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Kleanthis Konstantinidis, Ioannis Apostolakis

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REVIEW

PREPAREDNESS OF HEALTHCARE PROFESSIONALS TOWARDS A NEW CRISIS: A SHORT REVIEW OF EXPERIENCES, CHALLENGES AND LESSONS FROM THE COVID-19 PANDEMIC

Kleanthis Konstantinidis[1], Ioannis Apostolakis[2]

1. Radiographer, MSc, Department of Radiology & Medical Imaging, General Hospital of Attica KAT, Athens, Greece
2. Medical Informatics, PhD, School of Medicine, National & Kapodistrian University of Athens, Greece

Abstract

Background: The healthcare professionals have had to adapt their current practices and implement new strategies, to ensure a safe patient care environment during the COVID-19 pandemic. In addition, their training in the new conditions of the pandemic has been challenging.

Aim: The aim of this short review is to provide a brief record of the experiences and challenges faced by healthcare professionals and how these can constitute lessons for a new health crisis.

Method and Material: We conducted literature research in two electronic databases for the period from 2020 to 2022, using keywords. The collected material was classified based on the objectives set. A selection of literature sources was made, followed by a review with the creation of note cards.

Results: The review of the selected sources reveals challenges in the practice of healthcare professionals, the continuation of professional development and research activities, as well as the adoption of digital technologies and tools for communication, information and training. The lack of experience of healthcare professionals from a previous pandemic crisis and the delay in the digital transformation of healthcare are some of the obstacles, which can become lessons for the preparedness of the healthcare systems towards a new health crisis.

Conclusions: The findings highlight the essential role of a well-trained and well-informed healthcare workforce, to adequately face a health crisis. The analysis of these findings can contribute to the detection and identification of emerging needs of healthcare professionals, allowing policymakers to implement effective interventions for the continuing development of the workforce.

Keywords: Healthcare professionals, COVID-19, experiences, challenges, lessons.

Corresponding Author: Kleanthis Konstantinidis, 2 Nikis Str. Kifissia 14561, email: konstantinidiskleanthis@gmail.com

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INTRODUCTION

At the dawn of 2020, humanity was faced with the outbreak of a respiratory syndrome, which was caused by a novel coronavirus, the SARS-CoV-2 or COVID-19. Its rapid spread throughout the world forced the World Health Organization (WHO) to finally declare the event a pandemic on March 11, 2020.[1] As the humanity was in great shock, due to the rapid spread of the virus and the number of deaths it caused, so was the shock to healthcare systems globally, which were unprepared for the possibility of a pandemic crisis.

During the first waves of the pandemic, there was a number of countries around the globe, which showed positive signs of response to the pandemic, compared to others, which were recorded many human losses every day. However, this was a temporary situation, due to the early applied restrictions in human interactions and the suspension of economic and social activities. The prolonged suspension of the national economies and the lockdowns would finally have an expiration date, but also a great impact on the quality of the humans' lives.[2]

As a consequence of the pandemic, healthcare systems began to experience an unprecedented strain, as they had to treat more patients with COVID-19 infection. And as they were not prepared for this situation, the deficiencies in equipment, infrastructure, personal protective equipment (PPE) and workforce soon became apparent.

Healthcare Professionals (HCPs) are experiencing stress and fatigue, while trying to provide urgent and intensive care to the people in need, as well as assistance and expertise to other HCPs in need. In addition, they are trying to cope with home and professional life after the exhausting shifts.[3] The impact of fatigue, stress or a burnout on HCPs can cause a negative impact on their well-being, but also on patient care and the healthcare system.[4] There is a clear need for immediate action, to ensure the well-being and the continuation of professional development of HCPs. It is necessary to consider the obstacles, deficiencies and problems that have arisen and the emergency strategies that have been adopted as well, to constitute a legacy of knowledge for the preparedness of HCPs against a new health crisis.[5]

The purpose of this short review is to record the experiences and challenges that the HCPs have faced and continue to face since the start of the COVID-19 pandemic in practicing, training, being informed and up-to-dated. In addition, facilitators, opportunities and emerging training approaches are recorded.

