REVIEW ARTICLE

COVID-19 and the adaptation to emergency remote teaching: a scoping review

Jefferson Vilela da Silva Lima, Bianca dos Anjos Soares, Bruna Marques Maran, Leonardo Alves de Souza, Miguel Ângelo Hyppolito, Ana Cláudia Mirândola Barbosa Reis

ABSTRACT

Objective: To map the knowledge of the main challenges and possible opportunities in emergency remote teaching during the COVID-19 pandemic from the perspective of higher education health science professors and students. **Method**: This scoping review was based on the recommendations of the Joanna Briggs Institute. The search was conducted in two databases to identify primary studies published in Portuguese, English, or Spanish in 2020 and 2021; 15 publications that approached emergency remote teaching in higher education programs in the field of health were identified. **Results**: Of the analyzed publications, 73.3% were cross-sectional studies. Seven studies comprised students in the study group; four addressed professors' perspectives; and three analyzed both students' and professors' perceptions. The following main challenges were identified: carrying out practical clinical activities, peer distancing and less interaction, increased workload, Internet access difficulties/disparities and technical problems, presence of distractors hindering focus and motivation, attention difficulties in this teaching modality, quality of teaching, low student adherence, dissatisfaction with group activities, and difficulties using devices. The opportunities included class flexibility, interactive technology use, time saving, improved student-professor interaction, cooperation possibilities otherwise impossible due to physical barriers. **Conclusion:** From the students' and professors' standpoint, there were countless social, technological (access and knowledge), and pedagogical challenges. On the other hand, this context also provided new opportunities, which the academic community must consider and analyze as positive aspects incorporated strategically to transform the educational system.

Keywords: COVID-19, Education higher, Health sciences, Education distance.

INTRODUCTION

The COVID-19 pandemic, caused by SARS-CoV-2, interfered with the dynamics of society and impacted various sectors, including education. The need for social distancing led approximately 91% of students worldwide to have their in-person activities canceled, imposing a new global educational reality[1].

Once in-person classes had been suspended, higher education institutions (HEI) all over the world rushed to adapt to the necessary circumstances and minimize pedagogical damage, especially in health science programs. Many HEI chose to make temporary teaching adjustments, resorting to online resources to ensure the continuity of the program – a model named emergency remote teaching (ERT). Despite the use of technological resources to mediate the teaching-learning process, ERT is essentially different from distance education/learning – hence, they cannot be used interchangeably[2]. ERT refers to temporarily transposing pedagogical practices and methodologies inherent to in-person teaching-learning space to remote space in order to solve a crisis scenario. Distance education, on the other hand, refers to teaching-learning strategies planned for a digital format, in which classes are necessarily prepared for virtual learning[2,3].

The pandemic hastened the need to resignify the structural, curricular, methodological, and training aspects of education. The changes put into practice challenged the traditional teaching model and disregarded a set of important conditions in students' and professors' realities. A series of problems arose, demonstrating the true need for reflecting on education and training perspectives.

Thus, the objective of this study was to survey the main ERT challenges and opportunities

University of São Paulo. Medical School of Ribeirão Preto, (SP), Brazil

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during the COVID-19 pandemic from the perspective of higher education professors and students in health science programs.

METHOD

Type of review

This bibliographic research is a scoping review based on the recommendations by the Joanna Briggs Institute[4]. The purpose of a scoping review is to map, through a transparent and rigorous method, the state of the art in a given topic area and provide a descriptive perspective of the studies reviewed, without critically appraising them or synthesizing evidence from various investigations – which would be the case in systematic reviews[5].

The protocol was developed and reviewed by the authors and can be accessed upon request.

Review question

The review question was developed based on the PCC strategy (Problem, Concept, and Context). Hence, this review aimed to synthesize and publicize the results of scientific articles that addressed the challenges, limitations, and advantages of remote educational activities due to the new coronavirus, and thus answer the following question: "What are the challenges and opportunities of ERT during the pandemic from the perspective of health science programs?".

Eligibility criteria

The inclusion criteria were as follows: primary studies; study population comprising higher education (undergraduate and postgraduate) students and/or professors; and articles on health science ERT. Secondary studies, book chapters, commentaries, short communications, letters to the editor, studies addressing distance or online higher education at times other than the pandemic, and articles whose abstracts and full texts were unavailable were excluded.

Search strategy

The search was conducted in the Virtual Health Library (VHL) and Medical Literature Analysis and Retrieval System Online (MEDLINE/PubMed). The search strategy was constructed by combining descriptors and synonyms listed in the indexing vocabulary in Health Sciences Descriptors and Medical Subject Headings (MeSH Terms). All possible combinations of the descriptors "*acesso à internet*", "*educação superior*", and "*educação a distância*" were used in the search in VHL, as well as the various possible combinations of "internet access", "education, graduate", and "education, distance" in PubMed. When the review was carried out, the term ERT did not yet exist as a health science descriptor, which is why "distance education" was used instead. Language filters were used, limiting data only to studies published in Portuguese, English, or Spanish; the year of publication was also limited to include only articles published between 2020 and August 2021. Moreover, a supplementary manual search was used to identify other potential articles.

