NEW ERA MEDICAL JOURNAL

Short Communication

Wearable Devices in Monitoring Cardiac and Metabolic Health

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ABSTRACT

Wearable devices have emerged as valuable tools in the monitoring of cardiac and metabolic health, offering continuous, real-world insights that extend beyond traditional clinic-based assessments. The rising prevalence of cardiovascular and metabolic disorders highlights the need for early detection and ongoing monitoring strategies that support preventive and personalized care. This short communication discusses the role of wearable technologies, including smartwatches, fitness trackers, and wearable biosensors, in tracking key physiological parameters such as heart rate, physical activity, sleep patterns, and, in selected devices, cardiac rhythm and glucose levels. Evidence suggests that wearable devices can aid in the early identification of cardiac abnormalities, particularly atrial fibrillation, and support lifestyle modifications essential for metabolic health management. Additionally, real-time feedback from these devices promotes patient engagement and self-awareness, contributing to improved physical activity and health-related behaviors. Despite these advantages, challenges remain related to data accuracy, long-term user adherence, privacy concerns, and integration with clinical workflows. When used in conjunction with professional healthcare guidance, wearable devices have the potential to enhance early diagnosis, support personalized interventions, and improve long-term health outcomes.

Keywords: Wearable devices; Cardiac health monitoring; Metabolic health; Digital health technologies

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DOI: 10.62502/nemj/v1i3art5

Received: 19/08/2025
Accepted: 12/12/2025
Published: 20/12/2025

INTRODUCTION

Cardiovascular and metabolic diseases remain among the leading causes of morbidity and mortality worldwide. Conditions such as hypertension, diabetes mellitus, dyslipidemia, and obesity often develop silently over years, with clinical symptoms appearing only after significant physiological damage has occurred. Conventional healthcare models rely heavily on episodic clinic visits and laboratory-based measurements, which may not adequately capture daily variations in physiological parameters or lifestyle behaviors that contribute to disease progression. [1,2] In this context, wearable health technologies have gained attention as tools that enable continuous, real-world monitoring of cardiac and metabolic parameters. Devices such as smartwatches, fitness trackers, and wearable biosensors can measure heart rate, physical activity, sleep patterns, and, in selected devices, electrocardiographic signals and glucose levels. [3] These technologies shift health monitoring from isolated clinical encounters to continuous observation in everyday life, offering opportunities for early detection, prevention, and personalized care. [4]

Wearable Devices and Cardiac Health Monitoring

Wearable devices have shown particular promise in cardiac monitoring. Continuous heart rate tracking allows assessment of resting heart rate, exercise response, and heart rate variability, which are important indicators of

autonomic function and cardiovascular fitness. Advanced wearables equipped with single-lead ECG capabilities can detect rhythm irregularities, especially atrial fibrillation, which is often asymptomatic but associated with a high risk of stroke if left undiagnosed. [5] Large population-based studies have demonstrated that smartwatch-based rhythm monitoring can identify previously undiagnosed atrial fibrillation and prompt timely medical evaluation [6] Additionally, long-term heart rate trends captured by wearables may help clinicians identify early signs of cardiovascular stress or deconditioning, particularly in individuals with sedentary lifestyles or underlying metabolic disorders.

Role in Metabolic Health Monitoring: From a metabolic health perspective, wearable devices play a critical role in tracking physical activity, sedentary time, sleep duration, and energy expenditure. These factors are closely linked to insulin sensitivity, weight regulation, and cardiovascular risk. [7] Regular monitoring of step count and activity intensity has been associated with improved physical activity levels and better glycemic control among individuals with or at risk of type 2 diabetes. Some newer wearable systems integrate continuous glucose monitoring with activity and sleep data, providing a more comprehensive understanding of how daily behaviours influence glucose fluctuations. Such integrated data can support personalized lifestyle interventions and enhance patient engagement in self-care. [8]

Clinical Value and Behavioural Impact: Beyond physiological monitoring, wearable devices encourage health awareness and behaviour modification. Real-time feedback, goal setting, and progress tracking motivate users to adopt healthier habits, such as increased physical activity and improved sleep hygiene. Studies suggest that wearable-supported interventions are more effective when combined with professional guidance, rather than used as stand-alone tools. [9] However, challenges remain, including variability in measurement accuracy, user adherence over time, data privacy concerns, and limited integration with electronic health records. Addressing these issues is essential for the effective clinical adoption of wearable technologies. [10]

DISCUSSION

This short communication highlights the growing role of wearable devices in the monitoring of cardiac and metabolic health and their potential contribution to preventive and personalized healthcare. The findings from existing literature suggest that wearable technologies can bridge important gaps in conventional healthcare by enabling continuous, real-world monitoring of physiological and behavioral parameters that are otherwise difficult to capture during routine clinical visits.

In cardiac health, wearable devices have demonstrated significant value in tracking heart rate trends, heart rate variability, and rhythm disturbances. The ability of smartwatch-based ECG systems to detect atrial fibrillation has been particularly impactful, as this condition often remains undiagnosed until complications such as stroke occur. Early identification through wearable monitoring allows timely clinical evaluation and intervention, which may reduce adverse outcomes. However, while detection sensitivity is high, false-positive alerts can occur, emphasizing the need for clinical confirmation and appropriate interpretation of wearable-derived data.

From a metabolic health perspective, wearables support long-term monitoring of physical activity, sleep, and sedentary behavior, which are key modifiable risk factors for diabetes, obesity, and cardiovascular disease. Evidence suggests that individuals using wearable devices often show increased physical activity levels and improved awareness of lifestyle behaviors. When combined with structured guidance from healthcare professionals, these devices can support sustainable behavior change and improved metabolic outcomes. Nevertheless, user engagement tends to decline over time, highlighting the importance of motivational strategies and personalized feedback. Despite their advantages, several challenges limit the widespread clinical adoption of wearable technologies. Variability in measurement accuracy across devices, lack of standardized data interpretation, concerns regarding data privacy, and limited integration with electronic health records remain important barriers. Additionally, disparities in digital literacy and access may restrict the benefits of wearables to certain population groups.

CONCLUSION

Wearable devices represent an important advancement in the monitoring of cardiac and metabolic health. By enabling continuous, non-invasive, and real-world data collection, these technologies support early disease detection, lifestyle modification, and personalized health management. While technical and ethical challenges persist, ongoing improvements in sensor accuracy, data analytics, and healthcare integration are likely to strengthen the role of wearables in preventive cardiometabolic care.

DECLARATION

Ethical Approval: This article is based on a review and synthesis of previously published studies and does not involve direct interaction with human participants or the use of identifiable personal data. Therefore, ethical approval was not required.

Conflict of Interest: The authors declare that there are no conflicts of interest related to this publication.
Funding: No external funding was received for the preparation of this short communication.
Authors' Contributions: The author was solely responsible for the conceptualization, literature review, analysis, and writing of the manuscript.

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How to cite this article: Malakar S. Wearable Devices in Monitoring Cardiac and Metabolic Health: A Short Communication. New Era Med. J. 2025;1(3): 24-26 doi: 10.62502/nemj/v1i3art5