Special Collection on Covid-19 – Review Article

DIGITAL HEALTH

Digital Health
Volume 7: 1–19

DOI: 10.1177/20552076211009396
journals.sagepub.com/home/dhj
SAGE

The role of eHealth, telehealth, and telemedicine for chronic disease patients during COVID-19 pandemic: A rapid systematic review

Hind Bitar[1] and Sarah Alismail[2]

Abstract

Objective: To summarize the current status of, and the current expert opinions, recommendation and evidence associated with the use and implementation of electronic health (eHealth), telemedicine, and/or telehealth to provide healthcare services for chronic disease patients during the COVID-19 pandemic.

Materials and methods: We searched four electronic databases (PubMed, Google Scholar, Science Direct, and Web of Science Core Collection) to identify relevant articles published between 2019 and 2020. Searches were restricted to English language articles only. Two independent reviewers screened the titles, abstracts, and keywords for relevance. The potential eligible articles, papers with no abstract, and those that fall into the uncertain category were read in full text independently. The reviewers met and discussed which articles to include in the final review and reached a consensus.

Results: We identified 51 articles of which 25 articles met the inclusion criteria. All included articles indicated the promising potential of eHealth, telehealth, and/or telemedicine solutions in delivering healthcare services to patients living with chronic diseases/conditions during the COVID-19 pandemic. We synthesized the main findings into ten usages and eight recommendations concerning the different activities for delivering healthcare services remotely for those living with chronic diseases/conditions in the era of COVID-19.

Discussion and conclusions: There is limited evidence available about the effectiveness of such solutions. Further research is required during this pandemic to improve the credibility of evidence on telemedicine, telehealth, and/or eHealth-related outcomes for those living with chronic diseases.

Keywords

Chronic, eHealth, telehealth, telemedicine, technology

Submission date: 22 August 2020; Acceptance date: 20 March 2021

Introduction

The novel coronavirus (COVID-19) outbreak firstly appeared in Wuhan, China in December 2019, and has been spreading globally to the extent that it met the epidemiological criteria of being a pandemic.[1,2] On March 11, 2020, the World Health Organization (WHO) declared that coronavirus disease (COVID-19) becomes a pandemic.[2]

As of May 27, 2020, 216 countries had reported 5,596,550 confirmed cases and 353,373 confirmed fatalities.[3] The COVID-19 is primarily transmitted via the human-to-human route through close contact and respiratory droplets. This has disrupted the way health care services are delivered and prioritized the urgency of preventing community transmission.[1]

[1]Department of Information Systems, King Abdulaziz University, Jeddah, Saudi Arabia
[2]Center for Information Systems & Technology, Claremont Graduate University, Claremont, USA

Corresponding author:
Hind Bitar, Department of Information Systems, King Abdulaziz University, Al Ehtifalat St, Jeddah 21589, Saudi Arabia.
Email: hbitar@kau.edu.sa

Patients with chronic disease conditions, such as patients living with diabetes and/or heart condition, may be vulnerable to the COVID-19 pandemic, which means that they are a high-risk population.[4] In response to the existential health threat of a global pandemic, social distancing is a key factor to slow the spread of COVID-19, with the result that medical visits have been changed from in-person to remote medical appointments. Thus, electronic health (eHealth), telehealth, and/or telemedicine technologies are ideal ways to adopt in this era of communicable disease. The advantages of using such technologies in the face of disasters and pandemic situations have been well documented.[5,6]

Researchers have published numerous articles on the role of eHealth, telehealth, and/or telemedicine in delivering healthcare services to patients with chronic diseases/conditions during the COVID-19 pandemic. Yet, due to the developing nature of the crisis, policymakers, researchers, and/or practitioners among others urgently need a synthesis of evidence to help in producing policies, decisions, and/or guidance practices in the delivery of healthcare services for patients with chronic diseases. This calls for the need to conduct a rapid systematic review of recent articles to elucidate the status of evidence regarding the role of eHealth, telehealth, and/or telemedicine technologies in managing patients with chronic diseases/conditions during the COVID-19 pandemic.

To continue providing chronic disease patients with the healthcare services needed during the COVID-19 pandemic, this rapid systematic review aimed to: 1) summarize the current status of the usage and implementation of eHealth, telemedicine, and/or telehealth; 2) summarize the current expert opinions, recommendations, and/or evidence associated with the usage and implementation of eHealth, telemedicine, and/or telehealth technologies for those patients.

Background

eHealth, telehealth, and telemedicine

According to the World Health Organization (WHO), eHealth refers to "cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research".[7] Therefore, eHealth includes all types of information and communication technology (ICT), for example, apps and websites for health promotion, screening, assessment, and therapists' video-chat sessions.[8] Recently, there has been a huge use of these technologies across the world since there are many positive effects of the usage of eHealth, such as reducing costs and replacing face-to-face healthcare contacts and communications.[8]

According to the health resource services administration (HRSA), telehealth refers to "the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration".[9] Researchers sometimes use the terms telemedicine and telehealth interchangeably.[10] However, there is a slight difference between these two terms. Telehealth is a broader term than telemedicine in that it can denote both remote non-clinical services (such as administrative meetings) and remote clinical services. The term telemedicine, in contrast, is limited to remote clinical services only.[9]

Materials and methods

We employed a rapid systematic review methodology to provide the best available evidence within a shortened period[11] to synthesize and communicate the role of eHealth, telehealth, and/or telemedicine in delivering healthcare services to chronic disease patients during the COVID-19 pandemic. Rapid systematic reviews refers to "a form of knowledge synthesis that accelerates the process of conducting a traditional sysmatic review through streamlining or omitting a variety of methods to produce evidence in a resource-efficient manner"[12] (p.80). In this rapid review, we followed streamlined classic systematic review methods to synthesize evidence in a timely manner to inform decision makers in making emergent decisions in healthcare settings.[13] Since this is a rapid systematic review and due to the urgent nature of the pandemic and time constraints, this review was not registered on PROSPERO.

Search strategy and eligibility criteria

The literature search was conducted on April 20, 2020, and again on May 15, 2020. We conducted an electronic search using four electronic bibliographic databases: PubMed, Google Scholar, Science Direct, and Web of Science Core Collection to identify relevant articles. Searches were restricted to English language articles only. The keywords that were employed include: "eHealth," OR "telemedicine," OR "telehealth," AND "COVID-19," OR "coronavirus," AND "chronic disease."

