



# Clinical Learning in Medical and Health Professions Education amid COVID-19 Pandemic: A Literature Review of Various Methods and Innovations

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## Abstract

**BACKGROUND:** COVID-19 has caused disruption to medical education and health care systems around the world. The highly contagious nature of the virus makes it difficult for educational institutions to continue their studies as usual, thus affecting the medical and health professions education which is based on face-to-face lectures, practicum, skills laboratories, and clinical practice in health facilities.

**AIM:** This paper discovers clinical learning initiatives across the globe and highlights the contribution toward educational processes.

**METHODOLOGY:** This study utilized an integrated literature review method. A systematic search for articles published was performed in Springer, ScienceDirect, PubMed, and EBSCOHost. Primary search monetary terms were e-learning (all synonyms) and health sciences education (all synonyms), including COVID-19. Articles published within the period of COVID-19 pandemic included in this study. For the synthesis, the 20 included studies selected were coded. In this study, data were synthesized through narrative synthesis using thematic analysis (TA). To identify the recurrent themes author followed six steps when synthesizing data using TA, for example, familiarizing with the data, developing initial (sub) codes, searching for (sub) themes, reviewing (sub) themes, compiling ideas or issues, and producing final data in line with the study aims and objectives.

**RESULTS:** Out of records identified, a total of citations was screened, of which 20 were found to be of relevance to this study most were quantitative (14.70%) in design. Studies were published in 2020 since the beginning of COVID-19 pandemic. The geographical range of papers covered mostly the moderate-income regions. On conducting TA of the included studies, it was possible to obtain two broad descriptive themes/categories: enablers or drivers of, and barriers or challenges to, under which important themes have emerged.

**CONCLUSION:** Study suggests that developing e-learning in effective clinical learning is needed, not only limited to moving the learning process but also needing to follow the instructional design, so that learning outcomes can be achieved by students. In addition, a learning process that promotes self-directed-learning is needed so that students have flexibility, use relevant learning styles and are able to integrate knowledge, skills and attitudes as a meaningful learning process.

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## Introduction

COVID-19 infection may lead patients to life-threatening events and pose such a great challenge to medical education. Lecturers and educators expected to provide safe learning activities while maintain integrity and continuity of the educational system. Limited health services because medical personnel focus on treating the COVID-19 patients, thereby eliminating the opportunity for instructors to provide supervision for students [1]. This limitation affects the clinical learning process of medical and health education students, even being unable to complete clinical rotations. Some institutions are temporarily suspending clinical learning [2].

Another challenge that arises due to the COVID-19 pandemic is students are possibly exposed

to the virus during the learning process, so that there is a risk of community transmissions [3], [4]. The local and national government as well as regional authorities provide recommendations for physical distancing and staying at home to keep the transmission curve below the limit [5]. Curriculum changes are demanding as it is expected to support students in their learning and evade prolonged study period due to the pandemic. To this date, various medical and health education institutions have shifted from face-to-face learning for students to online platforms [6]. For preclinical students, this learning model is suitable for traditional didactic contents and classical lectures. This is related to the efficiency of learning that can be done without physically visiting the campus. Although it requires behavioral adaptation and dramatically changes the learning process, this learning method is considered the most effective for pandemic situations. However, it

should be noted that too intense interaction using digital devices causes symptoms of both physical and mental fatigue [7], [8].

Medical education and health professions institutions have also suspended student placements and clinical observation activities in hospitals as well as primary and community health services [2], [9]. There are many effects of this action. On the one hand, students' competence in clinical skills may decrease because they no longer have access to patient or laboratory skills. Therefore, students need a rich training and considerable time after returning to the clinical setting to achieve the desired level of competence. In addition, students in medical education and clinical health are unable to complete certain research, attend conferences, make presentations or conduct other scientific activities because of the risk of virus transmission that may occur [3]. The above activities are very important for students in developing knowledge, skills and attitudes as well as specialization in the future. Missing learning opportunities at this time results in students' anxiety about career development and competence [10].

Evaluation of students' knowledge and skills is greatly affected by the pandemic in all medical and health professions institutions. A written exam is changed to an open book exam and the evaluation of clinical skills is adjusted to the availability of learning tools [11], [12]. Medical and health professions institutions were able to identify risks of decreasing exam quality. Extensive learning materials from online sources promote theoretical knowledge acquisition among the students. Various policy measures have been implemented, including online supervision of all forms of written exams. The presence of an online proctor can simulate a more traditional exam environment where students do not have access to external resources for answering questions [13], [14]. It encourages students to do thorough preparation in studying relevant theoretical contents during the exam.

