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Features of distance learning in medical education - Systematic review

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Abstract: Due to the COVID-19 pandemic, higher educational institutions have moved from the usual mode of study to online learning. Therefore, the purpose of this systematic review was to investigate the effectiveness of distance learning for students and teachers in the context of the COVID-19 pandemic. Data search was carried out in databases – PubMed, Google Scholar using the search strategy "distance learning", "effectiveness of distance learning", "online education", "distance learning in medical education", "feedback from students and teachers about distance learning", "distance learning during COVID-19". The screening study has found 174 records after removing duplicates. The qualitative synthesis included 15 studies. Analysis of the included studies was performed using the Risk of Bias Quality Assessment Tool for Cohort Studies and the Assessment Tool for case series and cross- sectional studies. Quantitative student performance data regarding distance learning is synthesized in 6 scientific publications using (structured questionnaire, FSHM (Fellowship in Secondary Hospital Medicine) program, online questionnaire, distance education perception scale). There were 3 studies which found that modular control of the distance learning has contributed to academic success of students and the effectiveness of exams (69.5%), compared to the paper version (68.81%). The other 3 studies describe the effectiveness of distance learning as a good way to gain theoretical knowledge. The following 5 studies describe students' preferences for distance learning, namely: flexibility of study time, improved quality of education, student motivation for online learning, safety of avoiding contact, and potential impact of infection. Among the shortcomings identified there are technological problems (poor Internet connection), a sense of isolation, increasing training load, technostress. The analysis of teachers' feedback on the distance learning was performed in 4 studies. 61.1% of teachers are satisfied with online education, but 95.8% of researchers preferred face-to-face classes. According to this review, distance learning demonstrated a better impact on medical students' learning outcomes, ease of monitoring, flexibility of time and place, compared to traditional learning. In the presented results, the influencing factors of the selected studies are described, the positive and negative aspects of each research design are evaluated.

Key words: student, teacher, medical education, professional training, technostress.

1. Background

The spread of coronavirus disease worldwide has led to essential changes in all aspects of human life, including health facilities. American society of education and development defines distance learning as a wide range of applications and processes which include web-based learning, computer-

based education, virtual classes, and digital content. Conducted literature analysis describes, how distance learning affects the perception, confidence and satisfaction of students regarding the development of future medical professionals [1].

In general, distance education is an educational experience when students/graduate students/undergraduates and tutors of different departments/faculties/institutes, courses are separated by time and place [2]. It is very important to evaluate the use of distance learning in medicine and dentistry compared to the clinical bases of departments and laboratories [3]. For this purpose, the Christian Medical College, Vellore located in India has developed the FSHM (Fellowship in Secondary Hospital Medicine) program, which provides a combination of distance learning modules, contact sessions, project work and communication to provide educational opportunities for doctors working in geographically remote areas [4].

It is noted that to ensure the educational process higher educational institutions widely use multimedia platforms, software, tablets and other technologies, which open up new possibilities for the effectiveness of distance learning in medical education [5]. Therefore, we conducted a systematic review to assist healthcare professionals educators from around the world in developing ideas for creating more effective learning in medical education during periods of disruption (for example, when necessary adhere to social distancing) [6]. We aimed to answer the following research questions: 1) Is distance learning effective for medical students during COVID-19? 2) Assess the impact risk factors for medical students, postgraduates, teachers in distance learning conditions?.

Finally, we hope this review will provide medical educators with an understanding of the current state of the situation and prospects for further study.

2. Goal

The purpose of the study was to investigate the effectiveness and satisfaction of distance learning of students and teachers, as well as the factors that affect the effectiveness of learning during COVID-19, and to use this information to further practice that would improve the activities of medical education.

3. Materials and methods

3.1 Design

A systematic review of the literature was conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) controlled list of items, which is available at: http://www.prisma-statement.org).

The PRISMA diagram is used to illustrate the process of searching and selecting full-text articles included in the qualitative synthesis (Figure 1).

3.2 Information sources

The search for literature was carried out in PubMed, Google Scholar, during January 2021 - January 2023. Each source of information consulted last, was the following: PubMed (12.12.22), Google Scholar (12.01.23).

3.3 Search strategy

The search query strategy was based on keywords and phrases in accordance with the learning objectives and included: “distance learning”, “effectiveness of distance learning”, “online education”, “distance learning in medical education”, “feedback from students and teachers on distance learning”, “distance learning during COVID-19”.