METHOD AND MATERIAL

We performed literature search in the electronic databases PubMed and Wiley Online Library, to identify studies investigating the impact of the COVID-19 pandemic on HCPs for the period from 2020 to 2022. The keywords "healthcare professionals", "COVID-19", "experiences", "challenges" and "lessons" were used in various combinations. All the material collected was classified based on the sections of the review and the objectives set. A selection of articles in English language was made, followed by a review of these articles with the creation of note cards.

RESULTS

From the review of the literature findings, the following common themes emerged, regarding reported experiences, challenges, learning and training approaches during the pandemic period, as well as some facilitators and opportunities for implementing innovative methods for training and practicing during a health crisis.

Professionalism and leadership in the workplace

There are various reactions from the HCPs related to the pandemic. Some expressed a sense of preparedness and the willingness to contribute to a higher purpose, demonstrating adaptability, responsibility and professional pride. Conversely, others experienced insecurity and stress due to the novel coronavirus and lack of experience and skills in managing patients with COVID-19.[6] In addition to some policies applied to support the well-being of HCPs during the pandemic, the actions and behaviors of local and national leaders in implementing initiatives are of major importance and can make a real difference. An organization which does not interested in the staff's well-being can lead to the presence of mental and physical disorders among staff. Burnout have been shown to be related to patient safety and health outcomes.[7] A strong, effective and resilient leadership is required, to promote the development of an environment of psychological safety, open communication, honesty, freedom from regime of fear and ongoing training. By that, the

leadership of an organization will be able to support the workforce in the workplace.[8] Examples of confusing information disseminated from national, local leaders and scientists regarding the effectiveness of social distancing measures, the regularity of staff checking for infection and the supply, availability and management of PPE, impose a compelling need for a change in leadership culture within and between healthcare organizations.[9]

Information

Although the HCPs received instructions and guidelines for the management of COVID-19 patients from their institutions and scientific societies, there are also numerous literature and online sources, such as electronic articles and information in the Social Media and Mass Media. Nevertheless, there are cases, where there were no specific instructions for the management of COVID-19 patients. In these cases, the staff had to modify the general guidelines or even improvise, to manage COVID-19 patients, ensuring patients' safety. Such cases are imaging and interventional operations, where the patient must be transferred to the surgery, catheterization lab or imaging department from the COVID-19 care setting.[10] In addition, difficulties were also observed in the dissemination of information that the HCPs received, regarding guidelines. These difficulties had to do either with the lack of unbiased and timely information or with contradicting information from different sources.[11]

Deviations in the guidelines for the management of suspected and confirmed COVID-19 cases are observed, as well as in the methodology that each healthcare unit adopts, to control and prevent new infections between its patients and staff internationally and locally. Thus, different healthcare units use the instructions of experts in a different way and adopt different measures, even within the same health authority. In some cases, either a small number of hospitals had available guidelines for the possibility of an epidemic or pandemic before 2020, or the staff was not aware of the guidelines.[12] The different mission of each healthcare unit from the others, the availability of PPE and the infection control strategies are some of the most important factors, which have led to discrepancies in the implementation of guidelines.

Training culture within healthcare organizations

The role of healthcare organizations is crucial in the training of HCPs during and after the pandemic. The creation, retention and transfer of useful knowledge, teamwork, sharing of a common vision and values, effective communication and staff empowerment are key elements to successfully adopt a training culture of the staff within an organization.[13] Chronic deficiencies or organizational problems such as shortcomings of workforce, staff's disappointment for a system rewarding individual competence and excellence and additional staff shortages due to COVID-19 infection have reduced opportunities or have an inhibitory effect for front-line staff to be trained.[14]