Study screening and selection

After implementing the search strategies in the databases, retrieved records were exported to Endnote reference manager, web version, to identify duplicates. Once these were removed, the records were exported to Rayyan Systems Inc.[6] systematic review manager, web version, to screen them by title and abstract reading.

Three reviewers screened the records independently, which were classified as included, excluded, or maybe. Reasons for exclusion were also indicated. Conflicting decisions were solved by a fourth reviewer.

The full texts of eligible studies were retrieved via the CAPES/MEC Journals Portal and imported to Zotero reference manager. The same three reviewers assessed these studies independently.

The results of the study search and selection process were presented in a flowchart, as recommended by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)[7],

and the study report was based on PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews)[8].

Data extraction

Data were extracted with a standardized table developed in Microsoft Office Excel. The following data were extracted: title of the article, authors, year of publication, country of publication, study objective, study type, study population, measuring instruments, teaching platforms, and positive and negative ERT aspects.

Synthesis of the results

The results were presented in descriptive and tabular analyses.

RESULTS

The search in the two databases retrieved 247 records – 74 indexed in VHL and 173 in PubMed. There were 11 duplicates, which were removed. Hence, 236 records were screened by title and abstract reading, of which 186 were excluded for not meeting the inclusion criteria. The full texts of four out of the 50 selected studies were not available – thus, 46 publications were analyzed. After reading their full text, 34 studies were excluded for not meeting the study objective. Therefore, 12 articles that met the inclusion criteria were selected in the search process.

The manual search identified another eight references. After screening them by title and abstract, two were excluded, and the other ones were analyzed in full text. Only three studies met the inclusion criteria. Altogether, this review comprised 15 articles, as shown in Figure 1.

This review included studies published in 2020 and 2021. Ten[9–18] of them were published in 2020, and the others, in 2021[19–23].

Their distribution per continent was as follows: 46.6% (n = 7) were conducted in the Americas; 26.6% (n = 4), in Asia; 13.3% (n = 2), in Europe; 6.6% (n = 1) in Africa; and one (6.6%) was considered global because its authors were from three different continents. The studies were from 11 different countries: four were conducted in Brazil[12,13,16,20]; two in the United States of America[10,15]; two in the United Arab Emirates[21,22]; one in Croatia[9]; one in China[19]; one in Jordan[11]; one in Chile[17]; one in Germany[18]; one in Egypt[23]; and one was multicentric, with researchers from the United States of America, Canada, United Kingdom, and Australia[14].

As for the language, 11 articles were published in English[9–11,14,15,17–19,21–23], and the other ones, in Brazilian Portuguese[12,13,16,20].

The characteristics of the studies included in the review are shown in Chart 1.

