

Online medical education during the pandemic in different countries

Ensino médico *on-line* durante a pandemia em diferentes países

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ABSTRACT

Introduction: At the end of 2019, one of the great challenges of the 21st century emerged, affecting the whole world. The long period in isolation made people adapt to the way they work and study, and this same measure was taken in the medical course, bringing new methodologies and learning.

Objective: To analyze, through an Integrative Review, data on how the process of adapting online medical education was carried out during the pandemic.

Methods: This is an Integrative Literature Review and data search was conducted in the PubMed, Virtual Health Library (BVS), Coordination for the Improvement of Higher Education Personnel (CAPES), Scientific Electronic Library Online (SCIELO) and Latin American and Caribbean Literature on Health Sciences (LILACS) databases. The search began in July 2021.

Results: Initially, with the application of the inclusion criteria, a total of 841 articles were obtained from the selected databases. After excluding duplicate articles, this number was reduced to 242 articles. After applying the exclusion criteria, 22 articles were selected for the study.

Conclusion: It is known that Medicine is mostly a practical course, the physical contact of students with patients is essential to develop essential skills for a quality physician, both in medical semiology techniques and in the skills necessary to establish the doctor-patient relationship. However, the need for a way of learning arose with the pandemic and teaching could not stop. In view of the points raised in the literature research, the common sense would be the application of a hybrid teaching method - online and face-to-face - (aimed at optimizing time and breaking geographic barriers, without neglecting the importance of clinical practice), exceptionally online (when there are extraordinary situations, such as the COVID-19 pandemic) or only in person (in regions where the application of e-learning is not feasible).

Keywords: Education; Medicine; Pandemic; Teaching.

RESUMO

Introdução: Ao final de 2019, um dos grandes desafios do século XXI veio à tona e atingiu o mundo todo. O longo período de isolamento levou as pessoas a se adaptar a uma nova forma de trabalho e estudo. A mesma medida foi adotada pelos cursos de Medicina, o que resultou em novas metodologias de aprendizagem.

Objetivo: Este estudo teve como objetivo analisar, por meio de uma revisão integrativa, dados referentes ao processo de adaptação da educação médica on-line durante a pandemia.

Método: Trata-se de uma revisão integrativa de literatura em que se utilizaram os dados das seguintes plataformas: PubMed, Biblioteca Virtual em Saúde (BVS), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes), Scientific Electronic Library Online (SciELO) e Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS). A pesquisa teve início em julho de 2021.

Resultado: Inicialmente, com a aplicação dos critérios de inclusão, obteve-se um total de 841 artigos oriundos das bases de dados selecionadas. Após a exclusão de artigos duplicados, esse número foi reduzido a 242 artigos. Após a aplicação dos critérios de exclusão, chegou-se a 22 artigos selecionados para o estudo.

Conclusão: Como a Medicina é um curso prático em sua maioria, é fundamental o contato físico dos estudantes com os pacientes, de modo a desenvolver habilidades essenciais para um médico de qualidade, tanto em técnicas da semiologia médica como na desenvoltura da relação médico-paciente. Porém, a necessidade de um modo de aprendizagem surgiu com a pandemia, e o ensino não podia parar. Diante dos pontos levantados na literatura pesquisada, o senso comum seria a aplicação de um método de ensino híbrido – on-line e presencial – (visando à otimização de tempo e ao rompimento de barreiras geográficas, sem deixar de lado a importância da prática clínica), excepcionalmente on-line (quando houver situações extraordinárias, a exemplo da pandemia de Covid-19) ou somente presencial (em regiões onde é inviável a aplicação do e-learning).

Palavras-chave: Educação; Medicina; Pandemia; Ensino.

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INTRODUCTION

At the end of 2019, one of the significant challenges of the 21st century emerged, affecting the entire world. COVID-19, the disease caused by SARS-Cov-2 (acute respiratory syndrome coronavirus), had its first case identified, according to the World Health Organization (WHO), in the city of Wuhan, China, where cases of people with pneumonia of unknown agent were reported¹.

Due to the high contagion of this infection and little information about it, government agencies decided that the most appropriate measure for the given moment, aiming to contain the number of contaminated individuals, was social isolation². The long period in isolation made people adapt to how they worked and studied, using digital information and communication technologies so that activities could go on, aiming at minimizing the damage caused by COVID-19³.

