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Wearable Devices and Mobile Health Applications in the Era of Preventive Healthcare: A Decade of Advances, Disease-specific Monitoring, Gen Z and Gen Alpha Lifestyles, and Future Perspectives

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Abstract

Wearable devices and mobile health applications have mostly used as a promising tool for preventive healthcare such as continuous monitoring devices for physiological parameters, physical activity, sleep and other health problems. This review aims to examine a decade of advances in wearable devices and mobile health applications, their disease-specific monitoring, their relation to Gen Z and Gen Alpha lifestyles and their role in preventive healthcare. This review evaluates existing review literature on wearable devices, cardiovascular parameters monitoring, diabetes control management, mental health, lifestyle enhancement treatments and digital health applications. Available evidences exhibit the possibilities of smartwatches, wearable devices and mobile applications helps in physical activity monitoring, glucose management and health related changes. These devices and applications may also support health awareness and self-monitoring amongst younger populations, even though age-specific evidences require further examination. Some important challenges included such as variable measurement, accuracy, data protection issues, unequal access and limited evidence connecting to evaluate long-term clinical outcomes. Future progress depends on clinically validated devices, artificial intelligence, Person-centered digital healthcare methods, strong evidence on long term effectiveness. This review gives the idea about wearable devices and mobile health applications into preventive healthcare.

Introduction

- Preventive healthcare mainly focuses on the early identification of health risks, health enhancement and proactive healthcare measures to lower disease illness. (WHO, 2020)
- The growth of wearable devices and mobile health applications has advanced new possible for continuous health monitoring and personalized healthcare further traditional healthcare preferences. (Babu et al., 2024)
- Wearable devices included smartwatches, smart rings and electrocardiogram-enabled devices can monitor parameters such as sleep cycle pattern, physical activity, heart rate, and related physiological signs. (Kristoffersson & Lindén, 2020; Babu et al., 2024)
- -Mobile health applications relation to wearable devices by recording health data, supports self-monitoring, provides response and enhance communication between individuals and healthcare professionals. (Vegesna et al., 2017)
- In the cardiovascular healthcare system, wearable devices have proven promising for detects irregular heart rhythms and helps in the monitoring of cardiovascular risk factors. (Perez et al., 2019; ESC Working Group on e-Cardiology, 2021)
- The wearable devices and mobile health applications like continuous

glucose monitoring and other connected medical devices and applications can helps disease management by providing repeated measurements and helping users and clinicians identify changes in the user health condition. (Guo et al., 2021)

- Wearable physical activity monitor and mobile health involvements may motivate physical activity and healthcare behaviours in the children and adolescents and making them related to lifestyle-related health needs of Gen Z and Gen Alpha. (Böhm et al., 2019; Zhang et al., 2024)
- Irrespective of advantages, the accuracy, clinical validation, data protection and long-time effectiveness of wearable devices through over devices and applications. (Doherty et al., 2024)
- Integration of artificial intelligence, digital biomarkers and personalized healthcare analytics may further enhance the explanation of continuous health data and helps more personalized preventive actions. (Babu et al., 2024)
- Accordingly, this review inspected the development of wearable devices and mobile health applications from 2016 to 2026, their disease-specific monitoring applications, their relation to Gen Z and Gen Alpha lifestyle health, and their drawbacks and future outlooks in preventive healthcare system.

Literature Review

1. **Gu et al.,(2026) :** Recent research emphasizes the increasing role of smartwatches, wearable sensors, fitness tracker and mobile health applications. This device helps in physical activity analysis, physiological monitoring and disease risk analysis.
2. **Ribeiro et al.,(2026):** Wearables devices and mobile health applications in preventive healthcare are increasing due to early identification of changes in physiological parameters and helps health monitoring.
3. **Jamieson et al.,(2025) :** Wearable devices have been examined for functional health monitoring and disease-related changes. Consumer-grade wearable devices may help in cardiovascular monitoring and their health analysis.
4. **Zhang et al.,(2024) :** This systematic review examined digital health studies involving childrens and adolescents. It investigates applications in health enhancement, physical activity, disease prevention and treatment.
5. **Doherty et al.,(2024) :** Evidences from the systematic reviews shows that consumer wearable results different from to devices and health analysis, highlighting the need for careful clinical validation.

Research gap

Development of combine system devices that monitor cardiovascular, metabolic, sleep and activity related parameters together in one device. Development of AI based model that investigate and identified abnormal changes in health problems before symptoms become severe.

Evolution of Wearable and Mobile Health Technologies (2016–2026)

From 2016-2026, wearable devices and mobile health applications advanced from basic fitness tracking devices to advanced health monitoring systems. Improvements in scale-down sensors, wireless connective devices and data processing devices allowed continuous collection of physiological information outside hospitals and clinics.

