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Review

Telemedicine and cardiovascular diseases

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ABSTRACT

Background: Cardiovascular diseases (CVDs) rank high among the leading causes of death and account for a significant portion of healthcare expenses for both men and women. The use of technology-driven virtual platforms for medical intervention, known as telemedicine, has grown in importance within the healthcare field, particularly in the treatment of cardiovascular diseases. The primary goal of telemedicine technology is to deliver healthcare services cost-effectively, extending care to remote and virtual settings.

Methods: This paper aims to illustrate the importance of telemedicine in managing CVDs. Preferred healthcare databases were used for this paper, including PubMed, Cochrane Database of Systematic Reviews, CINAHL, PsycINFO, and Web of Science.

Results: Telemedicine is an essential tool for addressing medical issues, particularly concerning cardiovascular diseases. It improves patient adherence to therapy, lowers re-hospitalization rates, and shortens wait times, thereby facilitating better access to care, especially in remote areas. Despite these advancements, challenges related to legislation, resistance from patients and healthcare professionals, and technological issues persist.

Conclusions and Implications: In the medical field, telemedicine is a successful modality that meets most patients' expectations and offers a practical means for healthcare professionals to expand their services into underserved areas. To ensure that telemedicine reaches its full potential in improving patient outcomes and healthcare delivery, healthcare systems, legislators, and practitioners must adapt to and embrace this evolving technology.

Introduction

According to Townsend, Kazakiewicz (1), cardiovascular diseases (CVDs) are among the leading causes of mortality and a significant contributor to healthcare costs for both men and women. CVD encompasses a range of heart and blood vessel disorders, including coronary heart disease, venous thromboembolism, rheumatic and congenital heart diseases, and peripheral arterial disease (2). These conditions collectively account for over 17 million deaths worldwide annually. Modifiable risk factors for CVDs include hypertension, hyperlipidemia, smoking, alcohol consumption, unhealthy diets, and obesity (3). Given the substantial role of lifestyle choices in the development and management of CVD, patients often face a challenge in reconciling the clinical advice received with their ingrained habits.
Telemedicine, using technology-centered virtual platforms for medical intervention, has become increasingly significant in healthcare, particularly in managing cardiovascular conditions (4). The COVID-19 pandemic in 2020, telecommunication and technology necessitated a rapid shift in healthcare delivery, with telemedicine emerging as a key solution for cardiac patients, especially when in-person care was limited (5, 6). With telemedicine taking the lead and becoming the focal point of healthcare delivery, its significance has grown in the healthcare industry, particularly in the cardiovascular section. Due to the expectation that the majority of hospital space would need to be allocated to treating pandemic victims, most of the world's healthcare systems were redesigned for pandemic treatment in 2020. As a result, regular healthcare services had to be provided remotely, which sparked the global integration of telemedicine for cardiac patients (6).

In addition to extending healthcare delivery, telemedicine enables patients to communicate with medical staff no matter how close they are to receiving care. The distance between medical facilities can be addressed, and persons with critical ailments like cardiovascular disease can benefit from timely and meaningful contact and communication with healthcare practitioners by utilizing cellular data networks and the Internet (7). Furthermore, telemedicine bridges the gap between patients and healthcare providers, irrespective of location. By leveraging cellular data networks and the Internet, patients with critical conditions like CVD can maintain timely and effective communication with medical professionals (7).

Telemedicine Development

Telemedicine, a concept initially explored in the 1920s through radio physician care and experimental television transmission, has evolved significantly over the decades (8). The transmission of radiographic images in the late 1940s marked the beginning of teleradiology, laying the groundwork for telemedicine's integration into healthcare systems. Over time, telemedicine has become pivotal in providing accessible, cost-effective, and time-efficient care, particularly in settings like prisons, where there is a high concentration of patients with both acute and chronic illnesses (9).

The primary goal of telemedicine technology is to deliver healthcare services cost-effectively, extending care to remote and virtual settings (10). Telemedicine provides unique and rare types of treatment and interventions that are available in limited healthcare institutions. This is especially beneficial in specific medical scenarios, such as teleconsultations and remote monitoring of cardiovascular patients.

