

Original Article

Factors Influencing the Continuous Use of Wearable Health Technologies for Personal Health Management

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ABSTRACT

Wearable technology has recently played a huge role in the healthcare industry. Wearable technology (WT) is transforming the personal healthcare landscape around preventive healthcare, real-time health monitoring and personalized health management. Chronic Disease Management and Behavior Change through devices with sensors are becoming more common. Wearable technology is a great tool in the field of preventive and remote healthcare because of the rapid development of the field of artificial intelligence (AI), the Internet of Things (IoT), mobile health (mHealth) and sensor technologies. The aim of this review is to give a general overview of wearable health technologies, their applications in health care and other sectors, strengths and weaknesses, and possible considerations for adoption and continued adoption of these technologies in health care. This paper also reviews the latest research progress on these areas including real-time physiological monitoring, stress detection, cardiovascular health assessment, localization and long-term health behavior enhancement. The review also covers critical issues on data privacy, security, interoperability, sensor measurement accuracy, battery life limitations, and regulatory requirements obstructing the widespread use of wearable technology. Finally, the review demonstrates that there is significant potential for wearable health technologies to transform the provision of health services. They offer a way to connect with patients, keep track of their health over time, and provide evidence to help doctors make decisions, but they also have to deal with some technical and moral problems right now.

KEYWORDS

Wearable Health Technologies, Internet of Things (IoT), Artificial Intelligence (AI), Remote Patient Monitoring, Health Monitoring Systems.

1. INTRODUCTION

The World Health Organization defines health as a condition of whole physical, mental, and social well-being as opposed to only being free from illness or disability. Technology in health care is described as "the practical application of scientific understanding in the form of devices, drugs, vaccines, procedures, and systems with the goal of enhancing human health and well-being" (Kang & Hwang, 2022). An "Internet of Things" (IoT) is a system that enables data exchange and communication between inanimate and digital items over a network. Things that were formerly considered "dumb" can become "smarter" thanks to the IoT, which allows them to exchange data with both humans and other devices (Kumar et al., 2023).

Wearable healthcare gadgets allow patients to continuously monitor numerous physiological parameters, thanks to advancements in communication and sensor technologies. The term "wearable device" refers to a kind of medical equipment that includes sensors that may measure a variety of physiological characteristics while the user is in motion. "Wearable technology" (WT) refers to a wide range of devices that may be worn on the body to track different types of physiological information. In this group find metrics like heart rate, oxygen saturation, skin temperature, steps, estimated caloric expenditure, blood sugar, and ultraviolet radiation exposure (Patil et al., 2022). Physiological research, clinical diagnosis and prognosis, educational purposes (to promote health and physical fitness), and the provision of biological feedback to the user are all possible uses for this data (Dantuluri, 2026).

WT and its accompanying mobile health applications have seen massive adoption in Western nations, driven by an increasing focus on personal wellness and health. A lot of people think of WT as a method to learn more about themselves and their bodies, which can improve their health and overall well-being (Kyytsönen et al., 2023; Somula, 2025). Consumers in general are looking for self-tracking devices with fitness and physical activity or position features (such as sitting vs standing) as their top priorities. Additional variables that could be monitored include: levels of stress, emotions, sleep, whereabouts, food, weight, general vital signs, and indicators of diseases or disorders.

These days, digital wearables are a combination of several technologies that can aid in the treatment and prevention of sickness (Mahmud et al., 2026). For example, radar, smart sensors, AI, the Internet of Things, large amounts of data, and robotics all fall within this category. It is possible to track the breathing, temperature, blood pressure, and heart rate of the elderly who live in nursing homes and other care facilities (Mahmud, 2025). They are also able to recognize the early warning signals of imminent danger, such as a decline in health, a fall, or anything else that might be disastrous.

This review aims to achieve the following objectives:

- Wearable health device utilization in healthcare: a historical overview, present situation, and future prospects are the goal of this essay.
- To determine the important technology, behavior, social and healthcare issues related to the

sustained use of wearable health devices.

- In order to investigate the potential benefits of wearable technology in the areas of remote health care, illness prevention, and continuous personal health monitoring.
- To discuss the key challenges and constraints such as privacy, security, interoperability, data quality, and user interaction.
- To gather current research trends and emerging technologies such as AI, IoT, mHealth, blockchain, edge computing, and more that are advancing wearable health healthcare systems.