Digital technologies to the fight against the COVID-19 pandemic

The restrictions on social gatherings were a major problem for the people during the first waves of the pandemic, causing serious mental disorders. The digital technologies for information and communication and the Internet became particularly important during that period, enabling HCPs to be updated and stay connected with their friends and family, at any time from any place.[15] In addition, these technologies facilitated the lifelong learning for the HCPs, since the on-site training activities were suspended. It is worth noting that the pandemic crisis highlighted and promoted the potential of the digital technologies and the Internet for remote learning and working.[16] Thus, a trend of the scientific community to transfer its collective activities to the Internet is observed. Scientific conferences, scientific publications and achievements, as well as possibilities for networking and finding experts and collaborators are communicated via the Internet. On the other hand, free online educational content has grown and will continue to improve as remote interaction between members of the scientific community increases.[17] The COVID-19 pandemic turned educators and academics to the use of digital technologies, to create online education resources for the support of clinical practice of front-line HCPs.[18]

Students on medical, nursing and allied health professions

The pandemic also found the sector of higher education unprepared. The traditional on-site training and learning methods of students in the medical, nursing and allied health professions were suspended, due to the restrictions on social gatherings and for the protection of students' health. The impact of the pandemic was a catalyst for the transition to a new normal. A series

of digital tools were suddenly employed, to facilitate synchronous or asynchronous e-learning. In the case of synchronous e-learning, digital tools such as Webex, Zoom and Google Meet have served as virtual classrooms, to aid the interaction between academics and students. On the other hand, learning management systems (LMS) such as Moodle, E-class and Blackboard have facilitated the asynchronous learning, providing academics and students with a series of facilities for communication, progress monitoring and educational content exchange.[19] This sudden transition to a new normal, however, caused some problems. There are several reports on the literature, where the unavailability of Internet access or equipment (e.g. personal computer) is recorded from academics or students, as the major barrier to the continuity of theoretical courses. In addition to this problem, the suspension of practical courses and clinical placements has created a gap in adequately linking theory to practice. The clinical trainers, on the other hand, have expressed doubts whether they can fulfill their role and provide qualitative training, due to the increased workload in healthcare settings and the shortage of staff.[20]

It is demonstrated by the international literature that e-learning tools are useful pedagogical tools and can be successfully applied in the learning process, either as part of blended learning or in fully remote learning, leading in improved participation and interaction of learners with instructors.[21] The integration of e-learning into the learning process must involve both instructors and learners in the creation of knowledge and must be implemented following prespecified institutional processes.[22] The sudden transition from traditional learning to e-learning due to the pandemic has led learners and instructors to confusion and problems, such as musculoskeletal disorders from prolonged screen use and mental disorders due to the isolation and lack of real-life interaction.[23]

Finally, the suspension of clinical placements delayed the acquirement of the necessary competencies and the graduation of students in medical, nursing and allied health professions.[24,25] Subsequently, the entry of new HCPs to the healthcare systems also delayed, prolonging the problem of understaffing. In some cases, students revised their choice for professional career, eventually withdrawing from their studies.[26] This choice had to do either with livelihood problems or their fear of getting infected.[27]

Telemedicine for remote practice and training

The World Health Organization (WHO) defines telemedicine as "the provision of healthcare services at a distance with communication conducted between healthcare providers seeking clinical guidance and support from other healthcare providers (provider-to-provider telemedicine) or conducted between remote healthcare users seeking health services and healthcare providers (client-to-provider telemedicine)".[28] In the past the use of telemedicine was limited to teleconsultation of patients in remote rural areas, who did not need immediate health care, as well as rudimentary and basic assistance to non-specialist doctors, who were examining patients in remote areas or on ships at sea. Now, it is also used as a training tool for students and HCPs.[29] The literature demonstrates that the use of telemedicine during the pandemic period is patchy, with a large proportion of HCPs, who adopted it, not being familiar with it. The challenges arising from the adoption of telemedicine concern the lack of interoperability with the infrastructure of the healthcare system, the lack of skills from patients or HCPs to use information and communication technologies (ICT) and privacy and data protection concerns.[30] Nevertheless, telemedicine has improved to some point remote access to services by increasing delivery of healthcare services and reducing healthcare costs. In addition, as a teaching tool it has facilitated the educational process, especially in developing countries, where front-line HCPs are few in number, and therefore the access of students and newly qualified HCPs in training clinical settings is limited.[31]

According to WHO, to support the growth of telemedicine, implementation of strategies and infrastructures are needed to ensure that HCPs and patients have the necessary tools to effectively engage in telemedicine.[28] At the same time, healthcare organizations will need to engage in advocacy to ensure that policies are supportive of telemedicine and develop systems to monitor the impact of telemedicine on patient outcomes, healthcare quality, costs and equity. A roadmap for the successful implementation of telehealth services and telemedicine includes a series of conditions, which must be met from planning

to successful integration, and engage all parties, the policymakers and planners, developers, providers and end users (Figure 1).

