The Role of Smartwatches in Health, Exercise, and Sleep Monitoring

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WRIT 4999W: Technical Writing and Communication Capstone

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November 21, 2025

Executive Summary

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Smartwatches have become powerful products that often skirt the lines between consumer devices and medical devices. They offer features like ECG, heart rate tracking, sleep analysis, step counting, blood pressure tracking, and many more. These features all display varying degrees of accuracy, with some features, usually tracking more consistent biomarkers, demonstrating more accuracy than other, more complicated features, such as blood pressure, calorie tracking, and detailed sleep analysis. Accurate tracking could give the public more control over their health and increase preventive care. However, patients and healthcare providers should approach the data from smartwatches with caution, as it can be inconsistent depending on many factors.

While opinions differ between individuals, the public, especially those who are young and affluent, generally have a positive view of health wearables as devices that can help them track and monitor their health and fitness. Many healthcare professionals are also optimistic of technology but worries among them also exist about accuracy and privacy. Current laws do not usually cover smartwatches under HIPAA and are instead managed by different regulatory bodies that are struggling to keep pace with the development of the industry. Governments need to implement stronger data protection laws with these devices to ensure individuals' health data is not breached nor shared without their consent.

Overall, smartwatches prove promising technology, with the potential to change the way health is monitored in everyday life. However, since smartwatches are becoming more akin to medical devices, they should be treated more as such. Healthcare professionals and patients should understand that these devices are not substitutes for clinical medical treatment and testing, but that they are tools to be used alongside verified medical tools to potentially prevent/track health issues and track fitness.

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1. Introduction

Wearable technologies have exploded in popularity in recent years among consumers. Already, “almost one in three Americans uses a wearable device, such as a smartwatch or band, to track their health and fitness” (NIH, 2023, para. 1). The biosensor market, used in most smartwatches, has grown “from $150 million globally in 2016 to $25 billion in 2021” (Kelly, 2023, para. 1). Smartwatches are the most recognizable pieces of wearable technology, but the category also includes numerous other products such as fitness trackers, smart rings, fitness bands, among others. Many of these products advertise health and fitness features, with most tracking things like sleep, calories, heart rates, and others.

Smartwatches have given patients a new gateway to become more involved in their personal health and proactively track several metrics and potentially alert them of any health problems. Naturally, as wearable technology becomes more popular and ubiquitous, healthcare professionals and patients will have questions regarding them. How do patients and healthcare professionals view them? How does the law apply to them? How accurate are they?

Many studies and literature reviews have already been done on the subject. However, the wearable technology field is developing quickly, with new advanced features (shown in Section 4) being added to newer watches. Companies have found ways to incorporate technologies, such as AI, into their devices. AI and other technological advancements have enabled wearables to start tracking different biological markers, leaving room for potential gaps in pre-existing literature on the subject. This report aims to give context to current perspectives, accuracy, and the potential health outcomes of smartwatches and their use.

2. Methods

Since an impossibly wide variety of smart wearables exist to analyze in a single paper, this report focuses on smartwatches. Both Samsung’s Galaxy Watch8 and Apple’s Apple Watch Series 11 were chosen as representative samples due to their popularity. To determine what smartwatch features should be analyzed, a literature review was conducted to determine what the public, doctors, and the law thought of/expected of smartwatches. Chosen features were selected based on this literature review and taken from the Galaxy Watch8 and Apple Watch Series 11’s webpages for further analysis of their accuracy. Accuracy examinations were conducted using pre-existing sources varying from case studies, articles, and peer-reviewed studies. The results from these reviews are then tied together in the discussion section to form a conclusion.

3. Perspectives

3.1 Public Opinion on Health Wearables

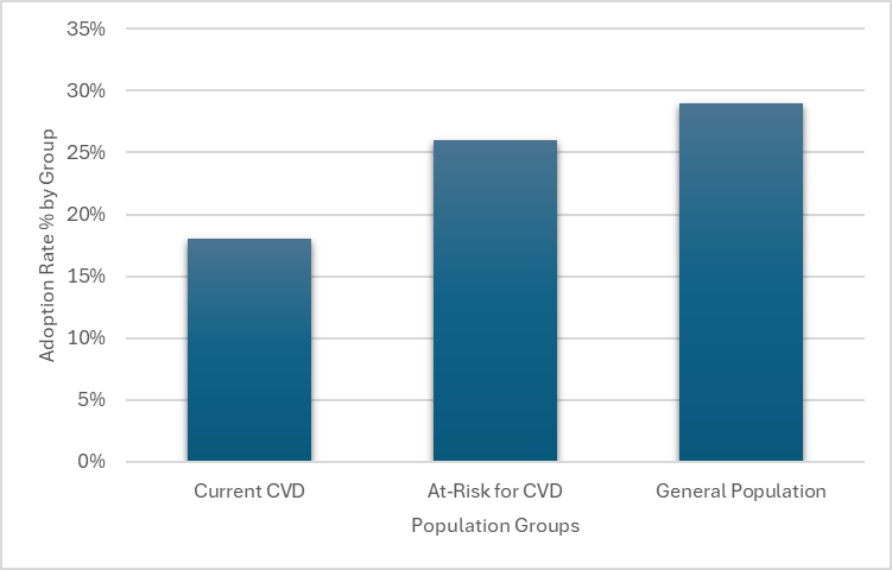
Understanding what the general populace thinks of health wearables and what they want to get out of wearing them helps frame the discussion around their impacts. Understanding general sentiment will