1.1. Structure of the paper

This paper is structured as follows for the rest of it. Section 2 offers a summary of wearable health monitor technology and applications. Section 3 covers the use of wearable technologies for healthcare, examining the advantages, obstacles, factors and trends. Recent literature on wearable health technologies is reviewed in Section 4. Section 5 wraps up the work and provides an outline of potential areas for future investigation.

2. OVERVIEW OF SMART WEARABLE FITNESS DEVICES (SWFDS)

SWFDs, are electronic devices designed to monitor/track an individual's fitness and health-related metrics. These devices can be fastened to various body parts, worn on the wrist, or hooked onto clothes. India is not alone in the world in the popularity of these gadgets. The capacity to give users incentive and real-time feedback has led to a surge in the popularity of such devices in recent years, particularly for health and fitness-related use cases.

- **Tracking Capabilities:** SWFDs have a number of sensors to record and quantify different physical activities. They are able to track not just the number of steps taken but also the distance travelled, calories expended, heart rate, and even specific physical activity like swimming, cycling, or running.
- **Data Display and Analysis:** Most SWFDs have a display/screen or are connected to a smartphone app to view the data they track in real time. These can be displayed on chart/graphs or simple 2 statistics to track activity and progress over time.
- **SWFDs could include goal-setting resources for users to set step goals, calorie burning goals, or other exercise goals for the day. Goal Setting and Motivation:** also provide visual feedback, reminders and notifications while keeping users motivated and on track for fitness routines.
- **Sleep Monitoring:** These devices may track the user's sleep, including their patterns such as total sleep time, the quality of their sleep, and the duration of each stage of the sleep cycle.
- **Heart Rate Monitoring:** Heart rate sensors in SWFDs allow continuous monitoring of the user's heart rate, helping them to understand their levels of cardiovascular fitness, monitor their heart rate zones while exercising and evaluate their level of effort and recovery.
- **Integration with Mobile Apps and Online Platforms:** Fitness trackers are frequently connected with mobile applications or websites that offer detailed fitness data analysis. These apps have ability to connect with friends or participate in virtual fitness communities.
- **Battery Life and Charging:** Battery life varies depending on the device; from a few days to

several weeks. The majority of fitness trackers are rechargeable with a charging cable or dock. Some high-end models offer wireless charging or long-lasting battery life and do not need to be recharged regularly.

2.1. Use of wearable devices in various sectors

The use of wearable devices has grown in all areas and has had a significant impact on many industries. The major applications of wearable devices are listed in Table 1, including applications for real-time monitoring and intelligent decision support for health care, fitness, workplace safety, customer service, and military operations. There are some examples of wearable devices in various industry sectors:

Table 1: Applications of Wearable Devices Across Various Sectors

Sector	Application of Wearable Devices
Healthcare	Monitors vital signs, supports chronic disease management, and enables remote patient monitoring and personalized healthcare.
Fitness and Sports	Tracks physical activity, fitness performance, exercise intensity, and assists in injury prevention and training optimization.
Manufacturing and Industrial	Enhances worker safety by monitoring environmental conditions and improves productivity through real-time feedback.
Retail and Hospitality	Supports inventory management, customer service, seamless transactions, and personalized guest experiences.
Military and Défense	Monitors soldiers' health, detects fatigue, and improves situational awareness using wearable sensors and AR technologies.

- **Healthcare:** Managing and monitoring healthcare is greatly enhanced by wearable gear. Their ability to monitor vital signs in real-time, including heart rate, blood pressure, and blood oxygen levels, gives users more agency over their daily health monitoring (Mukherjee, 2026b). Wearable health monitoring and control devices may help patients with diabetic, asthmatic, and sleep apnea. It allows healthcare providers to access patient records remotely, potentially improving the accuracy of diagnoses and the creation of personalized treatment plans.
- **Fitness and Sports:** Fitness trackers are worn by many to track their exercise, gauge their progress and motivate them to attain fitness objectives. They provide details on steps, calories burned and exercise level. In professional sports, wearable devices are also used to track the performance of 11 players, prevent injuries, and enhance training.
- **Manufacturing and Industrial Sectors:** Wearable devices are used in the manufacturing and industrial sectors to ensure the safety and productivity of workers. Consider, for instance, smart helmets that monitor temperature, noise levels and air quality, providing a safe working environment. Wearable technology can also give workers feedback in real-time, optimizing processes and productivity.
- **Retail and Hospitality:** WT like smartwatches or smart glasses are used in this sector to enhance the service to the employee (Warrier, 2020). Wearables can help with inventory, price checking, and streamline transactions. In the hospitality industry, wearables can help streamline operations, improve customer service, and boost efficiency.

