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Review Article

Telehealth in hypertension management: remote monitoring, adherence, and patient outcomes

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ABSTRACT

Hypertension, commonly referred to as high blood pressure, is characterized by consistently elevated blood force against artery walls. Managing hypertension involves lifestyle adjustments and, when necessary, medication. Telehealth is instrumental in transforming hypertension management, utilizing technology to enhance remote monitoring, engage patients, and enhance overall outcomes. This review seeks to amalgamate existing literature and advancements in telehealth applications specific to hypertension, offering a comprehensive understanding of the present knowledge landscape, identifying gaps, and shedding light on implications for patient outcomes. Telehealth stands as a revolutionary force in hypertension management, providing inventive approaches for remote monitoring, promoting medication adherence, and overall enhancing patient well-being. However, challenges like technological barriers, security concerns, and resistance to change need addressing. Issues surrounding device compatibility, accuracy variations, and limitations in substituting certain in-person examinations also require attention. A holistic strategy, encompassing technological progress, education, and policy evolution, is crucial to overcome these challenges and fully realize telehealth's potential in hypertension management, contributing to improved patient outcomes and a reduced global burden of hypertension and chronic diseases.

Keywords: Telehealth, Hypertension, Patient outcomes, Remote monitoring

INTRODUCTION

Hypertension, commonly known as high blood pressure, is a condition characterized by the force of the blood against the walls of the arteries being consistently too high. It is usually an asymptomatic condition and can be missed until severe consequences occur. Uncontrolled hypertension can cause damage to the heart, resulting in angina, heart attack, heart failure, arrhythmia, and stroke. It can also adversely affect the kidneys and cause kidney damage.[1] Global estimates regarding hypertension highlight the growing burden of the disease. According to the World Health Organization, approximately 1.28 billion people between the ages of 30-79 have been living with hypertension, out of which two third the affected population resides in low and middle-income countries. Moreover, it is estimated that around 46% of the adults living with hypertension are unaware of the condition. Out of those who know about the condition, only 21% have it under control and are compliant with their management plan. Hypertension is identified as one of the major causes of premature deaths around the world.[2] The centers for disease control (CDC) estimated that the prevalence of hypertension in the US is around 48.1%.[1] A study from the African region indicated that the prevalence of hypertension is around 25.9%, out of which 50% of the population is unaware of the condition they are suffering from.[3] Similar estimates were observed in China where a longitudinal study estimated the prevalence of hypertension to be 32.5%, out of which half of the population was diagnosed and were receiving some kind of treatment.[4] Another study highlighted the prevalence of hypertension in four Middle Eastern countries (Iran, Saudi Arabia, Palestine, and the United Arab Emirates); an overall prevalence of 33% was found in all the regions combined, with approximately 50% of the population being aware of their diagnosis.[5]

The management of hypertension involves a combination of lifestyle modifications and, if necessary, medication. A healthy diet, regular physical activity, moderation in alcohol consumption, smoking cessation, limiting caffeine intake, and stress management are primary perimeters of concern for the management of hypertension.[6] Multiple guidelines for the treatment of hypertension such as the Japanese society of hypertension guidelines for the management of hypertension (JSH 2019), JNC 8 guidelines for the management of hypertension in adults, and the guide to the management of hypertension 2008 by the national heart foundation of Australia suggested that all adults with a consistent blood pressure of more than 150-90 mmHG should be started on antihypertensive therapy and medications.[7-9] Usually, antihypertensive medications include a combination of thiazide diuretics, angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), calcium channel blockers, and beta blockers.[7] Due to the lengthiness of the comprehensive drug therapy required for hypertension, medication adherence is a very common issue associated with non-compliance and increased incidence of cardiovascular events. Several strategies have been recommended in the literature for the improvement of medication adherence in patients with hypertension like patient education, and telehealth or electronic monitoring.[10]

Telehealth plays a pivotal role in revolutionizing the management of hypertension by leveraging technology to enhance remote monitoring, foster patient engagement, and improve overall outcomes. Through telehealth platforms, individuals with hypertension can benefit from remote blood pressure monitoring, utilizing connected devices to transmit real-time data to healthcare providers.[11] Virtual consultations and telemonitoring enable healthcare professionals to conduct regular check-ins with patients, breaking down geographical barriers and ensuring consistent, proactive care. By promoting continuous communication, early intervention, and patient education, telehealth emerges as a valuable ally in the multifaceted strategy to combat hypertension, contributing to improved long-term management and better overall health outcomes for individuals managing this chronic condition.[12] As technology continues to advance, the integration of artificial intelligence and data analytics in telehealth platforms holds promise for further personalized and efficient hypertension management, ensuring that patients receive timely, tailored interventions to optimize their health and well-being.

