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Strengthening medical education during the post-COVID-19 era for building an effective healthcare workforce: A narrative review

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ARTICLE INFO	ABSTRACT
	Coronavirus disease 2019 (COVID-19) has emerged by the end of 2019 and spread as pandemic on March 2020 worldwide. Subsequently, it has universally disturbed the medical education and health systems. It leads to lethal circumstances, which become encounters for medical education. Therefore, there is a need to ensure the integrity and firmness of the medical education process and safe lecture delivery. Also, it is essential to re-examine structuring the workforce capacity with the condition of the swiftly altering healthcare system globally and worldwide requirements. A narrative review was conducted to reveal the critical aspects of medical education that need to be reinforced during the post-COVID-19, focusing on building an effective healthcare workforce. It included and examined the relevant papers using search terms in PubMed and Web of Science. The COVID-19 pandemic crisis has unlocked a creative horizon in accepting an appropriate educational methodology to convey safe health professionals, with the human-centered ethical value of professional skill and expertise embedded with humane behavior. A direct, hands-on scientific practice should be sustained with the usual methods to develop graduates' skills and experience and ensure the quality of medical education. However, to combat the crisis of the COVID-19 pandemic, medical schools and other health profession education institutions globally must adjust their curriculum and educational strategies through innovative distant learning modes, including extended reality technology, e-learning tools, and simulation amenities. From experience gained through a pandemic, medical schools should perform best practices for a dynamic shift to blended learning and assessment. Moreover, medical educators should develop practical guidelines or protective actions to conduct clinical teaching without negotiating safety, health, and quality of medical education.

Keywords: healthcare workforce, medical education, medical schools, post-COVID-19 pandemic |

INTRODUCTION

Across the globe, the medical education and health systems experienced an unparalleled interruption due to the "coronavirus disease 2019 (COVID-19)" pandemic. The life-threatening conditions resulting from COVID-19 create potential challenges for medical education since the integrity and steadiness of the medical education process should be ensured, along with the safe delivery of lectures by the faculty members [1]. Such challenges caused restricted patient care resulting from the emphasis on COVID-19 confirmed cases, limiting the accessibility of bedside education for medical students [2]. Also, clinical training via clinical rotations has been postponed as the medical students may get infected by the virus during their training and spread it to the community [3,4]. As a result, students are instructed to stay at home and adhere to social distancing rules. Hence, there is a need to develop a curriculum for medical education that offers students chances for constant learning while also evading interruptions from the pandemic [5]. On the other hand, the healthcare workforce is the first line of defense to overcome the COVID-19 disease. The pandemic insisted on a profound impact on the health care delivery system and its workforce [6]. As a whole, the COVID-19 pandemic crisis 2020 brought the medical education provider and experts to square zero, i.e., what should we teach to our future generation of doctors to nurture them to be safe health care providers? [7]. Should we teach them how to preserve and maintain health or treat disease and care for illness and how to conduct and deliver our education? These questions were raised in the early days of the

20th century leading to the creation of the Flexner report in 1910 for North America Medical Education [8]. Other reports and declarations, including Edinburgh's declaration 1993 [9], Bologna Declaration 2004 [10], and the latest Association for Medical Education in Europe (AMEE) declaration.

These changes that occurred during the last century and within the first two decades of the third millennium were based on the changes in health, personal, and community needs. Accordingly, the infectious disease threats to the community were closed in the mid of the 20th century and replaced by the infectious disease threat to hospitalized patients and the increased number of non-communicable diseases due to lifestyle changes. The main reason for such an approach was based on improving public health since the discovery of the vaccine, antimicrobial therapy that includes antibiotics, antiviral and antiprotozoal, and nutrition improvement [11]. This question regarding what to teach; how to teach the future medical and health professionals during post-COVID-19 emphasizes the role of the environment, society, community, and individual in health, illness, and disease. So, the curriculum and educational strategies should be revisited concerning human beings' safety, protection, and wellness in their health, illnesses, and disease during all stages of their lives. In [12], it was reported that during the very aggressive war against COVID-19 and it was observed that the healthcare workforce, either in the hospital or community, was fighting at the same level of responsibility and the same risk level. Re-examination of building the workforce capacity with the rapidly changing healthcare system globally and internationally needs to be considered [13]. Hence, this study focused on revealing the critical aspects of medical education that need to be strengthened during the post-COVID-19, concentrating on creating an effective healthcare workforce.