3.4 Inclusion and exclusion criteria

Inclusion criteria were original studies published in English, related to the effectiveness of distance learning, as well as feedback from students and teachers about distance learning. In particular, pharmacy students, who studied "Pharmaceutical assistance", doctors who completed a one-year training program, students of the medical faculty who used the distance education perception scale, second-year students of the medical faculty who studied the physiology of the cardiovascular system using online methods, foreign medical students and nurses, graduate students and teachers, who passed the relevant online survey on distance learning.

Review articles, non-original studies, conference materials (theses), studies not related to distance learning, unavailable articles were excluded from the systematic review.

3.5 Risk and Quality of Bias Assessment

We assessed the included studies by using an assessment tool quality of risk of bias for cohort studies (http://methods.cochrane.org). This tool included 8 questions with four possible answer options. It was noted that most studies were characterized by a low risk of bias.

Case series studies were evaluated using a quality bias tool that includes 10 questions with four options answers (file:///C:/Users/Admin/Downloads/JBI_Critical_ Appraisal-Checklist_for_Case_Series2017_0.pdf). For the presented studies, the overall quality indicator corresponds good evaluation of inclusions.

The quality of bias cross studies included 8 questions with four options answers (https://jbi.global/sites/default/files/2019-05/JBI_%20Critical_Appraisal Checklist_ for_Analytical_Cross_Sectional_Studies2017_0.pdf). The overall rating was good and answered criteria inclusion. The risk and quality of bias of these studies were assessed individually.