Meanwhile, in order not to eliminate clinical skills evaluation, educational institutions have scheduled a postponement of skills exams until a safe circumstance. This can result in a greater academic burden among students as they are required to master and perform many clinical skills in a short period of time [15], [16]. Overcoming the constraints on practical assessments is more complex and these assessments will likely continue to be postponed until a face-to-face evaluation is permitted. Medical and health professions institutions should seriously provide adequate time and a safe environment for students to prepare for clinical evaluation.

On the other hand, at the final stage of academic studies, medical and health education students face problems due to delays in the Objective Structured Clinical Examination (OSCE). OSCE is still a reliable standard for skills assessment, meanwhile

the committee continues to work on establishing virtual practice exam standards [13]. It is possible that virtual clinical evaluations will continue until the COVID-19 pandemic subsides. This topic is still being discussed at the level of educational institutions and students related to the validity of the results of clinical skills testing in very different situations.

It is important to consider how clinical practice will be returned to the way it was. As the number of the COVID-19 cases decreases over time, the social distancing rules will gradually be eased. As students practice in various clinical facilities and move from region to region, policy differences may occur as local cases remain active [17]. Another consideration that becomes the focus of clinical learning is the limited availability of personal protective equipment (PPE) for medical personnel and students. It is important to ensure that both the clinical facilities ensure the availability of PPE for instructors and educational institutions facilitate the provision of PPE for students' protection [18].

Institutions and educators were facing challenges to preserve effective yet meaningful clinical rotation amid COVID-19 pandemic. Diverse approaches have been introduced, following learners' characteristics and resources availability. However, research focusing on the field of clinical learning remains limited. This paper discovered clinical learning initiatives across the globe and highlighted the contribution to educational processes.

## Methods

This study utilized an integrated literature review method. Author performs identification, appraisal, and synthesis toward evidence-based study findings to achieve the research purposes. Literature review is intended to cater information from evidence-based studies [19]. In this study, we collect original research articles to present novel innovations that being implemented for the learning in medical education and health professions amid COVID-19 pandemic. Databases in this study covers wide-range option that popular and also present extensive topic in medical and health education. Searching strategy and processes are being recorded during the literature search. In addition, validation of the identified article was performed to ensure publication relevancy and period.

Systematic search for articles was performed in Springer, ScienceDirect, PubMed, and EBSCOHost in 2020. The primary keywords were e-learning and health sciences education using. The searching included words as follow "e-learning" OR "online learn\*" OR "distance learning\*" OR "virtual learning" OR "flipped learning"; "medical student" OR "nursing student" OR "health student AND; "clinical education" OR "clinical rotation"

OR “workplace-based learning” OR “clerkship\*” AND “competence” OR “problem solving skills” OR “critical thinking” OR “clinical reasoning\*” AND COVID-19. Table 1 provides PICO strategy to frame the research questions.

**Table 1: PICO**

P	Health professions education: medical student, nursing student, resident, dentistry student, midwifery student
I	Blended learning, e-learning, virtual learning, flipped learning, flipped classroom, online learning (in clinical education)
C	-
O	Competencies: Problem solving skills, critical thinking, Clinical reasoning skills, Clinical judgment skills, clinical skill, Self-directed learning, learning motivation, self-efficacy, self confidence

The inclusion criteria of this study were: Articles published in 2020; written in English language; involving research participants/study population from health professions education; organizing clinical learning education and implementing a qualitative or quantitative research methods Paper with no full-text availability, review, case studies, commentaries, discussion papers, posters, conference abstracts, thesis and dissertations, as well as articles published in secondary, non-empirical studies or grey literature excluded from this study (Figure 1).

For the synthesis, the 20 articles were coded for the following information: (1) educational level, (2) health professions major/program, (3) research design, (4) learning methods/(e-learning variation), (5) learning outcome/variable, and (6) Study phase/learning process.

### Data analysis

Final search results were the basis of data analysis and synthesis. 20 articles, mostly quantitative were met the review criteria. Data synthesis performed through a narrative synthesis using a thematic analysis (TA). TA recognized as methods in identification, analysis and themes reporting among scientific literatures. Author of this study entitled to follow six steps TA data synthesis. The steps including data familiarization, initial codes development, sub themes definition, sub-themes review, topic/idea compilation and extraction of final results.