METHODS

Search Strategy

This study involves a narrative review of the literature concerning the two key aspects: "COVID-19 and medical education" and "post-COVID-19 and medical education" using electronic databases such as PubMed and Web of Science. Scientific papers were selected based on the following inclusion criteria:

   i.   full-text original articles and reviews published between January 2020 and December 2021, and

   ii.   studies written in English.

In addition, few relevant studies satisfying the criteria were also from the reference sections of the identified papers. Besides, those papers other than original articles and reviews and those not written in English and not full-text were excluded.

Data Extraction

During the review, screening of publications was conducted in two phases. In the first phase, the authors independently screened the title and abstract of the included papers and classified them as either relevant or not relevant. Subsequently, in the second phase, all those relevant papers were only considered for examining their eligibility. The authors applied the inclusion and exclusion criteria to shortlist potentially eligible articles and extracted data from them. The
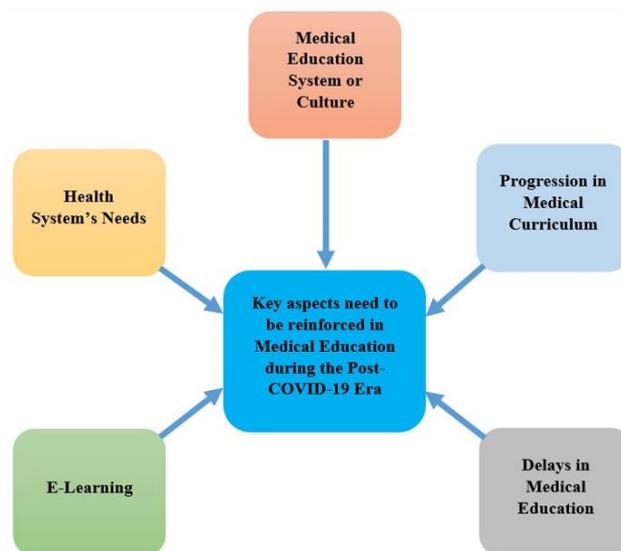

Figure 1. Key aspects of medical education to be strengthened during the post-COVID-19 era to create a better healthcare workforce

corresponding author independently checked any disputes, and a consensus was attained. Based on the extracted data following the screening process, five themes have emerged describing the critical aspects of medical education that need to be reinforced during the post-COVID-19 era for framing an effective healthcare workforce. Those five themes are, as follows (**Figure 1**):

1. the medical education system or culture,
2. the health system's needs,
3. e-learning,
4. progression in medical curriculum, and
5. delays in medical education.

KEY ASPECTS NEED TO BE REINFORCED IN MEDICAL EDUCATION DURING THE POST-COVID-19 ERA FOR BUILDING AN EFFECTIVE HEALTHCARE WORKFORCE

Medical Education System or Culture

Thibault [14] from Harvard medical school emphasized the importance of creating a culture for addressing the social determinant of health and a lifelong system. This attempt further extends to the learning environment by incorporating longitudinal integrated clinical experience. Such clinical experience facilitated insight into health determinants and created a sustainable learning environment that utilized all available resources. Those resources cover extended reality technology, big data, artificial intelligence, and others to build an integrated educational environment for all healthcare professions. Adapting such an educational system in Saudi Arabia will build a world-class healthcare workforce capable of creating a sustainable healthcare system, such as medical education and health profession education. Those should be based on two tiers presented in the Bologna Declaration 2004 [10]. The first tier is the interested students who will join the health workforce. Those students should have three years

associated diploma in biomedical science education. The second tier is the students who can pursue their studies in either science or health professional practice paths. The science path has an extra one year in biomedical science subjects to be granted a bachelor degree in biomedical science. While in the health professional practice path, students will choose one of the medical or health professional subjects, including the nursing profession, pharmacy profession, allied medical health professionals, and other health information and health administration profession. Such an approach requires creating a common vertical, horizontal learning electronic platform to facilitate, back up, and support the learning process and enhance the student's competitive differentiation and maturation processes to identify the achiever and talented student. This selection methodology will help the candidate select the health profession of his or her interest based on his personality traits, capabilities, and other criteria, including the labor market forces. This methodology will reduce the attrition of students, either early in their studies or after joining their professional carrier. Other factors, such as the demand and capacity of each profession, will be part of the country's human workforce plan of health [11].

