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**eHealth, telehealth, and telemedicine in the management of the COVID-19 pandemic and beyond: Lessons learned and future perspectives**

Giacalone A *et al*. eHealth, telehealth, and telemedicine services

Andrea Giacalone, Luca Marin, Massimiliano Febbi, Thomas Franchi, Marcos Roberto Tovani-Palone

**Andrea Giacalone,** Department of Industrial Engineering, Technologies for Sports Medicine and Rehabilitation, University of Rome Tor Vergata, Rome 00133, Italy

**Luca Marin,** Department of Research, Asomi College of Sciences, Marsa MRS 19112, Malta

**Massimiliano Febbi,** Department of Research, Asomi College of Sciences , Marsa MRS 19112, Malta

**Thomas Franchi,** The Medical School, The University of Sheffield, Sheffield S10 2RX, United Kingdom

**Marcos Roberto Tovani-Palone,** Department of Pathology and Legal Medicine, Ribeirão Preto Medical School, University of São Paulo, Ribeirão Preto 14049-900, Brazil

**Author contributions:** Giacalone A conceptualized the study and wrote the original draft; Franchi T and Tovani-Palone MR helped with literature acquisition and data validation; Marin L, Febbi M, Franchi T and Tovani-Palone MR helped in writing the original draft; Giacalone A, Franchi T and Tovani-Palone MR wrote the review; Franchi T and Tovani-Palone MR edited the manuscript; Tovani-Palone MR supervised the study.

**Corresponding author: Marcos Roberto Tovani-Palone, PhD, Academic Research,** Department of Pathology and Legal Medicine, Ribeirão Preto Medical School, University of São Paulo, 3900 Bandeirantes Ave, Ribeirão Preto 14049-900, Brazil. marcos\_palone@hotmail.com

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**Abstract**

In this article, we discuss evidence supporting the effective implementation of eHealth, telehealth, and telemedicine during the coronavirus disease 2019 pandemic, with a view towards its permanent future integration in healthcare. We performed a literature search for articles describing the use of telehealth/telemedicine in the pandemic context using five databases. The articles selected describe the use of telemedicine as its advantages in terms of practicality and cost-effectiveness. This synthesis of articles is applicable to high-, middle- and low-income countries. Some of the notable benefits include breaking down geographical and time barriers, reducing waiting lists and crowding in healthcare facilities, and saving on national healthcare expenditure. However, there are a number of difficulties with the widespread implementation of telemedicine services that mainly relate to bureaucratic and regulatory concerns. Moreover, it is also important to make healthcare professionals and providers aware of the limits of this tool to avoid potential cases of negligence. Patients in turn will have to be made aware of and be educated on the use of this new healthcare modality before it is accepted by them. In the current socio-economic climate, it is therefore essential to implement a telehealth model aimed at efficiency and continuity of healthcare, as well as leading to an improvement in the quality of life of patients, whilst optimising existing resources and reducing costs. In that regard, the adoption of eHealth, telehealth, and telemedicine services should be considered highly timely, despite current existing limitations.

**Key Words:** eHealth; Telehealth; Telemedicine; Coronavirus disease 2019; Pandemics; Delivery of healthcare

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**Core Tip:** In an attempt to contain the spread of coronavirus disease 2019, increasing pressure was placed on the healthcare sector to adapt to challenge of delivering care, thereby necessitating the adoption of innovative telehealth solutions to both ensure and optimize patient care. This has resulted in the accelerated development, utilisation and acceptability of telemedicine in several fields. In this sense, the current pandemic presents a once-in-a-generation opportunity for countries to implement appropriate telemedicine services. As healthcare continues to evolve and innovate, one of the main shifts in practice that we are likely to experience will be the growing use of digital healthcare technologies.

**INTRODUCTION**

The coronavirus disease 2019 (COVID-19) pandemic represents the most serious public health threat in modern times, with long-lasting negative sequalae being seen in several sectors of the normal lives of those in affected countries around the world. In an attempt to contain the spread of the disease, increasing pressure was placed on the healthcare sector to adapt to challenge of delivering care, thereby necessitating the adoption of innovative telehealth solutions to both ensure and optimize patient care[1]. This has resulted in the accelerated development, utilisation and acceptability of telemedicine[2,3]. Prior to the pandemic, the use of telehealth was limited, with the main use cases of telehealth interventions being the care of patients with noncommunicable diseases, such as diabetes; however, the pandemic has propelled the widespread adoption of eHealth across numerous settings[4-6].