Results obtained from the electronic search were downloaded into EndNote bibliographic software version X8 (Thomson Reuters, Philadelphia, USA). Inclusion criteria were as follows: articles were required to 1) focus on any chronic disease or condition; 2) be related to the COVID-19 pandemic; 3) focus on the use of eHealth, telemedicine, and/or telehealth; and 4) have

been completed between December 1, 2019 and May 15, 2020. Because of the evolving nature of the pandemic and the lack of an available number of experimental and complete studies, we included all articles that met the indiscriminate inclusion criteria regardless of the study design, such as preprint articles, commentary, and opinion papers.

Selection of articles for reviews

Initial screening for articles was performed by two independent reviewers (HB and SA) based on titles, abstracts, and keywords for relevance. The selected articles were based on the information obtained from the title, abstract, and keywords to see if the predefined inclusion criteria were met. Papers with no abstract available were added to a full-text review. We categorized articles into three categories: eligible, not eligible, and uncertain. To confirm eligibility, the potential eligible articles, papers with no available abstract, and those falling into the uncertain category were read in full text independently. Then, the reviewers met and discussed which articles to include in the final review and reached a consensus.

Data extraction

Data were extracted from the included articles on: author's name, publication year, paper type, country of the study, population and/or chronic disease, type of technology, current status of the use of eHealth, telemedicine, and/or telehealth, and outcomes (expert opinions, recommendation and/or evidence associated with the use of eHealth, telemedicine, and/or telehealth technologies).

Results

Overview

The majority of the included articles were reviews and experts' opinions; thus, the quality of evidence was not assessed due to the absence of included trails. Of the 51 retrieved articles, 25 met the inclusion criteria. Figure 1

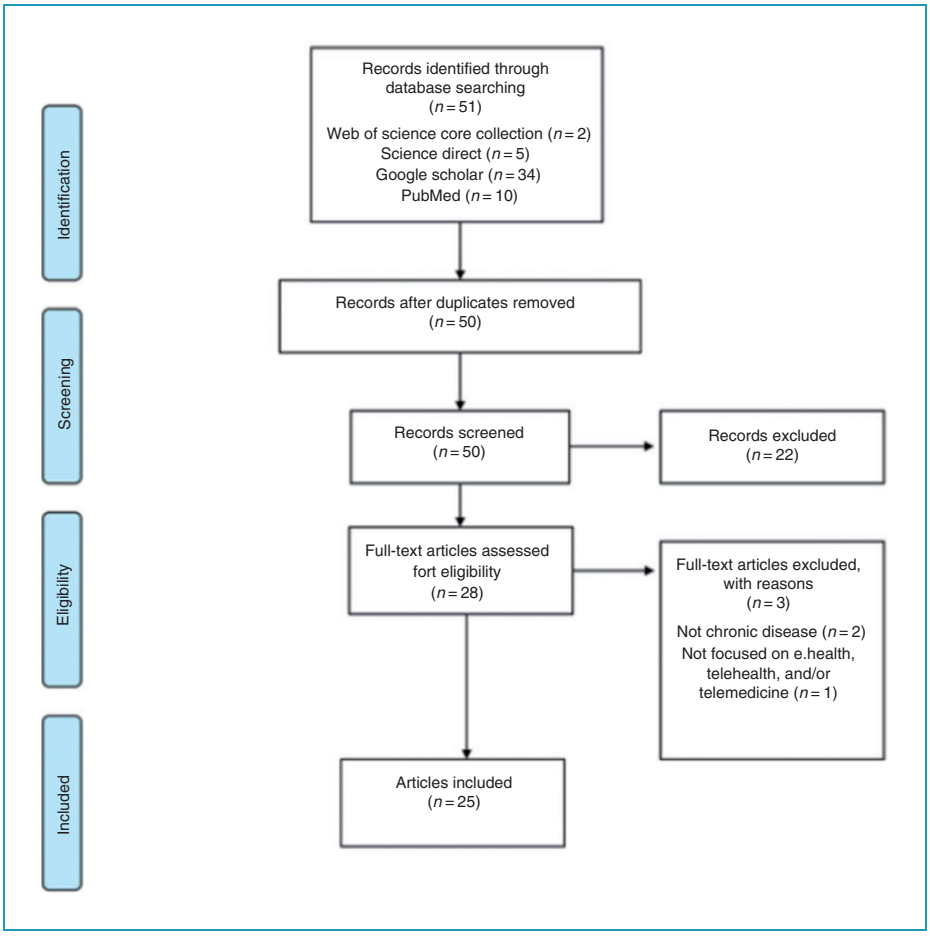

Figure 1. Selection process using PRISMA flow diagram.

illustrates the selection process using the PRISMA flow diagram.

Most of the articles used the term telemedicine (n = 17; 68%) to describe the used technology or recommended to use in providing healthcare services needed for chronic disease patients.[14–30] Fifteen articles used the term telehealth (53.8%),[15–17,27–38] while two articles used the term eHealth (7.7%).[18,32] However, some of these articles used more than one term (e.g.,[17]).

The settings included the United States,[16,17,20,30,31,34,37,38] Western China,[25] developing countries,[21] Europe,[14,15,18] Australia,[32] Canada,[18] Mexico,[18] and Asia.[18] Twelves articles had no defined setting.[19,22–24,26–29,33,35,36,38] Six articles focused on cardiovascular disease (CVD),[15,28,30,32,33,36] two on cancer,[17,18] two on chronic orthopedic conditions,[31,38] two on chronic neurological disorders,[20,27] one on chronic pain,[19] one on cystic fibrosis,[16] one on urologic chronic conditions,[22] one on mental health disorders,[34] one on chronic diseases requiring occupational therapy,[29] one on allergies, asthma, and immunodeficiency,[23] two on cirrhosis and chronic liver diseases,[24,35] one on diabetes,[26] and one on high-risk pregnancies.[37] Three articles focused on chronic diseases in general.[14,21,25]

The types of paper were varied including six review paper,[22,23,28,32,35,37] three articles,[13,14,36] four expert opinions,[18,19,27,34] two viewpoints,[24,26] one brief correspondence,[21] one commentary,[33] one position statement,[31] one feasibility study,[15] one perspective, opinion, and commentary,[20] one clinical practice statement,[29] one research letter,[16] one short survey,[17] one quantitative study,[30] and one mini review.[25]

Tables 1 to 3 detail the current status of the use and implementation of eHealth, telemedicine, and/or telehealth technologies to manage chronic disease patients during the COVID-19 pandemic as well as the main findings and/or recommendations regarding the use of eHealth, telemedicine, and/or telehealth technologies in providing care to patients living with chronic disease/condition during the pandemic.