- Military and Defence: WT has a number of applications in the military and defence sectors. Body sensors for vital signs, fatigue and overall physical state can be worn by soldiers. Augmented reality (AR) glasses or heads-up displays can provide real-time tactical information and enhance situational awareness.

3. THE HEALTHCARE INDUSTRY AND WEARABLES

The integration of wearable technology with AI, the IoT, and smart sensing has significantly expanded the wearable tech market, which has grown in tandem with the popularity of smartphones. These days, they're widely employed in many other industries, including healthcare, gaming, communications, safety, and industrial operations. Vscan, created by GE Healthcare, offers healthcare services that are more precise, quicker, and not restricted by time or place (D. V. A. J. R. M. Mittal, 2025). IBM's Mobile Wireless Health Solutions also provide a plethora of mobile services for the healthcare business. Fitness trackers, smartwatches, electrocardiogram (ECG) monitors, blood pressure monitors, and biosensors are just a few examples of the many wearable technologies used in contemporary medicine.

Several different approaches are taken when wearables are used as medical devices instead of just regular healthcare gadgets. First, accessories like wristwatches can be wearable health devices (Patel, 2026). Health and exercise are the primary goals of most accessory users. The ability to sync with smartphone apps is just the beginning of the detailed functions. Additionally, it may record the user's sleep habits, the distance they've travelled, the calories they've burned and consumed, and crucial data points like their mental health (Mukherjee, 2026a).

Wearable health gadgets can take many forms, the second of which is apparel. A user's vitals, including heart rate, respiration rate, and blood flow, can be monitored by "smart" clothing. This data is collected either by computer chips that send electrical signals and information or by materials that connect to a smartphone and perform various functions.

Thirdly, there are health trackers that can be worn. The Swiss company Sensimed monitors the intraocular pressure of glaucoma patients around the clock with a medical device that looks like contact lenses. The most crucial part of diagnosing glaucoma is looking for changes in intraocular pressure, and keeping an eye on that pressure can help slow down the disease's progression (Venkata & Koppireddy, 2025). These contact lenses can measure IOP thanks to antennas and sensors integrated right in. They can then transmit the data to a mobile device in real-time, which the doctor can then use to upload to their computer using Bluetooth.

The 4th choice is wearable biopsies. Most state-of-the-art wearables can now be taken internally or even implanted into a person's body. Patients who require continuous monitoring, like those with diabetes, can benefit from technologies that enable wireless skin implants to confirm changes in blood sugar levels in real-time and ingestible sensors that detect when medication is being swallowed are also examples of such technologies.

3.1. The benefits of wearable medical devices

The introduction of wearable health technology may significantly alter the healthcare system by enhancing patient outcomes while simultaneously decreasing expenses. In this regard, wearable health monitors, for example, can supply:

- **Continuous monitoring and real-time data capture:** WT allows for the real-time monitoring of vital indicators such as heart rate, blood pressure, and glucose levels. By utilizing proprietary algorithms, these devices may extract useful insights from this data. This paves the way for a multitude of at-home functions. These include assisting with the self-management of chronic diseases and monitoring patients' health after surgery.
- **More empowered patients:** The accuracy of consumer-grade wearables can't compare to that of medical-grade devices, but the data they provide about a person's sleep, activity, glucose patterns, and heart rate is still helpful, and it can give patients more agency over their health and how they live their lives.
- **Cost efficiency:** In light of the proliferation of telemedicine, wearable medical devices enable remote monitoring and lessen the need for in-person visits. This reduces the overheads for health providers and can ease the burden on health systems and shorten the diagnostic journey.

3.2. The challenges of wearable technology in healthcare

WT in healthcare is looking promising, but there are some hurdles that need to be taken care of before it can be integrated into clinical practice.

