized below [Table 2]. Subsequently, the participants' comments on each of the codes have been listed.

Since presenting all the participants' opinions for each of the codes would prolong the section and divert the readers' opinions from the main topic, only a few of the views that were considered more comprehensive by the

**Table 1: Frequency of participants in panels based on demographic information**

Location	Status	Male	Female
Iran University of Medical Sciences	Clinical Student	1	3
	Basic Medical Sciences	4	2
Babol University of Medical Sciences	Clinical Student	3	2
	Basic Medical Sciences	3	2
Kermanshah University of Medical Sciences	Clinical Student	1	4
	Basic Medical Sciences	2	3

**Table 2: Classes and subclasses categorized from data analysis**

Classes	Subclasses
Student life factors	<ul style="list-style-type: none"> <li>Impairment of individual adaptation to daily life</li> <li>Costs and financial responsibilities of the students to provide virtual education facilities</li> <li>Impairment of students' sense of being a student</li> </ul>
Interaction and communication factors	<ul style="list-style-type: none"> <li>Insufficient presence of professors in the department to cooperate with the students</li> <li>Insufficient interactions between the professors and the students and a lack of online and continuous debugging</li> <li>Fundamental deficits in holding question-and-answer sessions between the students and the professors</li> <li>Loss of dynamic and constructive academic communication between the students, academics, and society</li> </ul>
Psychological factors	<ul style="list-style-type: none"> <li>Lack of psychological and academic counseling support for the students</li> <li>Insufficient attention to anxiety relief and stress reduction in the students</li> <li>Concerns about the occupational future</li> <li>Anxiety about the inability to respond professionally</li> <li>Frustration, exhaustion, and stereotyping</li> <li>Obsessive compulsive disorder (OCD)</li> <li>Negative emotions</li> <li>Depression</li> <li>Disappointment</li> </ul>
Educational technology factors	<ul style="list-style-type: none"> <li>Lack of sufficient equipment</li> <li>Poor internet accessibility</li> <li>Inadequate use of new educational technologies such as simulation and combined education by the universities</li> <li>Slow mobile internet speed</li> <li>Internet bandwidth limitation</li> <li>Inadequate network coverage</li> </ul>
Factors related to the teachers or the professors	<ul style="list-style-type: none"> <li>Changing teachers' behavior in practical patterns</li> <li>Provide limited and inefficient audio files for clinical courses that require visual training</li> <li>Lack of appropriate and scheduled feedback on student assignments and interactions in the system</li> <li>Insufficient knowledge of some professors to use technology and virtual system</li> <li>Adherence of some trainers to providing educational programs in audio and PDF files and not necessarily online forms</li> <li>Lack of specific planning and scheduling by the professors for virtual training</li> </ul>
Limitations of educational and research planning	<ul style="list-style-type: none"> <li>Holding monitoring classes and virtual training classes in the form of webinars</li> <li>Insufficient training of educational colleagues and other students in using virtual education</li> <li>Lack of design of medical education applications</li> <li>Long and ineffective basic science education courses</li> <li>Instability and uncertainty in educational planning announced to the professors and the students</li> <li>Lack of theoretical training in adjunction with practical training</li> <li>Unexpected replacement of face-to-face classes with virtual training</li> <li>Lack of order in holding the exams</li> <li>Lack of crisis management training courses in the curriculum of the students</li> <li>Impossibility or postponement of thesis presentation</li> <li>Deficits of virtual and online training and the obligation to offer most courses offline in the universities</li> <li>Holding live classes in non-official hours</li> <li>Lack of lesson programs in educational groups</li> <li>Inability to provide appropriate content for the students and to present previous semester textbooks that have been used for face-to-face instruction</li> <li>Failure to form many classes with a physical presence or at least visual communication with students</li> <li>Lack of written training manuals and virtual exams</li> <li>Lack of establishing a universal networking culture in the students' education</li> <li>Lack of qualitative and interactive content in some courses</li> <li>Inadequate virtual training</li> <li>Imposing a lot of ignorance on teachers and students</li> <li>Problems and limitations in moving to other countries for study and research opportunities</li> <li>Transforming teaching hospitals from a learning-centered environment into a high-risk, challenging patient-centered environment</li> <li>Lack of learners' opinions and experiences utilized in promoting educational processes</li> <li>Impairment of clinical and bedside training</li> <li>Ethical considerations in video and virtual training recorded or taken from the patient's bedside</li> <li>Too many shifts for clinical students</li> <li>Shortage of clinical cases for educating students due to the allocation of teaching hospital spaces to patients with SARS-CoV-2 infection</li> </ul>