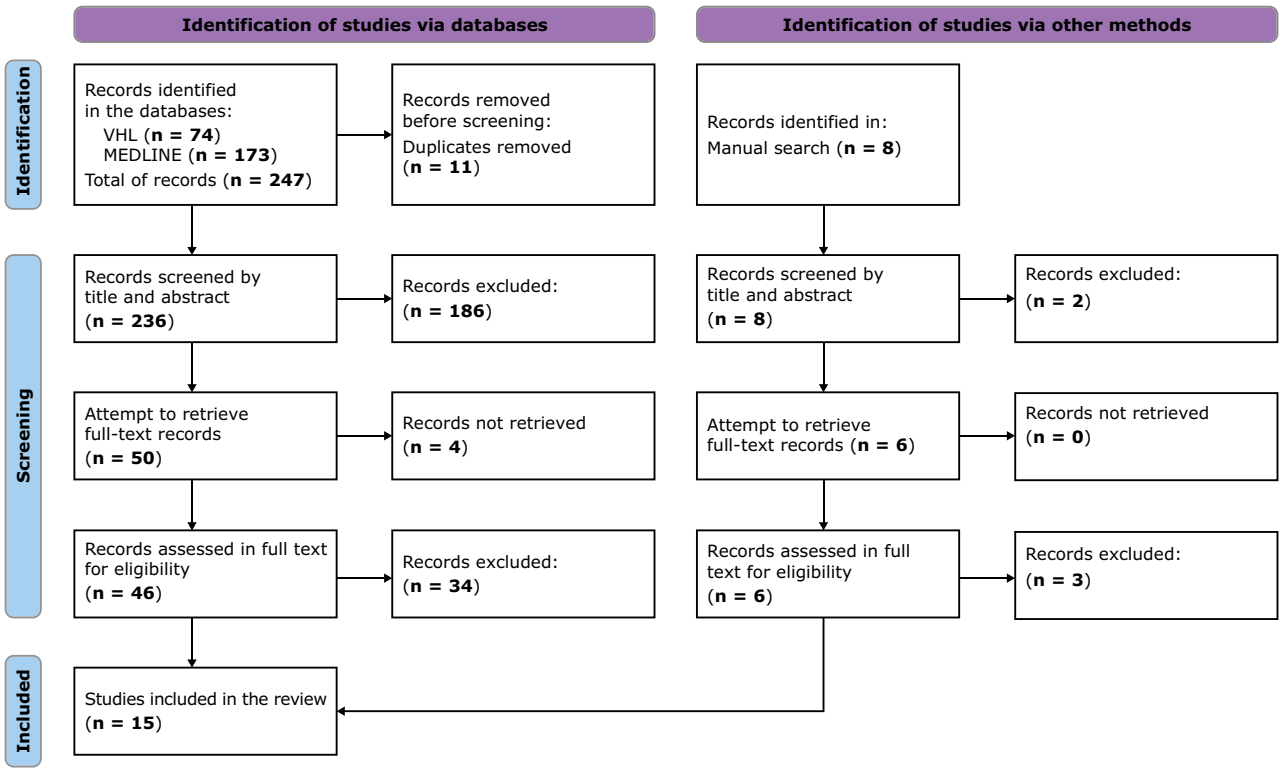

Figure 1: PRISMA flowchart of the study search and selection process in this scoping review.

Chart 1

Synthesis of primary studies, ordered by year of publication, presenting their title, authors, year of publication, and study design.

Study	Title	Authors	Year	Country	Design
S1	Attitudes and concerns of undergraduate university health sciences students in Croatia regarding complete switch to e-learning during COVID-19 pandemic: a survey	Puljak et al.	2020	Croatia	Observational, cross-sectional
S2	COVID-19 Conferences: Resident perceptions of online synchronous learning environments	Weber, Ahan	2020	United States of America	Observational, cross-sectional
S3	Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives	Al-Balas et al.	2020	Jordan	Observational, cross-sectional
S4	Emergency remote teaching in nursing graduation: Experience report during COVID-19	Bastos et al.	2020	Brazil	Experience report
S5	Strategies and challenges of remote teaching in nursing	Silveira et al.	2020	Brazil	Experience report
S6	International educators' attitudes, experiences, and recommendations after a abrupt transition to remote physiology laboratories	Choate et al.	2020	Multicentric	Qualitative exploratory
S7	Medical hematology/oncology fellows' perceptions of online medical education during the COVID-19 pandemic	Singhi et al.	2020	United States of America	Cross-sectional, non-experimental analysis

(Continuation...)

Chart 1

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Study	Title	Authors	Year	Country	Design
S8	New times, new challenges: Strategies to ensure equal access to emergency remote education	Appenzeller et al.	2020	Brazil	Observational, cross-sectional
S9	Orthopedic surgery residents' perception of online education in their programs during the COVID-19 pandemic: should it be maintained after the crisis?	Figueroa et al.	2020	Chile	Observational, cross-sectional
S10	Students' and lectures' perspective on implementation of online learning in dental education due to SARS-CoV-2 (COVID-19): a cross-sectional study	Schlenz et al.	2020	Germany	Observational, cross-sectional
S11	Barriers and facilitators to online 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	China	Observational, cross-sectional
S12	Distance learning in continued medical training during the pandemic: Feasibility and perceptions	Silva et al.	2021	Brazil	Observational, cross-sectional
S13	Rapid transition to distance learning due to COVID-19: Perceptions of postgraduate dental learners and instructors	Rad et al.	2021	United Arab Emirates	Converging mixed multiphasic methods
S14	Satisfaction with online learning in the new normal: perspective of students and faculty at medical and health sciences colleges	Elshami et al.	2021	United Arab Emirates	Observational, cross-sectional
S15	The experiences, challenges, and acceptance of e-learning as a tool for teaching during the COVID-19 pandemic among university medical staff	Zalat et al.	2021	Egypt	Observational, cross-sectional

Regarding the study population, seven studies focused only on students' perceptions and experiences[9–11,15–17,20], four studies[12–14,23] focused only on professors' perceptions, and the others[18,19,21,22] addressed both students' and professors' perceptions.

Chart 2 presents the educational level (undergraduate and/or postgraduate), programs, and/or departments to which the study populations belonged.

The synthesis of the studies included in the review regarding their objectives and main results that answered the review question is shown in Chart 3.

Chart 2

Study characterization regarding educational level and health science programs.

Study	Undergraduate	Postgraduate	Programs
S1	X	X	Nursing, Obstetric Nursing, Physical Therapy, Radiology Technology, Diagnostic Laboratory Medicine
S2		X	Medical Residency
S3	X		Medicine
S4	X		Nursing
S5	X		Nursing
S6	X		Physiology Laboratory (Sciences, Biological Sciences, Medical/Health Sciences)
S7		X	Fellowship in Hematology/Oncology
S8	X		Medicine
S9		X	Orthopedics Residency
S10	X		Dentistry

(Continuation...)