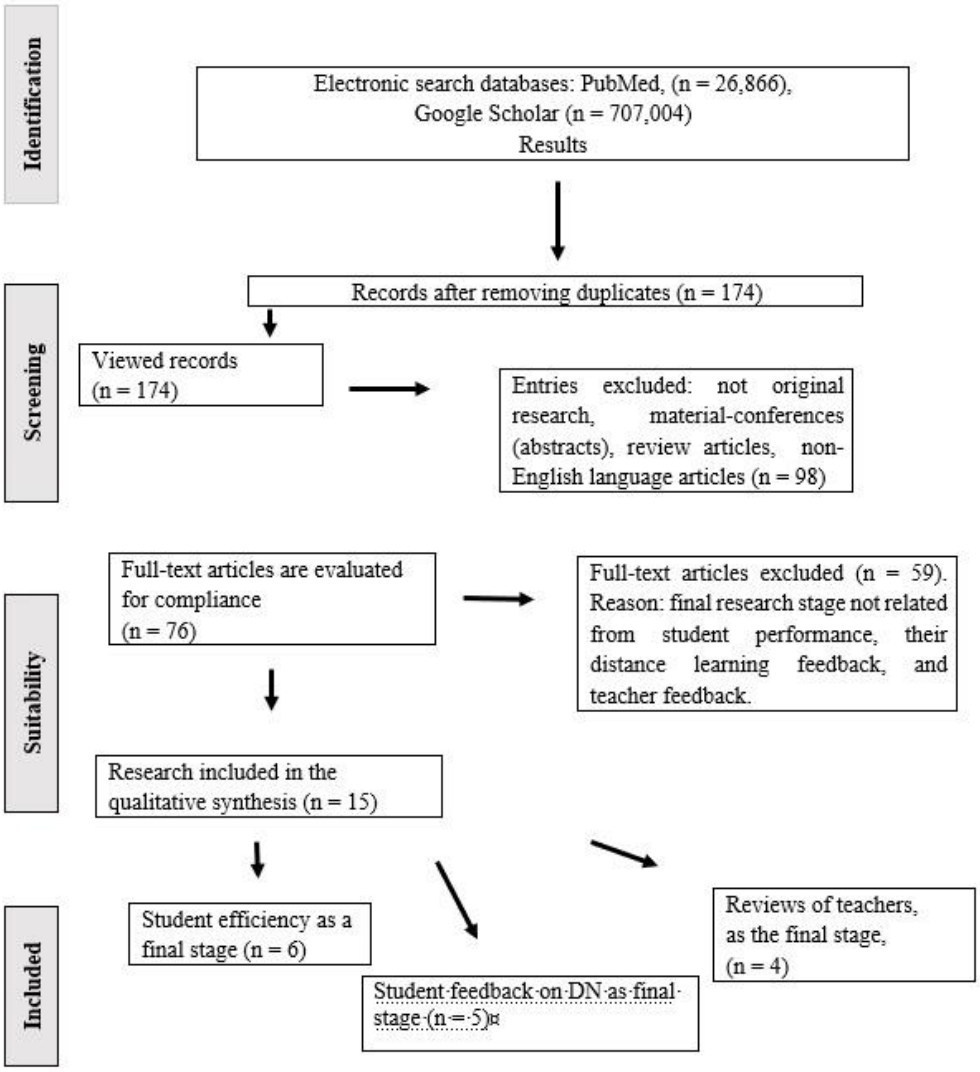

Fig. 1 PRISMA Flow Diagram.

4. Results

4.1 The results search

After conducting an electronic literature search (Fig. 1) about 26,866 articles were identified from medical and biological PubMed.gov databases, including: “distance learning” - 867 articles; “effectiveness of distance learning” - 1900 articles; “online education” – 13049 articles; “distance learning in medical education”- 1007 articles; “feedback from teachers on distance learning” – 14 articles; “distance learning during COVID-19” – 1029 articles. About 707,004 articles from Google Scholar includes: “distance learning” - 31600 articles; “effectiveness of distance learning” - 704 articles; “online education” – 16800 articles; “distance learning in medical education”- 17800 articles; “feedback from teachers on distance learning” – 18100 articles; “distance learning during COVID-19” – 622000 articles. Articles were screened, of which 127 duplicates were identified, 16 full-text articles were evaluated that meet the requirements for inclusion in the current review. In particular, 157 articles were excluded from the systematic review due to non-compliance with the study criteria (e.g., results of review articles, conference proceedings (abstracts), non-original studies, non-English-language articles).

4.2 Analysis of included of research

Analyzing the search results, 6 studies were evaluated (Table 1); they describe the effectiveness of distance learning of medical students, graduate students, bachelors and doctors. In general, a study performed by Abbasi MS. et. al. included 1255 participants from 11 developed countries, where 89% were undergraduate students, 11% were graduate students, 57.3% were bachelors of dental surgery (BDS) and 34.9% were medical students. It was marked that half of the participants preferred blended learning (classes, clinics, distance learning) in their courses for their best results. The perception and experience of distance learning was significantly higher among the students from developed countries compared to students from developing countries ($p < 0.05$). Significant impact on the students' perception and satisfaction with distance learning had a level of education and branch of education ($p < 0.05$). Students with the increase in the number of distance learning sessions attended, have shown significantly better experience and perception (positive correlation) during the COVID-19 pandemic ($r = 0.07$). 42% of students do not consider distance learning useful for the development of clinical and technical skills. However, it is noted that distance learning improves the motivation and concentration of students, improves the speed of submission of tasks than traditional learning, as well as greater convenience and attendance of students [1].

The other three studies have evaluated distance learning modules, in particular the modular control in Brazil with 82 pharmacy students, which noted that there were no significant differences during the first module (Drug Information), although the evaluation achieved in distance learning was higher than in a university-based format. In module 2 (Pharmaceutical services) there was a significant difference, the average value of students was higher in distance education ($p = 0.027$), compared to the university one ($p = 0.117$). Studies in India and the United States of America show evidence of interactive learning design that was comfortable and forced students to think; useful content with practical application in medium-sized hospitals; a distance learning format that provides flexibility and accessibility.

A recently published study by Razzak RA. et al. has found that the academic performance of students in a face-to-face learning environment and taking a paper-based exam did not give students an advantage in studying physiology compared to their peers who studied and had the exam online during the COVID-19 pandemic [4, 7-8].

Analyzing the research of Li W. et al. it was determined that 36.5% of students were satisfied with online education. In particular, it is stated a number of factors that influenced the success of online learning ($p < 0.05$), namely well-performed tasks, sufficient frequency Internet access for online learning [9].

