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AHA SCIENTIFIC STATEMENT

An Overview of Telehealth in the Management of Cardiovascular Disease: A Scientific Statement From the American Heart Association

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ABSTRACT: Telehealth enables the remote delivery of health care through telecommunication technologies and has substantially affected the evolving medical landscape. The COVID-19 pandemic accelerated the utilization of telehealth as health care professionals were forced to limit face-to-face in-person visits. It has been shown that information delivery, diagnosis, disease monitoring, and follow-up care can be conducted remotely, resulting in considerable changes specific to cardiovascular disease management. Despite increasing telehealth utilization, several factors such as technological infrastructure, reimbursement, and limited patient digital literacy can hinder the adoption of remote care. This scientific statement reviews definitions pertinent to telehealth discussions, summarizes the effect of telehealth utilization on cardiovascular and peripheral vascular disease care, and identifies obstacles to the adoption of telehealth that need to be addressed to improve health care accessibility and equity.

Key Words: AHA Scientific Statements ■ cardiovascular diseases ■ health services accessibility ■ telemedicine

Telehealth has experienced tremendous growth over the past several years. The ongoing pandemic caused by COVID-19 demonstrated the importance of telehealth as a substitute for in-person patient visits, because face-to-face contact was limited to reduce the spread of the virus. Up to 30% of all US ambulatory health care visits were conducted through telehealth early in the pandemic, with some centers delivering >90%, especially in behavioral health.[1,2]

The Quadruple Aim, adapted from the Institute of Healthcare Improvement's Triple Aim, involves reducing cost, improving population health and patient experience, and team well-being.[3] Telehealth can reduce costs; improve access to care in rural and underserved communities; and increase quality, patient centeredness, and patient satisfaction.[4,5] This is especially important regarding cardiovascular disease (CVD), which in 2019 accounted for 875 000 deaths in the United States.[6] It has been shown that CVD disproportionally affects patients of lower socioeconomic status. According to a study by Hamad and colleagues,[7] a simulation of 1.3 million 35-year-olds with low socioeconomic status on the basis of income or education level, projected that 250 000 will develop coronary artery disease by 65 years of age, which is nearly twice the rate of individuals with higher socioeconomic status.

The shift toward remote patient visits illustrates the health care system's resiliency and ability to adapt to new challenges. However, the sudden demand for telehealth uncovered systemic weaknesses, disparities, and limitations in the telehealth process.[5,8] The purpose of this scientific statement is to highlight the effect of telehealth in cardiac, cerebrovascular, and peripheral artery disease (PAD) disease management, review implementation strategies and obstacles to telehealth adoption, and discuss opportunities for future research.

DEFINITIONS

Since 2007, the World Health Organization has defined telehealth as "The delivery of health care services,