The same measure was taken regarding medical courses, which, aiming to protect teachers and students from contagion and not affect students with the prolongation of the course, the Brazilian Ministry of Education and Culture (MEC) authorized classes to be replaced by the remote model during the pandemic period. However, this situation raised questions about the future and the quality of these professionals' training, given that direct contact with the patient is of the utmost importance in the training of humanized doctors⁴. Moreover, intrinsic difficulties associated with this teaching method include the difficulty of maintaining focus, lack of motivation, and reduced communication, which may also lead to increased feelings of isolation, anxiety, and stress among students⁵.

For a better understanding of the operation of remote classes in the medical course, it is interesting to compare the methods used between developed and developing countries based on the classification of the Human Development Index (HDI). This comparison reveals that, depending on the social and economic situation of the country, the study conditions are discrepant. An example of this situation is that in less developed countries, universities and students may not have the minimum required equipment necessary to carry out the classes⁶.

The importance of this topic is based on the identification of flaws and the instituting of improvements in online medical education in undergraduate courses, not only in the current situation of the COVID-19 pandemic but also in future circumstances.

Therefore, this study aims to analyze, through an Integrative Review, data on how the process of adapting medical education to the online model was carried out during the pandemic.

METHODS

This is an Integrative Literature Review, which aims to summarize a series of studies on the topic of the implications of a remote teaching in the medical course, adopting a critical position about the main consequences of this method on the quality of the teaching-learning process and through an assessment between countries with different levels of development.

The study consists of six different stages. They are the identification of the topic and creation of the hypothesis/research question, establishing the inclusion and exclusion criteria in the search for the studies, defining the information that must be removed from the selected studies (study categorization), the evaluation of the studies selected for the review, the interpretation of the obtained results and, finally, the presentation of the final review⁷.

To search for the articles in the literature, the PubMed, Virtual Health Library (VHL), Coordination for the Improvement of Higher Education Personnel (CAPES), Scientific Electronic Library Online (SCIELO), and the Latin American and Caribbean Health Sciences Literature (LILACS) databases were used. The search started in July 2021.

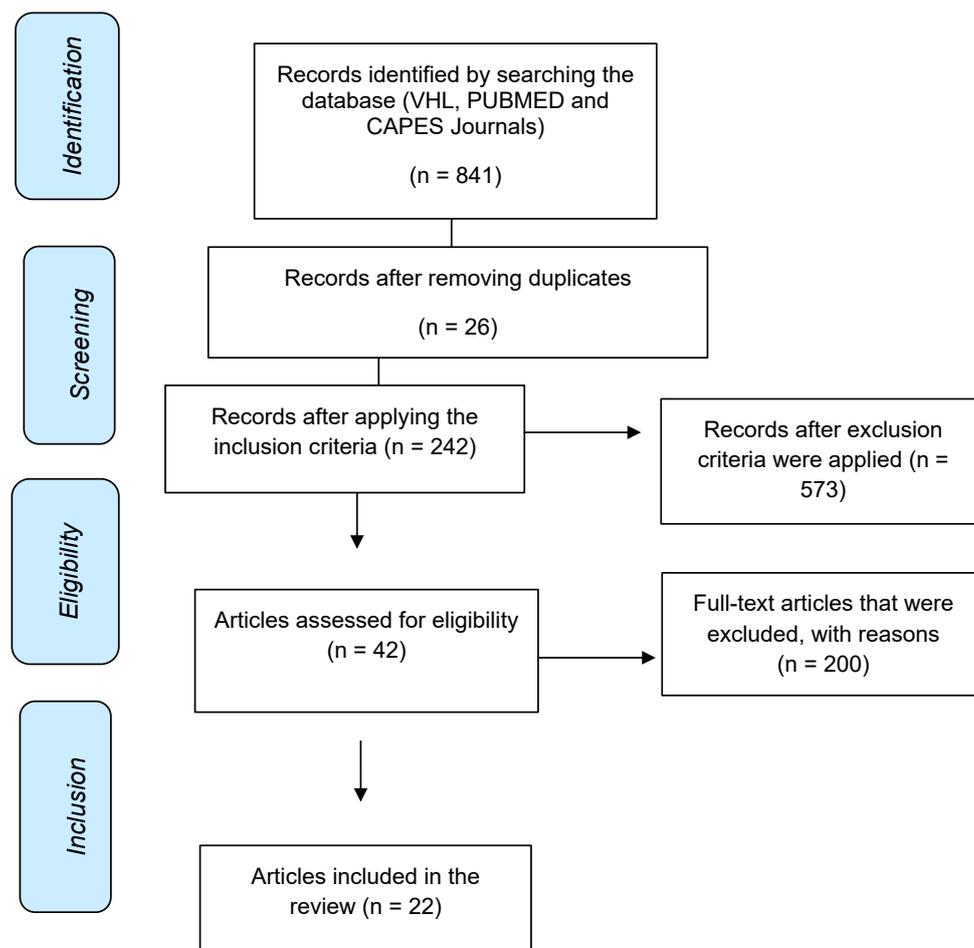
The descriptors used to search for articles were low-income countries, high-income countries, middle-income countries, COVID-19, medical education, and medical teaching. These were used in combinations in both Portuguese and English languages.