Table 1. Efficiency and satisfaction with distance learning

Author, year of publication	Sampling of the study	Type of study	Medical student Postgraduate	Learning format	Risk of bias	Advantages and disadvantages of distance learning
Abbasi MS. et al., 2020 [1]	n=1255	Cohort	Medical students Postgraduate students	Lecture	Low risk of bias	(+): Distance learning, as a good tool for gaining theoretical knowledge.
Gossenheimer AN. et al., 2017 [7]	n = 82	Cohort	Pharmacy students	Modular control	The quality of bias is high	(+): Increased academic performance of students in remote activities
Vyas R. et al., 2013 [4]	n = 70	Cohort	Students	Module	Low risk of bias	(+): The effectiveness of distance learning among students and teachers (80%) for the development of knowledge and practice in hospitals, as well as modular control (81%) have increased. 88% of students and 87% of teachers rated the contact sessions as good or very good to apply the acquired knowledge at the hospital.
Razzak RA. et al., 2022 [8]	n=378	Cohort	Students	Exams	Low risk of bias	(+): The efficiency of exam amounts for the entire online exam increased (69.5%) compared to the paper version of the exam (68.81%).
Li W. et al. 2021 [9]	n=316	A series of cases	Students	Teaching	Low risk of bias	(+): 36.5% of students are satisfied with online education; (-): overcoming the anxiety caused by the pandemic
Aristovnik A. et al., 2020 [10]	n=31212	Cross	Students	Teaching	The quality of bias is high	(+): dominant forms of online lectures were real-time video conferencing (Zoom, MS Teams, BigBlueButton, Moodle). Depending on the continents, students were satisfied with the support of the teaching staff, in general – 57.6%, the highest rating in Oceania – 78.8%, the lowest in Africa – 33.2%. (-): lack of electricity and poor Internet connection in remote and rural areas.

Notes: Advantages (+); Disadvantages (-).

According to the results of the Aristovnik A. et al. research it was noted that students are most satisfied with real-time video conferencing (3.30), they are followed by video recording (3.26), sending presentations (3.10) and written communication (3.14), they are the least satisfied with audio recording (2.98). However, at the global level, students' satisfaction with the organization of the learning process was quite high and almost the same: for lectures 3.30, textbooks and seminars 3.12 and mentoring 3.20. Slightly less than a third of students (30.8%) reported that their workload decreased, and in (42.6%) – on the contrary, the load increased. While studying in isolation at home, students faced a lack of self-discipline and inappropriate learning environment, which caused a feeling of overload and, as a result, the perception of high levels of stress. In addition, almost half of the respondents did not have a quiet place to study, and a third did not have constant access to printers (students from Africa, Asia and South America showed the lowest results). A good Internet connection as a key element of effective online learning was available to only 60% of respondents (29% in Africa and 71% in Oceania). However, the pandemic has also created opportunities for students about their future work, for example, improved digital skills [10].

Students' feedback on distance learning are represented in 7 scientific research works (Table 2) [2, 8, 11, 12-13]. Students usually have positive feedback about online learning, including various platforms (ZOOM, Microsoft Teams), channels (YouTube, Moodle and Skype). It was found that (64.7%) of students use several platforms during distance learning. ZOOM was the most frequently used platform for training (35.3%) [11].

Regarding the reported advantages, disadvantages and problems of distance learning, 55.9% of students reported of many benefits, including time savings, flexibility of classes, improved interaction with teachers and classmates. The main shortcomings were poor interaction with teachers, which was reported by (62.1%) of respondents. The quality of streaming Internet and its coverage was the main problem reported by 372 students (69.1%). Based on the students' views regarding the role and effectiveness of teachers in distance learning, 64.3% of students agreed that teachers took an active part in their discussions, and 78.3% of students admitted that teachers approached them through multimedia to achieve the desired goals of the course. The majority of students reported an effective response to their inquiries from teachers (that is 86.6% reported a response in less than 48 hours). On the other hand, according to 26.5% of students, the time devoted to distance learning was insufficient. According to 423 students (78.6%), distance learning will be a challenge for acquiring appropriate clinical medical skills [11]. According to the results of Ozkaya G. et al. study it was determined that with distance learning the quality of education increases ($\lambda = 0.860$), it is academically more interesting than full-time study ($\lambda = 0.831$). Students also noted that distance learning compared to full-time education provides better time flexibility ($\lambda = 0.933$) [2].

The following research evaluates students' feedback on distance learning, namely, describes the barriers that affect them. These are the lack of Internet, technological tools, Internet access and low quality Internet services. According to students, distance learning provides flexibility of learning habits, the opportunity to learn at their own pace and manage their schedule from anywhere and at any time [8].