The current status of eHealth, telemedicine, and/or telehealth solutions

Most of the included papers used eHealth, telemedicine, and/or telehealth to provide a healthcare services for chronic disease patients during COVID-19 crisis. We summarized these services into six usages of eHealth, telemedicine, and/or telehealth as reported in the included articles (see Figure 2). The following items outline the usages of such technological solutions, which are: follow-up visits, training, consultations, medications, communication, and caregiver support. The majority of the included articles reported that they use such technological solutions as a medium vehicle to consult their patients[18,20,28,32,34,37,38] using videoconferencing or telephone. Five articles reported the use of virtual visits for patient's follow-up appointments;[17,18,34,37,38] three stated the use of virtual communication tools (e.g., chatbot) to communicate health information,[23,28,38] and one noted the utilization of video calls to help provide caregiver support virtually;[18] two referenced the importance of ensuring access to medications as well as tracking the prescription of medication electronically.[18,32]

Two articles reported the importance of using such technological solutions for training purposes for both healthcare providers and patients.[37,38] For instance, training patients on how to use a home blood pressure cuff become important for pregnant women with hypertensive disorders receiving telehealth care; thus, such training can facilitate the provision of virtual prenatal care.[37] Furthermore, one reported the use of virtual reality to provide surgical training for surgeons as well as to remotely deliver physical activity sessions to patients at home.[38]

The top recommendations of eHealth, telemedicine, and/or telehealth solutions

We synthesized the main findings of this rapid review into eight recommendations in accordance with the remote healthcare delivery life cycle for chronic disease patients during the pandemic (see Figure 3). The remote healthcare delivery life cycle consists of three stages: pre-, during, and post- medical visits, for which each has a set of activities. Pre-medical visits refer to the period before patients with chronic diseases visit the clinic or the building phase of the telemedicine, telehealth, or eHealth system. The stage during medical visits refers to the time when healthcare professionals use this technology to deliver healthcare services to patients. Lastly, post-medical visits are defined as the period after the patients' visit and take into account the services that this technology has provided. There can be an overlap between these stages, and some activities can take place in multiple stages. The activities of this technology are as follows: 1) system integration, 2) remote outpatient care, 3) billing reimbursement, 4) continuity of care, 5) standardized transition process, 6) cost-effectiveness, 7) simplicity, and 8) privacy and data sharing.

Most of the included articles concentrated on the provision of continuity of care due to the nature of the diseases and conditions that were examined in this research.[14,15,17,19–22,26–28,30–34,37] Ten articles recommended focusing on remote outpatient care activity;[17,23,24,28,32,33,35–38] four of the included research articles reported system integration,[13,15,32,33] three articles stated the standardized transition

Table 1. Included opinion based on current observation articles.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
Omboni[14]	Article	Italy	• Italy missed the opportunity to have telemedicine to serve lockdown chronic disease patients during the COVID-19 pandemic. Several reasons are reported, such as a lack of integration with the national health systems and health records, and limited diffusion and availability of large-scale telemedicine solutions.	• The COVID-19 epidemic should promote a transition to a more modern model of care (full integration of telemedicine services in the armamentarium of healthcare services). • Telemedicine should be considered a proactive way to secure continuity of care for patients with chronic conditions during national emergencies.	Chronic diseases in general	Telemedicine (not specified)
Kadir[21]	Perspective, opinion, and commentary	Developing countries	• In developing countries, the public is unaware of telemedicine and its practical benefits.	• There is a need for a large-scale implementation of telemedicine to increase public awareness of it and its benefits.	Chronic diseases in general	Telemedicine (video conversation, integrated diagnostic devices; artificial intelligence, and computer-aided diagnosis)
Khera et al.[30]	Clinical practice statement	United States	• The COVID-19 situation varies across states, regions, and cities in terms of strain on and capacity of the healthcare system, local populations' socio-demographics, and number of cases and severity.	• Instead of delaying or deferring visits, telehealth visits are strongly preferred for continuity of patients' visits.	Patients with and at high risk for cardiovascular disease.	Telehealth; telemedicine (virtually visit-audio; video)
Lewis et al.[17]	Research letter	United States	• Implementing telehealth network with more than 300 sites and 60,000 patients a year. • More than 200 patients'	• Telemedicine services for radiation oncology is an efficient and cost-effective method for long-	Radiation oncology	Telemedicine; telehealth (telemedicine software and equipment

(continued)

Table 1. Continued.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
			interactions occur for radiation oncology services using telemedicine one year.	term patient follow-ups, especially for patients living in underserved areas.		consists of webcams, monitors, speakers, and liquid crystal display)
Desideri et al.[18]	Short survey	Europe, Asia, Canada, and Mexico	• The COVID-19 pandemic has led to changes in geriatric oncologists' methods of providing care to older patients with cancer. Italy: • Using phone to deliver systemic treatments to patients. UK: • Encouraging use of the phone in consultations. Netherlands: • Developed guidelines, but not published yet. This guideline advises the use of telemedicine in contacting patients. Germany: • Using telehealth/telephone in consultations. Denmark: • Using telemedicine in assessments and follow-up visits. Spain: • Using telephone or videoconference as much as possible in medical visits. Hong Kong: • Using eHealth to get the needed medication. • Caregivers support patients by using video calls.	• Each country and setting has its own issues, but all face similar challenges in delivering care for older patients with cancer during the pandemic.	Older adults with cancer	Telemedicine; telehealth; eHealth Italy: (phone) UK: (telephone consultation) Netherlands: (not reported) Germany: (telephonic contact among physicians and caregivers) Denmark: (disease-specific patient-reported outcome measures combined in the electronic medical record) Spain: (telephone or videoconference) Hong Kong: (video calls) Canada: (virtual visits) Mexico: (video messaging services or virtual visits)

