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NEW THERAPIES FOR CARDIOVASCULAR DISEASE (AA BAVRY AND MR MASSOOMI, SECTION EDITORS)

The New Role of Telehealth in Contemporary Medicine

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Abstract

Purpose of Review Understand the current uses for telehealth as well as future directions as it relates to the COVID-19 pandemic and cardiovascular medicine.

Recent Findings Telehealth interventions in various forms have proven to be efficacious in the management of obesity, hypertension, glycemic control in diabetes, hyperlipidemia, medication adherence, and ICU length of stay and mortality. The use and study of such interventions have been greatly expanded during the pandemic partly due to the expanded coverage by payers. However, heterogenous interventions and a relative lack of cost analyses are barriers to more widespread adoption.

Summary Telehealth has proven efficacy for modifying risk factors for cardiovascular disease. To date, this has not been shown to translate to a reduction in hard cardiovascular endpoints such as mortality. With ongoing research and expanded funding, the role of telehealth is likely to evolve as the COVID pandemic continues.

Keywords Telehealth · COVID-19 · Telemedicine · Cardiology

Introduction

Since its inception, "telehealth" has taken many forms but has generally been understood to refer to the use of telecommunication technology to connect patients and clinicians who are physically distanced. As far back as 1879, medical literature discussed the potential of the telephone to reduce clinic visits [1]. By 1992, evidence showed reduced medical service utilization, improved morbidity, and even reduced mortality were possible through telehealth [2]. While technological capabilities have continually progressed, the COVID-19 pandemic has thrust remote technologies into the spotlight. Telehealth visits in the USA increased 154% between March of 2019 and March of 2020, but evidence suggests that this increased capacity may still not meet the demand of our population [3•, 4]. This paper reviews telehealth modalities and outcomes, barriers to adoption, and trends and future directions with a particular focus on cardiovascular health through the COVID pandemic.

Modalities and Outcomes

Telehealth takes many forms such as mobile health applications, telephone encounters, video encounters, electronic consults, and intensive care (tele-ICU). Each of these modalities has a particular strength that can be leveraged to benefit the patient. By extension, each has a different capability to directly affect patient health outcomes. In sum, these technologies aim to overcome barriers including transportation, physical mobility limitations, potential exposure to pathogens, and rapid access to specialists.

Mobile phones and smart phones in particular are increasingly prevalent across the population, providing both clinicians as well as the general public access to mobile applications. These applications can be used as quick references to organizational guidelines or as tools to improve health among populations. There is heterogeneity among such interventions, but data show mobile apps are effective at

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promoting weight loss, improving medication adherence, and reducing blood pressure [5–7]. Remote patient monitoring, which frequently uses cellular technology, also has shown to improve glycemic control [8]. It can be inferred that the modification of these cardiovascular risk factors has the potential to reduce cardiovascular morbidity and mortality. In fact, models show that by simultaneously taking into account multiple variables, it is possible to identify heart failure decompensation earlier in their course [9]. However, to date, reduction in hard endpoints such as morbidity or mortality has not been consistently observed [10••].

Electronic consultations (E-consults) are communications wherein a clinician poses a question to a specialist thereby sparing face-to-face interaction between the patient and specialist. E-consults, as with other electronic systems designed to promote health outcomes for patients, have variability in the specifics of implementation. Positive data do exist, such as a single-center experience reducing the prevelance of rarely appropriate cardiac stress tests through e-consults [11]. The overall evidence to date has found that while generally safe, mixed evidence exists for E-consults to decrease patient wait times, reduce overall cost, or increase clinician/patient satisfaction [12–16]. However, this type of telehealth has not been widely adopted outside of single-payer environments or studied as widely as other telehealth modalities.

Telephone or video encounters with healthcare clinicians allow for the advantages of interactive two-way communication while limiting the potential challenges of in-person visits such as lack of patient transportation, physical mobility limitations, or possible exposure to infectious pathogens. There are also data to suggest that patient satisfaction remains high with such visits [17]. While there is again a great deal of heterogeneity in the studied interventions which make drawing definitive conclusions difficult, meta-analysis on the use of phone encounters for cardiovascular risk management has suggested that an average reduction of 12.45 mg/dL in low-density lipoprotein and 4.33 mmHg reduction of systolic blood can be achieved with these interpersonal interventions [18]. Quality of life, hospital readmission, and mortality outcomes in patients with cardiovascular disease and heart failure specifically have not been shown to decrease when using a summation of evidence [18].

Intensive care telemedicine (tele-ICU) is yet another tool designed to provide specialty access to patients. This form of telehealth employs remote patient monitoring, audiovisual conferencing, and remote access to the patient's electronic health record all to allow intensivists to offer advice to local clinicians from a remote location. Initially instituted to expand access to physicians with critical care expertise, tele-ICU care has expended from being available in 0.4% of intensive care units in 2002 to 11% of nonfederal ICUs by 2014 [19, 20]. There are various models of tele-ICU care, but their effect in aggregate is quite promising. In contrast to other telehealth interventions, tele-ICU has been shown to decrease hard endpoints including mortality and ICU length of stay [19, 21]. Data on cardiology-specific outcomes, however, is lacking.