- **Data privacy and security:** There is increasing worry about data privacy and security breaches caused by wearable devices because of their capacity to track sensitive health information. As data protection solutions continue to develop, including blockchain, new solutions have emerged to address patient data security issues.
- **Data integration:** The wearable data must be easily integrated into current EHRs and clinical processes. Data silos, which can restrict access and interoperability, might result from a lack of platform standards. The bright side is that providers that are quick to embrace new technology—like cloud computing and automated data processing—can better fulfil the requirements of these integration issues.
- **Access and affordability:** Medical-grade wearables could be more costly and less accessible than consumer electronics, posing access barriers and healthcare inequalities. As demand increases and technology evolves, however, there a reduction in costs and greater availability of these tools, which helps to make them more accessible over time.
- **Accuracy and reliability:** Wearables should be able to provide clinically accurate data and reliable and accurate for clinical use. Readings, however, may not always be accurate depending on the design of the device, how it is positioned on the body, etc. The good news is that ongoing research and innovation is driving device performance improvements. Prospects for the future of wearables are good because they are even more reliable and clinically valuable.

3.3. Advantages of Wearable Technology

Wearable technology offers NPs a multitude of advantages. By tracking their own vitals in real time, patients can better understand how their diet, amount of sleep, and exercise habits impact their health and play an active role in their treatment. Patients who are confined to their homes or live in rural regions have easier access to healthcare. Remote communication with experts, whether through data transfer or virtual interactions with nurse practitioners, can help patients save time and gas money (Bove, 2019). Wearable data can also assist family members and friends in monitoring the well-being of homebound patients, such as elderly parents (Dharmavaram & Bhanushali, 2026). Wearables that can also conduct autonomous analytics can supply data such as steps, sleep patterns, and electrocardiograms. Because they give NPs more information about what patients do on a daily basis, these records can help them figure out problems faster and step in sooner to avoid readmissions or other problems. Furthermore, wearables automatically collect data, which aids in overcoming short-term memory and accuracy issues.

3.4. Factors for wearable health technology

Several factors (Fig 1) can influence the development and implementation of standards for wearable health technology. These factors may differ depending upon the specific device and its intended use, but some common ones include:

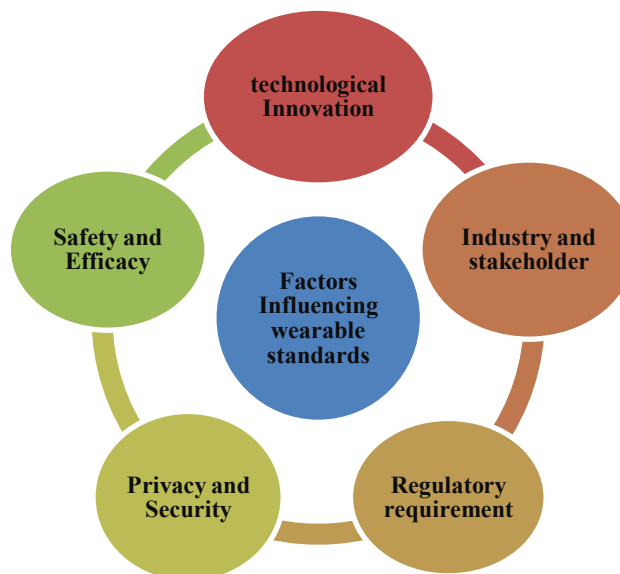


Fig 1 - Factors Influencing Standards for Wearable Health Technology

- **Safety and efficacy:** One of the main goals in developing reliable guidelines for wearable health technology is to achieve safety and effectiveness. Standards can be created to address accuracy, reliability, and interoperability, reduce patient and user risk, and more.
- **Privacy and security:** There are well-founded concerns about privacy and security of data collected and sent by wearable health devices. Data encryption and other security methods can be defined in standards to alleviate these worries.
- **Regulatory requirements:** The health technology that is worn could have specific regulations or requirements, depending on the jurisdiction and the use of the device. Standards may be

established to enforce these regulations, for example, as requirements for testing or labelling.

- Industry and stakeholder input: Industry and stakeholders can play a role in setting standards, including manufacturers, regulators, healthcare providers, and patients. These stakeholders may also provide comments and suggestions to ensure that the standards being considered are quality and safe.
- Technological innovation: Wearables is a dynamic and fast-changing area where new devices and applications are coming to market. Standards should be revised or revised to cover these changes and ensure that new technologies are safe and effective.

3.5. Data Privacy and Limitations

The ability to monitor health metrics in real-time is just one of the many benefits of wearable health devices, such as smartwatches and fitness trackers. But there are some major data privacy, regulatory, and device accuracy concerns to consider.