permit further exploration of whether smartwatches are meeting the desires and views of users. However, to fully interpret this sentiment it is also necessary to consider who is using these devices.

Several factors impact the ownership rate of wearables and opinions of them. Generally, divides such as income, age, ethnicity, and location create differences in adoption rates of technology. For instance, people who are more affluent and younger "have higher rates of wearable device ownership" (Nagappan et al., 2024, p. 2). These demographic gaps also appear in health-related populations (shown in Figure 1), with "wearable devices [being] used by 18% of those with existing CVD [cardiovascular diseases] and 26% of those at risk for CVD, compared to 29% of the general population" (Nagalwade, 2023, p. 1). The survey, taken by over 9,000 respondents, shows that those who have a CVD, or at risk of getting one, are lagging behind on the adoption of these devices. This means that when examining consumer expectations, it is important to understand what groups are being represented, and that views will vary by demographic.

Figure 1

Wearable Adoption Rates Among General Population and those with CVD Risk



Note. Data from Nagalwade (2023). CVD = cardiovascular disease. Percentages reflect the reported wearable device use among 9,000 survey respondents.

However, despite the demographic differences, Kelly (2023) states that consumers interested in health wearables generally tend to seek out several features:

- Blood pressure monitoring (59%)
- Sleep tracking (21%)
- ECG monitoring (11%)
- Exercise motivation and tracking (mentioned, but no specific number cited)

The high percentages of consumers that are interested in these health-related features show that there is a significant demand to use smartwatches to monitor things such as health, fitness, and sleep tracking. Additionally, since the smartwatch market is still growing, it is essential to see what those not interested in smartwatches view them, and what features they would like to use.

One qualitative study that compared the attitudes of wearable technology users and non-users found that, while some complaints were shared between users and non-users, “non-users were unique in their concerns for materialism and functionality (i.e., ease of use and charge) associated with wearables” (Burford et al., 2021, p. 1). It was also noted that non-users seemed more interested in motivating themselves internally. The study also noted that both non-users and users had a generally positive attitude towards health wearables. However, the study did not address the use of wearables in patient/doctor relationships, only the general adoption of the technology for personal use. This leaves open questions about how people feel about integrating their devices into clinical settings.

To determine whether patients would be willing to share health wearable data with their doctors, a survey was conducted. When researchers asked patients whether they would be okay with sharing information from their devices with their doctors, 80% said they would share the information (NIH, 2023). However, this number was taken from a group of people who were already wearing health wearables. Taken together, these findings show that while interest in wearable features is high, demographic differences, user attitudes, and clinical considerations shape how widely and effectively the technology is adopted.

3.2 Health Provider Opinions

Health providers, such as doctors and nurses, also have a stake in the impact of health wearables, making their opinions critical. Many health providers already have formed opinions on health wearables, through experience and literature. To illuminate these perspectives, several studies have examined how health providers view smart wearables and watches.

One qualitative study conducted by interviewing twelve health providers from doctors, dieticians, physiotherapists, and more, showed varying opinions on wearables. Primary concerns from the doctors consisted of “‘usability and understanding,’ ‘privacy and surveillance’ and ‘cost’” (Watt et al., 2019, p.1). Usability and understanding were a common concern among the doctors, as they worry the devices could be improperly used, giving patients inaccurate data or creating anxiety over non-clinical results. Interestingly, accuracy of the devices (when effectively use) was not among the common thematic concerns of the doctors in the study (Watt et al., 2019). While this study highlights early clinician perspectives, more recent research reveals how these opinions may be changing with time.