Health System's Needs

As medical education and health profession education are entirely driven based on health system needs, a unique look at changes that happened during the COVID-19 war to the health system needs to be studied. In response to the universal public health encounter, academics and policy planners should jointly assess and progress the health systems and policy [15]. Other observations reported in the stress of health system were some health systems that failed to sustain that stress. The definitions of health systems resilience have been stretched to consider reducing exposure to shocks and finding actions dealing with further foreseeable and lasting system strains or stresses. Though policymakers experienced the acute daily stresses of administering a health system, the COVID-19 pandemic has alerted them to the significance of longer-term planning and preparedness. This alert emphasizes the prerequisite to better realizing the strengths and weaknesses of health systems and how to react resiliently to the crisis [16].

On the other hand, medical educators reacted locally and nationally to plan concerns and deliver administrative principles by which academic health systems could aid a solid public health response. Simultaneously, those educators confirm that the physician graduates are equipped to handle the present and upcoming threats to society's health. Numerous common themes have arisen though each school advanced its response differently [17]. Besides, healthcare professionals managing COVID-19 confirmed cases are at high risk of getting the viral infection and suffering stress, fear, trauma, and other mental health disorders [18]. Several countries have adopted extraordinary measures to aid the mental health of health workers, generally through helplines and remote counseling. Some nations (such as Denmark, Italy, Malta, Finland, etc.) offered remote counseling sittings with psychiatrists for managing COVID-19-associated stress, preventing burnout, and providing mental healthcare [19]. Hence, new strategies to deliver medical education and health professional education during such events or post-event should be considered part of the health system. In the future, medical education and health professional education should develop the necessary curriculum content and training programs to improve the ability of the future medical and other

healthcare professionals to overcome/manage the stress raised due to a crisis or disaster.

E-Learning

During COVID-19, the lockdown interrupted medical education and health profession education in most countries, including Saudi Arabia. The continuity was carried by distant learning (DL) modalities, such as e-learning tools, especially theoretical ones [20]. A recent study [21] also stated that the COVID-19 pandemic pressured medical schools universally to move to DL as an alternate method to warrant that the content delivered is acceptable for student development. The educators should realize that the DL is forced as a no-alternative solution during the COVID era; until now, it is a possible and existing alternative and will further exist following this era.

To operationalize that, there is a need to structure the curriculum and utilize educational strategies augmented by new distant learning modalities, such as extended reality technology, e-learning tools, and simulation facilities [22]. As such, simulation and extended reality "XR" technology were used to substitute direct clinical bedside technology in those universities with such tools [21]. The extended reality technology comprises "augmented reality (AR)," "mixed reality (MR)," and "virtual reality (VR)," which were practiced virtually and under distant supervision from the tutors [23]. An earlier study [24] stated that methods used for practical skills in cardiac surgery had mirrored a practical module using virtual patients and severe gaming, resulting in an improvement. It is known that virtual reality and online gaming are widespread and accustomed since they are available and playable.

Moreover, several observations during e-learning delivery in the institution were encountered, including that role and pedagogical framework in clinical teaching were not spelled out. E-learning technology's role was not yet fully developed in clinical teaching, and such modalities as "XR" need to have pedagogical frameworks, mainly if used in assessment, if available [25]. Even education and its impact on student knowledge and attitude, especially with electronic learning, is positively involved in such an experience [1].