(continued)

Table 1. Continued.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
			Canada: • Using virtual visits for oncology visits and follow-up. Mexico: • For telehealth visits, patients and doctors use video messaging services or virtual visits.			
Parisien et al.[31]	Quantitative study	United States	• Telehealth services were more likely to be offered by institutions located in the Northeast and South regions. • 88 (83%) out of 106 institutions are using telehealth services. • Heat map analysis shows "an associative overlap of regional 'hot spots' with direct comparison of COVID-19 cases in the U. S. and orthopedic departments providing telehealth services" (p. 1).	• Using telehealth to deal with the pandemic may be changed permanently since telehealth deliverables evolve. This evolution is considered a valuable complement to in-person orthopedic clinical visits with net improvement in the care delivered in terms of value and quality.	Orthopedic Surgery	Telehealth (not specified)
Bini et al.[38]	Review	United States	• Many practices had to quickly switch from an in-person scribe model to using virtual scribes on telehealth platforms. Virtual scribes can document consultations in the electronic health record. • Chatbot services are currently provided by many companies, using telehealth for real-time assessment. • Virtual Physical Therapy showed similar results for face-to-face visits at lower cost. • Using wearable sensor devices	• The widespread adoption of digital health solutions in delivering remote health care services to patients during the pandemic has the potential to permanently change the care delivery model.	Orthopedics	Telehealth (platforms)

(continued)

Table 1. Continued.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
			would help to perform quantitative analysis and increase patients' involvement in their care by showing real-time data. • Simplifying the steps of cancelling and rebooking procedures by using surgical scheduling platforms. • Using virtual and augmented reality (VR and AR) for remote PT and surgical training. • Using "patient engagement platforms (PEPs) to provide both patients and physicians a means to interact and to facilitate longitudinal care," which helps to promote positive health outcomes. • "('3D printers') rushed forward with innovative solutions to help mitigate some of the equipment shortfalls. Designs for the manufacture of masks, face shields, and ventilator splitters were made available online through the National Institute of Health 3 D Print Exchange" (p. 572).			
Al Kasab et al.[20]	Expert opinion	United States	• Teleneurology is being used for patient consultations.	• Expanding and optimizing the usage of telemedicine services for the continuity of the delivery of outpatient care and monitoring.	Neurology	Telemedicine (not specified)

(continued)

Table 1. Continued.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
Boehm et al.[22]	Brief correspondence	Not specified	• 54.1% of 399 urological patients were eligible and willing to be scheduled for telemedicine-based appointments during the COVID-19 pandemic.	• Telemedicine-based consultations can be a solution for continuity of care for urological patients during the pandemic.	Urology	Telemedicine (videoconference)
Myers et al.[34]	Commentary	United States	• To meet the challenges associated with COVID-19 in the US for mental health patients, the number of outpatient appointments conducted using Veterans Affairs (VA) Video Connect, a secure video-teleconferencing platform, has increased.	• The Veterans Health Administration can be used as an instructive model for implementing telehealth across the country and other healthcare systems. • Taking advantage of the increased use of telehealth services and its subsequent refinements to the system in response to the crisis to improve the health of veterans experiencing barriers to ongoing access to care.	Mental health	Telehealth (video-teleconferencing platform)
Boettler et al.[24]	Review	Not specified	• Hepatologists are facing difficulties in promoting telemedicine services in the outpatient setting.	• Consider using telemedicine/appointments by phone if possible.	Chronic liver disease patients	Telemedicine (phone)

Table 2. Included expert opinion articles.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
Ryczek and Krzesinski[15]	Article	Europe	• Not reported	• Telemedicine can be used by cardiac patients to ensure continuity of care and adherence to epidemiological safety during the COVID-19 crisis.	Cardiac patients	Telemedicine (not specified)
Neubeck et al.[33]	Review	Not specified	• Not reported	• Encourage patients to initiate remote health care through existing systems and platforms. • Build a system for urgent consultations. • Deliver routine consultations for CVD patients via telephone or online services. • Ensure that patients do not need to access multiple unconnected services. • Monitor and support CVD patients by using connected technology, such as electronic trackers and blood pressure monitors • Ensure privacy and simplify the steps for patients, such as using a "how-to" guide. • Resources can be delivered synchronously or asynchronously. • "Audit your data and report it so that best practice in remote delivery can be upscaled, and lessons learnt can be shared with colleagues around the world."	Cardiovascular disease (CVD)	Telehealth (telephone; videoconferencing; digital trackers; patient portals; blood pressure monitors)
Płońska-Gościniak et al.[28]	Expert opinion and position papers	Not specified	• Electronic transmission of essential and imaging data using telemedicine or other means of	• "Continuity of using telemedicine and digital technology by the valvular heart teams." • Authors also recommend using telehealth in monitoring patients.	Valvular and structural heart disease management	Telemedicine; telehealth (phones; videoconferencing application; online

(continued)

Table 2. Continued.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
			virtual communication. • It is recommended to use online consultation (videoconference with imaging data transmission) if available.			transmission of imaging data)
Floyd and Wierzbicki[36]	Review	Not specified	• Not reported	• Using polypill combinations allied along with telehealth consultations may be a solution to consider.	Cardiovascular disease	Telehealth
Bloem et al.[27]	Viewpoint	Not specified	• Not reported	• The authors hope for the continuity of the advancement in telemedicine and remote monitoring after the COVID-19 crisis.	Chronic neurological disorders	Telemedicine (remote monitoring)
Shanthanna et al.[19]	Expert opinion	Not specified	• Not reported	• Using telemedicine as the first technique in most cases. • "Ensure adherence to the subscribed needs of telemedicine required by individual state or country of practice" (p. 4). • "Telemedicine platforms are available to engage in multidisciplinary interactions" (p. 4). • Telemedicine is used for opioid prescriptions in terms of evaluation, initiation, and continued use.	Chronic pain	Telemedicine (audio-video platforms)
Sarsak[29]	Review	Not specified	• Not reported	• Telehealth is useful and can be applicable for occupational therapy Future research is recommended to support telehealth-related outcomes and applications.	Occupational therapy practice	Tele-occupational therapy; telerehabilitation; telemedicine;

(continued)