A more recent study aimed to examine the opinion of health care professionals on the implementation of AI-based wearables. To obtain results, the study interviewed 611 nurses, using an online questionnaire, with researchers statistically analyzing the data for results. Findings found that many nurses said that AI could help improve “personalised care, chronic disease management, and healthcare efficiency” for patients (Alzghaibi, 2025, p.1). However, nurses were also skeptical about the affordability, accuracy, and technical reliability coming into question, closely relating to the Watt et al.

(2019) study. The study also identified important demographic differences, noting that differences in perspective were also based on differences in age, education, and workplace (Alzghaibi, 2025). Notably, the older the health provider, the more suspicious they generally were of smartwatches. However, health providers working in hospitals typically had a more positive view of smartwatches than primary care physicians. These findings show that while smartwatches hold promise for health providers, their support varies by factors like usability, privacy, age, and workplace.

3.3 Legal Perspectives

Since many wearable technologies directly deal with personal health data, governments strictly regulate them. The market can be confusing, so Adams (2025) lists three market segments to help illustrate the current landscape:

1. **Consumer wellness wearables:** things like step counters, fitness bands, and other wellness devices.
2. **Medical wearables:** devices that are medically validated, such as glucose monitors, which the U.S. Food and Drug Administration (FDA) and other government regulations.
3. **Hybrid Devices:** consumer wearables that blend the two other categories. Things like Apple watches, Oura rings, and other advanced devices fall under the category.

Currently, the FDA struggles to keep pace with the wearable industry. Many modern wearables fall under the *Hybrid Devices* category, being classified as 'health and wellness' products, not as medical devices" (Wallace, 2025, On Background section). However, this classification becomes rather dubious when advanced features of modern wearables are accounted for, ranging from blood pressure monitoring to ECG features that clearly overlap with the *Medical Devices* category. As a result, the lines between clinical use and general wellness have become more blurred.

The FDA has taken the approach of having to approve certain features of the device, instead of the device in general. For example, if Apple wanted to release a watch that tracks irregular heart rhythms, it would need to be approved by the FDA before going to market (Wallace, 2025). Regulating by individual features reflects the attempts the FDA has made to keep pace with the rapidly evolving technology.

Data management and privacy are also important legal aspects of wearables. While many people would assume that data from the watch, such as fitness data and sleep data, is covered by the Health Insurance Portability and Accountability Act (HIPAA), this is not always true. Instead, a diverse set of laws govern and regulate the industry. For example, in the case of personal data loss, the situation "may be covered by other healthcare privacy laws, like the Federal Trade Commission's (FTC) health breach notification rule and state breach notification laws" (Rudawski & Cook, 2025). Encouragingly, the FDA and FTC seem to be taking cybersecurity more seriously, even if they are still behind.

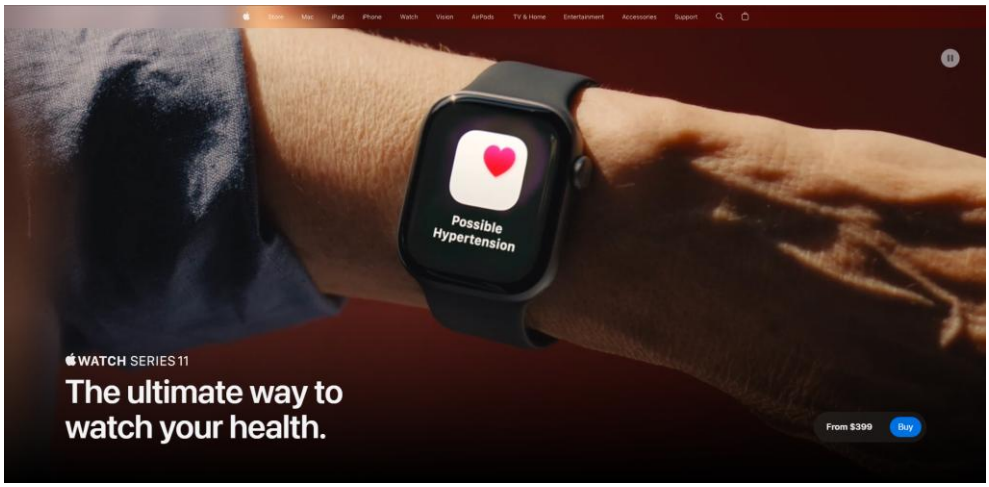
4. Feature Overview

4.1 Shared and Differing Features

Both Apple and Samsung advertise a slew of health features for their watches, which can be found on their product pages (Apple, 2025; Samsung, 2025). Both watches share primary functions such as sleep analysis, pedometers, heart rate monitoring, ECG, and exercise tracking. However, the watches also differ in their functionalities among shared features and tracking different variables. Listed below are several features the watches have and which ones they share.