Medical education and health profession education providers are not yet well-prepared to provide the education utilizing the high technology learning tools such as e-learning, cyperpatient, and extended reality "XR" Technology. This state was highly evident when a difficulty encountering practical competency because of incorporating the e-learning and extended reality technology within the assessment. It was not yet spelled clearly within the curriculum and educational strategies as there was no available plan for such a disaster. A study in Saudi Arabia observed that the faculty members demonstrated a positive attitude toward the application of e-learning. Compared to the pre-COVID-19 era, the application of e-learning among the faculty members was extremely augmented during the post-COVID-19 scenario. The majority were "enthusiastic" about and "confident" utilizing e-learning in teaching and learning. Until e-learning was not completely used as an alternative for practical training and evaluation. This situation urges promoting the preparedness and involvement among medical and health colleges for e-learning by settling a few specific infrastructural shortages. It is a suitable time for overwhelming blockades to "e-learning/teaching" as an integral teaching technique in medical and health colleges [26]. Furthermore, medical

schools might utilize this situation and frame a pulsating and comprehensive training structure to aid the students in attaining abilities and expertise in clinical skills during the pandemic [27]. In addition, recent studies stated that there is a need to organize the training programs for faculty members and students of medical schools in utilizing digital platforms during the pandemics [28, 29]. Besides, virtual learning could be powered in cardiovascular medicine and extensive medical education to offer comprehensive, active, and fair training for the present and next generation of physicians during and after the COVID-19 period because of different digital learning solutions, infrastructure requirements, and implementation of strategies improving participant engagement [30].

It was clear that the education system was neither well-prepared nor ready for such a disaster, where lockdown and other measures such as social distancing, wearing masks, and hand hygiene were imposed [25]. To combat that, educational institutions utilized e-learning as a primary tool to deliver theoretical knowledge as distant learning modalities for the time being. Accordingly, the theoretical part of the objective structure of clinical examination was tried in health sciences to test clinical skills performance and competence during the lockdown. However, for the practical part, the student should join the clinical practice directly in the community or hospital with maximum utilization of the available "XR" technology and simulation lab. The student should be attached according to the healthcare provided team and assigned to his/her profession, under the direct supervision of senior team staff of the team's profession as an apprentice. Student assessment, especially the clinical part, is still challenging; even some assessments can be easily converted to online [25]. Thus, both medical education and health profession education should build the capacity to create changes within the curriculum, educational strategies, and educational environment by incorporating e-learning, simulation, cyber patient, and extended reality technology laboratories to augment the learning outcome. Further, medical educators should use the pandemic experience and favor advanced thinking to execute best practices and stretchy methods in medical education worldwide for an active transition to online learning and evaluation [12].

Progression in Medical Curriculum

The COVID-19 pandemic may signify a lasting revolution in medicine with the progression of "telehealth," "adaptive research protocols," and "clinical trials" with stretchy methods to attain resolutions. Numerous instances exist whereby knowledge gained through complex experiences (e.g., response to disasters, the rise of HIV) altered science, discovery, and patient care. Educators and students can aid in recording and examining the impact of present variations to learn and implement recent principles and practices in the future. This period is not limited to the contribution to the progression of medical education in the framing of dynamic "curricular innovation and transformation"; however, it is perhaps a seminal moment for numerous medical disciplines [12].

Furthermore, teaching institutes have swiftly progressed to offer an "online curriculum" to best encounter their "student learners'" desires. As challenging evidence on virus epidemiology and personal protective equipment are highly existing, medical students are keen to get back to their education and serve as members of their healthcare crews.

Since the opportunities are obtainable for students, and their safety is protected, students should be greeted back to the responsibility of performing most-learn medicine. Definite policy changes regarding clinical care and the execution of a curriculum focusing on telemedicine would aid transition students securely returning to the bedside [20]. While reviewing the literature, a recent study stated that an inclusive online curriculum and assessment methods are necessary for preparedness over the post-COVID-19 time and such condition further needs the progression of adequate infrastructure and resources [31]. Another study stated that a fair percentage of online learning (20%-30%) should be incorporated into the medical curriculum, especially in the initial period of the course. It is necessary to offer the students the required knowledge and skills for positive online learning, boost interaction among them during online classes, and prepare students for upcoming crises. Also, training on evaluation tools in clinical clerkships such as virtual objective structured clinical examination, viva-voce, and patients is a prerequisite during the pandemic [32]. At the same time, it was stated that blended learning needs to be continued during the post-COVID-19 period with fair distribution of teaching hours to students at various academic levels [28]. Certain medical teachers also recommended that traditional and online virtual learning combinations be highly robust and sustainable in the long run [33]. Besides, COVID-19 adapted medical curriculum demonstrated that virtual workplaces and project-based teaching approaches could assist clerkship students in improving abilities and attaining significant workstation learning. It is recommended that the traditional clinical clerkships could be stretched to include other learning opportunities and clinical backgrounds such as telemedicine, public health, and quality improvement [34]. It was also stated that ophthalmology residents perceived telementoring, digital simulation, and webinars were useful [35]. Therefore, those learning tools should be sustained along with traditional teaching models during the post-pandemic era.