Chart 2

(Continuation)

Study	Undergraduate	Postgraduate	Programs
S11	X		Nursing and Medicine
S12	X		Medicine
S13		X	Postgraduation in Dentistry
S14	X		Dentistry, Pharmacy, Medical Laboratory, Nursing, Physical Therapy, Nutrition, Medical Imaging, Medicine
S15	X		Sciences Department and Clinical Department

Chart 3

Synthesis of the primary studies, presenting their objectives and main results.

Study	Objective	Main results			
		Devices	Connection	Challenges	Opportunities
S1	To explore Croatian health science students' attitudes and concerns regarding the complete change to e-learning during the COVID-19 pandemic	86% of students reported having a notebook/ desktop to access remote activities; 65% reported having other devices to access remote activities.	83.7% of students reported having adequate connection		
S2	To investigate medical residents' perception of synchronous online classes			Students reported less presenter-peer engagement, 62% reported less professor-student interaction, and 65% reported paying less attention to remote classes.	
S3	To explore the e-learning situation among medical students in their clinical years and identify possible challenges, limitations, satisfaction, and perspectives regarding this learning approach.	35.9% of students reported accessing remote activities with mobile phones; 14.5%, with notebooks/desktops; 49.6% with more than one device.	69.1% of students reported having low Internet coverage; 38.1% reported limited data plans	48.3% of students reported low quality of teaching, and 62.1% reported little interaction with professors	55.9% of students reported multiple advantages – e.g., time saved, class flexibility, improved professor/ student interaction
S4	To describe the emergency remote teaching experience in theoretical undergraduate Nursing classes due to COVID-19.		The study reports that, given the students' social condition, the institution distributed Internet SIM cards with mobile data plans for Internet access.	Professor-student distancing, learning distractions, little student adherence, and increased workload	Flexibility

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Chart 3

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Study	Objective	Main results			
		Devices	Connection	Challenges	Opportunities
S5	To report the teaching strategies used by undergraduate Nursing professors from Rio Grande do Sul and Santa Catarina, Brazil, and the challenges of remote teaching during the new coronavirus pandemic			Students had difficulties accessing the Internet, which can lead to nonattendance, interfering with learning. Keeping the students' focused and motivated.	Strategies such as interactive technologies proved to facilitate remote teaching. Technological resources facilitate teaching activities and professor-student interaction during the pandemic.
S6	To document physiology educators' experiences in quickly transitioning their laboratories to remote teaching during the COVID-19 pandemic		The professors reported that both they and students experienced unequal Internet access and speed	Professors reported the time available to transition from in-person to remote teaching, workload, limited specialization, unequal online access and workspace, academic integrity issues, professors' and/or students' stress directly related to the pandemic, and loss of interaction with students and workmates	Professors reported the possibility of cooperating and conducting studies inside and outside the institution, exploring new teaching technologies and platforms, using and integrating them in remote laboratories, rethinking and remodeling laboratory teaching curricula, and resources
S7	To assess scholarship students' perceptions of online learning during the pandemic, usefulness of videoconference lectures, and effects of these changes on their overall well-being and training experience	93% of students reported using notebooks/desktops to access remote activities	77% of students reported not having technical problems, including connectivity issues	60% of students reported changes in interaction; 33% reported paying less attention	100% of students reported online flexibility as a positive aspect

(Continuation...)

Chart 3

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Study	Objective	Main results			
		Devices	Connection	Challenges	Opportunities
S8	To demonstrate the strategies developed and institutional solutions found to provide equal access to remote teaching in the Medical program at FCM-Unicamp.	72.2% of students reported using notebooks/desktops to access remote activities; 19.2% used mobile phones; 6.3% used tablets	65% of students reported having both wi-fi and mobile Internet access; 30.9%, only wi-fi; 2.84% only mobile	The main problems identified were unstable and/or mobile-only Internet connection, difficulty following classes via web conferences and virtual meetings	
S9	To identify strengths and weaknesses of digital teaching in Orthopedics programs.		42% of students reported having technical problems, including slow Internet connection	42% of residents reported technical difficulties; 13%, lack of practical classes (surgical training); 9%, lack of concentration due to distractions at home; 9%, difficulties with schedules and overloaded presentations/ seminars.	
S10	To assess students' and professors' perspectives of remote teaching implemented due to COVID-19	69.8% of students reported using notebooks to access remote activities; 16.5% used tablets; 7% used mobile phones; 4.6% used desktops. 51.4% of professors reported using notebooks to access remote activities; 34.3% used desktops.	87.6 % of students reported accessing the Internet via wi-fi; more than 95% reported not having connection problems; 28.6% of professors accessed the Internet via wi-fi, and 62.9%, via cable; 62.9% of professors reported not having connection problems; 20% reported having minor problems	Students reported difficulties being prepared enough beforehand for remote teaching. Professors reported the greater time they had to dedicate as a negative aspect.	Students reported management and didactic benefits, motivation, modern teaching, and ease of participation. They also reported online teaching is more fun, improves the transfer of knowledge, and takes less time. Professors reported easily adapted content and remote teaching fun and modernity.
S11	To explore the quality of online education in China to foreign Medical and Nursing students coming from low- and medium-income countries, as well as the factors that influence their satisfaction with e-learning during the COVID-19 pandemic.	71.3% of students reported using mobile phones to access remote activities; 50% used notebooks/desktops; 7% used tablets		Students reported that the seriousness of the pandemic, the lack of experimental/ practical classes, the uncertainty of reopening the universities and continuing the classes, and COVID-related economic problems negatively impacted them. Professors reported the lockdown, feeling distant, the seriousness of the pandemic, workload, and lack of practical classes.	Students reported the positive impact of well-done tasks, Internet access frequency adequate to remote teaching, adequate university support and help, self-discipline, and adequate use of material. Professors reported good online course management, online subject design and organization, good teaching environment, good student results, and good discussion tools.