Figure 2

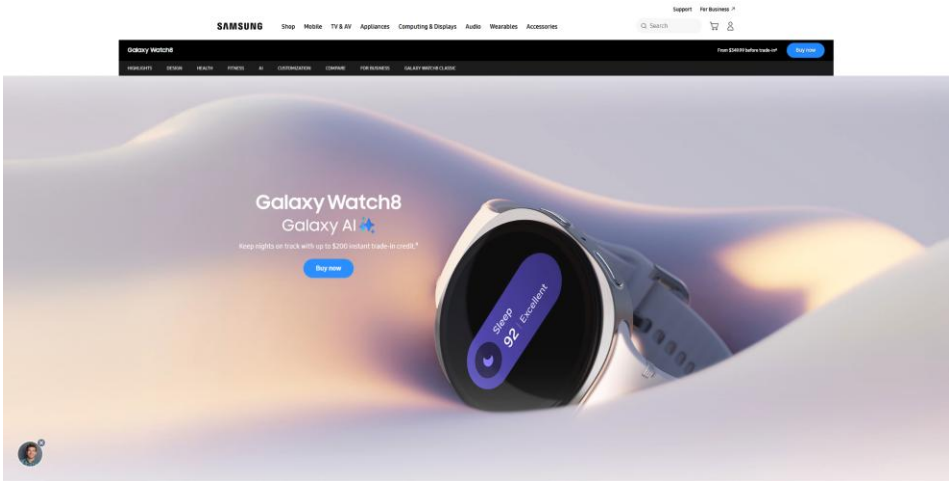
Screenshot of Apple Watch Series 11 Homepage



Note. The homepage of the Apple Watch Series 11 (Apple 2025) claims that the smartwatch is the "the ultimate way to watch your health," and shows an image of hypertension monitoring. This shows that Apple markets the watch as a health device.

Figure 3

Screenshot of Samsung Galaxy Watch8 Homepage



Note. The Samsung Galaxy Watch8's homepage stresses the use of AI in their smartwatch. It also has a picture of the sleep tracking feature giving a sleep score.

4.11 Galaxy Watch8

The Galaxy Watch8 has several features differing from the Apple Watch Series 11, including:

- Body composition analysis
- Vascular load monitoring
- Antioxidant index tracking
- Advanced (AI) sleep coaching

4.12 Apple Watch11

The Apple Watch Series 11 has one feature differing from the Galaxy Watch8:

- Blood pressure monitoring

4.13 Shared Features

The Galaxy Watch8 and the Apple Watch Series 11 share many features, including:

- Heart rate tracking
- Calorie tracking
- Blood pressure reading (not constant on Galaxy Watch8)
- Workout tracking
- Sleep tracking
- ECG
- Apnea detection
- AI training/coaching tools

As seen, although both watches share many features, the *Samsung Watch8* has more unique features than its Apple-based competitor. However, this does not consider the possible differences in accuracy between the watches and if these additional features are useful. Answering these questions, especially for the most demanded features, will help inform smartwatch users, patients, and health providers to make more informed decisions.

5. Accuracy

5.1 Fitness Features

5.11 Step Counting

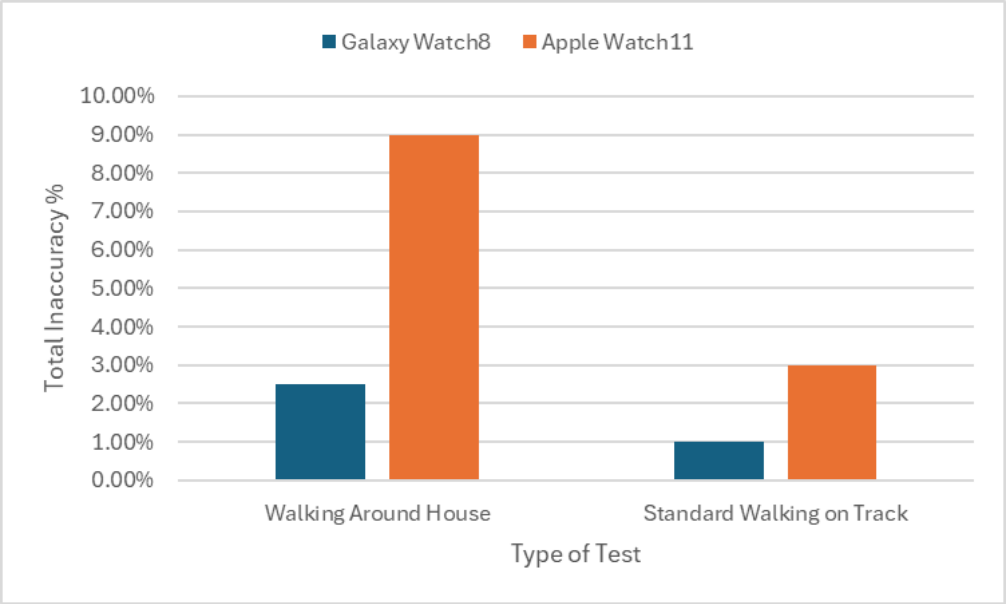
While now seen as a rather basic feature for almost any smartwatch, tracking steps can be an important part of a person's fitness goals. Making sure these pedometers record accurate data allows people to get a good idea of a critical physical activity marker in their everyday lives. While testing pedometers may seem easy, it is often more difficult than when it first appears.