Over the past four years, telemedicine has advanced to facilitate remote physiological data analysis and reduce the need for in-person referrals, minimizing the resources required for security, transportation, and unique accommodations in specific settings (6). Despite these advancements, there remains a gap in research regarding telemedicine's evolution in medical care, particularly in its effectiveness for treating cardiovascular diseases (CVDs).

While telemedicine has been recognized as a potential time-saver in CVD care, there is still a need for more comprehensive understanding and research in this area. In other words, it is essential to understand the needs and requirements to start any telemedicine program.

Moreover, there is a need for experimental studies to understand the needs, advantages, barriers and attitudes toward telemedicine. Additionally, patient adherence to telemedicine interventions presents another layer of complexity (11).

Telemedicine and CVDs

Telemedicine has been identified as a crucial tool in managing healthcare issues, particularly in the context of cardiovascular diseases (CVDs) (5, 12, 13). Its significance is pronounced in rural areas, where an undersupply of cardiac hospitals and specialists makes telemedicine a necessary alternative (14). It addresses barriers such as long distances and high travelling costs, making healthcare more accessible.

Despite the potential of telemedicine to improve the quality of life for individuals with CVDs, there remains uncertainty among practitioners about its efficacy (14). Studies suggest telemedicine, by promoting self-management behaviors and facilitating active monitoring, contributes to better short-term outcomes in managing CVDs (5, 6, 15). However, traditional care delivery methods may fail to achieve these goals, highlighting the need for telemedicine to complement conventional healthcare.

Research indicates that telemedicine can improve patient satisfaction, as evidenced in a study by Metzger (16) involving congestive heart failure patients. Metzger (16) carried out quantitative research to examine the satisfaction of congestive heart failure (HF) patients with or without telehealth utilization in-home healthcare. For this research, 86 volunteer patients aged between 59 and 99 were asked to complete a questionnaire of 15 items to compare usual home healthcare and telehealth home healthcare. Based on the conducted statistical analysis, it was found that using telehealth for in-home healthcare improves patients' satisfaction among older people.

Similarly, a meta-analysis conducted by Pekmezaris, Nouryan (15) revealed telehealth's benefits through an invasive implanted device that reduces the mortality or HF rate. In rural areas, it benefits those who live far away from hospitals or specialists or have transportation issues. It allows physicians to monitor the patients' chronic conditions and treat them accordingly, improving their healthcare quality. Telehealth provides a possibility for remote monitoring and self-management of various risk factors of CVDs, indicating the potential of this technology to revolutionize the healthcare environment by reducing the mortality rate among patients diagnosed with CVDs and improving the quality of care offered to patients and their families.

Telemedicine's role extends to early screening and reducing CVD risk factors (12). McMurray and Packer (17) highlight the importance of telemedicine in both outpatient and inpatient settings, especially for chronic heart failure patients who often face readmission within months of discharge. Telemedicine and telemonitoring have thus become essential in managing coronary artery diseases from patients' homes, improving patient safety and care quality (5).

The use of telepharmacy, a subset of telemedicine, has shown promise in managing CVDs. Alexander, Butler (18) noted that telepharmacy could shift CVD management towards more patient-centered care (19).

While telemedicine holds great potential in transforming healthcare for CVD patients, challenges remain. Mitchell-Gillespie, Hashim (20) indicated the need for more robust evidence to support its benefits. Concerns about the regulation and efficacy of many telemedicine applications also persist, coupled with limitations in current research, such as small sample sizes. Therefore, further research with larger cohorts is necessary to understand and leverage telemedicine's potential in CVD management fully.

Factors affecting telemedicine in CVDs

Adopting telemedicine-based programs faces several challenges, including resistance from healthcare professionals and patients, technological hurdles, cultural factors, and economic constraints. One significant barrier to telemedicine adoption is resistance from both physicians and patients, which often stems from a lack of information technology training. This makes it crucial to incorporate comprehensive training programs in telemedicine initiatives (21). In terms of technological and infrastructure barriers, poor infrastructure and inadequate funding significantly impede the successful implementation of telemedicine. Al-Shayea (22) highlighted the potential of cloud computing in telemedicine, emphasizing the need for advanced communication systems to support real-time remote health monitoring, which can reduce hospital congestion and enhance data delivery efficiency.