(Continuation...)

Chart 3

(Continuation)

Study	Objective	Main results			
		Devices	Connection	Challenges	Opportunities
S12	To analyze the perceptions of undergraduate Medical students of a federal university, the feasibility of e-learning in medical training, and the solutions proposed to cope with the problems caused by the new coronavirus pandemic	96.60% of students reported using mobile phones to access remote activities; 97% used notebooks; 26.30% used desktops; 25.90% used tablets	100% of students reported having Internet access; 76.70% did not have limited access, while 23.3% had limited Internet access.		
S13	To investigate postgraduate Dentistry students' and professors' perceptions of the transition to remote teaching, including the changes in learning and teaching and their effectiveness			Professors and students reported limited interaction and participation, lack of practical classes, information technology failures and limitations, lack of barriers (work/ home/college/home)	Professors and students reported that saving time and energy (which led to better teaching-learning efficiency) and better-balanced work and studies were positive aspects. Students also reported platform convenience and accessibility, while professors reported greater cooperation/ collaboration possibilities, overcoming physical barriers.
S14	To identify the factors that affect students' and professors' satisfaction with online teaching during the COVID-19 pandemic			35.2% of students reported the time taken to download material; 34.4.% were not satisfied with group activities. The students' main reported challenges were technical difficulties, screentime, and time zone differences. As for professors' negative aspects, 97.1% reported high workload; 91.4%, the greater time spent in preparation; 85.7%, technical problems;	47.5% of students reported flexibility as a positive aspect; 60.7%, communication in remote classes. 92.9% of professors reported the students' enthusiasm for remote teaching.

(Continuation...)

Chart 3

(Continuation)

Study	Objective	Main results			
		Devices	Connection	Challenges	Opportunities
S15	To estimate university employees' perceptions and experiences and recognize e-learning barriers and challenges during the COVID-19 pandemic. Also, to investigate the factors that influenced e-learning acceptance as a teaching tool in higher education	32.1% of professors reported lacking notebooks/ laptops to access remote activities.	40.2% of professors reported having insufficient or unstable Internet connection	40%, insufficient/ unstable Internet connection; 36%, inadequate laboratory computers; 32% lack of computers/laptops; 32%, technical problems; 28.3%, increased workload.	87.5% of professors reported the benefits of flexibility; 76.2%, ease of accessing and operating the remote teaching system. 88% agreed that technological skills acquired while teaching remote classes increase the educational value of the experience.

Data on pre-pandemic remote teaching experiences were not reported by 60% (n = 9) of studies. Most students and professors in the six studies that reported such data did not have remote teaching experience before the pandemic[11,14,18,19,22,23].

Students in two studies[9,12] and professors in one[13] reported previous knowledge of digital technology/platforms. Four studies[12,13,18,21] reported that both students and professors were trained to use platforms and resources made available after the social distancing sanitary measures. One of the studies[23] reported that about 24% of professors had limited technological skills.

Three studies[9,10,18] reported students' teaching modality preference – a little more than 35% of them preferred remote teaching[9,10]. None of the studies approached this issue from the professors' perspective. Nine articles[9,11,14,17–19,21–23] discussed the students' and/or professors' satisfaction with remote teaching. The ones that compared the satisfaction between both groups revealed greater satisfaction in professors than in students[19,21,22].

The tools used were not mentioned in 20% (n = 3) of the articles, which referred to them only as online platforms[10,19,20]. The most cited platforms included Microsoft Teams (53.3%)[9,11–13,17,21–23] and Zoom (26.6%)[11,17,23]. Other virtual learning platforms and tools were also cited – e.g., Moodle[11,13], WebEx[15,18], Google Classroom[13,16], YouTube[11,16], Google Meet[13], Skype[11], Blackboard[22], Big Blue Button[12], Facebook[11], WhatsApp[11], Knowledge-Based Medical Education[18], and Lt[14].

Most students were familiar with technology use and the digital world; notebooks/desktops were the most used access devices in the seven studies that reported this topic[9,15,16,18,20], followed by mobile phones[11,19]. One study[23] reported that 32.1% of professors identified a lack of notebooks/ desktops to access remote activities.