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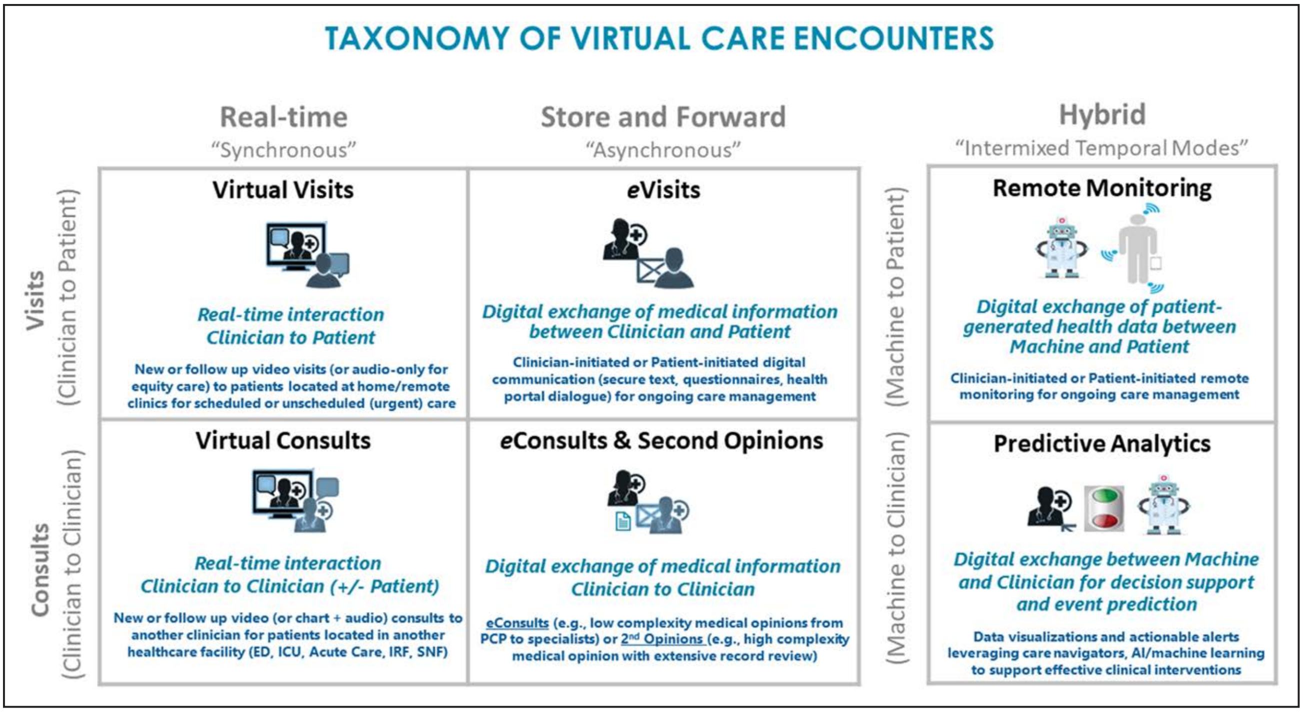

Figure 1. Taxonomy of telehealth encounters.
AI indicates artificial intelligence; ED, emergency department; ICU, intensive care unit; IRF, inpatient rehabilitation facility; PCP, primary care physician; and SNF, skilled nursing facility.

where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care professionals, all in the interests of advancing the health of individuals and their communities."[9] Although digital health, virtual care, telehealth, and telemedicine are terms often used interchangeably to refer to this practice of care delivered from a distance, for the purposes of this article, we will use the term "telehealth."[10] Because telehealth collapses the barriers of time and distance, it is ideal for providing care that is both patient centered and of high value as defined by efficient resource utilization to provide optimal outcomes.[11] It can be classified into 3 different scenarios: synchronous, asynchronous, or remote monitoring. Synchronous care is where there is an exchange of information by both parties simultaneously such as by a phone or video call. Asynchronous care is where there is exchange that can be decoupled and performed independently such as with text messaging or email. Remote monitoring is defined as non–face-to-face monitoring and analysis of physiological data or patient-reported symptoms or measures that are used to understand a patient's health status. Telehealth can also be characterized by the nature of the parties who are involved in the exchange, namely patients, health care professionals, or machines (Figure 1).

TELEHEALTH AND THE COVID-19 PANDEMIC

Before the COVID-19 public health emergency, use of telehealth was limited, especially in primary care and family practice. In a previous report, only 15% of family practitioners used telehealth to provide health care.[5] It has recently become clear that COVID-19 infection is associated with an increased rate of stroke, cardiovascular complications, and thrombotic episodes (eg, cerebral venous sinus thrombosis), and that patients infected with COVID-19 who have preexisting CVD experience greater morbidity and mortality.[12] It is reassuring that among hospitals participating in Get With The Guidelines-Stroke, patients presenting with acute ischemic stroke (AIS) during COVID-19 received similar quality care and experienced similar risk-adjusted outcomes compared with patients with AIS presenting pre–COVID-19.[13] Efforts to decrease contagion through social distancing led many medical centers to impose restrictions to in-person care, and there was a massive shift to telehealth (or virtual care) across all types of health care settings, payor groups, and patients.[14] Although this rapid adoption increased access to basic health care services for many, it clearly also reduced health equity among patients with lower health literacy, digital literacy, or English proficiency. In a recent report, cardiologists decreased their ordering of diagnostic testing and medications when comparing visits in the pre–COVID-19 versus the COVID-19 era, and those who performed in person versus remotely