The following two studies describe the learning outcomes in the United States [12-13]. 75% of postgraduate students do not agree that distance learning provides greater interaction with classmates, while 12% - believe the opposite. In particular, 87% of freshmen and 68% of postgraduate students believe that distance learning has reduced interaction with teachers. From the results it can be seen that most students perceived the lack of interaction between student and teacher as a result of the transition to distance education during the pandemic. Thus, the flexibility of time and space during distance learning was highly valued by postgraduate students (84%) compared to junior students. Postgraduate students' assessment (68%) regarding the effectiveness of distance learning tools such as WebEx and the Microsoft team was slightly higher than the junior students' assessment (61%). The rating of bachelors' tended to disagree and neutrality. About 42% of students prefer asynchronous learning, while only 29% of students prefer synchronous learning. The rest of the students either strongly disagreed or were neutral about the subject [12-13].

Table 2. Students' feedback on distance learning

Author, year of publications	Sampling of the study	Type of study	Medical student Postgraduate Bachelor	Learning format	Risk of bias	Quantitative results of distance learning
Al-Balas M. et al., 2020 [11]	n =5147	Cross	Medical students	Practical training	The quality of bias is high	(+): savings time (79%); flexibility of class time (63.8%); better instruction (11%); improved learning (13.6%); the best interaction instructor (13.6%); better interaction with classmates (3.3%). (-): poor interaction with teachers (62.1%); poor interaction with classmates (57.2%). Problems: poor internet coverage (69.1%); restrictions on online packages data (38.1%); absence of relevant devices (12.1%); diversity of educational platforms (38.1%).
Özkaya G. et al., 2021 [2]	n=429	Cohort	Medical students	Learning process	Low risk of bias	(+): with distance education the quality of education increases (λ = 0.860); distance learning is academically more interesting than full-time study (λ = 0.831); flexibility regarding time use (λ= 0.933); university prepared materials (e-books and electronic journals) for distance education students (λ=0.786).
Razzak RA. et al., 2022 [8]	n=378	Cohort	Students	Exams	Low risk of bias	(+): convenience over time; greater flexibility with the training schedule; safety by avoiding contact and potential exposure to COVID-19 infection. (-): poor Internet connection, overloaded servers and communication platforms; problems with concentration or loss of motivation and feeling of separation, isolation or inactive participation.
Al-Mawee W. et al., 2021 [12]	n=420	Cohort	Medical students Postgraduate students	Learning process	Low risk of bias	(+): flexibility of time (84%) and space; opportunity for students to attend more courses, independent study; 61% of graduate students and 68% of students agreed that distance learning is effective and easy to use. (-): lack of social isolation; feeling of isolation, difficulty in receiving immediate feedback; insignificant concern of

						Internet problems at home - 93% of students surveyed have a computer for distance learning, 4% of students lack personal computers, 4% of students were neutral.
Armstrong-Mensah E. et al., 2020 [13]	n=769	Cross	Bachelor Postgraduate Master Doctor of Philosophy	Training (theoretical knowledge + practical skills)	The quality of bias is high	(+): more time for tasks, as well as for communication with family and friends; flexibility of time, which allowed to manage the schedule of courses at your own pace. The advantage of asynchronous learning style (69.9%), synchronous - (30.1%), respectively; (53.6%) of students are motivated to online learning, (3.4%) of students have difficulty with motivation. (-): technical problems of using Internet resources; the transition to online classes increases the workload (64.5%) of students.

Notes: Advantages (+); Disadvantages (-).

Technology orientation of students: all students (100%) had a laptop or Chromebook, 47.3% also had a smartphone, 12.5% also had an iPad, tablet or Kindle, and 10.9% also had a personal desktop computer. Regarding Internet access at home, 88.6% of students had the cable company's access, and 11% had access via their mobile phones. The majority of students (64.5%) indicated that the transition to purely online classes increased their workload. The increase in workload was due to written assignments, reflection papers, test quizzes and posts for discussion. For other students (35.5%) there was no increase in workload.

According to the students who participated in the study, 24.3% of teachers performed their online classes in an exciting way, 31.8% were available in working hours during the transition to online classes, and 48% of teachers published their recorded lectures on iCollege. More than half (53.6%) of respondents were motivated and completed their tasks on time, only (3.4%) reported about difficulties while maintaining motivation to learn. In particular, the students also noted that they had more time to work on assignments, as well as to communicate with family and friends. In addition, more than a third of students reported no need to go to school and, subsequently, save money [12-13].