Telemedicine brings with it a host of benefits to patients, healthcare providers and the wider society, including reductions in the need for hospitalizations or readmissions, as well as on overall costs of healthcare and length of inpatient stay. In addition, it has been suggested that its use may provide psychological benefits to patients, including greater rates of satisfaction and medication adherence[7]. eHealth, telehealth and telemedicine solutions can be used interchangeably, providing convenient, low cost, and accessible health-related information and communication remotely, using internet-based technologies[8].

Several areas of healthcare have seen the successful adoption of telemedicine during the COVID-19 pandemic, ranging from mental health services to physical therapy and many others[4-6]. This article highlights the evidence for and opportunities presented by the use of telehealth/telemedicine during a pandemic scenario, as well as in periods of normality.

**METHODS**

A thorough literature search for articles was performed using five academic literature databases: CINAHL, MEDLINE/PubMed, Web of Science, Scopus, and Google Scholar. The search was done by combining keywords related to COVID-19, eHealth, telehealth and telemedicine, using the Boolean operators AND, OR, or NOT. The most recent, relevant and reliable scientific articles were considered and included in the review.

**TELEHEALTH FOR PHYSICAL AND MENTAL WELLBEING**

The incidence of mental health conditions saw a steep incline during the pandemic, likely due to measures of social isolation and fear of social interaction. Although mental health services began experimenting with the use telemedicine as a means of providing mental health care in the period prior to the pandemic, this practice had only been implemented in less than 1% of consultations[9]. Peri-pandemic, these numbers have increased exponentially, with data revealing that 41% of mental health care and/or substance abuse services were facilitated by telemedicine interventions[10]. Indeed, Zhou *et al*[11] have recommend the implementation of ‘telemental health’ services as a viable and appropriate approach to supporting patients, their families, and healthcare providers during these challenging times.

Another important aspect of consideration is that during the periods of confinement due to COVID-19, many people experienced a change in their eating habits and a reduction in physical activity levels. An illustrative example of the use of telemedicine can also be seen here. Increases in body weight in patients with non-alcoholic fatty liver disease (NAFLD) may lead to disease progression, whilst weight gain in patients with human immunodeficiency virus (HIV) has been associated with the onset of cardiovascular disease. Policarpo *et al*[12] monitored the eating habits of these patients through a telemedicine dietary intervention, which successfully limited weight gain in NAFLD-HIV patients, serving to reinforce the effectiveness of using such tools in the management of patients’ conditions.

**TELEHEALTH AND ITS WIDER APPLICATIONS**

A recent study by Kichloo *et al*[13] highlights various advantages of telemedicine, including its cost-effectiveness, increased access to speciality services, and key potential to help mitigate the growing worries of physician shortage. Miller *et al*[14] validated these advantages in their study that assessed the implementation of telehealth physical therapy services in the context of the COVID-19 pandemic, in which the authors identified several strategies to aid its implementation. Over the three-month period from March to May 2020, the authors conducted 4548 physical therapy sessions remotely *via* a telehealth platform. A survey completed by each patient to assess the effectiveness of this intervention, revealed that 94% of participants felt satisfied with the outcome they received from the sessions and that 92% would attend another telehealth session. These novel findings provide important patient-focused evidence to support the implementation of telehealth physical therapy as a feasible alternative to in-person visits during, and indeed after, the pandemic.

Stanhope *et al*[15] have additionally substantiated these findings and recommended the continuation of telephysiotherapy as a form of primary care post-COVID-19, prior to face-to-face sessions where needed, due to its particularly successful implementation during the pandemic. In this context, it is also worth noting that the telemanagement of patients with home-based bilevel positive airway pressure ventilation has been found to reduce the need for endotracheal intubation in the early stages of COVID-19 pneumonia, whilst decreasing contact time with healthcare staff and the possibility of transmission of COVID-19. Thus, the practice of such telehealth intervention could prevent disease progression and hospitalization in some cases[16].