The inclusion criteria were articles published since the pandemic's beginning, dated at the end of 2019. The exclusion criteria were duplicate articles, articles that did not directly fit the topic, articles carried out with students who were in postgraduate school, case report articles, perspective articles, point of view articles, opinion articles, review articles, letters to the editor and articles that did not show the positive and negative points, simultaneously, about the online study. These data are shown in Chart 1.

The PVO strategy was applied, used to determine the inclusion criteria: P (Problem), "Covid"; V, (Variable) "Medical students"; O (Outcomes) "What are the positive and negative points and limitations of the countries about online medical education during the pandemic?".

Then, the categorization of the studies was carried out, extracting the information, organizing and summarizing their information (author, year, country, the respective HDI, title, type of study, the objectives of the studies and their results - emphasizing the positive and negative points on the applicability of online teaching). The data were tabulated, and based on these, a database was created.

According to the latest update of the world HDI in 2019, countries with an HDI ≥ 0.804 were considered

Chart 1. Article inclusion/exclusion process for analysis.

Source: study data.

significantly developed, comprising 66 countries. Countries with HDI values between 0.796 and 0.703 were classified as having high human development, with 53 countries included in this category. Countries with medium human development comprise values between 0.697 and 0.554, with 37 countries in this category. Finally, countries with an HDI value between 0.546 and 0.394 are considered to have low human development, comprising 33 countries. In all, 189 countries were analyzed and classified according to the obtained HDI⁸.

RESULTS

Initially, after applying the inclusion criteria, a total of 841 articles were obtained from the selected databases. After excluding articles in duplicate, this number was reduced to 242 articles. After applying the exclusion criteria, 22 articles were selected for the study. The results are shown in Table 1 for a more transparent and objective view of the primary data collected from the articles used in this research.

DISCUSSION

Based on the information obtained from the assessed studies, it was observed that the best alternative for medical training not to be interrupted during the pandemic period was remote teaching. This situation was responsible for curricular renewal and the incorporation of technology into medical education. Moreover, the health sector urgently needed medical professionals to fight the COVID-19 pandemic^{29,30}.

The countries identified in this study were very developed (United States, Saudi Arabia, Hong Kong, Germany, United Kingdom, Korea, Portugal, and Qatar), developed countries (China, Iran, Brazil, Jordan, Libya, and Egypt), and medium-development countries (India). No studies were found in low-development countries among the evaluated studies⁹⁻³⁰.

The main positive points regarding the online study in the medical course in the evaluated studies⁹⁻³⁰ were: Flexibility of time for study; Better communication and interaction (teacher-student, student-student, or student-coordination); student self-control of the study; Higher student scores in evaluation exams; Platform with increased quality; Better availability of students' time for leisure activities, such as time for exercise,

Table 1. Main information of the articles selected for the construction of the integrative review.