Simulation for training as response to the COVID-19 pandemic

In situ simulation was used to improve the preparedness of HCPs for the management of COVID-19 patients. As a training method in situ simulation allows team-based training during real-world scenarios and can be used for the detection of safety issues during the management of COVID-19 patients in the emergency department (ED) or during their hospitalization. In addition, this method can play a crucial role in facilitating hospital preparation and training of large numbers of HCPs during a health crisis. In-situ simulation provides hands-on experience, improves self-efficacy, self-confidence and psychological safety and promotes interprofessional training, collaboration and communication prior to real tasks. Some examples that in situ simulation could improve are the techniques of using PPE and transfer issues of COVID-19 patients from one area of the hospital to another, e.g. from the clinic or the Intensive Care Unit (ICU) to the computed tomography (CT) scan room.[32,33]

On the other hand, virtual simulation employs emerging virtual reality (VR) technologies, which can facilitate training in a safe and infection-free environment. Virtual simulation is not a new training method, as it has been used in medical education since the 1960s, when the first virtual system was introduced by Robert Mann for the training in orthopedics, with the wearable head-mounted display (HMD) introduced in the late 1980s for VR visualizations in medicine.[34] During the COVID-19 pandemic, the application of virtual simulation for the training of HCPs has expanded internationally. VR HMD with handheld controls, screen-based 3D environments and 360° videos have been employed for the immersion of trainees in a virtual environment, either for virtual hands-on training in managing infected patients and PPE or for virtual psychoeducation in managing stress and anxiety.[35,36] In addition, VR simulation can prepare students in medical, nursing and allied health professions, such as radiography and midwifery, for their clinical placements. Clinical placements are an important part of the training process, through which the students can effectively gain clinical experience and link theory to practice. VR simulation can have a beneficial effect in times of pandemic, enabling trainees to practice their skills in a safe environment before clinical placements.[37,38]

From the mentioned evidence, it is concluded that the response to a future crisis lies in the combination of both a change in the way of training and collaboration within organizations and the adoption of digital solutions and new training practices, both in higher education curricula and in continuing professional development, to facilitate timely and correct information, remote and flexible learning, interprofessional collaboration and sharing of good practice between different disciplines, groups and organizations. Ensuring the necessary number of HCPs for the management of a new crisis, as well as the ever-increasing demand for the provision of health services must be considered without a doubt the necessary condition for the effective transformation of the workforce towards this direction (Figure 2).

DISCUSSION

As the pandemic has imposed a new normal on preparedness and training of HCPs, realistic interventions in their undergraduate curricula and continuing professional development combined with innovative training methods can provide them with the necessary skills to face a new health crisis. The entry and rapid integration of newly qualified HCPs is a crucial issue for maintaining adequate staffing, as healthcare systems try to recover from the impact of the COVID-19 pandemic.

On the professional level, the pandemic has highlighted the imperative need for a sufficient and qualified healthcare workforce and has been a catalyst for digital transformation, accelerating the implementation and adoption of changes in public health interventions. Healthcare organizations and authorities must monitor the ever-changing environment and adapt effective training practices, fostering an internal culture of learning among their staff members. Barriers like stress, anxiety mental and physical disorders, fatigue and burnout must be overwhelmed with sufficient workforce, to successfully establish a continuing training mindset and ensure that everyone is adequately trained before a new health crisis.

At the academic level, the experiences recorded during the COVID-19 pandemic can be integrated to the curricula of students in medical, nursing and health professions, by introducing courses for infection control, implementation of new patient

management practices, well-being, interprofessional collaboration, interdisciplinary research, and effective leadership. The integration of digital technologies and telemedicine in the educational process of students must be continued and expanded, through a framework of preparation for successful engagement with online learning and working environments.