Cultural beliefs and expectations also present unique challenges in telemedicine adoption, often influencing patients' acceptance and utilization of telemedicine services. Moreover, sustaining telemedicine in developing countries brings challenges, as Musa Jaber, Abd Ghani (23) noted, underscoring the need for robust data management systems. Al-Okaily, Al-Okaily (23) recommended building data warehouses to improve service quality and reduce costs. Additionally, Nasir, Goto (24) explored mobile health in Jordan's refugee context, highlighting obstacles like limited internet access and the skills needed to use these applications effectively. Similarly, Mitchell-Gillespie, Hashim (20) acknowledged the short-term success of telemedicine but also noted challenges such as inadequate infrastructure and cultural beliefs.

The COVID-19 pandemic has underscored the need for comprehensive national telemedicine plans, as evidenced by the success of certain telemedicine initiatives in Jordan (25). Obeidat, El-Salem (25) conducted a systematic review to evaluate the feasibility of telemedicine in Jordan over the past two decades. They proposed an effective telemedicine initiative to be established and implemented during COVID-19 and ensure its success even after the pandemic. Data was collected from a literature search, and relevant information was gathered from 19 articles. This study proposed designing a national telemedicine program that can be sustainable during and after the pandemic. This study also identified various stakeholders responsible for the implementation of telemedicine in Jordan and suggested various steps that can be designed and implemented to ensure that the programs work. Jordan is facing significant healthcare challenges following the COVID-19 pandemic.

In conclusion, the successful implementation of telemedicine services is hindered by a combination of professional and patient resistance, technological limitations, cultural factors, economic constraints, and the need for adequate training in information technology.

Future recommendations to implement telemedicine in managing CVD

Telemedicine and telehealth are increasingly recognized as valuable tools for providing quality healthcare, particularly in rural areas with limited access to healthcare resources. Several recommendations are proposed to maximize the benefits of telemedicine in managing cardiovascular diseases (CVD). Firstly, it is essential to encourage all hospitals, especially in the context of the COVID-19 pandemic, to adopt telemedicine systems. This is crucial not just for managing CVD but also for containing the spread of infections and minimizing physical interactions between patients and healthcare providers (25, 26). Additionally, hospitals should invest in advanced telemedicine technologies, as this will promote the success of telemedicine interventions and help overcome barriers to remote healthcare delivery. Addressing resistance to telemedicine by training and educating patients and practitioners about its potential benefits is also vital. Empowering them with knowledge and skills can facilitate more successful implementation (20). Integrating telemedicine systems into all hospital services is another recommendation which can save resources and time (27, 28). This should include a strategic plan for seamlessly integrating telemedicine into existing healthcare processes. Expanding electronic health records is also essential, as they are crucial for treating patients remotely using advanced technologies (28). Further research is needed in developing countries like Jordan to understand the specific needs and barriers to telemedicine implementation in these contexts. In conclusion, while telemedicine offers numerous benefits for patients, practitioners, and healthcare organizations, its successful adoption, particularly in CVD management, requires concerted efforts in training, technology investment, and strategic implementation.

Conclusion

Telemedicine has shown a remarkable capacity to revolutionize healthcare delivery, particularly in managing various diseases, including cardiovascular conditions. This review underscores telemedicine's growth in the medical field, noting its increasing role in providing high-quality care and enhancing patient satisfaction.Key findings from the literature reveal that telemedicine effectively addresses several healthcare challenges. It facilitates improved access to care, particularly in remote areas, enhances patient adherence to treatments, reduces re-hospitalization rates, and minimizes waiting times. Despite these advancements, challenges such as technological barriers, resistance from healthcare professionals and patients, and policy gaps persist.

Telemedicine's potential is vast, with opportunities for continuous improvement and innovation. Future advancements should enhance affordability, accessibility, and patient autonomy in managing chronic conditions. Additionally, the need for policy and legislative reforms cannot be overstated. There is a pressing need for policies that support telemedicine, especially regarding reimbursement models, to ensure that its benefits are maximized for public health improvement.

In conclusion, telemedicine has proven to be an effective modality in the medical field, meeting most patient expectations and offering a viable option for healthcare providers to extend their services to underserved areas. As telemedicine continues to evolve, healthcare systems, policymakers, and practitioners must adapt and embrace this technology to ensure its full potential is realized in improving patient outcomes and healthcare delivery.

Availability of data and materials

Data are available from the authors upon reasonable request.

Competing interests

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