For example, many popular reviews evaluate the step counter by going for a walk, while manually counting the number of steps they take (Ultra Value Tech, 2024, 1:57). Then they compare the number on the watch to the manually counted steps, dividing the number of steps over the manual amount to get the (+/-) inaccuracy percentage. However, many steps taken during the day are when people do household chores, go to the bathroom, or are walking on uneven terrain. Watches struggle to analyze these scenarios, as they need to tell the difference of arm movement from a step. Backing up this theory, is the fact that different watches had varying levels of accuracy, based on walking speed and terrain (Chukwuemeka, 2025, p. 5). To accurately judge whether a watch has an accurate pedometer, the use case should be accounted for in testing.

One test, conducted by YouTuber Ultra Value Tech (2024), aimed to see which watch counted steps most accurately around the house, while not mistaking arm movements for steps. To account for these errors, they manually counted their steps, while performing a regular routine. They would walk around their house, wash dishes, brush their teeth, and bike, comparing the watches' numbers to the manually counted ones. What they found (shown in Figure 4 below) was that the *Galaxy Watch8* had an inaccuracy of around -2.5%, while the Apple Watch Series 11 had an inaccuracy of around -9% when counting steps.

Figure 4

Step Count Accuracy Comparison of the Apple Watch Series 11 and Samsung Watch8



Note. Data taken from Ultra Value Tech (2024) and McGuire (2025). The figure shows the total step count accuracy between the Apple Watch 11 and Galaxy Watch8, based on different environments.

As shown in Figure 4, a standard walking test, measured by a continuous walk, using a clicker to measure steps, found that the *Apple Watch Series 11* had an inaccuracy of around -3% and that the *Galaxy Watch8* had an inaccuracy of around +1% (McGuire, 2025). The results show that, in a standard walking test, both watches are more than accurate enough for general health tracking. However, consumers should pay attention to their use cases, and not always trust the numbers, especially with cheaper watches (Ultra Value Tech, 2024, 6:09).

5.12 Distance Tracking

Distance tracking in smartwatches is another important feature, as many wearers use it while tracking their activities, such as running. Ensuring that distance is properly tracked gives people a better indication of how hard their activity was and how many calories they burned. Studies on specific watches can be hard to find, but Global Positioning System (GPS) technology is mature and variation between high-end smartwatches is minimal, as they use GPS technology, while budget watches can pair with smartphones for location data (Starmax, N.D.). GPS works by pinpointing the location of a device using satellites, developed and maintained by the US government.

To determine the accuracy of GPS-enabled watches, a study was done, having people walk, run, and bike within different environments. The different testing sites included forest, urban, and track & field areas (Gilgen-Ammann et al., 2020, p. 1). Participants had to complete these three activities, wearing four different watches. Results were then compared to the courses, which were marked and measured physically, to ensure reliability. The study found that activities like biking and walking, especially on the

track, were more accurate than running, especially in the forest and urban areas. For an actual accuracy percentage, the *Apple Watch 4* had a mean absolute percentage error (MAPE) of 5.1% (Gilgen-Ammann et al., 2020, p. 6). The study concluded that most of the watches had moderate to good distance tracking reliability, but that things like running lower this accuracy, due to excessive arm movement caused by running.

5.13 Calorie Tracking

Another important feature enabled by smartwatches is calorie tracking. Calorie tracking can be significant for things like weight management and other healthy eating habits. Having a reliable number will enable patients to make more educated decisions daily.

Unfortunately, tracking burned calories can be exceedingly difficult, as there are so many factors involved in tracking them and the differences between every individual. Le et al. (2022) confirmed this tracking difficulty by evaluating 20, healthy young Chinese adults (10 male, 10 female), and giving them three watches and having them perform a walking and running test over 2 kilometers (1.24 miles). The results from the watch were then compared to the COSMED K5, the gold standard for measuring energy expenditure (Le et al., 2022, p.2). The study found that the Apple Watch Series 6 had a MAPE of around 19.8% when walking and a MAPE of 24.4% when running (Le et al., 2022, p.4). The study concludes that the tested smartwatches “may generally have moderate validity in EE estimates for outdoor walking and running” (Le et al., 2022, p.4), indicating that they are not reliable in a clinical setting.