Nº	Title	Authors (Year)	Country	HDI	Study type	Objectives	Results		Limitations
							Positive aspects	Negative aspects	
1.	A comparative study regarding distance learning and the conventional face-to-face approach conducted problem-based learning tutorial during the COVID-19 pandemic	Foo et al. (2021) ⁹	Hong Kong*	0.949	Comparative retrospective study	The objective of this study was to compare the performance of students who use remote PBL tutorials with those of students who use the conventional in-person approach.	Greater time flexibility, higher exam scores, use of easy-to-use software, tutorial format that persisted, overcoming geographic barriers.	Reduced student engagement with classes, reduced teacher-student communication, low student motivation, and technical and technological challenges.	There was no randomization, and the comparison was subject to bias.
2.	Undergraduate medical education amid COVID-19: a qualitative analysis of enablers and barriers to acquiring competencies in distant learning using focus groups.	Reinhart et al.(2021) ¹⁰	Germany*	0.947	Case study	Explore perspectives, experiences, feelings, and attitudes towards the only online course to identify enablers/drivers and barriers/challenges.	Greater availability of time to practice sports, time flexibility, more time with close people, more intense student-teacher communication, more intense teacher feedback, and acquisition of specialized and applied knowledge.	Prolonged screen time, lack of social contact with colleagues, teacher's difficulty in monitoring student learning, lack of communication between students and patients, lack of practical training, and need for students to have the self-discipline to achieve focus on studies.	The views of students and faculty were addressed, and the specific impact of e-learning on patient outcomes or the behaviors, skills, or knowledge of healthcare professionals was not addressed.
3.	Perceptions of medical students towards <i>online</i> teaching during the COVID-19 pandemic: a national cross-sectional survey of 2721 UK medical students.	Dost et al. (2020) ¹¹	United Kingdom*	0.932	Cross-sectional study	To investigate medical students' perceptions of the role of online teaching in facilitating medical education during the COVID-19 pandemic.	Saving time and money on travel, time flexibility, students' capacity to learn at their own pace, the possibility for students to ask anonymously, decrease in student anxiety regarding assessments.	Pre-recorded classes can reduce communication with the teacher in real-time, distraction by family members, difficulties in connecting to the internet, loss of contact with colleagues, and generating or enhancing anxiety.	Some medical schools may have been disproportionately represented due to the difference in the number of responses. In addition, some aspects depended on the memory factor, perhaps introducing elements of memory bias.
4.	A qualitative analysis of third-year medical students' reflection essays regarding the impact of COVID-19 on their education	Kelly et al. (2021) ¹²	USA*	0.926	Qualitative study	To explore how COVID-19 has impacted the daily structure of medical education during this critical situation.	Learning practical lessons, adapting to new or dynamic healthcare environments, cognitive reformulation of experiences, and reassessing skills, values, roles, and leadership within the medical field.	Decrease in the development of skills and specialization exposure, frustration, and apprehension in preparing for exams	The findings may not be generalizable, as it was carried out in only one medical school, and the sample was predominantly white. There were word restrictions on the essay question, and respondents were asked to keep it "reflective." It was not possible to triangulate the answers with other sample data.

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Table 1. Continuation.