*Contd...*

**Table 2: Contd...**

Classes	Subclasses
Crisis management factors	Inadequate and ineffective management of the problems caused by the COVID-19 crisis in the universities and the psychological effects of the crisis on the students Untimely and late decision-making to control the crisis Lack of adequate facilities for personal protection against COVID-19 Moderation of the existing working individuals and its insufficiency for educating the students Delays in payment of financial claims of assistants and students Absence of a systematized plan to support the students in the COVID-19 crisis, including financial support, insurance, teaching aids, and counseling
Educational evaluation	Prevalence of cheating in virtual exams Inappropriate assessments based on e-learning Generalizing cheating to all students and adopting strict and non-expert solutions to prevent cheating (including insufficient time to answer exams) Disproportion of teaching with the method of evaluation Unknown evaluation method of some professors Unrealistic and ineffective educational evaluations Inability to provide immediate feedback to the students. Impossibility of gaining experience and skills from the feedback of different levels, especially internships

researchers and included the main concepts of the panels are provided that are as follows.

While discussing the psychological challenges and barriers, one of the participants mentioned the paucity of psychological and educational counseling support for the students: “Children need counseling during the Covid-19 crisis due to psychological and academic problems, while these centers have not been active at the universities”; “Due to the teleworking of the teachers, these systems were seldom used”; “considering the quality of classes and training, how can we become professional in our work.”

Discussing the challenges and obstacles of educational and research planning, one of the students stated that: “our classes are not held on regular programs and according to the schedule and hours of every unit. The teacher uploads the file at midnights and.”; another student stated: “In these critical situations, on-duty programs and shifts impose extra workload to us and makes our situation more stressful, and all of these make us more tired and concerned about being infected. Moreover, we have gotten more nervous these days.”

### Discussion

One of the important responsibilities of medical universities and higher health education systems is to train graduates to provide services to society and promote health in the communities; however, the existence of challenges and obstacles has an adverse effect on the quality of services provided by the graduates. Therefore, it is necessary to identify the challenges, solve current problems in the field of students’ education and training, and use all the capacities to manage education in the COVID-19 crisis. The COVID-19 epidemic has affected students in multiple unpredictable aspects. Patients’ care, research, and education have undergone

tremendous changes; thus, special and sufficient attention is warranted to the teaching of the teachers and the students, better designing of electronic courses, making the interaction between the professors and the students by establishing face-to-face communication, and providing more interactive learning environment while improving the capabilities of video technologies and the use of combined learning.

In this study, the perceived challenges and obstacles of medical students in the COVID-19 crisis were identified in the form of eight factors. The main challenges affecting students’ training include interaction and communication, psychological factors, educational technology, and factors related to the professors, which are consistent with the findings of Baticulon *et al.*<sup>[15]</sup> and Oladipo *et al.*<sup>[16]</sup> Limitations of educational and research planning, crisis management factors, and educational evaluation were also among the factors that were challenging for the students and are consistent with the results of the study by Farooq *et al.*<sup>[17]</sup> in 2020. For medical schools, the COVID-19 pandemic requires curriculum reassessment as well as significant changes in clinical attachments. Evidence suggests that the mental health status of medical students is currently poorer than the general population, and that academic stress is a major predictor suggesting that such changes will have a significant impact on students.<sup>[21]</sup> In this study, psychological factors were also mentioned among the challenges that affected medical students. Dynamiting the virtual learning environment using problem-based learning methods, welcoming students’ creative ideas, providing prompt feedback to the students by the trainers, teaching networking of the professors and the students, and designing effective evaluation models based on student surveys and perceived experiences of evaluation based on e-learning can be beneficial solutions that might turn the existing challenges into

opportunities for the development and growth of health education and training of efficient graduates. In this regard, special attention to effective clinical education and removal of existing barriers, including solving the problem of cases shortage other than COVID patients, providing simulation training facilities, activating the clinical skills center, creating specialized applications related to clinical training, providing patient-based educational videos based on ethical considerations, and emphasizing the appropriate and adequate interaction of the professors and the students at the patient's bedside is warranted.

### Limitation and recommendation

Among the limitations of this study was the inability to distinguish other factors that caused challenges and obstacles for students besides the COVID pandemic.

### Conclusion

Medical students have faced various challenges and obstacles during the COVID-19 pandemic; therefore, identifying their understanding and experience of education during the COVID-19 crisis and the necessary planning to manage these challenges will improve the quantity and quality of education and students' growth and development. In this study, the perceived challenges and obstacles of medical students in the COVID-19 crisis were identified in the form of eight factors including student life factors, interaction and communication, psychological factors, educational technology, factors related to the professors, limitations of educational and research planning, crisis management, and educational evaluation factors. Identifying the challenges of medical education understood by students and adopting appropriate strategies to overcome the existing barriers provides new opportunities for the universities to expand the scope of the curriculum, provide education and promote community health; furthermore, challenges of medical education and any skill-based discipline, such as medical sciences in the coronavirus pandemic requires much attention to cognitive sciences.