5.2 Health Features

5.21 Heart Rate Detection

Both the Galaxy Watch8 and Apple Watch 11 can detect heart rates. Monitoring heart rate during exercise and rest can be helpful indicators of overall health. To measure heart rates, smartwatches use optical sensors to detect the blood flow changes through the skin. When compared to traditional clinical tools, such as digital blood pressure monitors and pulse oximeters, the watches can hold up well (Ghosh, 2024). However, there are some nuances that need to be considered when using smartwatches to monitor heart rates.

Ghosh (2024) conducted a case study that compared the heart rate readings of the Galaxy Watch 4 against the more clinically reliable readings from a pulse oximeter and digital blood pressure monitor, taken from a local hospital. To assess them, he measured his heart rate at rest, then after a quick workout. He first measured his resting heart rate. Both the watch and the pulse oximeter recorded 73 bpm, while the blood pressure monitor showed a slightly higher reading of 77 bpm. For the next test, he completed “a quick 5-minute workout session consisting of sit-ups and pull-ups” (Ghosh, 2024, Post-Exercise Heart Rate Test section). After checking his heart rate, the watch and blood pressure monitor both shared a reading of 104 bpm, while the pulse oximeter had a reading of 108 bpm. Both tests showed a -4-bpm difference between the *Samsung Watch 4* and the device differing from it. Ghosh (2024) points out that the difference in readings between the pulse oximeter and smartwatch (which share the same technology) could be due to differences in implementation of the sensor technology.

Overall, the watch is rather accurate when tracking heart rate, with some limitations in high heart rate zones.

5.22 Blood Pressure Monitoring

Blood pressure and hypertension warnings are some other features included in many smartwatches. However, most Apple watches do not directly track and tell users their blood pressure numbers. Instead, it will only notify the user if hypertension is detected. On the other hand, Samsung Watches have been able to detect blood pressure since it was approved in 2020 by the South Korean government (Lee et al., 2025). Currently, Samsung watches require regular calibration, using numbers from more tested blood testing devices. Blood pressure is a critical aspect of cardiovascular health, with monitoring it helping increase the amount of desirable health outcomes. However, it can be noted that blood pressure naturally fluctuates throughout the day, based on many factors. Therefore, most health providers recommend tracking blood pressures long-term to look for trends and to achieve more reliable reading.

Lee et al. (2025) aimed to determine the usefulness and accuracy of using the Samsung Watch 6 as a blood pressure monitoring tool. 895 participants were included in a study, where their blood pressure was first clinically evaluated, with these numbers being input into Samsung's health app for the watch to use. Thereafter, for two weeks, participants would read their blood pressures every day in the morning and evening using the smartwatch. At the end of two weeks the participants then received another clinical blood pressure test to recalibrate the watch. Recordings were then taken after the second calibration and compared to the original to determine how the calibration drifted.

The study found that between the calibrations, the mean calibration difference for the Systolic Blood Pressure (SBP) was 4.64 ± 4.73 mmHg. Additionally, the mean calibration difference for the Systolic Blood Pressure was 3.66 ± 3.62 mmHg (Lee et al. p.9). This means that between calibration sessions the readings shifted by around +4 mmHg per reading. The study concludes that while the watches may not provide clinical-level blood pressure data, it still can be useful for regular, everyday blood pressure monitoring when calibrated correctly.

5.23 ECG

An ECG is a quick test that checks the heartbeat for a variety of issues. It does this by recording the electrical signals in the heart (Mayo Clinic, 2024). One common thing ECGs scan for are irregular heartbeats, such as those associated with atrial fibrillation (AF). Smartwatches, such as those from Apple and Samsung, have ECG features that monitor for things like atrial fibrillation.

One systematic review aimed to determine the accuracy of the Apple Watch ECG (used due to its popularity) when compared to the gold-standard 12-lead ECG when monitoring for AF (Shahid et al., 2025). Among the studies surveyed, it was found that Apple watches had a high accuracy and ability to detect which participants in the studies had AF, with the watches having a pooled accuracy of 94.8% when detecting for AF (Shahid et al., 2025, p. 3). The systematic review concluded that, while further studies are needed to determine the clinical significance and accuracy of the watches further, Apple's smartwatches proved to be a promising diagnostic tool for wearers.