## Results

Out of 1557 identified records, by following the Prisma Flow Diagram 20 articles were included in this study. 14.70% of the articles were quantitative study and all of the identified records published in 2020 from the beginning of pandemic. TA performed on the identified records suggested two major themes: driving force of the learning and challenges experienced by the educators and students.

The results of the analysis of the 20 articles indicated that e-learning in the clinical education amid the pandemic situation is potential to support the learning process. E-learning offers flexible and accessible educational activities. Several articles reported that e-learning provides high quality learning opportunities even in complex situations, utilized at various levels of study programs in the health majors and facilitates the achievement of specific clinical learning objectives [14], [20], [21]. Detailed summary of the reviewed articles provided in Table 2.

## Discussion

The author identified 20 articles published in 2020 relevant to clinical learning amid the pandemic (Table 2). Articles dominated by studies from postgraduate program (resident and fellowship) with 13 articles. A total of 6 articles conducted studies on undergraduate student, either medical or nursing education. Only 1 article reported e-learning for health professionals' population within the field of neonatal nurse. Residency education dominates the proportion of published articles, followed by undergraduate program. It conveyed that clinical skills competency shall not be deprecated or reduced even in a crisis.

Some studies reported that COVID-19 pandemic causing significant reduction of learning opportunities in clinical environments. This is indicated by the closure of health facilities, the decreased number of patients, the elimination of rotation, to the absence of specific disease cases needed in the study [14], [22]. Despite clinical education persists, the main concern of universities is the safety of students. Previous studies reported that educational institutions were obliged to follow public health strategies in promoting safe environment and community well-being. As several universities lifted limitations and substantially returning to normal learning sessions; COVID testing, other health and safety measures continued in place to protect students and community [20], [23], [24].

Current challenges demand medical educators to find new ways in continuing meaningful education. Postponement of students' educational progression is not a viable option given for the future health workforce. Students are encouraged to complete their education in a timely manner which is beneficial for themselves and the community. In this case, medical and health professional program that requires patient encounter encouraged to implement innovative learning activities based on the organization culture and resources availability. Tailored learning activities provide extensive benefits for the institution by delivering high quality materials, expanding interest in certain fields and promote competent healthcare personnel in the future.

Table 2: Integrated review summary

Author	Participants	Research design	Variable/outcome	Learning phase	Learning methods	Mediums
Adesoye <i>et al.</i>	resident, general surgery	narrative/sharing	Patient Care, Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement, Systems-Based Practice	During	Didactic, clinical, non-clinical	Cisco WebEx
Calhoun, Kristine <i>et al.</i>	residents	Thoughts	learning quality over quantity	During	Virtual learning not necessary	Virtual modules
Chertoff <i>et al.</i>	residents	Explore	Faculty development, resident education and virtual teaching	During	Virtual session with remote desktop software	Zoom, TeamViewer
Chick, Robert Connor <i>et al.</i>	residents	maintain education and safety of residents, educators, and patients.	Medical knowledge, practice-based learning and improvement	During	Propose innovative solutions to maintain rigorous education.	Zoom, WebEx, Skype
Conroy <i>et al.</i>	psychiatry education	Curriculum development	Raise the profile of AAGP, with the goal of inspiring interest within geriatric psychiatry.	Post	A web-based geriatric psychiatry curriculum for psychiatry residents and other learners	
Cunningham, Colette <i>et al.</i>	neonatal nurse education	critical discussion	form the basis for the critical discussion of the term eHealth, and the association with neonatal nurse education	Pre	Easily accessible and user-friendly resources	
De Ponti, Roberto, <i>et al.</i>	6 <sup>th</sup> year medicine and surgery students	questionnaire	perception on fully online training including simulated clinical scenarios	During	Introduction, virtual patient-based training, and debriefing	Body Interact™ Online Platform
Dua <i>et al.</i>	postgraduate rheumatology	Action research	impacts on formal education programs, development and deployment of online teaching, reflect on the challenges and opportunities for technology-enabled learning	During	ViRL Collaborative, technology-based learning platform	Zoom, WebEx
Durfee <i>et al.</i>	Radiology clerkship	Action research	Student's performance and feedback	During	4-week virtual radiology clerkship	Zoom
Guraya	Undergraduate and Postgraduate Medical	Commentary	teaching pedagogies and assessment strategies of medical curricula	During	Seamless educational transformation	Zoom, Microsoft Teams, Blackboard, and ClickMeeting
Jumat, Muhammad Raihan <i>et al.</i>	Medical school	Cohort reporting	Team-based learning	During	Team LEAD Team-based Learning	Zoom
Kan <i>et al.</i>	Final year medical students	Action research	Case-based discussion	During	Online video conference platform, polling platforms, small group discussions, and the chat function	Zoom, Poll Everywhere
Konrad <i>et al.</i>	Nursing students	Commentary	Clinical competence	Pre	Online formats for nursing clinical course	Zoom
Pedregosa <i>et al.</i>	Academic partnership	Systematic review	Model for health education	During	Clinical practice ability and teaching effectiveness in better in partnership model. Students from the group in partnership had greater clinical practice ability after clinical experience compared with students in the traditional group.	
Pollom <i>et al.</i>	Clerkship	Action research	Radiation oncology	During	Virtual radiation oncology	Zoom, WebEx, Epic Systems
Ramos <i>et al.</i>	residency and fellowship in orthopedic and neurosurgery	Objective measurement	Pandemic effect on education and measures taken	During	online virtual meeting spaces	
Roytman and Shreena	radiology residents	Narrative	Communication, preparation, leadership, education, wellness	During	virtual video conferences, simulated education, portable home workstation	Zoom, VPN
Sneyd <i>et al.</i>	Postgraduate students in anesthesia	Sharing/ opinion	Service delivery, rotations effects, flexibility, innovations, digitalization	During	time for rotation	Video
Stambough <i>et al.</i>	fellow and residency in orthopedic	narrative		During	socially distanced tutorials, virtual platforms, video laryngoscope online surgical video databases, orthopedic video theatre plus, digital educational experience, cadaver, bone substitute simulation, virtual face-to-face discussion	Web-based platforms
Upadhyaya, Gaurav Kumar, <i>et al.</i>	orthopedic training	cross sectional survey	(i) Impact on PG teaching (ii) Impact on surgical training	During	Virtual classes and online video platform	Zoom, Cisco Webex, Microsoft Teams