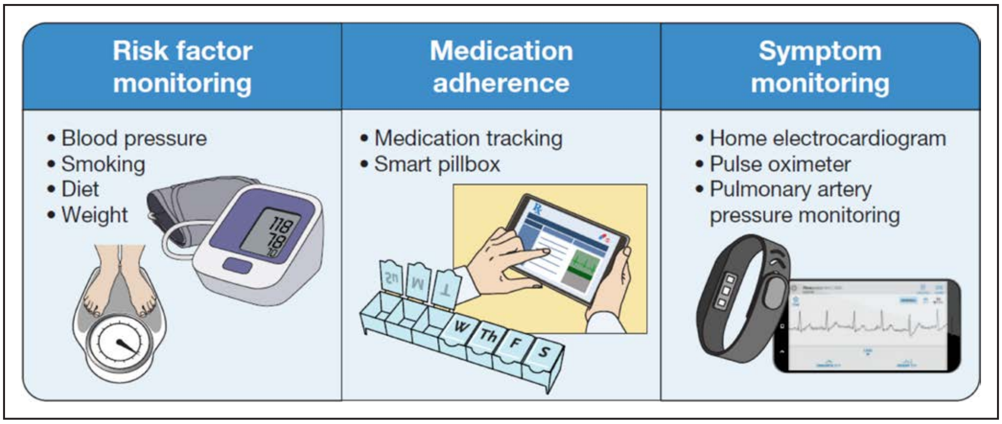

Figure 2. Telehealth tools for cardiovascular home monitoring.

through telehealth. Further studies are needed to clarify whether these decreases represent a reduction in the overuse of tests and medications versus an underuse of indicated testing and prescribing.[15]

TELEHEALTH IN CARDIAC DISEASE

Telehealth has been used to facilitate the management of many CVDs, such as arrhythmia detection, heart failure, hypertension, coronary artery disease, and myocardial infarction. Telehealth interventions can continuously monitor patients with CVD and may include anything from structured telephone or video support to remote monitoring of wearable or implantable devices. An advantage of the latter is that they can favorably affect CVD burden, such as significantly reducing blood pressure, progression of disease, and health care expenditures.

Telehealth is useful for risk factor modification, medication adherence, and symptom monitoring in both coronary artery disease and congestive heart failure (Figure 2).[16–20] Risk factor modification includes monitoring and improving blood pressure and lipid levels, encouraging exercise and dietary changes, and counseling toward smoking cessation. Through telephone calls, short message service texts, and online portals, individuals and clinicians can track the progress of vital signs and laboratory tests, provide more timely medication adjustments, and encourage physical activity, diet, and medication adherence, as well. Data from small randomized controlled trials and meta-analyses demonstrate significant improvement in risk factors with telehealth, although the durability of the interventions remains unclear.[16–20]

Telehealth also can detect symptoms and weight gain in congestive heart failure. Monitoring individuals with connected device weight scales that transmit data through Wi-Fi, Bluetooth, cellular, or other means can allow health care professionals to adjust diuretic doses. This, along with frequent check-ins through telehealth, can improve medication adherence, dietary salt intake, and evaluation of symptoms.[21–23] The ability for these measures to decrease hospitalizations is mixed with some studies showing no significant difference between control and intervention arms.[21–24] The differences in the findings of these studies may be attributed to variations in enrollment, clinical workflows, technologies, and analysis. Hence, more research into the application of telehealth in heart failure treatment is needed.[25] Likewise, the diagnostic evaluation of chest pain could potentially be improved by combining home ECG monitoring with symptom reporting. The data on chest pain evaluation through telehealth are limited and require further study.

Beyond external monitoring of symptoms and vital signs, implantable devices such as those that monitor intracardiac device impedance or pulmonary artery pressure may have a role in telehealth. Although device impedance to monitor patients' volume status has been used for many years, there has been no significant improvement in mortality rates or hospitalizations, and increased admission rates have been observed.[26,27] Further assessment is needed to determine the use of impedance in telehealth. Measuring pulmonary artery pressure through implantable devices (eg, CardioMems device by Abbott), on the other hand, appears to be useful demonstrating a reduction of hospitalization by 30% in the CHAMPION trial (CardioMEMS Heart Sensor Allows Monitoring of Pressure to Improve Outcomes in NYHA Class III Heart Failure Patients).[28] Although these devices require implantation by a physician, they do allow for home monitoring of individuals with congestive heart failure.

