

Fatigue Risk Management Info sheet: How to use personal sleep tracking devices



Why read this?

Technological developments have recently enabled us to track our own sleep using easily accessible devices. There are many sleep trackers available to purchase for individuals to use, including wrist-worn smart watches, headbands, smartphone apps, bedroom monitors, and 'smart' pillows or smart rings. This information sheet will help you to understand the pros and cons of different devices that are available on the market and decide if using a sleep tracker is right for you.

How accurate is sleep tracking technology?

A review of the relevant studies in 2018¹ concluded that there isn't enough sleep research on the accuracy of under-mattress sleep monitors, bedside sleep monitors, 'smart' pillows, and headband sleep trackers. Smartphone apps are only recommended for recording snoring.

Wrist-worn devices were the most accurate in measuring sleep duration compared to polysomnography (PSG), which is the specialist 'gold standard' method for measuring sleep and involves monitoring brain activity using electrodes placed on the head. This was confirmed in a review undertaken in 2021⁶, that found that whilst a variety of wrist-worn devices are not yet as accurate as the 'gold standard', they are getting much more accurate year on year, particularly at being able to detect sleep accurately, although many still struggle to detect periods of waking during the night.

Because many of the wrist-worn devices are based on movement, with some also using heart rate data, their accuracy can be reduced where people are awake but relatively motionless who can be incorrectly classified as sleeping. For example, if you read a book or listen to music in bed. This is also a problem for people with insomnia – who often lie in bed trying to fall asleep, and so may see their sleep monitoring data as being an overestimate of the sleep that they actually feel they got.



Typical information provided by sleep tracking devices:

- How much sleep you had over how many days.
- What time you went to bed (which may not be the time you fell asleep) & got up.
- Sleep quality & how much time you spent in each stage of sleep (light, deep & REM).

So, which measures can I trust?

The accuracy of sleep monitoring devices varies for different measures. Whilst the wrist worn and ring-based devices currently seem to be more accurate than other devices, they are still differences in the different measures.

- Sleep start and end times: in healthy individuals with no sleep disorders, the sleep start and end times of wrist-worn and ring-based devices tend to be reasonably accurate at identifying sleep. This is likely to be more accurate if you use the ability to edit your sleep start and end times in the associated app.
- Wake during the night: Current sleep research shows that many of the devices are not as good at detecting wake during the night as they are at detecting sleep
- Stages of sleep: Many of these applications include data on sleep staging. However, current evidence shows that these estimates are not very accurate
- Sleep quality or recovery scores: Like the sleep stages, there is limited evidence supporting the accuracy of this information.

If you are a safety critical worker, you should treat your sleep tracker scores or results with caution, as the scores are not always evidence-based, and the devices do not consider many of the factors that determine alertness and performance

Can tracking my sleep help me to improve my sleep?

Researchers recommend that adults should regularly sleep between 7 and 9 hours per night. An ongoing lack of sleep or poor sleep quality increases your risk of health problems such as an elevated risk of diseases including diabetes and hypertension, impaired performance (for example increased reaction times), and accidents².

People who don't have insomnia are generally able to make a good estimate of how much they slept on a given night, and whether they had good sleep quality. However, it is difficult to remember the duration and quality of sleep over longer periods unless you write this information down. This is where sleep trackers can help record information on sleep over a period of days, weeks, and months and track trends over time.

A sleep tracker may help you to recognise that you are not getting adequate sleep but it will not explain why and what you can do to sleep more³. You need to figure this out for yourself by thinking about how factors such as your work hours, sleep environment, health, habits, and social life could have contributed to sleep loss.

Tips for better sleep

1. Keep a consistent go to bed and wake schedule
2. Exercise at regular times each day
3. Don't eat large meals or drink caffeine or alcohol late in the day
4. Keep your room dark
5. Find ways to relax before bedtime each night

Does tracking my sleep have any disadvantages?

Trackers are not always correct. In people with insomnia, it has been shown that giving people a 'poor' sleep score, even if they slept well, results in impaired subjective performance and alertness the next day – so inaccurate scores can really have a negative impact on you. ⁴⁷.