Teachers' feedback on distance learning (Table 3). The study of Dulohery K. et. al. demonstrated that, the opinions of anatomists regarding remote work are ambiguous; approximately 54.2% of academics do not prefer to work remotely. The academic advantage of distance work was not related to teaching experience or workload. In addition, 54.2% of researchers were encouraged more online conferences [3].

Teachers' perspective of distance learning in teaching anatomy shows that 80% have online anatomy meetings or face-to-face; 13.3% cancel practical classes and 6.7% postpone practical classes. Of those who perform face-to-face classes, 41.7% said that adapting to practical lessons was not easy. The thematic analysis showed that the biggest problems facing universities in implementing adaptation to practical anatomy classes were logistics management (33.0%) and increasing workload (33.3%). Academics were also concerned how to reliably reproduce work experience in the preparation room in the Internet (19%); reduction in the number / capacity of staff (9.5%) and financial pressure to purchase personal protective equipment (4.8%) [3].

Research data of Panisoara IO. et.al. found that the continuation of work of teachers to use online learning positively and significantly is influenced by self-motivation ($p < 0.001$), confirming self-efficacy ($p < 0.001$), burnout and technostress ($p < 0.05$). In addition, burnout and technostress were significantly affected by internal motivation ($p < 0.001$) and external motivation ($p < 0.05$), but not self-efficacy ($p > 0.05$). The relationship between internal motivation and self-efficacy ($p < 0.001$) was noted [14].

Analyzing the impact of teachers' characteristics on the assessment of the quality of online education, it was found that 61.1% of teachers were satisfied with the effect of online education ($p < 0.01$). In general, this study showed that the percentage of dissatisfied professors (71.4%) was significantly higher than dissatisfied associate professors (28.6%). In addition, a number of factors influencing teachers' satisfaction with online education are given ($p < 0.05$). Among them there are 5 negative factors – the feeling of distance, blockage, the seriousness of the situation with COVID-19, the stress load for online teaching, as well as the lack of experimental / practical classes. Among the 12 success factors, the top 5 included: good administration of online courses, effective design and organization of online courses, good learning environment, satisfactory student results and quizzes and useful tools for discussion. In particular, it was found that a larger proportion of teachers preferred blended education (53.7%) compared to students (30.9%), while a larger proportion of students preferred full-time education (58.7%) than teachers (35, 8%) [14].

Voice symptoms in teachers during distance learning are caused by the following risk factors. In this study, the frequency of voice problems was related to stress levels (from $p = 0.002$ up to $p = 0.034$) and subjective working capacity (from $p = 0.000$ up to $p = 0.031$). The average value of subjective working capacity was 7.74 before distance learning and 7.68 during distance learning.

During distance learning, 73% of teachers consider acoustics at home to be sufficient. During distance learning, 46% of teachers used a headset, 8% – headphones, 4% – a separate microphone, 2% –

Table 3. Teachers' feedback on distance learning

Author, year of publications	Sampling of the study	Type of study	Teachers	Teaching Format	Risk of bias	Advantages and disadvantages of distance learning
Dulohery K. et.al. 2020 [3]	n=24	A series of cases	Clinical anatomists, teachers, professors directors	Lecture	The quality of bias is high	(+): 95.8% academics preferred face-to-face practical classes, and 78.3% preferred face-to-face lectures. 95.6% of scientists have increased technological capabilities during distance learning. (-): mental strain of academic staff; lack of computer skills.
Panisoara IO. et.al. 2020 [14]	n=980	Cohort	Teachers	Learning process	Low risk of bias	(+): Use of digital resources in its own field successfully contributes to the performance of work tasks. (-): the relationship between cognitive-affective factors in an unstable work context. Internal motivation with a strong positive intensity influences the intention to continue online teaching and, with a strong negative intensity, it influences burnout and technostress.
Li W. et al. 2021 [9]	n=120	A series of cases	Teachers	Learning process	Low risk of bias	(+): 61.1% of teachers are satisfied with online education. The most influential barrier was a sense of distance, and the factor was successful online administration - courses to expand cooperation with foreign institutions to create opportunities for students' practice. (-): overcoming the anxiety caused by the pandemic.
Patjas M. et.al. 2021 [15]	n=121	A series of cases	Teachers	Learning process	The quality of bias is high	(+): vocal symptoms appeared less often during distance learning (44%) than during regular training (71%). (-): poor indoor air quality negatively affects the voice; a connection with an increased level of subjective stress and a decrease in working capacity was revealed.