Nº	Title	Authors (Year)	Country	HDI	Study type	Objectives	Results		Limitations
							Positive aspects	Negative aspects	
5.	Is remote near-peer anatomy teaching an effective teaching strategy? Lessons learned from the transition to <i>online</i> learning during the Covid-19 pandemic.	Thom et al. (2021) ¹³	USA*	0.926	A prospective study with historical controls	Evaluate the effectiveness of the anatomy curriculum about the equivalent in-person learning environment using student assessment scores and collect student perspectives on the online learning environment, identifying its limitations and potential areas for improvement.	The peer anatomy curriculum remained impactful in the change to remote learning. The course design was strong enough to result in no significant difference in medical student assessment scores after transitioning to online learning.	Student satisfaction is reduced, and more negative perceptions of course quality are observed.	The results of this study reflect the experience of a single institution. They may not be generalizable to all medical schools that have used new program tutorials in their transition to remote anatomy teaching.
6.	How the coronavirus disease 2019 pandemic changed medical education and deans' perspectives in Korean medical schools	Park et al. (2021) ¹⁴	Korea*	0.916	Observational study	It explored how Korean medical schools have responded to the coronavirus disease 2019 (COVID-19) pandemic and the medical deans' perspectives on what and how these adaptations influence the present and future of medical education.	The possibility of offering individualized learning and online meetings has improved communication and increased transparency in decision-making between interested parties.	Presence of technical problems, including internet networks, and user lack of experience regarding online teaching.	Experience in medical education in Korea may not be transferable to other countries with more severe conditions or fewer resources. Deans obtained the results of this study and may not reflect the perspective of faculty or students.
7.	Pre-graduation medical training including virtual reality during COVID-19 pandemic: a report on students' perception	Ponti et al. (2020) ¹⁵	Portugal*	0.864	Observational study	To evaluate medical students' perception of fully online training, including simulated clinical scenarios during the COVID-19 pandemic.	The interaction between the class and the tutor was maintained; the virtual platform was considered realistic and valuable.	Difficulty accessing the platform and remote operation of the software.	No further assessment was performed on the tutors' experience and the potential opportunities of the virtual patient simulation modality. Combining the terms "useful" and "realistic" may have introduced bias to the inferred results.
8.	A comparative study of <i>Online Learning</i> in Response to the coronavirus disease 2019 pandemic versus conventional learning	Hanafy et al. (2021) ¹⁶	Saudi Arabia*	0.854	Comparative cross-sectional study	To explore the attitude and perception of undergraduate medical students and their classmates towards educational methods (conventional versus online) and evaluate their performance accordingly.	Timesaving, immediate feedback after the exam.	Technical difficulties and increased fraud and cheating.	Sample taken from a single institute, which overshadows the generalizability of the results. Data collection included self-reported actions that are not always objective.

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Table 1. Continuation.

Nº	Title	Authors (Year)	Country	HDI	Study type	Objectives	Results		Limitations
							Positive aspects	Negative aspects	
9.	Medical students' acceptance and perceptions of <i>e-learning</i> during the Covid-19 closure time in King Abdulaziz University, Jeddah.	Ibrahim et al. (2021) ¹⁷	Saudi Arabia*	0.854	Cross-sectional study	To determine medical students' acceptance and perceptions of e-learning during the Covid-19 school closure period in Jeddah.	Online learning was adaptable and less time-consuming than classroom learning. The topic of the e-course, the instructional design of the e-learning course, the motivation, efficiency in communication, and a user-friendly learning method system were facilitators.	Students agreed that their exams could be affected by poor internet access quality. Resources are limited, and there is a lack of personal preference (negative attitude) towards e-learning. Inadequate computer knowledge and training.	Small sample size.
10.	Student satisfaction with videoconferencing teaching quality during the COVID-19 pandemic.	Fatani et al. (2020) ¹⁸	Saudi Arabia*	0.854	Observational study	Assess student satisfaction with the quality of teaching in case-based discussion (CBD) sessions conducted through video conferences.	Greater dynamism in classes and more significant interaction between the students and students and tutors.	Technical difficulties such as sound quality and internet connectivity.	It was carried out in a group of male students in pediatrics and a single center. Inaccuracies and subject to memory bias may have limited responses. Not all students were exposed to the same online teaching orientation or style, skill or competency. Student retention or success rates were not detailed.
11.	The sudden transition to synchronized <i>online</i> learning during the COVID-19 pandemic in Saudi Arabia: a qualitative study exploring medical students' perspectives.	Khalil et al. (2020) ¹⁹	Saudi Arabia*	0.854	Qualitative study	To explore medical undergraduate students' perceptions of the effectiveness of synchronized online learning at Unaizah College of Medicine and Medical Sciences, Qassim University, Saudi Arabia.	Recorded classes helped to understand the content better, saving time, reducing anxiety, and spending more time with close people.	Methodological challenges such as quality assurance in the delivery of lecture content and implementation issues, technical difficulties such as internet access, and communication software failure.	The findings of this study cannot be generalized, as it was carried out in only one medical school.
12.	Using Assessment Design Decision Framework in Understanding the Impact of a rapid transition to remote education on student assessment in health-related colleges: A qualitative study.	Jaam et al. (2021) ²⁰	Qatar*	0.848	Qualitative study	To investigate the local challenges and processes involved in the planning of assessments that were predominant during the COVID-19 pandemic and how students and teachers were affected by the change in assessment strategy.	The Assessment Design Decision Framework can assess experiences related to faculty assessment and student perspective.	Increased workload for the faculty, decrease in assignment assessments, decreasing student performance.	Grouped data rather than presented per each school. Heterogeneity between schools in assessment approaches before the transition to remote learning. Focus only on one aspect of the educational process, which are the assessments.