Most studies (67%) analyzed students' and/or professors' perceptions of connectivity to access teaching-learning activities; it was considered satisfactory, with adequate connection in 50% of studies[9,15,16,18,20], including teaching institution support[12,16]. In studies that reported difficulties, they were related to limited data plans regarding speed, coverage, and instability.

Surprising results were found regarding the review question – "What are the challenges and opportunities of ERT during the pandemic from the perspective of health science programs?". ERT challenges were reported in 93% of the studies; the most cited one was peer distancing and less interaction[10–12,14,15,19,21], and increased workload[12,14,17–19,22,23], followed by focus, attention, and motivation problems[10,12,13,15,17,21], Internet access difficulty/disparity[13,14,16,17,23], difficulties with

or lack of practical activities[17,19,21], and technical difficulties/problems[21–23]. The following challenges were mentioned in just one article each: quality of teaching[11], low student adherence[12], dissatisfaction with group activities[22], stress[14], difficulties following synchronous classes[16], uncertainty of HEI reopening to continue the studies, and financial problems due to restrictions imposed by the pandemic[19].

On the other hand, most of them identified remote teaching advantages (opportunities), such as flexibility[11,12,15,18,21–23], interactive technology use[13,14,18], time saving[11,18,21], improved professor-student interaction[11,13], cooperation possibilities otherwise impossible due to physical barriers[14,21]. Aspects such as easier participation, communication, self-discipline, motivation, and educational value of the experience[18,19,22,23] were also mentioned.

Regarding clinical practice during the pandemic, students' main concerns involved non-compensated practical classes[9], fear that the lack of practical courses would permanently affect their professional training for the future[9], not feeling prepared for practical aspects by only taking part in remote classes[18], and the challenge of acquiring clinical skills during remote teaching[11]. Professors reported difficulties conducting practical sessions in remote teaching[23]; they also acknowledged that virtual alternatives were excellent tools and training complements during the pandemic, though they were not sufficient substitutes for in-person experiences and skills acquired in real practice[14,21].

Expectations for the future post-pandemic teaching mode were debated in eight out of the 15 studies[9–11,14,17–19,21]. Most professors and students suggested maintaining some elements of remote teaching, in a mixed approach. In one of the studies, 58.7% of students preferred returning to in-person classes, while 53.7% of professors suggested implementing a hybrid style[22].

DISCUSSION

This review investigated 15 studies that portrayed a series of aspects of the remote teaching experience from the perspective of undergraduate and postgraduate health science students and professors during the pandemic. The discussion was presented in topics, each of which addressed a facet of the findings.

Accessibility

Transitioning to ERT made all faculty dependent on digital tools, requiring from both professors and students access to digital devices (e.g., mobile phones, notebooks, desktops, and tablets), Internet connection, and knowledge and skill to handle the devices and virtual teaching platforms. Hence, adapting to the new reality imposed by the pandemic posed countless challenges. Education was asymmetrically compromised, as the transition to ERT requiring technology use was not equivalent to all – especially due to digital inequality, which is inversely proportional to people's socioeconomic situation.

Digital exclusion is a term used to refer to differences in information and communication technology (ICT) access and use[24]. However, some authors[25] considered that the discussion on digital issues cannot be dichotomous – i.e., access or no access – because a variety of determining factors are involved. More recent studies on the topic divide digital exclusion into three levels: access to digital devices and fast connection; digital competency skills (technical, informational, and strategic); and results from the benefits of access and use[26].

Approximately 90% of the European population has Internet access[27], corroborating study data approached in this review. They indicate a high percentage of students and/or professors from European countries who report having Internet access (with either cable or wireless connection) and no technical problems[9,22]. Likewise, 77% of students in a study conducted in the United States reported not having faced technical problems, including connectivity issues[15] – ratifying data from the United States census, which revealed that at least 85% of homes had some type of Internet subscription[28].

In contrast, South American connectivity data indicate that only 72% of the population has Internet access[29]. Brazilian and Chilean studies included in this review portray the said accessibility data. Only 39% of Brazilian

students had Internet access via wi-fi; 2.84% via mobile phones; and 65% had both modalities[16]. In another study, 100% of medical students reported having Internet access. However, about 23% of them had limited connection; there was a significant relationship between family income and Internet speed[20]. In Chile, 42% of students reported technical problems during ERT[17].

In Asia, specifically Middle Eastern countries, a little more than 67% of the population has Internet access[30]. The analysis of the studies showed no difference in accessibility issues between Middle Eastern HEI professors and students – 40% of professors reported unstable and insufficient Internet access[23]; about 69% of students had low Internet coverage; and 38% of them had limited Internet access[11].

ICT in education as a teaching tool: Learning management systems

Digital technology is one of the essential pillars that ensured the continuity of the teaching-learning process during the pandemic. However, technological transition affected the education of half the world's students[31]. These circumstances and ICT use in education as a teaching tool demonstrate that both students and professors must be familiarized with them, and their skills must be updated. Successful ICT implementation and use are positive predictive factors of academic performance, resulting in a more interesting and motivating learning process[32,33]. According to Krumsvik[34], professors must not only have digital skills but also pedagogical digital skills to use ICT in favor of their teaching practices.