- These devices can frequently capture PHI, which is sensitive and must be secured from unauthorized access and use (M. Mittal, 2024). On the other hand, being GDPR or US HIPAA compliant is essential to maintain that trust.
- There are some limitations, especially with regards to data accuracy, but improvements are made. Misleading or inaccurate health data can have a negative impact on health decision-making and health safety. In healthcare systems, data management and data integration are hindered by the presence of multiple operating systems, causing interoperability issues.
- To address these challenges, healthcare organizations should implement robust data protection measures, such as encryption, frequent risk assessments, and user-access controls tailored to specific roles. Furthermore, transparency in the use of data and industry self-regulation efforts, such as guidelines and voluntary code of conduct, must be ensured.

3.6. Trends in the market

In the past decade, the wearable technology market has advanced dramatically as a result of consumer demand, technological advancements, and shrewd investments. The world wearable technology market is expected to grow at a rate of 13% per year from 2016 to 2028, according to new industry studies (Alsulami et al., 2019). It reaches \$118 billion by 2028. This is because more people are familiarizing themselves with the benefits of digital health tools and more are adopting Smart Tech in personal and professional environments. Most of the market consists of wearable technology for consumers such as exercise bands and trackers. Apple, Samsung, and Garmin are the leaders in this field. In the case of the Apple Watch, for instance, the watch has become a pioneer in the field of advanced health tracking by introducing ECGs, blood oxygen monitors, and fall detection. These options have helped to render wearables more attractive to people who aren't solely interested in exercise. It is also now embraced by older people and those with chronic diseases. Wearable tech has also seen a surge in popularity due to the COVID-19 pandemic, which has made virtual health tracking an essential part of telemedicine and the response to the epidemic.

4. LITERATURE REVIEW

Recent studies have demonstrated significant advancements in wearable health technologies, emphasizing their role in continuous health monitoring, personalized healthcare, mental health assessment, and long-term health management. I. G. Gregório et al. (2026) assembled a team of experts, held a scoping review, a multi-stakeholder workshop, developed a roadmap for both visible and invisible DHTs, interviewed relevant parties, and, lastly, put the criteria into action by making the framework operational. (i) the framework starts with a list of value aspects that cover clinical, technological, organizational, ethical, legal, and economic domains; (ii) it follows each aspect until the best evidence is available to evaluate it; and (iii) at the later stages, it proposes indicators that vary from artefacts pertaining to conceptual problem-structuring to performance descriptors.

Prashar & Kataria (2025) explored the most up-to-date developments in cardiovascular monitoring wearable health technology. There are multitudinous benefits to heart rate monitoring. There is a strong possibility that wearable technology alters the way healthcare is delivered. Wearable technology has evolved from a far-fetched concept to a very real possibility in recent years. Get a sneak peek at the latest innovations driving wearable tech. By monitoring vital signs, wearable electronics is revolutionizing individualized medical treatment.

Prince et al. (2025) created a system that integrates vibration, heart rate, breathing, MEMS accelerometer, and Galvanic skin response sensors to measure physiological indications of stress. The collected data is subjected to ML methods such as RF Classifier, SVM, LR, and KNN in order to categorize the stress levels as low, medium, or high. As a result, it may raise awareness about mental health and find ways to identify signs of sadness and stress earlier.

Awoyemi et al. (2024) An analysis of the data was conducted using 380 replies that were gathered. A logistic regression model is specified and analyzed in this work using the MLM. When people use digital health technology to access body-fitting apps and health tracker apps on their mobile devices, the probability that they report a positive health status increases by 47.65% and 49.91%, respectively. A glucometer raises the likelihood of reporting good health status by 42.73% and a smartwatch by 42.73%, respectively, when worn as an extra piece of wearable health gear.

McLeish et al. (2024) outlined a system that uses Bluetooth-low-energy environment beacons in conjunction with a wearable bracelet to better localize and contextualize the wearable data, allowing for a more clinically appropriate assessment of function. Collect data over the course of many days in five distinct real-life homes with varying sizes and layouts by having participants keep a journal in which they note their precise position every fifteen minutes. Afterwards, give a preliminary verification that the system's location data is accurate. A confusion matrix can help to see the outcomes. Compared to activity alone, the mean overall accuracy is superior at 94.0% (range 88.8-98.8%), allowing for the formulation of more relevant outcomes for patients.