The purpose of implementing e-learning in clinical education amid the pandemic was to safeguard the academic activities and allowing students to acquire knowledge and skills in accordance with the competency standards [22], [25]. In general e-learning would facilitate the mastery of clinical skills as part of a patient care process [15], [26]. Facilitating clinical education ultimately contribute to the achievement of student competence.

Several initiatives have been introduced by higher institutions such as virtual clerkships and online team-based learning [24]. The learning activities were carried out to engage students with clinical facilities.

In this regard, video conferencing was fundamental modality for students to stay connected with the clinical environment. Consumer software such as Zoom, Microsoft Teams, and Cisco WebEx were used by educational institutions. Characteristics and features that being considered in choosing the software including ease of use, bandwidth usage and integration functionality with academic systems [12].

In Wisconsin, medical students were invited to participate in novel learning opportunities that have been adapted for competency evaluation. A "night on call" virtual approach presented advantages to bridge learning gaps despite being considered lack of

sufficiency to meet clinical courses objectives [24]. At the orthopedic education, rising concerns in the learning process including fair amount of appropriate orthopedic education and sufficient exposure toward surgical opportunities. The American Board of Orthopedic Surgery increased away residency training from 4 to 6 weeks in fostering students' medical knowledge, interpersonal skills and communication skills, patient care, professionalism, systems-based practice and practice-based learning [27].

Author classified the articles based on clinical learning phases. The included phases were pre, during and post clinical learning. This review dominated by articles that focusing in the course of learning by 20 articles (86%). There were 2 articles in the pre phase and one article in the post clinical learning phase.

The articles in the pre phase focused on preparing educators, learners and learning resources. The activities at this phase including briefings, content development [28] and others [24]. Preparations established by creating relevant case vignettes and provision of learning media (videos, images and sounds) [15], [29].

The implementation phase of clinical learning associated with student's rotation in health facilities through e-learning. Activities organized in this phase were virtual case conferences, online focused group discussions, remote skills laboratory simulation and (virtual) bedside teaching and telehealth exercises [22], [23], [30], [31]. Educational institution takes advantage of learning management system (LMS) to distribute various learning resources. Many educational institutions implemented popular LMS, but there were also institutions that developed their own LMS.