Learning Management System (LMS) use by the academic community has sharply increased in the last years[35]. Various studies in this review reported the use of platforms such as Google Classroom[13,16], Moodle[11,13], and Blackboard[22]. LMS are web-based systems used by education institutions; they offer a wide range of functionalities that manage and help distance learning and support in-person teaching. These systems provide resources and tools that make it easier to turn in and access didactic material, helping students develop and organize their learning pace[36].

Synchronous and asynchronous interactivity environment

During the pandemic, most universities used online platforms due to the need to transpose in-person to remote teaching. Hence, countless platforms were used to continue classes in virtual environments. Synchronous interactivity environments enable professors and students to participate and communicate in real time, ensuring greater participation between peers. In the asynchronous format, interactions occur independently from time, ensuring greater student flexibility[37].

Most analyzed students used various tools whose interfaces enabled synchronous communication and activities[9–19,21–23], via videoconferences. Strategies included dialogical classroom exposition, flipped classroom, clinical case discussion, and studies. Asynchronous activities and communication[9,11–14,16,18,19,22,23] included recorded classes, podcasts, material availability, reading suggestions, virtual visits, support videos, and discussion forums. Professors mostly used synchronous classes; choosing this format may be directly related to the possibility of re-creating situations inherent to in-person classes[38]. Data from a previous study[39] demonstrate that professors would rather use visual presentations and virtual platforms than blogs and social media. The present study verified that HEI and professors used videoconference platforms that enable visual presentations and social media, emphasizing videoconference and LMS platforms.

When planning distance academic activities, professors must reflect on the interactive environment they will use. Peer distance and less interaction was the challenging situation most reported by both professors and students in the studies in this review[10–12,14,15,19,21].

Digital competencies

Guillén-Gámez and collaborators[40] believe in the essentiality of professional development programs, through which professors can improve effective ICT skills in teaching practices. In some

of the studies[12,13,18,21], professors reported having received innovation training to get acquainted with available tools and resources. Nevertheless, this is not continuous, but emergency education, which can put excessive pressure on professors[41]. Some scholars indicate that HEI must help carry this burden, as there were no plans or models to implement and integrate digital technology in the classrooms[42,43].

The percentage of professors in the selected studies who had never used online teaching before the pandemic ranged from 59.8% to 82.9%[14,18,19,22,23]. Some studies indicate that about 44% of university professors do not often use digital technology in teaching[44]. In other words, professors tend to use technology as class preparation support, classroom administrative management, and research – but not to teach[43,45].

Impacts on clinical practice during the COVID-19 pandemic

Various HEI inevitably had to put plans into action to address the pandemic. They had to make emergency adjustments to mitigate the negative effects on education and maintain teaching, research, and outreach. Theoretical-practical integration in health science programs and courses is essential to professional training; hence, it was directly affected by the pandemic. Thus, clinical practice has been a great challenge, due to the necessary adaptations, causing great concern in both professors and students[17,19,21]. The effects of the pandemic seem to be even greater on students already in the clinical years, in comparison with those in the basic years[19].

The analysis of the pandemic period, which required adaptations, lead to discussions of the future perspective of teaching in the field of health. New online technology can be included to help teaching and learning in clinical training. Many educators have currently changed their views regarding the possibility of implementing online practical learning in health programs. However, there seems to be a consensus between them that such resources help mitigate the lack of clinical exposure in the pandemic and add complementary training value, but that they are not equivalent to traditional practical training[14,21].

This topic must be carefully and thoughtfully discussed. Scholars point out that disproportional technology use may separate students from clinical settings, with medium-to-long-term effects on their training, influencing their future professional practice[46].

Challenges of remote teaching

Teaching continuity during the pandemic depended on immersing in a totally virtual world, in which the classroom transcended the physical-temporal space. In this sense, the sudden reconfiguration from the traditional teaching model was both challenging and enriching to pedagogical practice.

Undoubtedly, the lack of Internet access, low-quality Internet access, electronic device unavailability, and lack of devices with minimal technical quality to meet the purpose of ERT affected the students' capacity to participate in online teaching. Moreover, not only students faced this challenge[11,13,14,16,17]; professors likewise reported technical and connectivity problems as obstacles in online teaching[14,23]. Thus, this was one of the greatest challenges, especially for students and professors from countries with greatly different social conditions. Even when access is ensured, there are other inequalities – e.g., broadband distribution and Internet availability and speed, which are molded by socioeconomic status, educational attainment, family income, and place of residence[47].

Unlike in-person teaching, remote teaching depends on a series of technological prerequisites and skills, which may limit and directly affect students' learning experience and professors' pedagogical practice – which in turn also directly affects students' satisfaction and engagement[48]. Besides the academic teaching and research activities, professors also had to cope with the effects of the pandemic on their teaching practice. Issues such as how to adapt program and course content, how to assess students in online teaching, and how to make the teaching-learning process effective were part of the professors' experience in ERT[49].

