

The Role of Telemedicine in Chronic Disease Management: A Literature Review

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ABSTRACT

Chronic diseases like diabetes, hypertension, and heart disease pose growing challenges to healthcare systems worldwide. Telemedicine has emerged as a key tool in managing these conditions by enabling remote monitoring, real-time consultations, and personalized care. This literature review examines the effectiveness of telemedicine in chronic disease management, highlighting its ability to improve patient outcomes, reduce hospital visits, and enhance quality of life. While telemedicine shows significant promise, its success depends on effective implementation, patient engagement, and overcoming barriers such as technology access and regulatory issues.

Keywords: telemedicine; telehealth; health management; chronic disease

INTRODUCTION

Telemedicine has emerged as a valuable tool in the management of chronic diseases, offering benefits such as improved patient outcomes, reduced healthcare costs, and enhanced disease management.

COVID-19 emerged in late 2019 in Wuhan, China, caused by the SARS-CoV-2 virus, leading to a global health alert and pandemic declaration in early 2020. Social distancing quickly became a key strategy to prevent the spread of the virus, prompting a surge in telemedicine use to minimize exposure during medical consultations.

Although telemedicine was in use before the pandemic, primarily in advanced triage services in hospitals like Jefferson Health and Cleveland Clinic, the pandemic significantly accelerated its adoption. Telemedicine has roots dating back to 1905 when William Einthoven conducted the first remote consultation using tele-electrocardiography and telephonic cardiac auscultation. Today, it is widely applied in managing chronic diseases, and mental health, and providing care in rural areas where access is limited.

The COVID-19 lockdowns exacerbated challenges in healthcare access, especially for patients with chronic conditions like hypertension, who faced difficulties in managing their health during the early months of the pandemic due to mobility restrictions [1]. Given the growing patient population and the global shortage of healthcare professionals, ensuring timely access to healthcare is a significant challenge in service delivery.

This challenge can be addressed by the widespread adoption of communication technologies, particularly smartphones, which are increasingly accessible and widely used. As of early 2023, over 85% of individuals use smartphones, and the majority of them have access to the Internet [2]. Advanced technologies, combined with high-quality network services, enhance healthcare delivery and expand its accessibility to a broader population. Telemedicine, in particular, offers significant advantages by facilitating access to preventive care and supporting long-term health management [3].

TELEHEALTH AND TELEMEDICINE

Telehealth is the use of technology-based virtual platforms to provide health information, prevention, monitoring, and medical care. It is the fastest-growing sector in healthcare, with telemedicine being its largest component [4]. Telehealth enhances the efficiency of hospital and clinic operations while safeguarding both healthcare workers and patients.

Prior to COVID-19, the telehealth market was already advancing in home healthcare. Key emerging practices in telehealth include telephysical therapy, teleneurology, telemental health, management of chronic conditions like CHF, COPD, and diabetes, as well as home hospice, mechanical ventilation, and dialysis [5]. The WHO defines telemedicine, or e-health, as the practice of providing medical care through interactive audiovisual and data communication. This encompasses delivering medical care, diagnosing, consulting, treating, offering health education, and transferring medical data [6].

Telemedicine encompasses a range of services designed to support patients and healthcare providers. Its uses include online consultations, remote monitoring, telehealth nursing, and virtual physical and psychiatric rehabilitation.

Telemedicine improves healthcare by offering better choices, enhancing emergency services, speeding up diagnoses, and cutting costs for both doctors and patients by optimizing clinical procedures and reducing travel. It has expanded access to high-quality care, allowing patients to receive tailored services and consult with top medical professionals through video calls.

It also offers clinicians advanced tools for networking, data management, and report handling, which enhances medical practice and reduces the need for rural assignments. Additionally, telemedicine improves patient experience by reducing wait times, streamlining access to patient information, and enabling doctors to treat more patients efficiently [3].

TELEMEDICINE'S ROLE IN CHRONIC DISEASE MANAGEMENT

Chronic diseases have been a major issue in health management for a long time. The Global Burden of Disease 2015 study found that chronic diseases were responsible for over 50% of global deaths, with cardiovascular diseases, diabetes, and Chronic Obstructive Pulmonary Disease (COPD) being the top contributors. In China, 75.8% of adults over 60 have at least one chronic disease, and in Europe, chronic disease management accounts for 70% of healthcare costs. Given the aging population in many countries, these figures are expected to increase, leading to greater social burdens. Therefore, developing effective chronic disease management systems is crucial [7].