Furthermore, Thatcher *et al*[17]highlighted in their work several opportunity costs of attending orthopedic clinic consultations in person. Their survey found that patients often miss work (46%), lose income (34%) and drop out of their usual recreational activities (27%) in order to attend consultations. Patients became aware that through telemedicine it is possible to avoid the need for travel or time spent waiting in the clinic, resulting in time saved to dedicate to their usual activities. However, most patients (61%), preferred for their first consultation to be in-person, with telemedicine used for orthopedic follow-up care. Telemedicine can reduce both overcrowding in outpatient clinics and waiting lists. This would be an advantage for severe acute respiratory syndrome coronavirus 2 infection prevention as well as ensuring timely access to treatment for all those in need[18].

**TELEHEALTH-BASED MODELS OF CARE**

A model of care based on the use of telemedicine from the first contact between healthcare professionals and patient (in a primary care setting), has been shown to be of fundamental importance. Gudi *et al*[19] outlined how telehealth interventions have the potential to address persistent challenges in primary care worldwide, while strengthening the public health response to COVID-19. Further, Monaghesh *et al*[20] corroborated this notion in their systematic review of eight studies, which concluded that telehealth interventions are able to improve the overall delivery of care whilst maintaining the safety of patients and healthcare providers during the pandemic.

Looking forwards, Doraiswamy *et al*[21] provided compelling evidence for the ongoing application of telehealth interventions in the future landscape of healthcare. However, this review highlights discrepancies in the application of telemedicine in resource-limited settings, which may serve to widen the economic and societal divide already seen in healthcare. This concern is of course valid, given that many countries do not have any form of telemedicine integrated into their national healthcare systems. Although there is a strong focus on the growth of telemedicine in high-income countries, the telemedicine revolution could have an even greater benefit in low- and middle-income countries, where it has the potential to improve healthcare access to the most vulnerable and geographically remote patients[22]. In this sense, the COVID-19 pandemic could be viewed as a once-in-a-generation opportunity for countries to implement telemedicine services through an appropriate regulatory framework[23]. For this to become a reality, aspects such as privacy and data protection should also be addressed by governments and health authorities in order to ensure the safety of users[24].

**RISKS AND LIMITATIONS OF TELEHEALTH**

As with face-to-face medical consultation, telehealth and telemedicine practices similarly carry liability risks. The three main areas for telecare pitfalls relate to: Documentation issues, poor triage decisions, and a dysfunctional office system. This can lead, in some cases, to superficial use of defined care pathway that can put the patient at risk[25]. In addition to the risks to patient, healthcare professionals must take responsibility for their actions within the scope of their competence. This means being aware of the legal aspects relevant to the delivery of telehealth and telemedicine services. Thus, telemedicine service providers are encouraged to determine in advance what each local region’s policies and requirements are for informed consent, malpractice insurance coverage and maintaining privacy and security in this type of setting[26].

It is noteworthy that not all medical consultations can be performed through telemedicine, so healthcare professionals must be able to assess whether or not the situation is suitable for remote consultations. Moreover, patients should always be informed about the functionalities and limitations of this type of health care delivery[27]. This is especially pertinent given the relatively low levels of patient awareness regarding telemedicine and that many patients have never used it before[28].

In the current healthcare service environment, there remains a concern that system security can be targeted by a cyberattack. In order to guarantee the security of patients and their data, it is important to ensure adequate and effective security measures are in plac[29].

**CONCLUSION**

As healthcare continues to evolve and innovate, one of the main shifts in practice that we are likely to experience will undoubtably be the growing use of digital healthcare technologies, such as the Internet of Things, the Internet of Medical Things, big data analytics, artificial intelligence, machine learning, 5G and beyond telecommunications, and blockchain technology[30,31]. Whilst not discounting the high initial costs when adopting telehealth approaches to care[32], we conclude that there is currently sufficient evidence in the literature to validate telehealth and telemedicine interventions as viable alternative to providing optimal patient management in many areas of healthcare[33].

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