In addition, individuals now have access to a large number of commercially available health portals and smart devices. These devices and platforms support greater patient engagement in improving their own health, monitor for irregularities, and report back to their health care professional. By measuring heart rate, physical activity levels, and single-lead ECGs, patients can go to their physician with a larger array of data.[29] The market for these direct-to-patient technologies will likely continue to grow as will their reliability. However, the implementation of these data within the constraints of the average clinical visit time requires further refinements to processing and electronic medical record infrastructure. Last, medication adherence through smart pill dispensers may improve symptoms and outcomes by ensuring regimens are followed as prescribed.[30] Although these types of technologies make use and monitoring simpler going forward, further trials are needed to validate their use for disease management.

TELESTROKE

The best studied area with the most compelling evidence of benefit and clinical acceptance of telehealth in CVD is its use in AIS and evaluation for reperfusion therapy.[31,32] The field of artificial intelligence has recently been applied to cardiovascular imaging, with several Food and Drug Administration–approved algorithms in patients with ischemic stroke for the automated detection of early signs of brain infarction, large vessel occlusion, and the volume of brain with impaired perfusion, although further investigation into the additional value of these algorithms is needed.[33] These tools, coupled with enhanced methods for interdisciplinary communication among the health care team, including emergency medical service personnel, emergency clinicians, neurologists, and neuroendovascular specialists has shown promise in increasing the proportion of patients with large vessel occlusion detection and shortening the time to mechanical thrombectomy.

Telestroke, the application of telehealth for acute stroke, was initially proposed in 1999.[34] Treatment of AIS with intravenous thrombolysis is time dependent, and in 1999 <1.5% of patients with AIS were being treated with intravenous thrombolysis. Contributors to the poor treatment rates and the need for telestroke services included inadequate hospital access in rural and ethnically diverse communities and inadequate stroke expertise at most hospitals at that time. Hub-and-spoke telestroke networks first emerged as key systems of care within academic medical centers to mitigate these issues.[35] In these networks, stroke experts at primary and comprehensive stroke centers provide telehealth consultation for acute stroke evaluation and treatment at community and rural hospitals without onsite stroke expertise. Subsequently, alternative organizational delivery networks have evolved that may leverage any combination of the following: existing employed or private affiliated medical staff, third party outsourced staffing models supplied by for-profit or nonprofit companies, physician and advanced practice clinicians. These consultations may be documented directly into the originating site's electronic health record, or into the telestroke service's medical record system with health information exchange to the originating site, and orders may be conveyed as recommendations to the bedside treating physician or written directly into the computerized order entry system. Many factors drive which model is used and include local human and financial resource availability, network affiliations, available service offerings, and case mix.

Multiple published reports from academic health systems or clinical trials have subsequently shown that telestroke improves the accuracy of AIS diagnosis, improves rates of intravenous thrombolysis, and is cost-effective.[36–38] Data further suggest that telestroke can expand access to acute stroke care without racial and ethnic disparities.[8] Telestroke has been a crucial component of stroke systems of care, including the designation of different levels of hospital stroke readiness.[39] Although AIS thrombolysis treatment rates have improved since 1999, overall treatment rates remain low along with substantial gaps in access to mechanical thrombectomy for AIS.[40,41]

Telehealth use in acute stroke has recently expanded to the inpatient and prehospital setting. In the inpatient setting, teleneurology consultation provides access to expertise for inpatient management in the subacute phase of care to help guide secondary prevention decision-making and discharge interventions. This has become increasingly important to ensure access to care in nonurban areas where significant gaps in hospital-based neurology care exist. These services can efficiently and effectively address a broad spectrum of neurological conditions beyond stroke, which is important because many patients with suspected stroke turn out to have other conditions that will also require expert consultation.[42] In many European stroke systems of care, ongoing telestroke consultation to support patients who remain at the originating site is the predominant model.[43]

In the prehospital setting, mobile stroke units are ambulances equipped with computed tomography imaging capabilities and telehealth videoconferencing that allow rapid prehospital evaluation, faster treatment of AIS, and appropriate triage of patients with hemorrhagic stroke. A recent randomized trial, and a systematic review and meta-analysis, as well, found that patients treated in mobile stroke units had significantly shorter time to treatment and higher odds of better clinical outcomes than those treated in hospitals.[44,45] Although not all mobile stroke units include remote evaluation, the reliability of on-site and remote National Institutes of Health Stroke Scale examinations have been shown to correlate well.[46] Overall, telestroke for acute stroke evaluation and treatment is a major success story for the utility of telehealth, and, given this success, expansion of telehealth into other realms of stroke care is occurring.