Table 2. Continued.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
						telepractice; telehealth (videoconferencing system; virtual reality; electronic/portable devices)
Brough et al.[23]	Review	Not specified	• Many countries are affected by COVID-19, with the result that communication with the primary clinician often occurs through telemedicine.	• One of the recommendations provided for managing childhood allergies and immunodeficient is the use of telemedicine-based consultations.	Allergic, asthmatic and immunodeficient children	Telemedicine (not specified)
Tapper and Asrani[35]	Expert opinion	Not specified	• Not reported	• Considering integrated telehealth for optimal care for cirrhosis patients. • There is a need for novel quality metrics to highlight the importance of team-based care and telehealth. • Telehealth demands for co-deployment of behavioral interventions to improve patient participation across different socioeconomic strata and awareness on technology.	Patients with cirrhosis	Telehealth (remote monitoring; video consultations; telephone consultation)

Table 3. Included articles about the description of e-health actions conducted during the COVID-19 crisis.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
Hong et al.[25]	Viewpoint	Western China	• The West China Hospital of Sichuan University (WCHSU) activated a multimodal telemedicine network in January 2020. The network synergizes a new 5G service, an existing telemedicine system, a hotline telephone, and a smartphone app.	• Telemedicine success experience in Western China can be used as a reference elsewhere in the world.	Chronic diseases in general	Telemedicine; teleeducation (remote consultation networks-e.g., remote CT scan; portals; smartphone applications; real-time video consultation system; telephone hotline for online consultations)
Nicholls et al.[32]	Position statement	Australia	• The Australian government has expanded the use of telehealth, including telephone- and video conferencing-based consultations, in addition to electronic fast tracked prescription of medications.	• Continuity of providing management and support for patients with CVD. • Telehealth has the potential to provide CVD patients with access to healthcare professionals. • Consider the best way to interact with patients based on their accessibility and familiarity with technological tools. There is a need to assess the efficacy and cost-effectiveness of new processes for long-term utilization beyond the COVID-19 pandemic.	Atherosclerotic cardiovascular disease	Telehealth services; eHealth (telephone consultations; internet websites; videoconferencing; fast-tracked electronic prescribing of medicines; smartphone applications; text messaging; wearable devices-e.g., activity trackers and smart watches)
Compton et al.[16]	Feasibility study	United States	• Not reported	• By implementing a telemedicine clinic process during the COVID-19 pandemic in a cystic fibrosis (CF) multidisciplinary clinic using a standardized	Cystic fibrosis (CF)	Telemedicine clinic (telephone visits; WebEx virtual rooms)

(continued)

Table 3. Continued.

Reference	Type of paper	Country	Current status	Findings and author recommendation	Population/specific health condition	Technology type (digital solution's specification)
				process, established that the quality improvement of tools is a feasible and sustainable process that can be used by other multidisciplinary programs. • It is important to have organizational support in health information and technology to allow for the implementation and billing of telemedicine visits. • Having a standardized access to technology.		
Gupta et al.[26]	Mini review	Not specified	• In India, telemedicine guidelines for physicians for diabetic care during the crisis have been published.	• Telemedicine can be useful in managing diabetic patients during the crisis.	Management of patients with diabetes	Telemedicine (not specified)
Aziz et al.[37]	Article	New York City, USA	• Performed virtual visits with patients accessing appointments via Epic Connect and MyChart applications using their smart devices. • Trained and guided the patients how to install the software remotely by telephone guidance and/or emailed instructions. • Used telehealth-based consultation. • Used email or phone call to review patients' measurements, such as blood glucose.	• Using Telehealth for prenatal care is feasible and can reduce the exposure of COVID-19 • Consider tailored telehealth services for high-risk prenatal patients.	High-risk pregnancies	Telehealth (Epic Haiku/Canto to access the electronic medical records; Epic Cennect and MyChart application via phones or tablets to access appointments.)

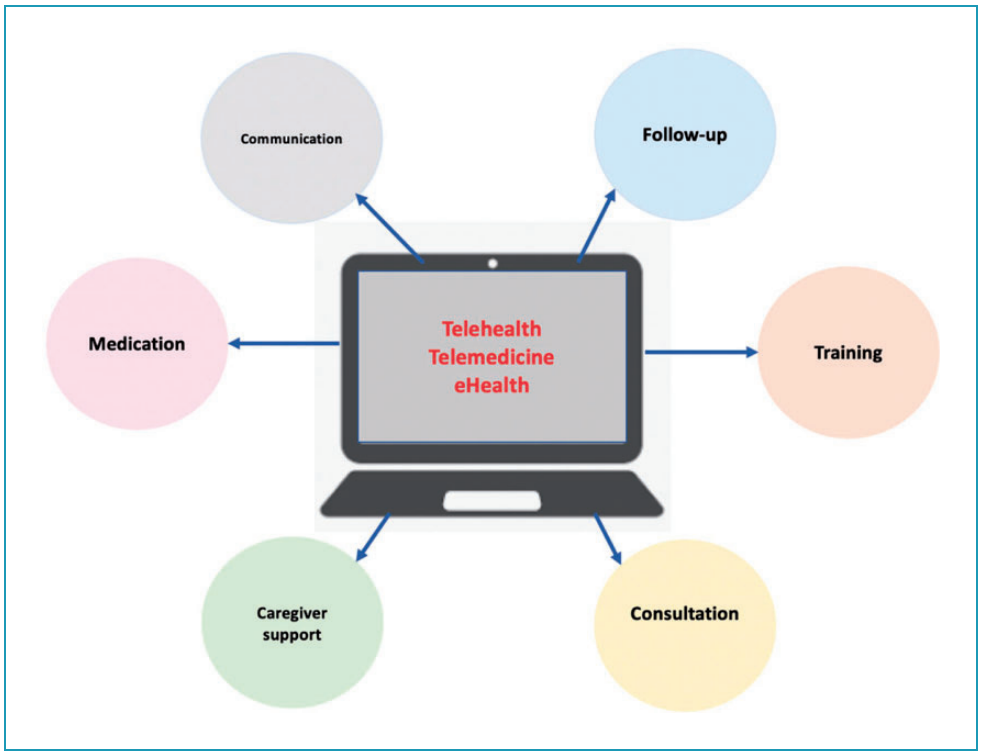

Figure 2. The six usages of eHealth, telemedicine, and/or telehealth solutions during the COVID-19 pandemic.