5.3 Sleep Features

5.31 Sleep Tracking

Most smartwatches can track sleep, including popular models like the Apple Watch Series 11 and Galaxy Watch8. To monitor sleep, these devices typically track:

- Physical movement
- Heart rate
- Breathing patterns
- Skin temperature
- Blood oxygen
- Noise (like snoring)

However, while smartwatches can estimate sleep duration, quality, and cycles, they do not actually measure sleep directly (Northwestern Medicine, 2021). Understanding the accuracy of sleep data could be important for many people, especially those suffering from things like sleep apnea, as accurate data from smartwatches could allow them to better monitor and manage their health.

Schyvens et al. (2025) aimed to evaluate the accuracy of several smartwatches, including the Apple Watch Series 8, against polysomnography (PSG). In the study, 62 adults each wore 2 to 4 devices overnight while undergoing PSG. The results state that the Apple Watch Series 8, along with smartwatches, “demonstrate clinically acceptable accuracy in measuring total sleep time (TST) and sleep efficiency (SE)” (Schyvens et al., 2025, p. 16). However, other factors like detecting the distinct types of sleep and sleep stages remain unreliable for a clinical setting. Although, it was noted that these trackers could still help monitor general trends over the long term, making sure their data is critically examined.

6. Discussion

6.1 Overview

The smartwatch field has grown rapidly in the past decade. With nearly 29% of Americans owning and using smartwatches (Nagalwade, 2023), many perspectives have been formed on the topic by health providers and the public. Understanding these perspectives will help give a clearer view of the smartwatch landscape and how they interact with public health. Another aspect that has become more complicated as smartwatches become more advanced is the legal perspective. Because many of these devices deal with people’s personal health data, the control and security of this data hold a large moral weight upon society.

Another aspect that is also inextricably linked with smartwatches is their accuracy. Since modern smartwatches offer a wide host of features (Samsung, 2025; Apple, 2025), determining which features could be practically used by patients to monitor their health is crucial for health providers and patients. Since many people currently have a positive view of smart devices for health monitoring, health

providers should understand how to advise their patients on how best to interpret this data and when it would be better to consult a health provider. This section seeks to interpret the information given in earlier sections and give answers to health providers and health-conscious individuals.

6.2 Perspectives

6.21 Public Perspectives

Currently, smartwatches seem to be most popular among affluent young people (Nagappan et al., 2024). Unsurprisingly, this does not make up most of the population, and people who are older, who have a CVD, or are more likely to get a CVD do not wear smartwatches to the same extent as younger, healthier people. A big reason for the difference in adoption rates is likely due to older generations generally adapting to recent technologies more slowly than younger ones. However, with smartwatches becoming more affordable and more commonplace, the usefulness of people that have a CVD or getting a CVD, should not be discounted by health providers. Most people who do search for a smartwatch to buy, look for features such as blood pressure monitoring, ECG, sleep tracking, and exercise motivation (Kelly, 2023, para. 1). These desires clearly show that, among those interested in smartwatches, consumers understand the potential benefits of having a reliable wearable for their health.

6.22 Healthcare Provider Perspectives

Overall, health providers seemed hopeful but critical of smartwatches and their use. These perspectives likely reflect their training and education in the medical field, which demands that the reliability and use of medical tools are scientifically proven. However, among health providers, perspectives on smartwatches differed between things like the age of the health provider and the setting of their workplace. For example, older professionals working in private clinics were more likely to be skeptical of smartwatches (Kelly, 2023). On the other hand, younger professionals working in hospital settings were more likely to support use of health wearables.

While there may be more reasons for the difference of perspectives between these groups, age is likely the most notable factor. Hospital staff are likely to be younger, while those working in primary care tend to be older (HRSA, 2024). Primary physicians tend to have a longer-term relationship with their patients than hospital staff have with their patients too. This could cause PCPs to encounter patients misinterpreting their smartwatch data, or misdiagnosing themselves according to data, which would cause PCPs to be more cautious of smartwatches.

Another notable reason doctors were skeptical of smartwatches was for the privacy of their patients. This reason makes sense, as smartwatch data is not always regulated to the same extent as most medical information, potentially leaving patient information exposed to vulnerabilities, such as data breaches or misuse of data by smartwatch manufacturers. Further legal prospects will be discussed in Section 6.3.

6.23 Comparison of Perspectives

Table 1

Comparative Priorities on Smartwatches Between Healthcare Providers and Public

Concerns	Healthcare Providers' Priorities	Public's Priorities
Accuracy/Reliability	Yes	Yes
Clinical Usability	Yes	No
Affordability	Yes	Yes
Functionality	No	Yes
Motivation	No	Yes

Note. Information taken from Burford et al. (2021).