Barriers to Adoption

While more conspicuous during the COVID pandemic, access to broadband telecommunication services remains limited in the USA. It is estimated that as recently as 2019, between 19 and 42 million Americans are without access to this service [22]. Because broadband telecommunication is the platform on which most telehealth relies, this poses an obvious barrier to adoption for a large segment of the population. Of course, the telephone has been around for over 100 years and has not been embraced as a significant method of healthcare delivery. Furthermore, data suggest that disparities exist in the adoption of this technology. Female sex, non-english language, older age, Black or Hispanic race, and median household income of less than $50,000 all are associated with decreased use of telehealth [22, 23]. Large rural areas of the USA have no appreciable access to broadband, except expensive and burgeoning satellite-based systems.

Another significant concern about the expansion of telehealth is the ability to protect personal health information. Because technologies within telehealth use different platforms, standardization of data protection standards is lacking. Beyond patient concerns, an inability to secure electronic encounters or interactions has potential legal consequences for institutions which act as a barrier for more widespread adoption. The regulatory environment continues to evolve with technology. In many instances, telehealth communications cross jurisdictional boundaries and contribute to a lack of policy consensus [24].

There is no doubt that telehealth requires an initial investment of time and capital. Simple telehealth interventions such as telephone conversations likely require little additional resource allocation as access to telecommunication expands. Tele-ICU care, conversely, may require an initial investment between $50,000 and $100,000 per ICU bed just to acquire this capability [21, 25]. Maintaining this service once installed is also resource intensive and is generally considered cost-effective [19, 21]. Financial ramifications of telehealth outside of the ICU setting remain relatively unknown. While reimbursement for telehealth services has expanded during this declared public health emergency, it is not clear that such financial backing will continue indefinitely [26•].

Beyond the logistical challenges regarding telehealth, it has been suggested that the use of these technologies comes at the cost of interpersonal interaction including non-verbal cues, expressiveness, and rapport between patient and provider

[24]. These tools are very difficult to measure but are widely considered to be foundational in a therapeutic relationship. Furthermore, the physical exam is foundational to clinical medicine, and telehealth is unable to replace this valuable interaction. It is not surprising then that both clinicians and patients find value in face-to-face encounters, and such interactions remain the standard of medical care.

Trends and Future Directions

The utilization of telehealth visits has exploded since the pandemic began. It is estimated that telehealth visits have increased 154% between March of 2019 and March of 2020 [3•]. E-consult volume similarly has been noted to increase where available [27]. Recognition of the potential value in this domain leads to the Centers for Medicare & Medicaid Services along with many commercial insurers to expand their coverage of such encounters [26•]. While the number of telehealth visits was rising prior to this reimbursement expansion, it has been postulated that increased funding permitted the growth in implementation that was seen [3•].

The implementation of telehealth is not without potential detremental effects. Inserting an electronic tool into the patient-provider relationship may add convenience but also has the potential to violate the sanctity of that relationship. Whether that electronic tool is an application, remote monitoring, or a platform for communication, risk exists that personal health information could be accessed outside of the therapeutic relationship or not in the manner intended by the patient [28]. It is also plausible that a lack of face-to-face interaction could lead to incomplete or inaccurate care, especially if the limitations of telehealth are not recognized [28]. How these ethical considerations are addressed is surely as unique as each intervention itself, but a recognition that solutions are needed is necessary to maintain the therapeutic relationship foundational to medical care.

Telehealth interventions have the potential to positively affect patient outcomes while simultaneously saving time and costs and improving patient satisfaction. However, partly due to the large amount of heterogeneity in interventions, meta-analyses to date have shown a relatively narrow benefits. Proving an effect on hard outcomes such as mortality remains an elusive goal for interventions outside of a tele-ICU setting. While inferences may be made based on risk factor modification, the degree of contribution to population health is more difficult to quantify.

By extension, the optimal way to compensate for telehealth interventions has not been firmly established. Some data does exist, however. The *Medly* program instituted in Canada focuses on the management of heart failure through telehealth and has been able to demonstrate it is cost-effective when used on a larger scale, reporting a willingness to pay threshold of $37,718 per quality-adjusted life year in US dollars [29]. This sort of larger-scale intervention has the potential to help lay the foundation for reimbursement models utilizing telehealth.

Difficulty empirically showing benefit is partly due to the heterogenous nature of interventions, and yet personalization is partly why it is hypothesized telehealth can be so effective. The consequence is that it may be difficult convincing payers there is justification for reimbursement for any single intervention. Beyond proving efficacy, cost–benefit analyses may prove pivotal for future funding as expanded coverage for telehealth is not assured post-pandemic.

The relative lack of evidence coupled with the potential to create a truly beneficial intervention is not lost on researchers. An explosion literature has resulted. The National Library of Medicine indexed 4233 articles with the terms "telehealth" or "telemedicine" in 2019 compared to 8459 in 2020 and over 6100 as of the time this manuscript was completed in late 2021. This new knowledge includes a wide range of interventions that holds further promise in defining how telehealth can be used in a post-pandemic setting. There are a further 631 trials listed on clinicaltrials.gov which are actively recruiting patients hinting at even more robust data to come.

Conclusions

Telehealth interventions in various forms have proven to be efficacious in the management of obesity, hypertension, glycemic control in diabetes, hyperlipidemia, medication adherence, and ICU length of stay and mortality. Utilization as well as research has expanded at a tremendous rate since the beginning of the COVID-19 pandemic and will likely shape future use. Further defining effective interventions and understanding the extent of benefit will be crucial as traditional medicine evolves to meet this challenge. COVID has been life-altering for almost all healthcare clinicians and will have lingering consequences long after the pandemic is over. The use of telehealth is likely to be one important manifestation of this change.

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Compliance with Ethical Standards

Disclaimer The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States Government.

Conflict of Interest The authors have no conflicts of interest to disclose.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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