Gu & Chang (2024) Investigated the impact of WHT on health and lifestyle management in

the long run among the elderly, hoping to find mHealth uses that might suit their needs. The first 12-week WHT trial was followed up by this two-year one. Voluntary participation in this semi-structured interview study was only obtained from twenty-four out of eighty-four individuals in the prior trial. Discovered three distinct types of health awareness changes in older adult users: 2 cases of low change consistency, 7 cases of great change consistency, and 15 cases of enhanced change consistency. Improvements in health and lifestyle were associated with long-term behavioral changes in the two years after the 12-week WHT study ended, thanks to the trial's enhanced awareness.

A summary of the recent research on wearable health technologies is outlined in Table 2, which includes the objectives of the research, the approach used and the results, as well as the key challenges and limitations

Table 2: Summary of Recent Studies on Wearable Health Technologies

Author(s) & Year	Objective	Methodology/Technology	Key Findings	Challenges and Limitations
I. Gregório et al. (2026)	Develop a value assessment framework for wearable and invisible DHTs.	Five-step framework including scoping review, expert interviews, stakeholder workshop, and multi-criteria evaluation.	Proposed a comprehensive framework covering clinical, technical, organizational, ethical, legal, economic, and patient-centred value aspects for early-stage DHT evaluation.	Lacks real-world clinical validation and quantitative performance assessment across diverse healthcare settings.
S. Prashar & P. Kataria (2025)	Review recent advancements in wearable healthcare technologies.	Analysis of wearable health monitoring systems for cardiovascular care.	Demonstrated that wearable devices enable real-time heart rate monitoring, improve patient safety, and support personalized healthcare.	Focuses mainly on heart rate monitoring; issues such as privacy, battery life, interoperability, and long-term user engagement remain insufficiently addressed.
D. Prince et al. (2025)	Developed a wearable-based stress detection system.	Integrated physiological sensors with Random Forest, SVM, Logistic Regression, and KNN classifiers.	Successfully classified stress levels (low, medium, high), enabling early detection of stress and depression.	Performance may decrease in real-world environments due to sensor noise, individual physiological differences, and limited dataset

					diversity.
B. Awoyemi et al. (2024)	O. Evaluate the impact of digital health technologies on health outcomes.	Logistic regression analysis using survey data from 380 respondents.	Mobile health applications and wearable devices significantly improved reported health status.	Relies on self-reported survey responses, limiting generalizability and lacking continuous physiological monitoring data.	
K. McLeish et al. (2024)	Improved contextual patient monitoring using wearable localization.	Wearable bracelet integrated with BLE beacons and evaluated in five residential environments.	Achieved a mean localization accuracy of 94.0%, improving contextual health monitoring.	Validation involved a limited number of environments and participants; scalability to larger or more complex settings remains uncertain.	
X. Gu & X. Chang et al. (2024)	Investigate long-term effects of wearable health technologies among older adults.	Two-year follow-up study using semi-structured interviews after a 12-week wearable intervention.	Demonstrated sustained improvements in health awareness and lifestyle behaviours.	Small sample size (24 participants) and qualitative analysis limit the generalizability of findings to broader populations.	

5. CONCLUSION AND FUTURE WORK

Wearable devices, as a key component of the healthcare technology sector, enable real-time, personalized healthcare monitoring and disease detection beyond the walls of traditional healthcare facilities. The focus of this review was to identify the development, utilization, advantages, factors and recent studies of wearable healthcare devices. The data show that wearable technologies, when coupled with AI and IoT, ML and mHealth platforms can provide enhanced real-time physiological monitoring, remote patient management, and preventative health care. However, several challenges exist in the use of these that must be overcome for them to be more widely adopted: privacy issues related to data security, interoperability issues, sensor accuracy, battery life, high cost of implementation, and a lack of standardized regulatory frameworks. The ability to tackle these constraints is pivotal to improving the trustworthiness and value of wearable technologies. Future studies should be directed towards the design of smart, wearable devices that are energy efficient, have greater capabilities for sensing, and have a standardized communication protocol and cybersecurity measures. Moreover, when combined with other technologies like Explainable AI, Federated learning, Blockchain, Digital Twins, and Edge Computing, these technologies can facilitate secure, intelligent, and privacy-preserving healthcare solutions. Wearable health technology will be even more effective and widely used for continuous personal health management with the help of multi-modal sensor fusion, investigations with varied populations, and continual clinical validation.

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