Notes: Advantages (+); Disadvantages (-).

a speaker at a conference and 41% – no technical acoustic equipment other than a computer. In general, the feedback of teachers on distance learning and the use of platforms is mostly positive, which is confirmed by the results of research [14].

5. Discussion

As distance learning is the dominant method of learning activity among medical students and teachers during the COVID19 pandemic, it is important to assess its perception and satisfaction on them, to identify weaknesses, improve quality.

The analysis of the conducted studies characterizes the significant problems associated with online learning. Among the main ones affecting contributors' performance were voice disorders related to stress levels, changes in the learning environment, namely changes in acoustics, duration of learning, background noise, and concerns about internet problems at home. In addition, it was found that satisfaction with online education is influenced by the teacher's professional title, country of origin and current place of residence.

The thematic analysis proved that the biggest problems faced by universities when implementing the adaptation of practical classes in anatomy were the management of material and technical support and the increase in workload. The most common problem faced by scientists during the assessment there is a conspiracy changes in the assessment format, technical problems, increased workload, management material and technical support.

As for students, the most influential barrier for them was the seriousness of the situation with COVID-19, the uncertainty of the opening date of the university, the feeling of distance, lockdown, and the seriousness of economic problems.

In accordance to the design found, strong and weak sides selected studies. According to of the reviewed literature, distance learning improves increases the level of motivation and concentration of students level of submission of tasks, than traditional training, improves students' attendance at practical classes[1]; ease of use of the Internet and students' accessibility to materials [14]; saving time, and the ability to use software functions more often, to identify new resources, which allows students to develop an understanding of anatomical relationships, variations and pathologies [11]. It should be noted that self-isolation introduced during distance learning resulted to a low level of motivation and psychological problems, in particular through feeling of increased level of anxiety [1].

A recent study published by Agnes Nogueira Gossenheimer together with colleagues discussed the issue of the success of pharmaceutical students on the course "Pharmaceutical assistance", where it is stated that the students cannot develop socialization and interpersonal communication skills. The fact that what they mention as a disadvantage of distance learning is the lack of contact between them and difficulties in solving requests. This is explained by what students are not used to attending distance learning classes with this type of interaction [7].

The following review explored how anatomists in the United Kingdom (Great Britain) and The Republic of Ireland perceives learning adaptations made in response to COVID-19 and how these adaptations affect their teaching experience. It was established that anatomist teachers noted concerns about the adaptation required for teaching and assessing students. But, analysis proved that 95.6% of teachers improved their skills in using new technologies, which met the training requirements [11].

An educational design was created where distance learning modules for doctors were interactive, convenient and forced students to think. Therefore, distance learning modules supported by contact sessions helped junior doctors to develop their knowledge and skills for effective practice in rural hospitals in India. Combining a mixed program helped them to improve patient care. In particular, students in the Fellowship in Secondary Hospital Medicine program recommend a change content of distance learning modules, to provide at the same time, an in-depth review of them, add new modules, such as a dermatology module; and use to evaluate questions with answer options, rather than essays, in order to improve the learning structure [4].

The staff of the Department of Biostatistics of the Faculty of Medicine of the Bursky University created a remote educational evaluation scale for its perception by medical students. The scale helped to identify the main methods for encouraging distance learning and their further impact on learning strategies [2].

According to an online survey on the Qualtrics platform, 87% of freshmen and 66% of graduate students believe that distance learning has reduced interaction with fellow students, as well as providing flexibility in time and place [12].

Regarding the study of the physiology of the cardiovascular system, the majority of students were satisfied with the recorded lectures, this affected their learning of this material. At the same time, it can be noted that a less positive perception of learning is associated with the type of distance learning methods or means. It has been determined that the transition to distance learning affects the academic performance and overall performance of each student. This is confirmed by research data, where 69.5% of students prefer visual study of the physiology of the cardiovascular system [8].