Both students and professors perceived the increased workload and reported it as one of the negative aspects of online teaching[12,14,17–19,22,23]. Educators who were used to always teaching in person were obligated to adapt the whole didactic content to teach it fully online, while still in line with the objectives of the courses. The need for creating and preparing material that transposed concepts to be taught online while still maintaining students' engagement and attention requires more of the professors' time and effort[50]. Increased workload and stress can impact professors' performance[51].

There were various levels of digital knowledge, virtual teaching experiences, and pedagogical digital skills among professors. Thus, limited technological knowledge was another barrier educators faced – which can make them insecure to cope with technological complexities. Based on these experiences, HEI administrators must reflect on technical investments, ensure assistance to professors, incorporate active measures to provide adequate technological support to professors and ensure the continuity of quality education. Professors, especially those that are not tech-savvies, may feel uncomfortable and unprepared due to the lack of training, which in turn may lead to their poor adaptation to online teaching[49,52]. It is also relevant to consider that remote teaching depends on escaping from traditional professor-centered approaches, which are based solely on transmitting knowledge.

Regarding health science programs and courses, the lack of practical classes was another latent concern of students and professors[17,19,21]. Many students were apprehensive about the impact on their training and performance in clinical settings and their future profession. This exposed a fragile aspect of the teaching-learning process during the pandemic. Experiencing the clinical and hospital setting and having interpersonal contact are uniquely essential to training, developing, and improving health professionals' skills[53]. This issue still needs further investigation and reflections from the academic community, as the results of systematic reviews suggest that online teaching in health science programs may be as effective as the traditional model when teaching and improving knowledge and clinical skills[54–56].

The lack of peer interaction and socialization was another great concern reported by both groups regarding remote teaching[10–12,14,15,19,21]; hence, they have an important role in student satisfaction with online teaching[22]. The student-student and student-professor relationships directly impact students' engagement with learning[57]. According to other studies, students' intellectual development is motivated by peer interaction inside and outside the academic environment – thus, it is a great loss to students[58–60]. Encouraging online class interaction may importantly ensure active learning[61]; however, significant interaction depends on the students' camera and microphone use[62].

Students also included attention difficulties and digital fatigue among remote teaching disadvantages. Maintaining the students' attention and engagement are some of the most prominent challenges professors face in online teaching[63]. The lack of barriers also posed a challenge to professors.

Opportunities in remote teaching

Despite the countless ERT challenges faced by HEI, educators, and students, from a positive standpoint, this unprecedented experience also brought about didactic and educational benefits. It created a series of opportunities that must be discussed for future planning.

Students reported many positive aspects of remote teaching, including flexibility[11,12,15,18,21–23], time saving, convenience[11,18,21], learning autonomy, self-discipline[19], and modern teaching[18]. Flexibility is one of the great benefits of ERT. Ease of access to didactic material at any time and place enables students to better manage their learning. The result of this process is the students' greater autonomy, encompassing different learning styles[64]. On the other hand, being increasingly responsible for their own learning requires greater involvement, engagement, and self-discipline. Besides these, adequate HEI help and support also positively influenced the students' experience[19], demonstrating the importance of this specific type of help.

Professors reported the possibility of having interdisciplinary and international cooperation[14,21],

exploring new teaching technologies[13,14,18], convenience, time saving, and balancing personal and professional life[21]. Ease of platform access and use[19,23] and good student performance[19] positively influenced the professors. The online setting and technology use may facilitate the cooperation between research teams, establish academic and professional connections with the participation of international research members, sharing ideas, encouraging opportunities for personal and professional self-development, and overcoming physical and geographical barriers[65,66].

CONCLUSION

This scoping review reported the main ERT challenges and opportunities for higher education health students and professors. The following ERT challenges were identified in this review: peer distancing and less interaction, increased workload, Internet access difficulties/disparities, the lack of practical activities, presence of distractors that hinder focus and motivation, difficulties in or lack of practical activities, difficulties paying attention in this teaching modality, quality of teaching, low student adherence, dissatisfaction with group activities, difficulties using devices, and more general pandemic-related aspects – e.g., the uncertainty of HEI reopening to continue the classes and financial problems due to the restrictions imposed by the pandemic.

On the other hand, there were opportunities as well. The following advantages/opportunities were identified: class flexibility, interactive technology use, time saving, improved student-professor interaction, cooperation possibilities otherwise impossible due to physical barriers, and aspects such as ease of participation, communication, self-discipline, motivation, and educational value of the experience.

Despite the adversities experienced in this period, the academic community and HEI have reflected on teaching mode expectations for the post-pandemic future. Based on what has been learned, implementing some remote teaching resources – which were perhaps inconceivable a priori – is increasingly closer and intrinsic to our reality.

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Corresponding author:
Jefferson Vilela da Silva Lima
jeffersonvilela@usp.br

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