Telerehabilitation interventions that have been studied in stroke survivors have included motor recovery, speech/language, depression, caregiver strain, cortical dysfunction, and management of stroke risk factors.[47] Approaches may be synchronous with a therapist in real time, asynchronous using online computer-based/

recorded interventions, or a combination of both. Similar to objectives of treatment in acute stroke, telerehabilitation can improve access to care and reduce disparities in stroke rehabilitation and recovery. Although early adoption of telerehabilitation dates back to the 1990s, widespread adoption has been slow.[47,48] New data showing similarity of outcomes of clinic-based rehabilitation compared with home-based telerehabilitation, coupled with the rapid expansion of telehealth use in the context of the ongoing COVID-19 pandemic, may result in marked increases in the use of telerehabilitation for stroke in the coming years.[49]

Use of telehealth for stroke evaluation and treatment in both the acute and rehabilitation/recovery phases has potential to improve access to care and reduce disparities. Ongoing and future efforts should target vulnerable populations such as racial and ethnic minorities, men, older people, and those living in rural areas who are less likely to use telehealth.[50] These expansions of various modes of telehealth for stroke care across the continuum from prevention through recovery lay the groundwork for new hybrid care delivery models. The incorporation of remote patient monitoring and patient-generated health data from digital health devices at home, augmented by synchronous video and asynchronous care plan elements, represents a viable care paradigm (see Figure 1) complete with reimbursement. These new frameworks of care will require sophisticated decision-support algorithms, robotic process automation, integration within electronic health record systems, all positioned within a coherent framework for assessing quality and outcomes in telestroke.[46]

TELEHEALTH IN PAD MANAGEMENT

Telehealth holds promise in numerous applications toward the management of patients with PAD. The use of telehealth in clinical practice has proven successful in terms of reductions in costs and travel times and improvement in patient satisfaction.[51–53] Although telehealth can be used for simple facilitation of discussions surrounding new patient history-taking, and the communication of findings on a recent imaging study, as well, the scope of synchronous and asynchronous telehealth encounters in practice is much wider.

Given the chronicity and morbidity associated with PAD, its management requires longitudinal monitoring and follow-up. This can often prove cumbersome to the patient and their support team. Various monitoring devices have been developed to assist in prevention of adverse outcomes in the patient population with PAD. For example, elevated temperature detection on a foot without a wound may represent a vulnerable area for future pedal wound development. As such, the use of pedal temperature sensors has been demonstrated to be feasible and efficacious in reducing incident pedal ulceration.[54–56] There are several devices that allow measurement of pedal pressure during static and dynamic weight-bearing, and devices that can assess and track patient compliance with the utilization of prescribed pedal offloading footwear, as well.[57–60]

In a randomized controlled study among 182 patients with diabetic foot ulcers, telehealth was noninferior to standard outpatient care when comparing wound-healing rates.[61] Of note, in this study, amputation rates were lower in the telehealth group. Other studies have shown that the addition of wound photographs to a clinical vignette improves the diagnostic accuracy of wound infection.[62] In a systematic review, experts suggest that the use of smart technology through wearable devices can extend the duration of ulcer-free days after ulcer healing.[59,63] Few studies focus specifically on the postoperative monitoring of wounds; however, reports suggest that this approach is feasible and warrants further evaluation in patient populations with PAD.[64,65] Large well-designed studies introducing wearable technology, telecoaching, and innovations in shared medical appointment paradigms are needed.