Negative thoughts about sleep can, then, cause stress, which is accompanied by the production of hormones like adrenaline that make it more difficult to fall asleep. In turn, the individual can respond by becoming even more focused on the results of the tracker, and potentially develop orthosomnia – 'a perfectionist quest to achieve perfect sleep'⁵.

If you think you may be paying too much attention to your sleep tracker, you should stop using it. Visit a sleep expert if you still feel you have difficulties with sleep.

What devices are available and how is sleep tracked?

The market for sleep devices is developing and changing fast. Below we have described the main types of sleep tracking devices that are currently available.



Wrist-worn devices:

Sleep tracking is a common feature of smartwatches and fitness trackers. Most wrist-worn devices monitor your movement via an accelerometer. The movement data, and sometimes other data, collected by the device, such as heart rate, are analysed to determine various measures of your sleep

Pros:

These devices are small and light

They can be worn continuously by some people without being noticed

Cons:

The wrist-worn devices can be uncomfortable to wear at night



Ring-based trackers

Smart rings are similar to the wrist-worn devices and use movement and other data (such as heart rate) which are analysed to determine various sleep measures.

Pros:

May be better tolerated than wrist-worn devices

Small and light device, unobtrusive

Cons:

Require an app to see your data – there is no screen

New to market meaning there are few independent validation studies of this technology compared to other devices



Sleep-tracking apps:

There are many sleep-tracking apps that can be installed on our smartphone. You then need to put your smartphone next to you on the bed, or under your pillow while sleeping. These apps monitor sleep by recording mattress movements via an accelerometer and sounds while sleeping.

Pros:

Most apps are cheap, and you can even find some for free.

If you are worried about snoring, you can use an app to record sound during the night and take the recording to your doctor.

Cons:

Apps may be inaccurate if you sleep with your partner or pet because their movements are mistakenly assumed to be yours.



Headband sleep trackers:

Are worn on the head when sleeping and measure brain electrical activity with electrodes attached to the forehead.

Pros:

Some devices also collect heart rate and respiration data

Headbands are less likely than the apps to be impacted by movements that are not yours

Cons:

Their accuracy can drop due to unintentional movements of the headband while sleeping, due to sweat.



Bedside sleep monitors:

Are standalone devices that are put next to the bed, e.g., on a bedside table. They measure your sleep by recording sound coming from your upper body while sleeping. The idea is that if you are not moving, you are likely asleep.

Pros:

There is no discomfort when using these monitors because they do not touch your body

Cons:

You should not expect accurate indications because they are too distant from the sleeper



Under-mattress sleep monitors:

These sleep trackers have a sensor or pad that is placed under the mattress. Sleep is monitored by recording pressure and heart rate.

Pros:

These trackers are not intrusive because you do not have to wear anything

Cons:

May not be accurate if you share a bed with your partner or pet because their movements may mistakenly be assumed to be yours



Smart pillows:

These pillows collect information about your sleep while you have your head on the pillow

Pros:

Sleep is monitored unobtrusively

Cons:

It is not clear how well data is collected when a sleeper changes head position or the position of the pillow

To summarise

There are many types of consumer sleep trackers on the market. However, many of them are not as accurate as we would like, and only wrist-worn sleep trackers have good evidence to support their accuracy, and only for providing an indication of sleep duration. Many of the other devices have not yet been adequately researched or are not effective when people share a bed or bedroom. More accurate sleep tracker devices are likely to become available on the market soon. It is also important to think about how you are using your device – is it a useful tool that gives you rough guidance on your average sleep timings, or are you getting caught up in the details of every minute spent in different sleep stages and trying to improve your sleep score.

References

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Our Fatigue Risk Management Team help organisations manage the risks associated with fatigue and workload and specialise in delivering fatigue risk management solutions for companies whose employees are involved in safety critical work, such as aviation, the petrochemical industry, road transport and the emergency services. Their work provides organisations with the evidence needed to ensure that the business is operating within an acceptable risk threshold.

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