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### Conflict of interest

There are no conflicts of interest.

### References

1. Gyampoh AO, Ayitey HK, Fosu-Ayarkwah C, Ntow SA, Akossah J, Gavor M, et al. Tutor perception on personal and institutional preparedness for online teaching-learning during the COVID-19 crisis: The case of Ghanaian colleges of education. *African Educ Res J* 2020;8:511-8.
2. Hilburg R, Patel N, Ambruso S, Biewald MA, Farouk SS. Medical education during the coronavirus disease-2019 pandemic: Learning from a distance. *Adv Chronic Kidney Dis* 2020;27:412-7.
3. Dhillion J, Salimi A, ElHawary H. Impact of COVID-19 on Canadian medical education: Pre-clerkship and clerkship students affected differently. *J Med Educ Curric Dev* 2020; 7:2382120520965247.
4. Ahmed H, Allaf M, Elghazaly H. COVID-19 and medical education. *Lancet Infect Dis* 2020;20:777-8.
5. McClements EA. Learning in the time of COVID-19: A preclinical student's perspective. *Acad Psychiatry* 2020; 44:677-8.
6. Rose S. Medical student education in the time of COVID-19. *JAMA* 2020;323:2131-2.
7. Dickman, Nomy, and Barbara Schuster. "Back to the Future: Changing the Education of Medical Students." *Active Education for Future Doctors*. Springer, Cham, 2020:1-7.
8. Stokes DC. Senior medical students in the COVID-19 response: An opportunity to be proactive. *Acad Emerg Med* 2020; 27:343-5.
9. Jumreomvong O, Yang E, Race J, Appel J. Telemedicine and medical education in the age of COVID-19. *Acad Med* 2020; 95:1838-43.
10. Kinder F, Harvey A. Covid-19: The medical students responding to the pandemic. *BMJ* 2020;369:m2160.
11. Bao W. COVID-19 and online teaching in higher education: A case study of Peking University. *Hum Behav Emerg Technol* 2020; 2:113-5.
12. Watson A, McKinnon T, Prior SD, Richards L, Green CA. COVID-19: Time for a bold new strategy for medical education. *Med Educ Online* 2020; 25:1764741.
13. Nakhostin-Ansari A, Sherafati A, Aghajani F, Khonji MS, Aghajani R, Shahmansouri N. Depression and anxiety among Iranian medical students during COVID-19 pandemic. *Iran J Psychiatry* 2020; 15:228-35.
14. Gismalla MD, Mohamed MS, Ibrahim OSO, Elhassan MMA, Mohamed MN. Medical students' perception towards E-learning during COVID 19 pandemic in a high burden developing country. *BMC Med Educ* 2021; 21:377.
15. Baticulon RE, Sy JJ, Alberto NRI, Baron MBC, Mabulay REC, Rizada LGT, et al. Barriers to online learning in the time of COVID-19: A national survey of medical students in the Philippines. *Med Sci Educ* 2021;31:656-6.
16. Oladipo AT, Fashola OT, Agboola EI, Adisa OO, Oyekanmi OD, Akinsete AM. Challenges with medical education in Nigeria in the covid-19 era. *Pan Afr Med J* 2020; 37:223.
17. Farooq F, Rathore FA, Mansoor SN. Challenges of online medical education in Pakistan during COVID-19 pandemic. *J College Physicians Surg Pak* 2020;30:67-9.
18. Tuma F, Nassar AK, Kamel MK, Knowlton LM, Jawad NK. Students and faculty perception of distance medical education outcomes in resource-constrained system during COVID-19 pandemic. A cross-sectional study. *Ann Med Surg* 2021; 62:377-82.
19. Armstrong-Mensah E, Ramsey-White K, Yankey B, Self-Brown S. COVID-19 and distance learning: Effects on Georgia state university school of public health students. *Front Public Heal* 2020; 8:576227.
20. Hattar S, AlHadidi A, Sawair FA, Alraheem IA, El-Ma'aita A, Wahab FK. Impact of COVID-19 pandemic on dental education: Online experience and practice expectations among dental students at the University of Jordan. *BMC Med Educ* 2021; 21:151.
21. O'Byrne L, Gavin B, Adamis D, Lim YX, McNicholas F. Levels of stress in medical students due to COVID-19. *Journal of Medical Ethics*. 2021;47(6):383-8.