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Table 1. Continuation.

Nº	Title	Authors (Year)	Country	HDI	Study type	Objectives	Results		Limitations
							Positive aspects	Negative aspects	
13.	Challenges and opportunities of the COVID-19 pandemic in medical education: a qualitative study	Hayat et al. (2021) ²¹	Iran**	0.783	Qualitative study	To explain the challenges and opportunities of the COVID-19 pandemic for medical education.	It prevented the separation of students from the educational environment; the e-learning promoted the quality of instruction, thanks to the increase in documented content; self-control of the study.	Lack of communication between student and teacher, lack of student commitment to attendance and professional behavior during virtual classes, deficiencies, and infrastructure problems.	Study carried out at a single university. The possibility that the study was biased.
14.	The need for changes in medical education and the perception of teachers before the Covid-19 pandemic	Serra et al. (2021) ²²	Brazil**	0.765	Qualitative study	Recognize the changes required in medical education due to the outbreak of the health crisis and identify the teachers' perceptions about these issues.	Greater autonomy for the student, facilitating interactions by encouraging collaborative learning, and the participation of teachers in the collective construction of OSCE, which promoted dialogue between the disciplines and made it possible to update knowledge, communication skills and the flexibility to create new ways of listening and speaking.	Difficulties with infrastructure, challenges for teachers to deal with technologies, failure to overcome the teacher-student contradiction is one, long-term classes that are virtually exhaustive, difficulties in methodological renewal or the search for new references, increase in symptoms of anxiety, depression, loss of sleep quality, increased use of drugs and psychosomatic symptoms by students, lack of digital accessibility, difficulties with online education and the acquisition of content in this format.	Limited to the universe of a public medical school still using a traditional teaching model.
15.	A novel structure for <i>online</i> surgical undergraduate teaching during the COVID-19 Pandemic	Chandrasinghe et al. (2020) ²³	China**	0.761	Observational study	To analyze students' acceptance and attitude towards the low-cost resource maximization approach.	Possibility of applying classes by national and international teachers, improving clinical sense and interest in clinical medicine.	Low internet connectivity and limited access to meeting platforms.	None.
16.	Barriers and facilitators to <i>online</i> medical and nursing education during the COVID-19 pandemic: perspectives from international students from low- and middle-income countries and their teaching staff.	Li et al. (2021) ²⁴	China**	0.761	Observational study	To explore the quality of online education in China for international medical and nursing students from low- and middle-income countries (LMICs), as well as the factors that influenced their satisfaction with online education during the COVID-19 pandemic.	Reproduction support for online courses, capacity to study independently, quality of course resources, and easy-to-use course resources.	Absence of experimental/practical classes, the severity of economic problems.	Small sample size.

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Quadro 1. Continuation.

