

Telemedicine in cardiology in the time of coronavirus disease 2019: a friend that everybody needs

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To the editor From January 2020, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, causing coronavirus disease 2019 (COVID-19), has rapidly spread from China around the world. With more than 6.4 million infections worldwide, COVID-19 remains a serious global public health concern. Extensive measures to reduce person-to-person transmission of the disease have been undertaken to control the current outbreak. In several countries, the quarantine has been one of those measures, including home isolation and avoiding social contacts with other people in the neighborhood, supermarkets, or public transport.

In fact, a great proportion of the world population is currently in some kind of isolation. Therefore, the COVID-19 pandemic has abruptly disorganized healthcare across the world, forcing systems to divert both human and economic resources to overcome the COVID-19 crisis.^{1,2} Nonemergency procedures and follow-up consultations with family physicians, cardiologists, and other healthcare and/or medical professionals have been postponed and/or cancelled. This decision was taken to free up hospital beds for patients with COVID-19.³ Furthermore, a proportion of medical professionals have been reallocated in order to support the care of these patients.³ Lastly, healthcare professionals are at high risk of infection—this is something that can prove detrimental in combating this pandemic.

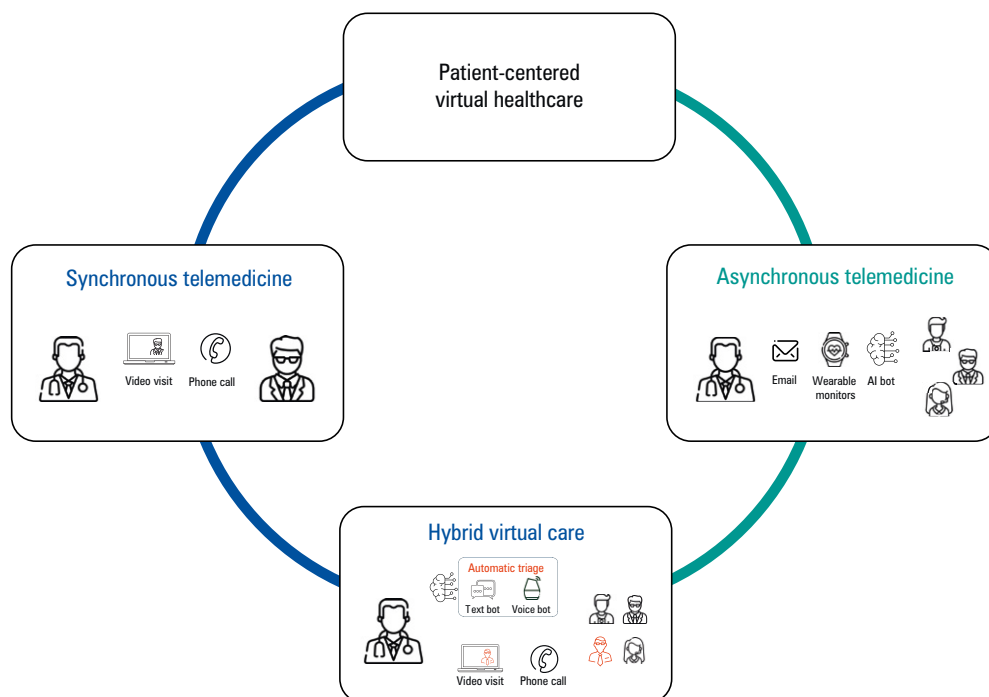
The generic terms “telemonitoring” or “telehealth” cover a wide range of activities aimed at delivering care at a distance, without direct physical contact with an individual or a patient.⁴ Telemonitoring (TM) was credited with the potential to improve medical care, quality of life, and prognosis of chronically ill patients.⁵ Home TM involves the use of electronic devices and telecommunication technologies for digital transmission of physiological and other disease-related data

from the patient's home to a healthcare center, thus assisting in disease management.⁶ Telemonitoring can be used synchronously (telephone and video) and asynchronously through email communication, artificial intelligence (AI) agents (text and voice chatbots), and wearable devices, while medical data are gathered on patient portals.⁶ Furthermore, a synergistic hybrid virtual care approach provides strong support in population-wide triaging and patient-centered care (FIGURE 1). However, despite the available data and the growing interest in TM among cardiologists, its use has not been widely adopted.⁷ This is mainly due to lack of a multidisciplinary approach to the patient, which is in line with the modern concept of personalized medicine, and lack of financial support. Advances in data collection and transfer (Bluetooth, broadband, and Wi-Fi) allow for the regular, reliable, and accurate communication of vital signs and symptoms from community-based patients.⁶

As even a 6-minute hall walk test can be performed with the use of a smartphone application, a variety of novel technologies can be employed to support patient monitoring during a public health emergency, for example: clinical electronic thermometers, heart rate monitors, electrocardiographs (ECGs), cardiac monitors, over-the-counter electrocardiogram software, pulse oximetry (SpO₂), noninvasive blood pressure monitors, respiratory rate or breathing frequency monitors, and electronic stethoscopes.²

Adoption of TM services gives the opportunity to maintain continuity of medical care while reducing the potential for community spread of the virus. The main purpose is to deliver care at a distance, without direct physical contact with the patient, offering in-person clinic visits only to those who have urgent (yet not emergency-level) clinical concerns requiring a detailed physical examination. Recent evidence has shown that

FIGURE 1 Patient-centered care based on hybrid telehealth services combining artificial intelligence (AI)-led screening and triaging chatbots and provider-driven synchronous solutions enabling real-time communication between the patient and the doctor



e-consultations are an effective and safe tool, which can contribute to outpatient cardiology care, with low rates of bouncing back to traditional consultations.⁸