Telemedicine consultation and telemonitoring are commonly used for managing chronic diseases. Nine studies reviewed the effectiveness of telemedicine interventions for diabetes management. Results varied: some studies reported improvements in fasting blood glucose (FBG) and HbA1c levels with telemonitoring and telemedicine consultation, while others did not show significant improvements in HbA1c. Notable findings include improvements in glucose levels after 24 and 52 weeks with telemonitoring and positive effects on HbA1c with combined telemedicine consultation and telemonitoring. Four studies evaluated telemedicine interventions for hypertension, indicating that telemedicine consultation and home blood pressure telemonitoring improved blood pressure control over periods ranging from 6 to 12 months. Telemonitoring showed better control of systolic blood pressure compared to typical care.

Two studies assessed telemedicine for rheumatoid arthritis patients. One study found reduced anxiety and depression with telemedicine consultation, while another found it enhanced medication compliance but did not significantly improve disease symptoms [8].

Among the three studies on hyperlipidemia, two evaluated LDL-C levels, two assessed total cholesterol, and one looked at triglyceride levels. Of the two studies comparing intervention and control groups, one found no significant differences in LDL-C and triglyceride levels after 5 months, while the other found no significant changes in total cholesterol after 12 months [9]. Studies showed that telemedicine interventions are effective for managing chronic conditions such as systemic lupus erythematosus [10], cystic fibrosis [11], chronic obstructive pulmonary disease (COPD) [12,13], and chronic liver disease [14]. Additionally, telemedicine has shown positive effects on other conditions such as cardiovascular diseases [15].

CHALLENGES OF TELEMEDICINE IN CHRONIC DISEASE MANAGEMENT

The effectiveness of telemedicine in chronic disease management has been supported by various systematic reviews and meta-analyses [8,9,16,17]. These reviews highlight the positive impact of telemedicine on outcomes related to clinical disease management, patient self-management, adherence, and quality of life. Furthermore, telemedicine has been associated with improvements in patient outcomes through regular remote monitoring, virtual consultations, and pharmacist-managed telemedicine clinics [14,16,18].

Despite the benefits, challenges exist in the widespread adoption of telemedicine for chronic disease management. Concerns such as differences in technology, data security, regulatory issues, and ethical considerations have been identified as potential obstacles [19]. Additionally, the fact that individuals with lower incomes often have fewer resources and less access to telehealth services. Disparities in managing chronic diseases and accessing telehealth services are intensified by factors like geography, race, ethnicity, and education [20,21]. However, with proper planning and infrastructure, telemedicine has the potential to revolutionize healthcare delivery by bridging gaps in access to care, particularly for patients with chronic and debilitating diseases [19,22].

CONCLUSION

Telemedicine has emerged as a crucial tool in the management of chronic diseases, providing significant benefits in terms of patient outcomes, cost reduction, and enhanced disease management. The COVID-19 pandemic accelerated the adoption of telemedicine, highlighting its potential to address healthcare challenges, particularly in times of crisis. However, despite its advantages, telemedicine faces challenges related to technology access, data security, and disparities influenced by geography, race, ethnicity, and socioeconomic status. To fully harness the potential of telemedicine, it is essential to address these barriers through strategic planning, infrastructure development, and targeted educational initiatives. With the right support, telemedicine can play a transformative role in bridging healthcare gaps, especially for patients with chronic conditions.

CONFLICTS OF INTEREST

No competing interests were declared.