As the pandemic uncovered medical education and healthcare faults, medical educators should appraise the curriculum by the "bioscientific model of health" and expand the educational method by including the health elements (i.e., social, behavioral, and environmental aspects). The medical curriculum should comprise the core elements such as "scrutiny for illness," "contribution in injury and disease prevention, and disaster planning" [13].

On the other hand, medical schools are responsible for offering continuing education to their students during the COVID-19 pandemic. The continuance of teaching is vital to allow the graduation of future doctors into the community. The evidence recommends that virtual teaching is active, and institutes are engaged in creating these resources further to enhance student involvement and interactivity. Furthermore, medical teachers must choose a complete method for student education and focus on the mental effect of COVID-19 on students and enhance the safety and expertise of virtual platforms [23].

Delays in Medical Education

Medical education faced universal challenges due to the present COVID-19 pandemic. The current undergraduate medical education experienced a high academic risk due to the postponement of clinical rotations and several classes advanced towards the virtual platform. Past instances (i.e.,

"Hurricane Katrina" and the "SARS outbreak") have uncovered a basis for how medical education can sufficiently be accustomed during the crisis. Those instances also highlight the possibility of long-term influences on education, academic achievement, and residency claims. The current state requires flexibility on behalf of medical colleges, residency programs, students, and accrediting agencies. In addition, a sensible sight of how decisions would impact medical trainees is essential to confirm the fairness of education and appropriate training of learners during their residency training programs [3]. It was stated that the current pandemic had affected medical students and residency applicants in several ways [36]. Subsequently, medical students should be involved in the decision-making process related to further medical education and play a dynamic role since they are affected mainly by the sequel of decisions made [37]. Further, necessary actions must be executed to engage them in delivering support with minimal contact with affected cases. Perseverance and reacting positively to the constant variation in the current situation will show productivity for the students. Though adequate support and wise rules are anticipated from the policymakers to motivate them, several innovative thoughts are being discovered to evade hindering the steadiness of education and their medical profession, nevertheless, with unverified efficacy [36].

Additionally, lockdowns resulting from the COVID-19 crisis led to delays or cancellations in academic and professional medical exams. Such delays have stretched the graduation times and resulted at the beginning of postgraduate medical studies. This condition will also impact female medical students who might experience cultural burdens to drop out or students from low-income families who feel it hard to handle lengthy medical school stays. Such delays also affect the students' mental health [38]. It was stated that enabling medical students by offering them a complete medical education and good clinical practice for their profession could stop significant disturbance and postponements in clinical training [1]. Hence, to overcome such issues during and after the crisis, there is a need for a well-structured medical education system with pre-determined processes and procedures to avoid delays in lectures, exams, graduation times, and enrolling in postgraduate medical courses. At the same time, the quality of medical education should not be compromised at any cost.

CONCLUSION

This COVID-19 pandemic crisis has opened a new horizon in adopting a suitable educational methodology to bring safe health professionals, including doctors, nurses, and allied health professionals, with the humanistic ethical value of professional competence and professionalism embedded with altruistic behavior. For inculcating such graduate attributes, a direct, hands-on clinical experience should be continued with the standard methods to build their skills and experience as a part of the quality of medical education. Nevertheless, medical schools and other health science institutions worldwide must adapt their curriculum and educational strategies with new distant learning modalities, such as extended reality technology, e-learning tools, and simulation facilities, to compensate and overcome the crisis created by the COVID-19 pandemic. Moreover, based on the lessons learned from this pandemic experience, medical schools should execute best practices for an active transition to online learning and evaluation. Furthermore, it is suggested to continue blended learning during the post-COVID-19 era with a considerable percentage of online modes as traditional and online virtual learning combinations are considered highly robust and sustainable in the long run. Additionally, medical educators should frame the appropriate guidelines or precautionary measures to conduct clinical teaching activities without compromising medical education's safety, health, and quality.

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