Nº	Title	Authors (Year)	Country	HDI	Study type	Objectives	Results		Limitations
							Positive aspects	Negative aspects	
17.	Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives	Al-balas et al. (2020) ²⁵	Jordan**	0.729	Observational study	To explore the situation of remote E-learning among medical students during their clinical years and identify possible challenges, limitations, satisfaction, and perspectives.	Saving time, class flexibility, and better interaction with instructors and colleagues.	Technical and infrastructure resources.	Inability to measure educational outcomes linked to remote e-learning and compare them to traditional learning
18.	Impact of the COVID-19 Pandemic on medical education: Medical students' Knowledge, attitudes, and practices regarding electronic learning	Alsoufi et al. (2020) ²⁶	Libya**	0.724	Cross-sectional study	To provide an overview of the situation experienced by medical students during the COVID-19 pandemic and to determine medical students' knowledge, attitudes, and practices toward electronic medical education.	Acceptable level of knowledge, attitudes, and practices towards e-learning, the potential to reach medical students and transform medical education, high levels of proficiency in informatics and information technology, access to fourth-generation internet services with an acceptable or good internet connection, allowed the continuity of medical training.	Financial or technical difficulties in using e-learning platforms, concerns about exposure to SARS-CoV-2 during their clinical training and with the viral transmission in the community, and difficulty in knowing the credibility and reliability of the results obtained in evaluations.	Conducted in a single country with specific settings, cross-sectional study design, difficult to separate isolated effects of COVID-19 on study variables.
19.	<i>Online</i> medical education in Egypt during the COVID-19 pandemic: a nationwide assessment of medical students' usage and perceptions	Mortagy et al. (2022) ²⁷	Egypt**	0.707	Observational study	To characterize medical students' use and perception of online medical education in Egypt, as well as to explore the effectiveness of different e-learning modalities.	More comfortable being at home, learning at your own pace, more flexible, and cost savings.	Difficulty accessing the internet, students did not feel comfortable asking questions, and increased hours spent studying.	It did not include an analysis of institutional factors or faculty feedback. The number of students shared in the survey is not an accurate representation of the total number of students at each university.
20.	Assessment of <i>online</i> teaching as an adjunct to medical education in the backdrop of COVID-19 lockdown in a developing country – An <i>online</i> survey	Desai et al. (2020) ²⁸	India***	0.645	Observational study	To assess the awareness about online classes and whether they can help to learn in the medical field amidst the lockdown.	Increased control and individual engagement with content, flexibility, overcoming geographic barriers, and cost savings.	Lack of experience with technology, difficulty connecting to the Internet, distractions, and housework, reduced communication, and lack of practice.	Small sample size, the same questions were asked to teachers and students and may have some bias.

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Quadro 1. Continuação.

Nº	Title	Authors (Year)	Country	HDI	Study type	Objectives	Results		Limitations
							Positive aspects	Negative aspects	
21	The pilot of a questionnaire study regarding the perception of undergraduate medical students towards online classes: Process and perspectives.	Menon UK et al. (2021) ²⁹	India***	0.645	Pilot observational study	To document the process of a pilot study for questionnaire-based research on undergraduate medical students' perceptions of ongoing online classes.	Responses obtained from 30 students were analyzed for the pilot study based on the satisfaction level (23.3%) and usefulness (23.3%) of the observed ongoing online classes.		More studies are encouraged that analyze the effectiveness of online learning and online healthcare service provision in rural and primary care areas of the country.
22	Perceptions of students regarding E-learning during Covid-19 at a private medical college.	Abbasi S et al. (2020) ³⁰	Pakistan***	0.557	Cross-sectional observational study	The purpose of this study was to determine the perceptions of students toward e-learning during the lockdown.	N/A	Overall, 77% of students have negative perceptions of e-learning. 76% of the students use a mobile device for e-learning.	Students did not prefer face-to-face teaching during the lockdown situation. Members of the administration and faculty should take necessary steps to improve e-learning for better learning during the lockdown.

Legend: HDI: Human Development Index * Highly developed countries ** Developed countries *** Medium developed countries.

Source: study data.

time with family, among others; Deliver of faster, higher-quality feedback to students and faculty; Decreased anxiety of students with evaluation exams; Overcoming of geographic barriers to expand the study; Specialized and applied knowledge; Cost savings with displacement; Adaptability; Evaluation of teachers and students.

On the other hand, the main negative points found in the evaluated studies⁹⁻³⁰ about this teaching method were: Technical challenges, such as internet access and access to adequate technology, among others; Difficulties with evaluation exams in general; Impaired student commitment and focus; Impaired communication and interaction (teacher-student, student-student or student-coordination); Students' perception that the quality of the course is reduced; Difficulty monitoring students; Lack of practical training for students; Longer screen time; Distractions in the home environment during classes; Increase and development of anxiety; Increased workload for teachers.