The rationale for conducting this review stems from the increasing prevalence of hypertension worldwide and the transformative impact of telehealth technologies on healthcare delivery. With hypertension being a leading risk factor for cardiovascular diseases, stroke, and other health complications, exploring innovative approaches to its management is crucial. Telehealth, encompassing remote monitoring, virtual consultations, and digital interventions, has emerged as a promising avenue to address the challenges associated with hypertension. This review aims to synthesize existing literature, studies, and advancements in telehealth applications specific to hypertension, providing a comprehensive understanding of the current state of knowledge, identifying gaps, and shedding light on the implications for patient outcomes. By critically examining the role of telehealth in remote blood pressure monitoring, medication adherence, and its overall impact on patient outcomes, this review aims to contribute valuable insights to both healthcare practitioners and researchers, fostering informed decision-making and guiding future directions for telehealth in hypertension management.

LITERATURE RESEARCH

The research project, initiated on November 14th, 2023, began after a thorough examination of existing literature. To conduct a comprehensive literature review, multiple databases, including PubMed, web of science, and Cochrane, were utilized. Various medical terms were employed in diverse combinations during the search

process, and manual searches on Google Scholar were also conducted to identify relevant research terms. The literature review focused on key areas such as the prevalence of hypertension, management strategies, the role of telehealth in hypertension management, and its impact on medication adherence. Keywords related to types of remote monitoring, patient-related outcomes, and hypertension indicators were incorporated into the search strategy. It is essential to emphasize that the criteria for selecting articles were established based on multiple factors to ensure a thorough and robust review process.

DISCUSSION

Telehealth not only allows for a more comprehensive understanding of daily blood pressure fluctuations but also facilitates timely interventions based on personalized patient data. These electronic platforms often incorporate features like medication reminders, educational resources, and lifestyle management tools, promoting medication adherence and empowering patients to make informed decisions about their health. Moreover, the integration of telehealth with electronic health records enables seamless data sharing, fostering a collaborative approach between patients and healthcare providers.

Remote monitoring

Remote monitoring itself is a vital umbrella concept, which can cater to self-monitoring of blood pressure as well as the use of telehealth devices such as connectable blood pressure monitors or smartwatches. Patients can use home blood pressure monitors that are linked to a telehealth platform, enabling healthcare providers to track blood pressure readings in real time. Integration with wearable devices, such as smartwatches and fitness trackers, enables continuous monitoring of physical activity, heart rate, and other relevant parameters that also contribute to hypertension management.[13] In addition to that, patients can have virtual consultations with healthcare providers, allowing for regular check-ins without the need for in-person visits. These virtual appointments facilitate timely adjustments to treatment plans based on remote monitoring data. Telehealth platforms ensure secure communication channels, enabling patients to ask questions, report issues, and receive guidance from healthcare professionals in a timely manner.[14] Literature suggests that the management of hypertension with telemedicine requires a shorter time duration to achieve ideal blood pressure (BP) levels as compared to usual care. Moreover, patients were more compliant with reporting and connecting online instead of visiting in person due to the time and cost of travel.[15] Another study reported a significant association between remote physiological monitoring of blood pressure and a reduction in the mean arterial pressure of the study participants.[16] Additionally, remote monitoring generates a wealth of data. Advanced analytics can help healthcare providers identify trends, assess treatment efficacy, and make data-driven decisions to optimize patient care. Telehealth systems often integrate with electronic health records, allowing seamless sharing of patient data between healthcare providers. This integration ensures that all relevant information is accessible during virtual consultations.[17]