Similarities between skepticism/willingness to adopt smartwatches exist between doctors and their patients based on age. However, just because the age groups may correlate with each other, it does not mean that both groups have the same reason for slow adoption rates. Table 1 shows the differences and similarities between health providers and the public's opinions. Generally, health providers were more skeptical of the clinical viability of the watches and patient privacy. On the other hand, patients seemed to care more about "concerns for materialism and functionality (i.e., ease of use and charge) associated with wearables" (Burford et al., 2021). The difference in concerns between the public and health providers could likely be due to the complicated nature of health laws surrounding these wearables. Additionally, for most people, they are likely not expecting/demanding clinical accuracy out of these devices, while doctors are. Understanding the different perspectives is crucial for both patients and health providers, as both have valid points. Health providers should aim to educate their patients in the use of smartwatches and the potential risks that come along with them.

6.3 Legal & Ethical Implications

Since smartwatches collect health-related data from their users, they exist in a regulatory gray area between consumer electronics and medical devices. As stated in Section 3.3, a lot of the data collected by smartwatches do not fall under HIPAA, like medical information collected by a health provider would be (Rudawski & Cook, 2025). This could leave users vulnerable to data breaches and unclear data-sharing practices. Currently, FDA and FTC monitor these devices and their manufacturers, but they only regulate and confirm the specific features of a watch that fall into the medical sphere (such as ECG or blood pressure monitoring), which could leave inconsistencies with other technologies found in the smartwatches. Going forward, stricter legal frameworks should be developed to better protect consumers' health data and ensure that they have stronger means of recourse in cases of data mismanagement.

6.4 Accuracy and Reliability

The reliability of smartwatch data varies from feature to feature. Depending on the watch, some features were more reliable, while others were more inconsistent.

More reliable features included,

- Step counting
- Distance counting
- Heart rate detection
- ECG
- Total sleep time tracking

Some less reliable features included,

- Blood pressure monitoring
- Calorie tracking
- Sleep type detection

These differences in reliability show that, while smartwatches can provide reliable and accurate data, it highly depends on the feature and smartwatch. One rule of thumb was that features continuously monitoring biological markers performed better, such as step count and heart rate monitoring. Conversely, more complicated data like calorie tracking and blood pressure had a higher margin of error when compared to clinical tests. Understanding the differences in the data and what is reliable and what is not, allows health providers and patients to better interpret that data smartwatches give. However, even with the more reliable features, smartwatches serve as a more complementary tool rather than a medical substitute. Additionally, many more studies will be needed for newer features. Currently, a gap exists in the literature around advanced smartwatch features recently released.

6.5 Limitations and Future Directions

This report focuses on Samsung and Apple smartwatches, as they are some of the more popular options among consumers right now. However, more studies are needed on other popular smartwatch options. Another limitation was that the novelty of some features did not permit time for researchers to catch up and study them, leading to gaps of information. Many of the new AI features on smartwatches have exploded in popularity throughout the previous year. Additional studies need to be done to determine just how impactful and accurate they are. Additionally, long-term studies on the health outcomes of smartwatch wearers should be done, as technology has gotten more advanced in recent years and overlaps with medical technology increasingly.

7. Conclusion

Smartwatches have become powerful products that often skirt the lines between consumer devices and medical devices. They offer features like ECG, heart rate tracking, sleep analysis, step counting, blood pressure tracking, and more. These features all have varying degrees of accuracy, with some features,

usually tracking more consistent biomarkers, demonstrating more accuracy than other, more complicated features, such as blood pressure, calorie tracking, and detailed sleep analysis. Accurate tracking can give the public more control over their health and increase preventive care. However, patients and healthcare providers should approach the data from smartwatches with caution, as it can be inconsistent depending on many factors.

While opinions differ between individuals, the public, especially those who are young and affluent, generally have a positive view of health wearables as devices that can help them track and monitor their health and fitness. Many healthcare professionals are also optimistic of technology but worries among them also exist about accuracy and privacy. Current laws do not cover smartwatches under HIPAA most of the time and are instead overseen by different regulatory bodies that are struggling to keep pace with the development of the industry. Governments need to implement stronger data protection laws with these devices to ensure individuals health data is not breached nor shared without their consent.

Overall, smartwatches prove promising technology, with the potential to change the way health is monitored in everyday life. However, since smartwatches are becoming more akin to medical devices, they should be treated more as such. Healthcare professionals and patients should understand that these devices are not substitutes for clinical medical treatment and testing, but that they are tools to be used alongside verified medical tools to potentially prevent/track health issues and track fitness.

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