In this new normal, the application of telehealth services and telemedicine seems to develop an important role across countries of the European region of WHO.[39] According to a recent systematic review, the provision of telehealth services was found to significantly enhance patients' clinical outcomes, improve the long-term follow-up of patients by medical professionals and showed an overall benefit for both patients and HCPs. However, some countries have still way to go to benefit from these digital solutions, since barriers related to the insufficient digital skills and training, access to technology and availability of the necessary infrastructure for the users still remain a major concern.[40] In addition, operational and institutional issues like heavy workload and the lack of guidelines or a legal framework combined with workforce shortcomings substitute a major barrier for specialties of healthcare and medical professionals, who are already engaged with such technological advantages.[41]

In addition, digital training approaches can improve the competencies and satisfaction of HCPs and can be deployed to deliver education to remote areas, enabling lifelong learning and facilitating virtual practice communities among HCPs. However, the effectiveness depends on how these approaches are implemented. The choice of digital training delivery should reflect the learning needs of HCPs and availability of resources with a focus on scalability, sustainability and fidelity, rather than by the novelty of the interventions.[42]

Finally, the COVID-19 pandemic has illustrated that digital technologies can strengthen healthcare systems, guiding them towards the digital transformation of healthcare. The fast deployment of various digital solutions, such as the electronic registry of COVID-19 patients and e-prescription has helped the national healthcare authorities to detect and prevent the spread of the novel coronavirus. However, digital technologies only provide the necessary tools and cannot transform the healthcare systems automatically. Successful digital transformation in the healthcare sector is not just an issue of technical transformation but requires a fundamental change in individual and organizational attitudes and competencies, investments in technical infrastructure and continuing support and adaptiveness, as well as changes in the legal and financial frameworks of HCPs' practice.[43]

CONCLUSIONS

A large-scale health crisis can be a catalyst for changes in the way HCPs are educated and trained, but also highlights weaknesses in matters related to these activities. During the recent pandemic, changes such as e-learning, telemedicine and telehealth services were implemented suddenly and without prior experience. In many cases, these changes caused concers to HCPs, due to the urgency that arose, insufficient technological infrastructures to operate and support these changes, and a large volume of patients to manage. It is therefore understood that the pandemic with its weaknesses, barriers, and opportunities for a change should be a lesson for the preparedness of HCPs against the possibility of a new crisis. Also, a well-prepared workforce needs new technological tools to better manage a crisis, while the adoption of these tools premises a workforce, which possesses the appropriate competencies to successfully integrate them into daily practice. Finally, effective policy-making leadership is mandatory to support the HCPs and build their trust in the benefits of digital solutions for training and practice, to address the expertise and new competencies according to the needs opposed during the recent pandemic and adapt the legal and financial frameworks according to new or extended roles of HCPs.

REFERENCES

1. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. Acta Biomed Atenei Parm 2020;91(1):157–60. https://doi.org/10.23750/abm.v91i1.9397
2. Anastasiou E, Duquenne MN. First-Wave COVID-19 Pandemic in Greece: The Role of Demographic, Social, and Geographical Factors in Life Satisfaction during Lockdown. Soc Sci 2021;10(6):186. https://doi.org/10.3390/socsci10060186