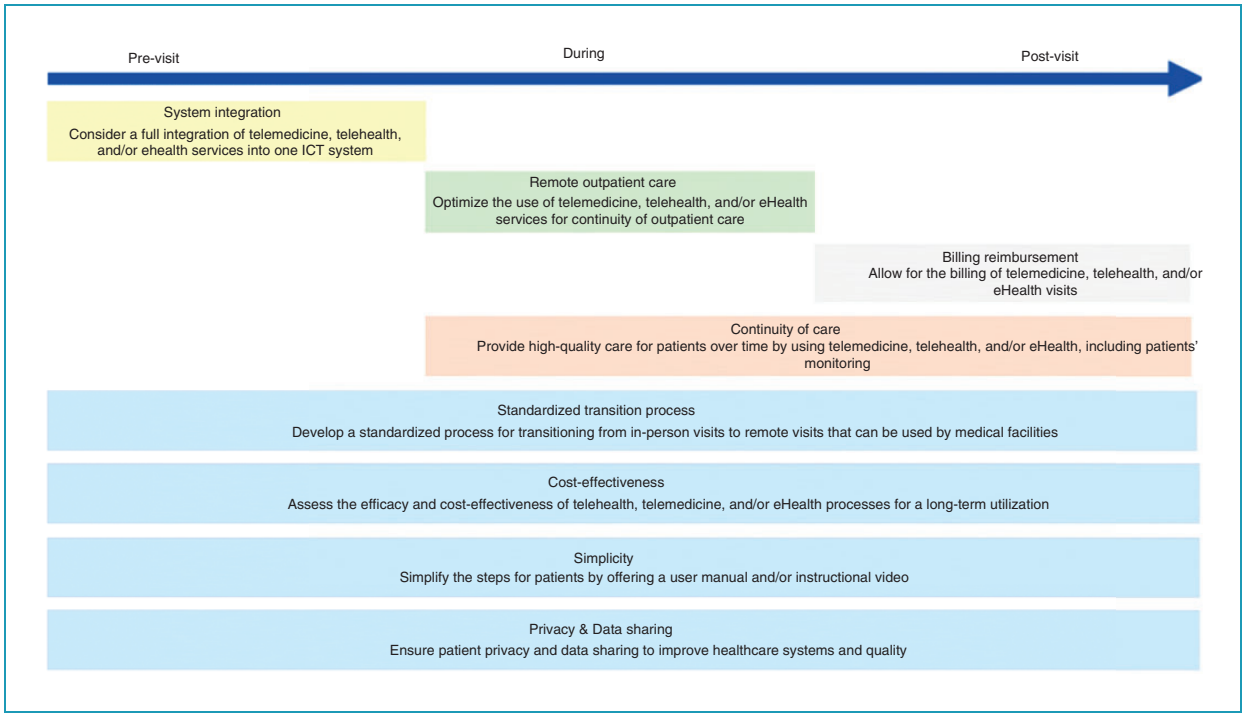

Figure 3. The top recommendations of eHealth, telemedicine, and/or telehealth solutions.

process,[13,15,18] and two articles highlighted the need to conduct more cost-effectiveness studies,[16,31] and studies on privacy and data sharing.[14,32] Lastly, one article also emphasized billing reimbursement,[15] while another article stated the importance of simplicity in the technology.[32]

Discussion

The present paper has undertaken a rapid review to summarize the role of mHealth, telehealth, and/or telemedicine solutions in the delivery of healthcare to chronic disease patients during the COVID-19 pandemic. This rapid review confirms that researchers from several specialties across the world have made a huge effort to improve healthcare services for chronic disease patients. All included articles indicated the promising potential of eHealth, telehealth, and/or telemedicine solutions in delivering healthcare services to patients living with chronic diseases/conditions during the pandemic. Some of these articles also support and encourage the continuity of using such technological solutions in the future when the COVID-19 crisis is over.

The authors of the available literature included their key findings and recommendations regarding the use of such technological solutions to ensure the continuity of delivering services to chronic disease patients during the pandemic. We synthesized these results and determined the top eight recommendations concerning the different activities for delivering healthcare services remotely for those living with chronic diseases/conditions in the era of COVID-19. However, there is limited evidence available about the effectiveness of such solutions; quantitative data were limited and no experimental design studies were found. Having more experimental studies as one of the articles noted[29] is required to improve the credibility of evidence on the outcomes for telemedicine, telehealth, and eHealth.

We aimed to include all chronic diseases in the search strategy. However, there were a limited and under-represented number of papers about some chronic diseases/conditions compared to others. Evidence on the role or effect of using such technological solutions to deliver healthcare services to patients during the pandemic may vary based on the type of chronic disease/condition. If more research were available, it would be possible to group the evidence of the role of eHealth, telehealth, and telemedicine on the delivery of healthcare services based on the type of chronic disease/condition. It is important to note that the term "chronic disease" was the only diagnosis specific search keyword used to search in the databases, which may result in excluding articles that only use the exact diagnosis term (e.g., diabetes) in their papers. Future work should address this limitation by using more specific chronic disease diagnosis keywords to search in the databases.

The majority of the included articles (n = 12; 46.1%) had no specified country; reporting the country of the study may assist in identifying which technology(ies) is/are the best fit in a specific context. It could aid in highlighting some recommendations and challenges associated with designing telehealth, telemedicine, and/or eHealth solutions.[39]

Furthermore, it is very important to improve the healthcare system infrastructure for developing and even some developed countries, such as Italy. Infrastructure refers to "the built environment and supporting elements: equipment, access, information technology (IT), systems and processes, sustainability initiatives and staff"[40] (p.4). A lack of infrastructure in addition to other factors (e.g., less educated patients[41]) would affect the quality of health care delivered to these patients—it could be more harmful than beneficial.[42] The literature cites some recommendations regarding the design and development of the infrastructure for this technology. First, the evidence points to the importance of incorporating intelligence, mobility, usability, adaptability, and interoperability features into the infrastructure.[43] Second, it advises against the inclusion of an upper limit of quality of services measurements for infrastructure, such as bandwidth.[43] In addition, there are various recommendations related to the use of eHealth in developing countries, such as avoiding the use of a restricted number of Internet service providers and poor telecommunication infrastructure.[44] Other evidence points to the valuable additions of superior customer service and customization features on products and services while developing the eHealth system.[44] Moreover, there are additional important issues that researchers, designers, and developers must consider while building telemedicine infrastructure. First, it is necessary to monitor and manage the costs, since these projects can be expensive.[45] In addition, they must focus on leveraging existing information and communication technology (ICT) infrastructure to take advantage of the value of telemedicine technology, especially in developing or undeveloped regions, such as Sub-Saharan Africa.[46]