The strategies used for didactic-pedagogical activities in the studied literature⁹⁻³⁰ indicate the use of videoconference platforms for holding virtual meetings carried out according to problem-based teaching, division into small groups for teaching, which facilitates interactivity, use of the flipped classroom method, faculty mediating the contents and information that students must access and dedicate themselves to studying before class, pre-recording of classes, the use of asynchronous chat and even the scheduling of synchronous times for supervision and -pedagogical support, use of mental map of the exam, differential diagnosis and management summary, with links to resources to be used in clinical cases, as well as asynchronous discussion forums; through a symposium that facilitates social interactions and the teacher's presence; a learning portfolio that facilitates aspects of personal goals and reflects organizational mastery; presentation of virtual cases by the students themselves; virtual discussion roundtables; and support for students through synchronous and asynchronous monitoring by specialists, online seminars and videoconferences based on problem-solving, usually accompanied by research results or a long dialogue with the patient, were also reported as strategies.

The COVID-19 pandemic has had a profound effect on clinical education for medical students. While students reported negative impacts on their education and career development, they highlighted the positive aspects of learning to adapt, finding meaning in their experiences, and a desire to work as educators and public health advocates. It will be valuable to see how these students integrate these lessons into their practice when they become independent physicians¹².

Innovative educational adaptations have been essential, but further evaluation is required before their permanent

adoption. A direct transition from the conventional teaching method to an online format is still necessary, thus reducing the impacts⁹, regardless of the development.

It is essential to highlight that within the classification carried out through the HDI 2019, all categories showed technical limitations to e-learning teaching in their results. Among the difficulties related to these limitations are low connectivity, limited access to the meeting platform, and a lack of technological knowledge by teachers and students. It was also observed that the flexibility of classes and time was present in all categories, representing positive aspects of online teaching.

Beyond the COVID-19 pandemic, we anticipate greater incorporation of online teaching methods into traditional medical education. This may accompany the observed shift in medical practice towards virtual consultations¹¹.

Communication difficulties were pointed out by 25% of the studies, and 12.5% of the studies mentioned an increase in depressive symptoms and anxiety, lack of practical classes, lack of student commitment, lack of trust in online teaching, increased hours spent, and difficulties to adapt to the new teaching method. This is an antagonistic point regarding the results found in the categories. Communication was a characteristic that was expected to be made easier through online teaching, which was demonstrated in some studies; however, other studies showed that communication had worsened.

Studies are required not only to map but also to explain the effect of these secondary measures on the students' learning and mental well-being¹⁰⁻¹². Medical educators are urged to incorporate lessons learned from this unique educational tipping point to improve curricula in the future¹³.

Another highlight raised by the studies is that we are dealing with Generation Z. They designed more innovations in teaching and learning methods, especially applying inverted learning¹⁴. More training is recommended for students and tutors, as a better teaching design, interaction, motivation, and combined learning^{16,17}.

With advances in technologies and social media, remote learning is a new and rapidly growing approach for undergraduate, graduate, and healthcare professionals. It can represent an ideal solution to maintain learning processes under exceptional and emergency circumstances. Technical and infrastructure resources are identified as a major challenge for the implementation of distance learning; therefore, understanding the technological, financial, institutional, educators' and student's barriers are essential for the successful implementation of remote learning in medical education^{19,20,23,25}.

The study extensively explored the benefits and barriers to online teaching methods, with the potential to

provide medical schools with a direction regarding resource development. The development of innovative educational projects was initiated to improve remote medical education¹¹. The time for change is upon us, and support and enthusiasm are necessary to provide valid solutions²⁶.

CONCLUSION

It is known that medicine is mostly a practical course and that the student's physical contact with patients is essential to develop essential skills for a quality doctor, both in medical semiology techniques and the skills necessary to establish the doctor-patient relationship. However, the need for a way of learning emerged with the pandemic, and teaching could not stop. Considering the points raised in the researched literature, common sense would be the application of a hybrid teaching method - online and face-to-face - (aimed at optimizing time and breaking geographic barriers, without neglecting the importance of clinical practice), exceptionally online (when there are extraordinary circumstances, such as the COVID-19 pandemic) or only in person (in regions where the use of e-learning is not feasible).

AUTHORS' CONTRIBUTION

Antônio da Silva Menezes Junior, Anna Karlla Gomes Moreira Farinha and Paulo Sérgio Machado Diniz: Study concept; Methodology; Formal Analysis; Review and Editing of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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