Adherence to medications

Individuals with chronic diseases such as hypertension have shown negative patient outcomes majorly due to the lack of long-term medication adherence.[18] WHO reported that almost 50% of the diagnosed patients with chronic diseases in developing countries are not adhering to their medication schedule.[19] Medication adherence depends on various contributing factors and plays a vital role in the management of hypertension. One of the features of telehealth applications is empowering patients with the tools to monitor their own health and make informed decisions. This fosters a sense of responsibility and control over their condition. Such telehealth approaches that promote patient education and self-awareness have been responsible for better medication adherence in hypertensive patients.[20] Telehealth platforms can also include interactive features for patient education, enabling individuals to learn about lifestyle modifications, dietary changes, and other factors that can positively impact hypertension. Moreover, applications featuring medication reminders help patients remember their medication schedule by receiving timely alerts on their smartphones or other devices.[21] A recent study from 2021 has highlighted that telehealth interventions for medication adherence are associated with higher medication possession ratios (MPR).[20] Telehealth also breaks down geographical barriers, ensuring that patients in remote or underserved areas have access to hypertension management resources and expertise. Evidence suggests that connecting with health professionals such as pharmacists through telehealth can be beneficial in improving medication adherence. These virtual interventions were deemed effective for bridging the gap between health professionals and patients, reducing health disparity due to inaccessibility.[22] For individuals with mobility issues or other barriers to in-person visits, telehealth provides a convenient alternative for receiving timely and effective healthcare. Another study observed the impact of a patient education intervention through telehealth in a primary healthcare setting, which resulted in remarkable improvements in medication adherence among hypertensive individuals, strengthening the role of telehealth in successfully improving medication adherence.[23]

Improved patient outcomes

Generally, telehealth has been an effective intervention in maintaining the blood pressure levels of hypertensive patients within optimal ranges and has been recognized as a fruitful strategy in the management of hypertension. Studies indicate that telehealth supports long-term management strategies, fostering a continuous and

collaborative relationship between patients and healthcare providers, leading to better overall outcomes.[24] With continuous remote monitoring and virtual check-ins, healthcare providers can identify issues early and intervene promptly, potentially preventing complications associated with uncontrolled hypertension.[22] Moreover, patient satisfaction has also been surveyed in individuals using telehealth for the management of hypertension, and positive feedback has been reported from the majority of the users.[25] However, several risks have been identified, which can be potential barriers to the widespread use of telehealth for the management of hypertension. Reduced patient interest and compliance are the foremost ongoing issues identified with the use of telehealth systems.[12] Another issue faced by the researchers was access to technology and digital literacy. Most of the patients with hypertension belong to the older age group and may lack the digital literacy skills needed to navigate telehealth platforms and devices, leading to potential difficulties in using the technology effectively.[25] Additionally, telehealth may not fully substitute in-person visits, especially when a physical examination is necessary. Certain aspects of hypertension management, such as assessing peripheral edema or listening to heart sounds, may be challenging remotely. Both healthcare providers and patients may also exhibit resistance to adopting telehealth practices, stemming from a preference for traditional healthcare models or concerns about the quality of care delivered remotely.[24] Another concern highlighted in the evidence was that the accuracy and reliability of remote monitoring devices can vary. Ensuring the quality and calibration of these devices is crucial for obtaining trustworthy data for hypertension management.[26] And lastly, in emergencies or acute situations, telehealth may not provide the immediacy required for timely interventions.[27] Addressing these issues requires a comprehensive approach involving technological advancements, education for both healthcare providers and patients, and the development of supportive policies, for the betterment of patient outcomes related to telehealth and its use in reducing the worldwide burden of hypertension and other chronic non-communicable diseases.

CONCLUSION

In conclusion, telehealth has emerged as a transformative force in the management of hypertension, offering innovative solutions for remote monitoring, medication adherence, and overall improvement in patient outcomes. Despite its numerous benefits, challenges such as technological barriers, resistance to change, device compatibility and accuracy, and the inability to substitute certain aspects of in-person examinations exist. A comprehensive approach involving technological advancements, education, and policy development is essential to overcome these challenges.

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