Most of the included articles used the term telemedicine, followed by telehealth, whereas few articles used the term eHealth. In fact, there were variations in using these terms in which some seemed to use them interchangeably while others distinguish between them. It may be the case that these variations can infer the ambiguity and the lack of clarity in the terms' definitions and their concepts.[10]

To our knowledge, this is the first review that explores the role of eHealth, telehealth, and

telemedicine technology in the delivery of healthcare services to patients living with chronic diseases/conditions during the COVID-19 crisis. However, this study had some limitations. This is not a comprehensive review, as the search was limited to articles published in English. Thus, we may have excluded relevant articles published in other languages. Furthermore, the quality of the included articles is not known; hence, we should exercise caution when interpreting this evidence.

Although much literature is being published on the role of eHealth, telehealth, and/or telemedicine during the COVID-19 crisis, there is a lack of evidence of quantitative, qualitative, and mixed-methods studies, which underscores the need for more rigorous studies. However, this rapid review was conducted in a short timeframe, and more articles are rapidly emerging daily. The justification of the present paper is that the spread of the pandemic creates the need to rapidly assess and synthesize the evidence that has been generated. Future work should address the limitations of this work using a traditional systematic review to further synthesize the role of eHealth, telehealth, and/or telemedicine during the pandemic, a context for which the digitalization in the health care system has exploded.

Despite these limitations, we highlight critical gaps in the literature, including the lack of studies focusing on the effects of using eHealth, telehealth, and/or telemedicine in delivering healthcare services to chronic disease patients during the COVID-19 pandemic. In other words, this rapid review offers some opportunities for future research. Further significant evidence is needed on the effectiveness and cost-effectiveness of mHealth, telehealth, and/or telemedicine-based solutions.

Conclusion

This rapid review summarizes the existing role of eHealth, telemedicine, and/or telehealth in the continuity of delivering healthcare services to patients with chronic diseases or conditions during the era of the COVID-19 crisis. The literature lacks studies on the effects of eHealth, telemedicine, and/or telehealth on delivering health services such as medical consultations to chronic disease patients during this crisis. However, experts concur that the use of such technologies is likely to offer an opportunity to warrant the continuity of delivering the needed healthcare services to patients living with chronic health diseases or conditions during and after this pandemic. This emphasizes the urgency of conducting further research during this pandemic to assess the role of these technologies in improving access to service for those living with chronic diseases.

Contributorship: All authors contributed substantially to all stages of the review, and helped to draft and revise the manuscript. All authors approved the final version to be published.

Declaration of conflicting interests: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval: None required.

Funding: The author(s) received no financial support for the research, authorship, and/or publication of the article.

Guarantor: HB.

ORCID iDs: Hind Bitar https://orcid.org/0000-0003-1779-9958
Sarah Alismail https://orcid.org/0000-0002-9504-4326

Peer Review: This manuscript was reviewed by reviewers who have chosen to remain anonymous.

References

1. Zheng S-q, Yang L, Zhou P-x, et al. Recommendations and guidance for providing pharmaceutical care services during COVID-19 pandemic: a China perspective. *Res Social Adm Pharm* 2021; 17: 1819–1824.
2. World Health Organization. Coronavirus disease 2019 (COVID-19) situation report–51, www.who.int/docs/default-source/coronaviruse/situation-reports/20200311-sitrep-51-covid-19.pdf?sfvrsn = 1ba62e57_10 (2020, accessed 29 March 2021).
3. World Health Organization. Coronavirus disease (COVID-19) pandemic, www.who.int/emergencies/diseases/novel-coronavirus-2019/e (2020, accessed 29 March 2021).
4. Centers for Disease Control and Prevention. People who are at higher risk for severe illness, www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-at-higher-risk.html (2020, accessed 29 March 2021).
5. Lurie N and Carr BG. The role of telehealth in the medical response to disasters. *JAMA Intern Med* 2018; 178: 745–746.
6. Hollander JE and Carr BG. Virtually perfect? Telemedicine for COVID-19. *N Engl J Med* 2020; 382: 1679–1681.
7. World Health Organization. e-Health, www.emro.who.int/health-topics/ehealth/ (accessed 29 March 2021).
8. Stevens WJM, van der Sande R, Beijer LJ, et al. eHealth apps replacing or complementing health care contacts: scoping review on adverse effects. *J Med Internet Res* 2019; 21: e10736.
9. Office of the National Coordinator for Health Information Technology. What is telehealth? How is telehealth different from telemedicine? www.healthit.gov/faq/what-telehealth-how-telehealth-different-telemedicine (2019, accessed 29 March 2021).