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REFERENCE

- [1] Quesada-Caballero, M. et al. (2023). Telemedicine in elderly hypertensive and patients with chronic diseases during the COVID-19 pandemic: A systematic review and meta-analysis, *Journal of Clinical Medicine*, 12(19), p. 6160. doi:10.3390/jcm12196160.
- [2] Parsaei, Z. et al. (2024). Functional and nonfunctional requirements of Virtual Clinic Mobile Applications: A systematic review, *International Journal of Telemedicine and Applications*, 2024(1). doi:10.1155/2024/7800321.
- [3] Haleem, A. et al. (2021). Telemedicine for healthcare: Capabilities, features, barriers, and applications, *Sensors International*, 2. doi:10.1016/j.sintl.2021.100117.
- [4] Mechanic, O.J. et al. (2022) Telehealth Systems, StatPearls [Internet]. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK459384/> (Accessed: 20 August 2024).
- [5] Rosen, J.M. et al. (2021). Telehealth's New Horizon: Providing smart hospital-level care in the home, *Telemedicine and e-Health*, 27(11), pp. 1215–1224. doi:10.1089/tmj.2020.0448.
- [6] Stowe, S. and Harding, S. (2010) 'Telecare, telehealth and telemedicine', *European Geriatric Medicine*, 1(3), pp. 193–197. doi:10.1016/j.eurger.2010.04.002.
- [7] Xiao, Z. and Han, X. (2023) 'Evaluation of the effectiveness of telehealth chronic disease management system: Systematic Review and meta-analysis', *Journal of Medical Internet Research*, 25. doi:10.2196/44256.
- [8] Ma, Y. et al. (2022) 'Telemedicine application in patients with chronic disease: A systematic review and meta-analysis', *BMC Medical Informatics and Decision Making*, 22(1). doi:10.1186/s12911-022-01845-2.
- [9] Mabeza, R., Maynard, K., & Tarn, D. (2022). Influence of synchronous primary care telemedicine versus in-person visits on diabetes, hypertension, and hyperlipidemia outcomes: a systematic review. *BMC Primary Care*, 23(1). doi:10.1186/s12875-022-01662-6
- [10] Bruera, S. (2023). Telemedicine for patients with systemic lupus erythematosus in a publicly funded hospital system: a retrospective study (preprint). *Interactive Journal of Medical Research*. doi:10.2196/49065
- [11] Fainardi, V., Capoferri, G., Tornesello, M., Pisi, G., & Esposito, S. (2023). Telemedicine and its application in cystic fibrosis. *Journal of Personalized Medicine*, 13(7),1041. doi:10.3390/jpm13071041
- [12] Toledo, P., Jiménez, S., Pozo, F., Roca, J., Alonso, A., & Hernández, C. (2006). Telemedicine experience for chronic care in COPD. *Ieee Transactions on Information Technology in Biomedicine*, 10(3), 567-573. doi:10.1109/titb.2005.863877
- [13] Li, W. et al. (2021) 'Perceptions of patients with chronic obstructive pulmonary disease towards telemedicine: A qualitative systematic review', *Heart & Lung*, 50(5), pp. 675–684. doi:10.1016/j.hrtlng.2021.03.081.
- [14] You, A., Kawamoto, J., & Smith, J. (2014). A pharmacist-managed telemedicine clinic for hepatitis c care: a descriptive analysis. *Journal of Telemedicine and Telecare*, 20(2), 99-101. doi:10.1177/1357633x13519043
- [15] Brunetti, N., Molinari, G., Acquistapace, F., Zimotti, T., Parati, G., Indolfi, C., ... & Carugo, S. (2020). 2019 Italian Society of Cardiology Census on Telemedicine in cardiovascular disease: a report from the working group on telecardiology and informatics. *Open Heart*, 7(1), e001157. <https://doi.org/10.1136/openhrt-2019-001157>
- [16] Littauer, S., Dixon, D., Mishra, V., Sisson, E., & Salgado, T. (2017). Pharmacists providing care in the outpatient setting through telemedicine models: a narrative review. *Pharmacy Practice*, 15(4), 1134-1134. doi:10.18549/pharmpract.2017.04.1134
- [17] Wootton, R. (2012). Twenty years of telemedicine in chronic disease management – an evidence synthesis. *Journal of Telemedicine and Telecare*, 18(4), 211-220. doi:10.1258/jtt.2012.120219
- [18] Ezeamii, V. (2024). Revolutionizing healthcare: how telemedicine is improving patient outcomes and expanding access to care. *Cureus*. doi:10.7759/cureus.63881
- [19] Kale, E. (2023). Telemedicine revolution: bridging gaps in access to healthcare. *International Journal on Recent and Innovation Trends in Computing and Communication*, 11(7), 394-399. <https://doi.org/10.17762/ijritcc.v11i7.9424>
- [20] Almalki, Z. et al. (2023) 'Access and disparities in the use of telemedicine among patients with chronic conditions in Saudi Arabia: A cross-sectional study', *Journal of Multidisciplinary Healthcare*, Volume 16, pp. 3789–3798. doi:10.2147/jmdh.s433653.
- [21] Williams, C. and Shang, D. (2023). Telehealth for Chronic Disease Management Among Vulnerable Populations. *Journal of Racial and Ethnic Health Disparities*, pp.1–8. doi:10.1007/s40615-023-01588-4.
- [22] Shrivastava, A. (2024). Modeling telemedicine consumer behavior amid COVID-19 pandemic. *International Journal of Pharmaceutical and Healthcare Marketing*, 18(3), 375-397. doi: 1108/ijphm-08-2021-0085