In a recent published study, Li Wen and colleagues noted that it was student completion of practical assignments, Internet accessibility during online learning, clarity of purpose and support for online course replay, self-study capability, adequate use of course resources, and proper administration of online courses that affected on satisfaction with online learning. The development and organization of online distance learning courses have proven to be effective for teachers. In addition, a good learning environment, satisfactory results of student quizzes and useful discussion tools ensured the expected organization of the learning process. It was revealed that the satisfaction of teachers with online learning, as well as the feeling of distance, quarantine and the seriousness of the situation, were affected by COVID-19, and the stressful load for online learning [9].

According to the results of the study, the teachers' internal motivation had an impact on the intention to continue online education. Its combination with related knowledge with technology integration, can reduce personal perceptions of difficulty in connection with online learning [14]. Most teachers noted symptoms of tension, restlessness, nervousness, difficulty falling asleep. Another important argument was the negative reactions to the use of technology, provoking professional burnout and technostress [15].

Conducted by us analysis of Aleksander Aristovnik research and his colleagues on the use of various forms of online lectures by students, proves that they were most satisfied with video conferencing in real time, then recording videos, sending presentations and written communication, and the least - by audio recording [10].

As for infrastructure, here three-quarters of the respondents had computers, these were mainly high school students, dominated by countries, for example, Oceania, North America, Europe. It had an effect on the activity of three elements of the pedagogical process – lectures, educational seminars and mentoring. On the other hand, students from undeveloped, remote ones and rural areas had problems with poor internet connection or lack of electricity, which had a negative effect on the effectiveness of online learning. At the global level, students from Oceania (59.8%), Europe (58.0%) and North America (54.7%) reported that their load increased or significantly increased, causing a feeling of negative emotions, and therefore a higher level of stress and anxiety. In particular, a decrease in workload was observed in Asia and Africa, probably due to insufficiently developed Internet network and absence of computer skills [10].

Almost half of the respondents didn't have a quiet place to study, and a third did not have regular access to printers; African, Asian and South American students reported about the lowest learning results. Studying isolated at home, students faced with a lack of self-discipline, an inappropriate learning environment, which caused a feeling of boredom, frustration, anger. But they also felt positive emotions: hope, joy and relief [10].

In the following study, it was considered that students prefer the asynchronous style of online learning because it provides the opportunity to learn at their own pace and complete coursework when they are ready. This affected the learning outcomes and ensured the convenience and timeliness of completing tasks. It was noted that access to pre-recorded lectures and course resources was

convenient and provided the ability to manage them according to one's own schedule. The majority of students (64.5%) noted that the transition to online classes increased their study load, primarily in the form of new tasks, which were added, including journaling, writing assignments, reflections, tests and discussions [13].

For the purpose of assessing the risk of bias of cohort studies and quality of case series bias and cross-sectional studies we used tools which characterize the selected studies. The presented tools helped to improve the quality systematic review reporting.

The screening process for cohort studies was performed according to the selected bias assessment tool. The included studies were found to be at low risk of bias, suggesting an excellent design of the original studies.

An overall assessment of the quality of bias of case-series and cross-sectional studies articulates the appropriate high-quality bias of study analysis and confirms their eligibility, which affected on synthesis and interpretation of results.

6. Recommendations for further practice

- introduce a mixed type of education among medical students to support clinical practice in hospitals with further reproduction of practical skills;
- to improve the monitoring of psycho-emotional states among students and teachers using the method consultancy;
- to increase self-discipline of students in the learning environment by providing appropriate infrastructure;
- implement full-fledged vacation, to avoid professional burnout and technostress.

7. Conclusions

1. Distance learning is an excellent tool for supporting the educational process in the conditions of a pandemic COVID-19. This mode of operation cannot completely replace traditional education, only has some advantages and serves as a proper aid in emergency situations.

2. Features of distance learning among students, postgraduates, bachelors and doctors testify about satisfaction and success in distance learning, skill development for effective practice in hospitals, convenient schedule of classes and flexibility of time and place. The most common factors that affect the quality of distance learning are an increase in the learning environment, causing a feeling of anxiety and stress, poor internet connection, lack of proper infrastructure.

3. Features of the design and organization of distance learning among teachers characterize the effective conduct of online classes, despite concerns about the adaptation of teaching and assessment, improving the skills to use new technologies. In general, it is noted which cognitive-affective factors in an unstable working environment provoked professional burnout and technostress.

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