10. Fatehi F and Wootton R. Telemedicine, telehealth or e-health? A bibliometric analysis of the trends in the use of these terms. *J Telemed Telecare* 2012; 18: 460–464.
11. Tricco AC, Langlois EV and Straus SE. *Rapid reviews to strengthen health policy and systems: a practical guide*. Geneva: World Health Organization, 2017.
12. Hamel C, Michaud A, Thuku M, et al. Defining rapid reviews: a systematic scoping review and thematic analysis of definitions and defining characteristics of rapid reviews. *J Clin Epidemiol* 2021; 129: 74–85.
13. Khangura S, Konnyu K, Cushman R, et al. Evidence summaries: the evolution of a rapid review approach. *Syst Rev* 2012; 1: 10.
14. Omboni S. Telemedicine during the COVID-19 in Italy: a missed opportunity? *Telemed J E Health* 2020; 26: 973–975.
15. Ryczek R and Krzesiński P. Cardiac patients and COVID-19: What the general practitioner should know. *Pediatr Med Rodz* 2019; 15: C6–C9.
16. Compton M, Soper M, Reilly B, et al. A feasibility study of urgent implementation of cystic fibrosis multidisciplinary telemedicine clinic in the face of COVID-19 pandemic: single-center experience. *Telemed J E Health* 2020; 26: 978–984.
17. Lewis GD, Hatch SS, Wiederhold LR, et al. Long-term institutional experience with telemedicine services for radiation oncology: a potential model for long-term utilization. *Adv Radiat Oncol* 2020; 5: 780–782.
18. Desideri I, Pilleron S, Battisti NML, et al. Caring for older patients with cancer during the COVID-19 pandemic: a young international society of geriatric oncology (SIOG) global perspective. *J Geriatr Oncol* 2020; 11: 1175–1181.
19. Shanthanna H, Strand N, Provenzano D, et al. Caring for patients with pain during the COVID-19 pandemic: consensus recommendations from an international expert panel. *Anaesthesia* 2020; 75: 935–944.
20. Al Kasab S, Almallouhi E and Holmstedt CA. Optimizing the use of teleneurology during the COVID-19 pandemic. *Telemed J E Health* 2020; 26: 1197–1198.
21. Kadir MA. Role of telemedicine in healthcare during COVID-19 pandemic in developing countries. *Telehealth Med Today* 2020;
22. Boehm K, Ziewers S, Brandt MP, et al. Telemedicine online visits in urology during the COVID-19 pandemic – potential, risk factors, and patients' perspective. *Eur Urol* 2020; 78: 16–20.
23. Brough HA, Kalayci O, Sediva A, et al. Managing childhood allergies and immunodeficiencies during respiratory virus epidemics – the 2020 COVID-19 pandemic: a statement from the EAACI-section on pediatrics. *Pediatr Allergy Immunol* 2020; 31: 442–448.
24. Boettler T, Newsome PN, Mondelli MU, et al. Care of patients with liver disease during the COVID-19 pandemic: EASL-ESCMID position paper. *JHEP Rep* 2020; 2: 100113.
25. Hong Z, Li N, Li D, et al. Telemedicine during the COVID-19 pandemic: experiences from Western China. *J Med Internet Res* 2020; 22: e19577.
26. Gupta R, Hussain A and Misra A. Diabetes and COVID-19: evidence, current status and unanswered research questions. *Eur J Clin Nutr* 2020; 74: 864–867.
27. Bloem BR, Dorsey ER and Okun MS. The coronavirus disease 2019 crisis as catalyst for telemedicine for chronic neurological disorders. *JAMA Neurol* 2020; 77: 927.
28. Płońska-Gościniak E, Suwalski P, Bartuś S, et al. Valvular and structural heart disease management during the COVID-19 pandemic. Expert opinion of the working group on valvular heart diseases, the working group on cardiac surgery, and the association of cardiovascular interventions of the polish cardiac society. *Kardiologia Polska* 2020; 78: 498–507.
29. Sarsak H. Telerehabilitation services: a successful paradigm for occupational therapy clinical services. *Int Phys Med Rehabil J* 2020; 5: 93–98.
30. Khera A, Baum SJ, Gluckman TJ, et al. Continuity of care and outpatient management for patients with and at high risk for cardiovascular disease during the COVID-19 pandemic: a scientific statement from the American Society for Preventive Cardiology. *Am J Prev Cardiol* 2020; 1: 100009.
31. Parisien RL, Shin M, Constant M, et al. Telehealth utilization in response to the novel coronavirus (COVID-19) pandemic in orthopaedic surgery. *J Am Acad Orthop Surg* 2020; 28: e487–e492.
32. Nicholls SJ, Nelson M, Astley C, et al. Optimising secondary prevention and cardiac rehabilitation for atherosclerotic cardiovascular disease during the COVID-19 pandemic: a position statement from the cardiac society of Australia and New Zealand (CSANZ). *Heart Lung Circ* 2020; 29: e99–e104.
33. Neubeck L, Hansen T, Jaarsma T, et al. Delivering healthcare remotely to cardiovascular patients during COVID-19: a rapid review of the evidence. *Eur J Cardiovasc Nurs* 2020; 19: 486–494.
34. Myers US, Birks A, Grubaugh AL, et al. Flattening the curve by getting ahead of it: how the VA healthcare system is leveraging telehealth to provide continued access to care for rural veterans. *J Rural Health* 2021; 37: 194–196.
35. Tapper EB and Asrani SK. COVID-19 pandemic will have a long-lasting impact on the quality of cirrhosis care. *J Hepatol* 2020; 73: 441–445.
36. Floyd CN and Wierzbicki AS. Reorganizing the treatment of cardiovascular disease in response to coronavirus disease 2019; time for the polypill? *Curr Opin Cardiol* 2020; 35: 428–433.
37. Aziz A, Zork N, Aubey JJ, et al. Telehealth for high-risk pregnancies in the setting of the COVID-19 pandemic. *Am J Perinatol* 2020; 37: 800–808.
38. Bini SA, Schilling PL, Patel SP, et al. Digital orthopaedics. A glimpse into the future in the midst of a pandemic. *J Arthroplasty* 2020; 35: 3056.
39. Combi C, Pozzani G and Pozzi G. Telemedicine for developing countries. *Appl Clin Inform* 2016; 7: 1025–1050.
40. Luxon L. Infrastructure – the key to healthcare improvement. *Future Hosp J* 2015; 2: 4–7.

41. Anwar S and Prasad R. Framework for future telemedicine planning and infrastructure using 5G technology. *Wireless Pers Commun* 2018; 100: 193–208.
42. Electronic Health Reporter. Dividing e-health, telehealth and telemedicine, https://electronichealthreporter.com/dividing-e-health-telehealth-and-telemedicine/ (2018, accessed 29 March 2021).
43. Li J and Wilson LS. Telehealth trends and the challenge for infrastructure. *Telemed J E Health* 2013; 19: 772–779.
44. Yusif S and Jeffrey S. Preparedness for e-Health in developing countries: the case of Ghana. *J Health Inform Develop Countries* 2014; 8: 18–37.
45. Myers MB. Telemedicine: an emerging health care technology. *Health Care Manag (Frederick)* 2003; 22: 219–223.
46. Kifle M, Mbarika VW, Tsuma C, et al. A telemedicine transfer model for Sub-Saharan Africa. In: *Proceedings of the 41st annual Hawaii international conference on system sciences (HICSS 2008)*, 2008, pp. 244–256. USA: IEEE.