The study discovered wide range of learning media and methodologies. The most common applied synchronous modality was live lecture with scheduled online video conferencing. Asynchronous learning was dominated by video contents to visually convey information among students to enable them to learn comprehensively. However, video playback did not allow real-time discussion. In more advanced level, institutions facilitated clinical simulation through the internet to enable direct interaction with instructors [13], [22]. A virtual clinical encounter was executed to response the suspension of clinical practice. This learning activity allows students to perform assessment, diagnosis, planning, implementation, and treatment evaluation remotely.

Virtual delivery of healthcare is another option that should be taken into consideration in facilitating clinical education. Telemedicine was neglected due to lack of regulation and scarce financial resources, but since amid pandemic, telehealth services were being delivered to outpatient clinics. The role of clinical instructors becomes ultimately important in this context. Instructors required to present information related to patient care [22], [26]. In the meantime, students expected to actively engage themselves in creating meaningful encounter with clinical instructors and patients [14], [25].

Disruption of the pandemic affected the assessment and exams in medical and health professions education. Standardized methods that remain in place to assess students' knowledge and competencies were multiple-choice questions, OSCE, logbooks and portfolio [28]. Maintain a high quality of assessment process is fundamental. Notwithstanding physical movement limitation, organize virtual assessment without physical attendance of students and examiners is feasible [3].

Corresponding to the recovery of medical education in post pandemic era, curriculum reform is required [28]. As students losing their practice opportunities due to limitation of attendance in a sense of COVID-19, the e-learning exist to bridge the gap. In the future, this could be an alternative for permanent curriculum modification especially for students with limited opportunities in their home programs. Nevertheless, it is essential to customize the learning activities based on student's characteristic and readiness of the resources. Continuous needs assessment in medical and health professional education favorable to produce competent graduates [20].

This integrated review has several limitations. First, the articles discovery related to e-learning in clinical education amid the pandemic carried out limited to five electronic databases. There was no gray literature searched by the author in the study phase, as it is possible that there are articles that not being included in the review. Second, this study did not contact the authors for validation purpose that led to the

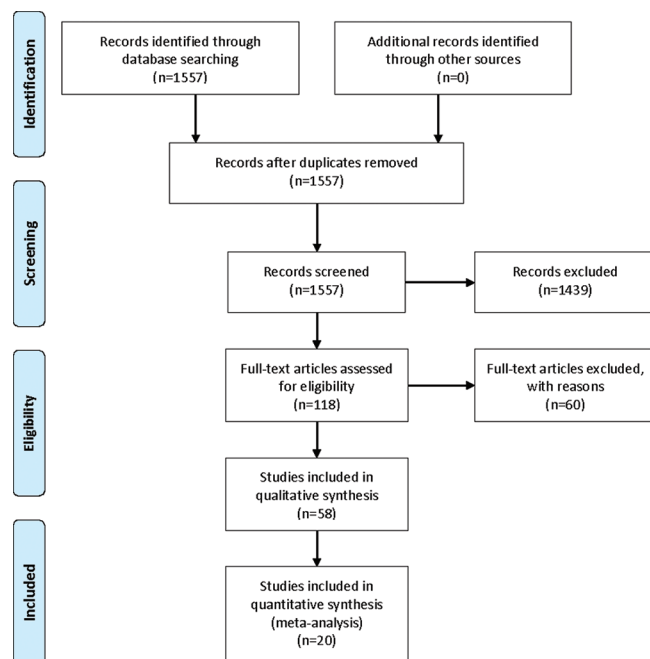


Figure 1: Prisma flow diagram

absence of additional information/data in avoiding bias. Third, this review had limited diversity of articles quality, study sample size and study population.

## Conclusion

This review discovered various forms of e-learning in medical and health professional education during COVID-19 pandemic and points out rarely studied areas. Study finding suggests that development of e-learning potential to enhance effective clinical learning. Transforming conventional learning into digital activities need to comply with instructional design in promoting the outcome achievement. In addition, a learning process that promotes self-directed learning is essential to provide flexibility for students in applying relevant learning styles to integrate knowledge, skills, and attitudes.

Institutional strategy is a key point in the implementation of e-learning in clinical education. Emerging disruption caused by COVID-19 demand institutions to adaptively response by developing flexible, accessible, and low-cost learning activities. Nevertheless, applied initiatives in the clinical education supposed not leave behind the goal to facilitate students in acquiring designated competencies. Integration of e-learning in traditional clinical education needed to ensure future development, despite the main idea of the implementation was to facilitate learning amid the pandemic.

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