1. Smartwatches and fitness bands
   It is mainly used for step tracking, distance measurement and physical activity tracking. Modern healthcare devices include hearth rate monitoring, sleep cycle tracking. This supports to observe daily activity, heart rate patterns and lifestyle changes.
2. ECG-enabled wearable devices
   It is used to record electrical activity of heart using wearable devices. The smartwatches can record ECG signals and helps estimate possible irregular heart rhythms. It supports cardiovascular monitoring and encourages early medical consultation.
3. Continuous glucose monitoring (CGM) devices
   Some wearable devices measure glucose levels in continuous interstitial fluid monitoring and provide glucose patterns and warnings for people managing diabetes.
4. Smart rings and wearable patches
   Smart rings are designed for monitoring conditions like heart rate, sleep pattern and temperature related analysis. Wearable patches are used to continuously collect physiological signals such as ECG, heart rate and sleep.
5. Smartphone-based health applications
   Smartphone based health applications such as sensors, cameras and GPS to collect health related information. Mobile health applications mainly used to record user's physical activity, sleep, diet and medication adherence. These devices provide heath condition information, reminders and personalized lifestyle response.
6. Integration of wearable devices with mobile applications
   Modern wearable devices are connected to the smartphones through Bluetooth and wireless networks. Mobile applications are used to collect data and also display wearable data in the form of graph, trends and health information. So, by the use of cloud-based platforms and repeated monitoring allow heath information to be shared with healthcare professionals if necessary.

Disease-Specific Monitoring and Applications

The wearable devices and mobile health applications used in the disease-specific monitoring and applications.

1. Cardiovascular Disease Monitoring

Wearable devices like smartwatches, ECG-allowed sensors monitor heart rate, heart rhythm, heart-rate variability (HRV) and physical activity. It identifies irregular pulse patterns and ECG features to record rhythm abnormalities. It helps early identification of heart rate abnormalities, monitored and prompt consultation with healthcare professionals. The mobile health applications help to collect health data, display heart rate and monitored cardiovascular health

2. Diabetes monitoring

Continuous glucose monitoring (CGM) devices helps to detect and evaluates in level of glucose through the day. It sensors measure glucose level in interstitial fluid and provide performances without using finger-prick testing. The condition can be managed by changes in the lifestyle management such as physical activity, proper sleep and healthy lifestyle diet meals. It also helps glucose management as well as recognition of hypo- and hyperglycemic events and treatments.

3. Sleep monitoring

The devices like smartwatches, fitness bands and smart rings used for the monitor sleep duration, sleep cycle and night time heart rate. The wearable devices evaluate total sleep time, sleep and wake periods and helping users to understand their sleeping routine and necessity. The mobile applications give sleep reminders, summaries and recommendations of sleep habit and gives regular routine sleep schedule. By the used of this devices and application helps to improve sleep related disorders and improvement of sleep routine.

4. Stress monitoring

The wearable devices and mobile health applications used to support mental well-being. The advanced wearable devices and mobile health applications combines factors such as heart rate variability (HRV), electrodermal activity (EDA), skin temperature are physiological responses associated with stress. Some wearable devices and mobile health applications gives the instructions about stress relaxation exercises and activities, and also encourage the early attention to mental well-being.

Gen Z and Gen Alpha Lifestyle Health

- Gen Z and Gen Alpha increasing rate to mostly interact with the smartphones, computers, gaming platforms and other digital devices so which affect on their daily physical activity and sedentary activities.
- The wearable devices like smartwatches and fitness band helps them to monitor daily steps, movements patterns, exercise routine and daily active minutes.
- Sleep tracking devices like smartwatches and smart rings helps to track the sleep duration, sleep routine, sleep schedules and reminders support

to improve daily performance among childrens and adolescents.

- By the usage of wearable devices and mobile health applications supports to improve physical activity, sleep and physiological information to early identify symptoms like unhealthy patterns of sleep and provide personalized preventive healthcare.

Future aspects

Advances in biosensors and continuous monitoring emerges biosensors may allow to be more convenient on monitoring the physiological and biochemical parameters supports users to track changes in their health. Future wearable devices may enhance the early identification of warning signals related with cardiovascular problems, sleep disturbances, stress and metabolic changes, allowing timely medical inspection. Artificial intelligence can analyze continuous data collection and identify abnormalities in health patterns and helps in personalized healthcare preventive measures.

Conclusion

Wearable devices and mobile health applications have the potential to improve the problems like cardiovascular monitoring, glucose management, physical activity and stress monitoring and also encourage healthier lifestyle habits to offer opportunities among Gen Z and Gen Alpha through activity tracking, sleep monitoring and digital health involvement.

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