TELERADIOLOGY

The COVID-19 outbreak accelerated the use of teleradiology because clinical staff moved to remote working platforms. Teleradiology systems first became commercially available in the 1980s.[66] Technological advances in computer systems, communications systems, and the digitization of radiographic images led to the growth of remote image viewing and interpretation starting in the mid-1990s. Modern teleradiology enables more health care accessibility for underserved groups and more expeditious care for patients in regions without subspecialized radiologic expertise.[67]

Teleradiology plays an important role in cardiac and stroke care. According to a survey of radiologists from 2019, ≈78% of respondents interpreted imaging acquired from a different facility.[68] Among the cohort of respondents, ≤93% of subspeciality-trained cardiothoracic radiologists and 86% of neuroradiologists participate in offsite examination interpretation. Recent studies, such as the SCOT-HEART Trial (Scottish Computed Tomography of the HEART Trial), have demonstrated the important role for coronary computed tomography angiography in the initial chest pain evaluation.[69] Likewise, the non–contrast computed tomography of the head is the initial diagnostic imaging test to evaluate for intracranial hemorrhage in patients presenting with signs of stroke and is crucial for guiding cerebrovascular reperfusion therapy.[70] Prompt image interpretation through teleradiology enables faster and more streamlined CVD care, in particular, in settings that lack staffing or resources.

Despite the widespread clinical use of teleradiology platforms, there are still limited data on the objective

Table 1. Potential Obstacles to Telehealth Implementation for Health Care Professionals and Patients

Health care professional–centered obstacles	Patient-centered obstacles
Institutional infrastructure	Limited internet bandwidth
Legal and regulatory issues	Lack of telephone service
Health care professional biases	Health literacy
Reduced reimbursement	Digital literacy
Limited patient rapport	Digital mistrust
Potential data breaches	Lingual barriers

effect of teleradiology systems on coronary and cerebrovascular disease. How this technology improves CVD outcomes has not been measured. Furthermore, with advancements in technology, multiple apps have been cleared by the Food and Drug Administration for diagnostic image viewing on portable devices in the past 10 years.[71] Many opportunities remain to assess the role of these mobile apps in CVD management.

OBSTACLES TO TELEHEALTH FOR CLINICIANS

Although emerging data have shown that telehealth use has grown rapidly, numerous obstacles remain that contribute to the adoption and use of telehealth by clinicians (Table).[5,72,73] In the context of managing CVDs, clinical perception, system-based barriers, legal and regulatory issues, and patient perceptions may slow the adoption of telehealth.[74]

Implementation of telehealth has the potential to decrease health care costs while simultaneously improving access and quality of care to patients with CVD; yet health care professionals' acceptance and uptake of telehealth varies.[75–77] Infrequent use of telehealth mechanisms for CVD management is hindered by clinicians' biases and attitudes.[78,79] Age, technology expertise, and perceived accessibility and usefulness of technology are characteristics in individuals that may impede telehealth adoption and use.[74,78] In particular, uptake of telehealth may stagnate at the clinical level because of logistical challenges; that is, factors that interrupt clinical practice and workflow (eg, coordinating care and clinic schedule) and create time constraints to establish patient rapport and deliver effective and efficient patient-centered care.[78,80] Devices for home monitoring may also require infrastructure to analyze results, which can lead to increased implementation costs. Little is known about the physician characteristics associated with the successful transition to virtual health care, but data from one large health system found that female, primary care, and behavioral health physicians were most likely to lead the transformation to virtual health care.[81]

System-level factors such as reimbursement, medical licensure, privacy, and data security are additional obstacles to endorsing telehealth, and may contribute to the reluctance of health care professionals to use virtual services.[5,82] First, a significant restriction to telehealth's widespread adoption and use is the limited coverage and reimbursement from federal programs (Centers for Medicare & Medicaid Services) and commercial/private insurance plans.[5,83] In addition, reimbursements of telehealth services vary by state and are covered on the basis of the type of virtual service (eg, real-time video transmission, forwarding of prerecorded video transmission, and remote monitoring) and health condition treated. Also, many state laws and regulatory mandates require a valid practice license to provide virtual care.[84] Because each state's regulations differ, multistate licensure and its cost make telehealth unattractive to clinicians and a critical barrier.