3. Klug N, Butow PN, Burns M, Dhillon HM, Sundaresan P. Unmasking Anxiety: A Qualitative Investigation of Health Professionals; Perspectives of Mask Anxiety in Head and Neck Cancer. J Med Imaging Radiat Sci 2020;51(1):12–21 https://doi.org/10.1016/j.jmir.2019.09.009
4. Patel RS, Bachu R, Adikey A, Malik M, Shah M. Factors Related to Physician Burnout and Its Consequences: A Review. Behav Sci 2018;8(11):98. https://doi.org/10.3390/bs8110098
5. Moazzami B, Razavi-Khorasani N, Dooghaie Moghadam A, Farokhi E, Rezaei N. COVID-19 and telemedicine: Immediate action required for maintaining healthcare providers well-being. J Clin Virol 2020;126:104345. https://doi.org/10.1016/j.jcv.2020.104345
6. Mortensen CB, Zachodnik J, Caspersen SF, Geisler A. Healthcare professionals' experiences during the initial stage of the COVID-19 pandemic in the intensive care unit: A qualitative study. Intensive Crit Care Nurs 2022;68:103130. https://doi.org/10.1016/j.iccn.2021.103130
7. Hall LH, Johnson J, Watt I, Tsipa A, O'Connor DB. Healthcare Staff Wellbeing, Burnout, and Patient Safety: A Systematic Review. PLOS ONE 2016;11(7):e0159015. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0159015
8. O'Donovan R, Mcauliffe E. A systematic review of factors that enable psychological safety in healthcare teams. Int J Qual Health Care 2020;32(4):240–50. https://doi.org/10.1093/intqhc/mzaa025
9. Popic T. European health systems and COVID-19: Some early lessons. British Politics and Policy at LSE 2020. https://blogs.lse.ac.uk/politicsandpolicy/european-health-systems-and-covid-19/
10. Akudjedu TN, Lawal O, Sharma M, Elliott J, Stewart S, Gilleece T, et al. Impact of the COVID-19 pandemic on radiography practice: findings from a UK radiography workforce survey. BJR|Open 2020;2(1):20200023. https://doi.org/10.1259/bjro.20200023
11. Vázquez-Calatayud M, Regaira-Martínez E, Rumeu-Casares C, Paloma-Mora B, Esain A, Oroviogoicoechea C. Experiences of frontline nurse managers during the COVID-19: A qualitative study. J Nurs Manag 2022;30(1):79–89. https://doi.org/10.1111/jonm.13488
12. Martini C, Risoli C, Nicolò M, Tombolesi A, Negri J, Brazzo O, et al. COVID-19 outbreak impact on health professionals: A survey on the Italian radiographer experience. J Med Imaging Radiat Sci 2022;53(2):212–8. https://doi.org/10.1016/j.jmir.2022.02.006
13. Alonazi WB. Building learning organizational culture during COVID-19 outbreak: a national study. BMC Health Serv Res 2021;21(1):422. https://doi.org/10.1186/s12913-021-06454-9
14. Lyman B, Horton MK, Oman A. Organizational learning during COVID-19: A qualitative study of nurses' experiences. J Nurs Manag 2022;30(1):4–14. https://doi.org/10.1111/jonm.13452
15. Shah SGS, Nogueras D, Woerden HC van, Kiparoglou V. The COVID-19 Pandemic: A Pandemic of Lockdown Loneliness and the Role of Digital Technology. J Med Internet Res 2020;22(11):e22287. https://doi.org/10.2196/22287
16. Li C, Lalani F. The COVID-19 pandemic has changed education forever. This is how. World Economic Forum 2020. https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/
17. Konstantinidis K, Katsas I, Apostolakis I. Social Media as a Tool of Influence and Mentorship among Healthcare Professionals. Hell Health Serv Manag Assoc 2022;32(184):7–11
18. Hogg P, Holmes K. Rapid creation of a website to produce educational and clinical support resources for global use during and beyond the COVID-19 pandemic. Radiography 2022;28(S1):S3-S8. https://doi.org/10.1016/j.radi.2022.07.011