Disruptions in heart failure (HF) care are among the consequences of the COVID-19 pandemic.¹ During this time, the physical separation of patients from their medical teams may lead to lack of motivation and poor compliance. Changes in dietary and lifestyle behaviors during social isolation, such as increased food and alcohol consumption and decreased physical activity, may trigger HF decompensation. In these patient group, TM services are of great value, as it has been already well established that TM is associated with a better prognosis and reduced risk of hospitalization.⁹

The cutting-edge development in the field of AI and natural language understanding brought voice assistants into the market, which enable verbal communication between patients and voice-driven chatbots. Clinical-grade medical software deployed on widely used smartphones and smart speakers (ie, Amazon Echo and Google Home) provides a scalable framework for acute care triage and chronic disease management. Recently, Mayo Clinic (Rochester, Minnesota, United States) has implemented an Amazon Alexa-based tool incorporating COVID-19 guidelines from the Centers for Disease Control and Prevention, United States (<https://newsnetwork.mayoclinic.org/discussion/mayo-clinic-introduces-skill-for-amazons-alexa-about-covid-19/>). The voice chatbot-driven symptom checker streamlines repetitive operational tasks associated with answering coronavirus-related questions and provides first-line screening.¹⁰ Moreover, voice-enabled technology has been applied to support the complex medical workflow.

The CardioCube voice AI medical chatbot deploying Amazon Echo was clinically validated at Cedars-Sinai Medical Center¹⁰ (Los Angeles, California, United States) and implemented in routine clinical practice, helping telenurses to manage patients with HF (<https://fcncare.com/>). Using voice interface, users answer a set of pre-specified clinical questions. Collected verbal information is automatically converted from audio to text using a speech-to-text cloud service, whereas actionable data are gathered in patients' electronic health records in hospital or clinic databases. To optimize the workflow, a clinical decision support system integrating electronic health records automatically screens responses and red-flag values exceeding predefined thresholds and notifies healthcare providers accordingly. Long-term home monitoring with CardioCube supports early detection of HF deterioration prompting an adequate medical decision (<https://fcncare.com/>). As exemplified, voice AI technology can multiply medical workforce and help to deliver remote care providing safety for healthcare professionals and patients.

Exercise training is a cornerstone in the prevention and treatment of cardiovascular disease. Exercise-based cardiac rehabilitation (exCR) is commonly delivered in hospitals and should include an individualized program. However, even before the COVID-19 pandemic, referral rates and uptake of exCR were low, and participation was often limited by program availability, transport restrictions, inconvenient scheduling, and domestic or occupational responsibilities.¹¹ These barriers suggest that accessibility is the primary factor limiting utilization of traditional center-based exCR programs.¹⁰ It has been already proven that TM exCR is at least as effective as center-based exCR in reducing modifiable cardiovascular

risk factors and improving functional capacity.¹² During the present crisis, as expected, physical activity levels are falling. A study from the United States has shown that physical activity, measured objectively by Fitbit trackers, has fallen by 39% in March, since social distancing measures were introduced.¹³ This fact raises significant concerns. Individuals with a known history of cardiovascular disease have many questions about COVID-19 as to what they should or should not do. A TM service can efficiently answer these questions. Furthermore, advanced mobile health (mHealth) exCR platforms including wearable sensors, smartphones, and real-time remote data transmission can provide exercise monitoring, feedback, coaching, and individualized exercise advice.¹⁴

Finally, the COVID-19 pandemic, except causing disruption in healthcare delivery around the world, has also a significant impact on clinical trials.² The safety and well-being of trial participants and research team members must be a priority. Once again, recommendations are primarily based on the concept of “physical distancing.” Participants are no longer able to undergo in-person study procedures or follow-up visits, and many research team members are working remotely.² On March 2020, the Department of Health and Human Services in the United States announced steps to expand Americans’ access to telehealth services during the COVID-19 outbreak.¹⁵ The aim of this action is to minimize out-of-window study follow-up visits and missing study data, without the effect on safety issues caused by remote study visits.¹⁵ Apart from clinical parameters, other data that can usually be obtained remotely in a reliable way include: 1) adverse events; 2) mortality; 3) morbidity; 4) hospitalization; 5) medications; 6) changes to medication; 7) clinician-oriented measures of patients’ functional status (eg, New York Heart Association functional class ranking); and 8) various patient-reported endpoints such as self-administered quality of life questionnaires.² Such questionnaires can be sent to patients as a hard copy by mail or electronically, where validated electronic means are available.²

The outbreak of COVID-19 represents one of the greatest medical and socioeconomic challenges over decades. One thing is certain—nobody was really prepared. The crisis revealed the urgent need for full transition to a novel model of healthcare. Telemedicine should no longer be viewed as an option or a complementary solution in emergency situations.⁴⁻⁶ In fact, it should be considered a daily routine, which secures continuity of care in patients with chronic comorbidities, in whom care cannot be postponed at a time of national emergencies.^{2,15}

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CONFLICT OF INTEREST WW is a shareholder of CardioCube Corp., Seattle, Washington, United States. TJ is a cofounder and chief science officer of CardioCube Corp., Seattle, Washington, United States. Other authors declare no conflict of interest.

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HOW TO CITE Koulaouzidis G, Charisopoulou D, Wojakowski W, et al. Telemedicine in cardiology in the time of coronavirus disease 2019: a friend that everybody needs. *Pol Arch Intern Med.* 2020; 120: 559-561. doi:10.20452/pamw.15432

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