Last, it has been suggested that organizational arrangements to accommodate technology infrastructure, including health resource use and operating costs, limit the implementation of telehealth.[80] For example, with the rapid introduction of numerous telehealth platforms, difficult-to-use technology may require third-party configurations and oversight, necessitating extensive technology training attributable to various virtual care settings (eg, home, office, allocated space) and numerous technology devices.[83] Of equal importance, as telehealth transforms health care delivery, privacy and security risk are major concerns. Despite the fact that most telehealth platforms are highly encrypted, with Health Insurance Portability and Accountability Act–compliant platforms (eg, Zoom or Skype), they are not fully secure and are at risk for data breaches.[72,85]

OBSTACLES TO TELEHEALTH FOR PATIENTS

Several factors create obstacles that hinder patient participation in telehealth care. One particular challenge involves ensuring health equity and accommodations for disadvantaged populations: older adults, low-resourced minority populations, and individuals requiring translational services.[86] Vulnerability factors, coupled with adverse environments, limited resources, digital mistrust, digital literacy, lack of internet connectivity or health information technology device, are among the challenges cited as thwarting telehealth uptake in patients.[87] Individuals who have lower socioeconomic status, health literacy issues, or cultural and linguistic barriers remain encumbered and unable to harness digital platforms' full capabilities, particularly when it comes to digital health technologies, consumer wearables, and other devices that require patients to purchase, subscribe, or pay for monitoring.[86–88]

Furthermore, insufficient internet bandwidth speed is a major barrier that disrupts and limits virtual care services for the patient, especially in rural or poorer areas of the country.

STRATEGIES TO OVERCOME TELEHEALTH OBSTACLES

Barriers to telehealth implementation are largely centered around infrastructure, technology, and reimbursement. The infrastructure required for broadband internet needs to be improved, especially in rural America where having adequate medical infrastructure is lacking because of a "medical desert."[89] Approximately one-quarter of American adults do not have broadband access.[90] This issue could be improved through changes in public policy to supplement efforts by the private sector.[91] Future research that appraises the current policy systems and identifies potential targets for policy reform is necessary.

The use of telehealth spiked early in the COVID-19 pandemic, but data have shown that utilization has slowly declined.[1] Perceived limitations in quality of deliverable care through remote visits may play a role in the retention rate. Although more clinical consultations and follow-up shift back to in person, telehealth has the potential to have a larger role in urgent diagnosis and remote monitoring. Thus, we encourage more investigation into the role telehealth can play in the evolving landscape of CVD management beyond the pandemic.

Reimbursement challenges for telehealth such as patients who seek care at academic centers from different states needs to be simplified as it is for in-person face-to-face visits. During the COVID-19 pandemic, the Centers for Medicare & Medicaid Services, and private insurance companies, as well, established telehealth payment parity to reimburse certain telehealth services at rates equal to in-person services. However, not all insurance payers support full payment parity between telephone and video visits, which ultimately penalizes health care professionals caring for patients of lower socioeconomic status who lack video capability.[88] Whether payment parity will persist after the pandemic is unclear. Opponents of payment parity suggest that telehealth may require less clinical effort and results in less value than in-person care. Moreover, there are data to suggest that neither the presence nor the duration of state parity laws are associated with adoption of telehealth.[92] Thus, more research on the effect of reimbursement changes to telehealth implementation is needed.

Last, there is a lack of standardized methods for assessing telehealth quality. Potential metrics could include patient-reported outcomes, compliance with device usage, and tracking outcomes related to false-positive rates.[93] Applying these quality metrics is a challenging endeavor given the broadness of telehealth. Nevertheless, it would allow for better appraisal of telehealth modalities that could pave the way for better reimbursement and incentives for adoption if positive patient outcomes and reduced expenditure are demonstrated.

CONCLUSION

Cardiovascular diseases affect a significant proportion of the population and disproportionately affect patients in rural and minority communities. Advances in technology have enabled the growth of telehealth strategies to improve patient care and medical resource accessibility, which has led to more equitable care. The COVID-19 pandemic improved the telehealth infrastructure through necessity but also uncovered systemic weakness, limitations, and inequities. Further research into barriers for telehealth implementation and equitable execution are important to ensure the delivery of high-quality care for patients.

ARTICLE INFORMATION

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $5 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity or owns $5 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

†Significant.

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Sanjeev P. Bhavnani	Scripps Clinic and Research Institute	Scripps Clinic (Immediate Family Members; Unrestricted educational and research grant to study digital health technologies and artificial intelligence in CV care)*	None	None	None	CorVista†; Blumio*	None	None
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*Modest.

†Significant.

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