19. Wajid G, Gedik G. Impact of COVID-19 on health professionals' education in Eastern Mediterranean Region. East Mediterr Health J. 2022;28(7):506–14. https://doi.org/10.26719/emhj.22.062
20. Teo LW, Pang T, Ong YJ, Lai C. Coping with COVID-19: Perspectives of Student Radiographers. J Med Imaging Radiat Sci 2020;51(3):358–60. https://doi.org/10.1016/j.jmir.2020.05.004
21. Konstantinidis Kl, Apostolakis I, Karaiskos P. A narrative review of e-learning in professional education of healthcare professionals in medical imaging and radiation therapy. Radiography. 2022;28(2):565–70. https://doi.org/10.1016/j.radi.2021.12.002
22. Alhasan M, Al-Horani Q. Students' perspective on the online delivery of radiography & medical imaging program during COVID-19 pandemic. J Med Imaging Radiat Sci 2021;52(4):S68–77. https://doi.org/10.1016/j.jmir.2021.07.009
23. Al-Balas M, Al-Balas HI, Jaber HM, Obeidat K, Al-Balas H, Aborajooh EA, et al. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. BMC Med Educ 2020;20(1):341. https://doi.org/10.1186/s12909-020-02257-4
24. Tay YX, Sng LH, Chow HC, Zainuldin MR. Clinical placements for undergraduate diagnostic radiography students amidst the COVID-19 pandemic in Singapore: Preparation, challenges and strategies for safe resumption. J Med Imaging Radiat Sci 2020;51(4):560–6. https://doi.org/10.1016/j.jmir.2020.08.012
25. Cairney-Hill J, Edwards AE, Jaafar N, Gunganah K, Macavei VM, Khanji MY. Challenges and opportunities for undergraduate clinical teaching during and beyond the COVID-19 pandemic. J R Soc Med 2021;114(3):113–6. https://doi.org/10.1177/0141076820980714
26. Lawson Jones G, York H, Lawal O, Cherrill R, Mercer S, McCarthy Z. The experience of diagnostic radiography students during the early stages of the COVID-19 pandemic – a cross-sectional study. J Med Radiat Sci 2021;68(4):418–25. https://doi.org/10.1002/jmrs.544
27. Yang G, Wang L, Wang J, Geng Z, Liu H, Xu T. Career choice regret during COVID-19 among healthcare students and professionals in mainland China: a cross-sectional study. BMC Med Educ 2021;21:534. https://doi.org/10.1186/s12909-021-02972-6
28. World Health Organization. Implementing telemedicine services during COVID-19: guiding principles and considerations for a stepwise approach. WHO Regional Office for the Western Pacific 2020. Report No.: WPR/DSE/2020/032. https://apps.who.int/iris/handle/10665/336862
29. Gareev I, Gallyametdinov A, Beylerli O, Valitov E, Alyshov A, Pavlov V, et al. The opportunities and challenges of telemedicine during COVID-19 pandemic. Front Biosci-Elite 2021;13(2):291–8. https://doi.org/10.52586/E885
30. Elawady A, Khalil A, Assaf O, Toure S, Cassidy C. Telemedicine during COVID-19: a survey of Health Care Professionals perceptions. Monaldi Arch Chest Dis 2020;90(4). https://doi.org/10.4081/monaldi.2020.1528
31. Sharma D, Bhaskar S. Addressing the Covid-19 Burden on Medical Education and Training: The Role of Telemedicine and Tele-Education During and Beyond the Pandemic. Frontiers in Public Health 2020;8. https://doi.org/10.3389/fpubh.2020.589669
32. Aljahany M, Alassaf W, Alibrahim AA, Kentab O, Alotaibi A, Alresseeni A, et al. Use of In Situ Simulation to Improve Emergency Department Readiness for the COVID-19 Pandemic. Prehospital and Disaster Medicine 202;36(1):6–13. https://doi.org/10.1017/s1049023x2000134x
33. Juelsgaard J, Løfgren B, Toxvig N, Eriksen GV, Ebdrup L, Jensen RD. Healthcare professionals' experience of using in situ simulation training in preparation for the COVID-19 pandemic: a qualitative focus group study from a Danish hospital. BMJ Open 2022;12(1):e056599. https://doi.org/10.1136/bmjopen-2021-056599

