

# Tracking Sleep: The Impact of Wearable Devices and Sleep Apps on Sleep Health – A Mini-Review

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## Abstract:

Technology, specifically wearable devices and sleep tracking apps can help individuals monitor and improve their sleeping habits. These devices use sensors to track parameters such as onset of sleep, duration, and number of nighttime awakenings. While there are limitations to the current technology, such as inaccuracies and reliance on user reporting, future advancements can lead to more accurate and personalized tracking, as well as integration with other healthcare devices. Overall, wearable sleep devices and applications have the potential to significantly improve sleep quality.

## Key Words:

Sleep, Sleep disorders, Sleep hygiene, Wearable sleep devices, Smartwatches, Sleep tracking apps, Physiological parameters, Sleep parameters, Polysomnography

## Introduction

Sleep is a vital process in our lives. It allows us to rest and recover and it is important for health, productivity, and well-being. A good sleep habit is important for cognition, regulation of mood, good mental health, and adequate functioning of our cardiovascular, cerebrovascular, and metabolic systems [1]. Those who suffer from sleep disorders are not able to fully benefit in these regards [1].

Technology has advanced in recent years, allowing more persons to access to wearable sleep devices such as smartwatches and smartphones which can tracking sleeping habits, and thereby allow improvement in sleeping habits [2].

Persons can monitor their sleeping habits including onset of sleep, quality, duration, and number of

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nighttime awakenings [3]. Using this information, together with medical consultation, may allow for the improvement of sleep hygiene through lifestyle changes, or determining the need for further sleep studies and assessments.

### **Wearable Devices for Sleep Tracking**

There has been the introduction of wearable devices which have the capability of monitoring sleeping habits. These devices are usually worn on the wrist such as a smartwatch. They are equipped with sensors which can track physiological parameters. Other devices which are usually fitness trackers may also have the capability of monitoring sleep efficacy. Wearable devices use various means of sensing external stimuli, including accelerometers, gyroscopes, and heart rate monitors. These sensors detect the changes while sleeping and are used to determine the sleep parameters previously mentioned [4].

Research has been carried out on a number of these devices, including brands such as Fatigue Science Readiband, Fitbit Alta HR, EarlySense Live, and SleepScore Max, which have been shown to demonstrate similar or better performance than actigraphy in determining sleep/wake patterns [5]. These devices may be able to provide a numerical sleep score, as well as possible recommendations for improving quality of sleep.

### **Sleep Tracking Apps**

Various software applications have been used to track and analyze sleeping patterns. Some of these apps are include Sleep Diary, Sleep Tracker Tylenol PM, and Track'N'Share [7]. These apps work similarly to wearable devices using sensors, audio or video recordings, and heart rate tracking to determine sleep information. The sleep tracking apps which use the accelerometer that is built into smartphones can detect if there is movement during sleep. This can be combined with other information to provide data on sleep parameters such as duration of sleep, quality and number of nighttime awakenings, similar to the process used by wearable devices [7]. Applications can also use the phone's audio and video capabilities to detect snoring, sleep talking, sleep related events, and may even be able to record these events for review at a later time [8].

### **Limitations of Technology in Sleep Medicine**

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There exists limitations to the technologies we currently use in wearable sleep devices and applications. One study found that the Fitbit devices tended to overestimate total sleep time during nighttime sleep period by an average of 52 minutes and during daytime naps by 4 minutes, compared to polysomnography, which is the gold standard [6].

Another limitation is reliance on use reporting and compliance. Individuals may not wear devices consistently, may forget to charge their devices, may be unwilling to share personal sleep data, or may not report other factors affecting sleep quality such as alcohol, caffeine, and diet. The algorithms used to calculate sleep parameters may not be validated or transparent. And there will exist varying results between different devices, making comparability between devices difficult.

### **Future of Technology in Sleep Medicine**

Even though there are limitations to the current technologies use in wearable sleep devices, there are many areas in which improvements can lead to vast improvements in their usefulness and implementation [10, 11, 12]. Devices can attain greater accuracy and personalized sleep tracking through the development of advancements in sensors and algorithms.

Future advancements may allow integration with other technology such as the electronic medical record and other telemedicine platforms. This can allow for doctors and other healthcare professionals to remotely access and analyze sleep data. This can lead to increased efficacy and efficiency.

These new advancements in the technological limitations of these devices, their increased accuracy, and their avenues for connectivity with other healthcare devices holds great potential for the future of improving sleep quality [10, 11, 12].

### **Conclusion**

Wearable sleep devices and applications have the potential to significantly improve sleeping habits through allowing persons to track their sleep and make necessary lifestyle changes. However, limitations exist such as accuracy, consistency, and other factors affecting data. Future potential exists for the development of more accurate devices which may even be able to allow for integration into the medical health record and allow for remote monitoring.