34. Pantelidis P, Chorti A, Papagiouvanni I, Paparoidamis G, Drosos C, Panagiotakopoulos T, et al. Virtual and Augmented Reality in Medical Education. Medical and Surgical Education - Past, Present and Future. IntechOpen;2017
35. Pallavicini F, Orena E, di Santo S, Greci L, Caragnano C, Ranieri P, et al. A virtual reality home-based training for the management of stress and anxiety among healthcare workers during the COVID-19 pandemic: study protocol for a randomized controlled trial. Trials 2022;23(1):451. https://doi.org/10.1186/s13063-022-06337-2
36. Buyego P, Katwesigye E, Kebirungi G, Nsubuga M, Nakyejwe S, Cruz P, et al. Feasibility of virtual reality-based training for optimising COVID-19 case handling in Uganda. BMC Medical Education 2022 13;22(1):274. https://doi.org/10.1186/s12909-022-03294-x
37. De Ponti R, Marazzato J, Maresca AM, Rovera F, Carcano G, Ferrario MM. Pre-graduation medical training including virtual reality during COVID-19 pandemic: a report on students' perception. BMC Med Educ 2020;20(1):332. https://doi.org/10.1186/s12909-020-02245-8
38. Hayre CM, Kilgour A. Diagnostic radiography education amidst the COVID-19 pandemic: Current and future use of virtual reality (VR). J Med Imaging Radiat Sci 2021;52(4S):S20–3. https://doi.org/10.1016/j.jmir.2021.09.009
39. WHO. Telemedicine has clear benefits for patients in European countries, new study shows. https://www.who.int/europe/news/item/31-10-2022-telemedicine-has-clear-benefits-for-patients-in-european-countries--new-study-shows
40. Saigí-Rubió F, Nascimento IJB do, Robles N, Ivanovska K, Katz C, Azzopardi-Muscat N, et al. The Current Status of Telemedicine Technology Use Across the World Health Organization European Region: An Overview of Systematic Reviews. Journal of Medical Internet Research 2022;24(10):e40877. https://doi.org/10.2196/40877
41. Raposo VL. Telemedicine: The legal framework (or the lack of it) in Europe. GMS Health Technol Assess 2016;12:Doc03. https://doi.org/10.3205/hta000126
42. WHO. Digital education for building health workforce capacity. WHO 2020. https://www.who.int/publications-detail-redirect/9789240000476
43. Socha-Dietrich K. Empowering the health workforce to make the most of the digital revolution. OECD Health Working Papers No 129 2021. https://doi.org/10.1787/37ff0eaa-en

ANNEX

Figure 1. A roadmap for telehealth/telemedicine implementation.

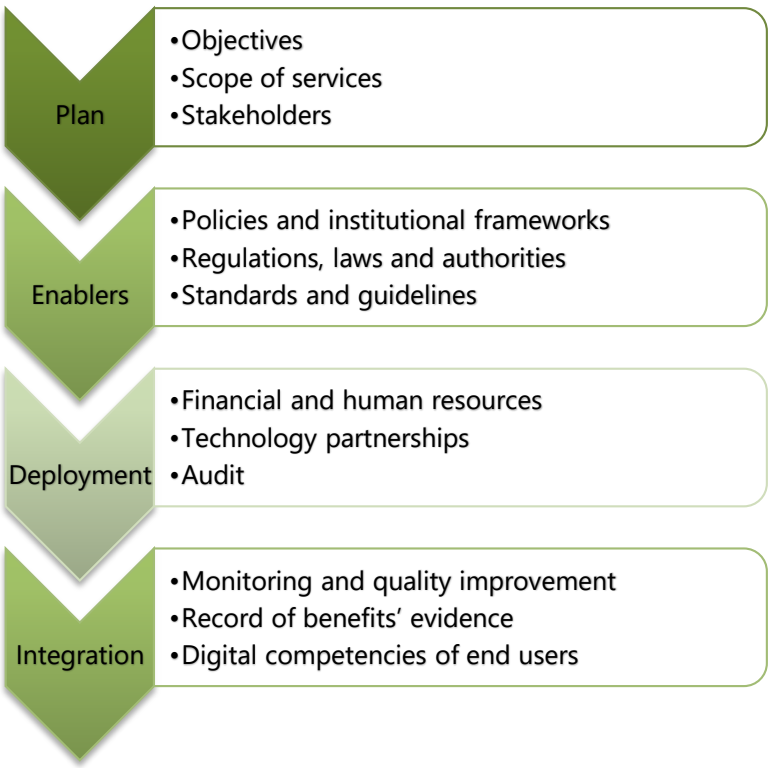

Figure 2. The necessary components for effective responce to a health crisis.