How wearables detect diseases now and in the future

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Reading time 11 mins

Key Points

- Diseases wearables detect are the foundation for digital healthcare, remote patient monitoring, and preventative medicine
- According to the World Health Organisation, heart disease and hypertension are major causes of premature death in adults worldwide – both of which could be treated or prevented with the early detection signals that wearable ECG and Blood Pressure Monitors provide
- Biosensors and wearable sweat sensors can detect illnesses such as congenital heart disease, infectious diseases, diabetes, and cystic fibrosis
- Wearables democratise healthcare by reducing costs, moving the point of care from hospitals to wherever the patient is, increasing accessibility, and reducing the time it takes to administer tests and analyse results
- Wearables are also a more practical option for the management of health indicators that need continuous monitoring (e.g. heart rate, respiration, blood pressure, glucose levels)
- Wearables for disease detection still aren’t as accurate and reliable as tests done in a hospital setting. Those that haven’t been approved for use as a medical devices could give users false reassurance
- Limitations and challenges aside, the future of wearable devices in preventative medicine is bright

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As we slowly settle into a ‘new normal’ in the aftermath of the COVID-19 pandemic, the phrase ‘prevention is better than the cure’ has seldom seemed more relevant. While the concept and practice of preventative healthcare in the form of leading a healthy lifestyle (e.g. regular exercise and a balanced diet) isn’t anything new, the technology we now have at our disposal is. Portable electronic devices with built-in sensors and robust computing capabilities, aka wearables, have changed the face of healthcare and preventative medicine. Rather than waiting for symptoms to appear before diagnosing illnesses and administering treatment, diseases wearables detect, even before the wearer notices any signs of ill health, include:

- Wearable ECG Monitors: Help to prevent heart disease
- Wearable Blood Pressure Monitors: Could reduce illnesses caused by hypertension
- Biosensors: For congenital heart disease and infectious disease detection
- Wearable Sweat Sensors: Help to detect diseases diabetes and cystic fibrosis

The types of diseases wearables detect now and possibly in the future certainly have a meaningful

impact on healthcare and how it's administered. That said, it's important to remember that they're not a replacement for conventional healthcare and in-person medical consultations. In this post, we'll look at some of the ways wearables are leading the way in disease prevention – but also key precautions to remember, as even the best innovations could have unintended consequences.

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Wearable devices in healthcare facilitate disease prevention

Wearable technology encompasses a broad range of applications, including everything from smartwatches and jewellery to wearable pharmaceuticals, e-textiles, and hearing aids. Fitness, health, and entertainment are the most common categories that wearable devices fit into, with those used for healthcare being the most popular. When used as lifestyle management devices (i.e. fitness trackers and sleep monitors) that help users develop overall insights regarding their health, there's no

shortage of affordable and valuable options on the market. However, users need to be more discerning when looking for wearables that can be used as medical devices for disease detection.

Wearable ECG Monitors: Help to prevent heart disease

According to the World Health Organisation, cardiovascular diseases (CVDs) are the leading cause of death globally. Most CVDs can be prevented by addressing behavioural risk factors such as an unhealthy diet, obesity, and physical inactivity. Therefore, early detection is vital so that counselling and treatment can begin.

Wearable devices in the form of ECG (electrocardiogram) monitors can help with the early detection of abnormal heart rhythms that signal potential problems. The range of wearable ECG monitors on the consumer market not only makes these devices affordable, accessible and easy to use but also facilitates the sharing of data in real time so that people who are vulnerable and at risk can be monitored remotely and provided with medical assistance/intervention timeously.

As beneficial as these devices can be, it's important to note that efficacy and reliability can vary. Those that aren't approved for use as medical devices could give false reassurance to users, which could, in turn, discourage them from seeking professional, in-person care timeously.

Wearable Blood Pressure Monitors: Help to reduce hypertension

High blood pressure, or hypertension, is common but can be serious if left untreated. The World Health Organisation estimates that 46% of adults with hypertension are unaware that they have this condition, making this another major cause of premature death (e.g. kidney failure, heart disease, stroke) worldwide.

Wearable, cuffless blood pressure monitoring devices could be a preventative solution for at-risk people as they allow for 24-hour monitoring. As one of the only blood pressure monitoring devices to be registered as a medical device with the CE (European Union) mark of approval, the Aktiia blood pressure bracelet is promising:

- Allows users to see how lifestyle changes improve blood pressure
- Allows doctors to evaluate the impact of medication on blood pressure
- Provides valuable insights (e.g. changes in blood pressure during sleep)
- Continuous monitoring helps to detect changes in blood pressure that intermittent cuff-based monitors might not detect
- Lightweight and comfortable to wear

As promising as the benefits that blood pressure monitoring devices such as these are, variations and standards and validation protocols (according to a report by European Heart Journal on Digital Health) remain challenging.

Biosensors for congenital heart disease and infectious disease detection

Biosensors are analytical devices that convert a biochemical recognition event into a measurable signal: pregnancy kits and glucose monitoring devices are common examples in everyday use. When it comes to diseases wearables detect, biosensors in digital healthcare provide an opportunity to:

- Improve care for patients with congenital heart disease
- Convert wearable biosensor data into actionable insights
- Understand the physiology of the patient at any given time
- Track heart rate, activity/step counts, arrhythmia (irregular heartbeat) burden, and oxygen saturation

However, a research paper published by ScienceDirect concluded that there are no current standards of care for wearable biosensors, and those available on the consumer market lack peer-reviewed or published analytical validation data. The findings were similarly inconclusive in a separate review conducted to evaluate the performance of sensor technologies to detect out-of-hospital cardiac arrest (OHCA). While these technologies show promise, small sample sizes, risk of bias, and databases with low external validity made generalisations challenging.

Biosensors for the detection of infectious illnesses are another frontier where wearables are showing promise. Scientists at Toyohashi University of Technology in Japan are working on developing biosensors that can test for contagious diseases or detect biomarkers for cancer at home. While many of these technologies are still in their development stages, the impact that robust diagnostic methods in the form of biosensors will have on clinical health management is crucial:

- They enable fast and specific disease identification
- The development of technologies such as nanotechnology will only improve their effectiveness
- Biomarkers will help to democratise disease management as they offer cheaper, more accessible, portable, and less technical (in terms of skilled technicians required to administer testing) alternatives

Wearable Sweat Sensors: Help to detect diabetes and cystic fibrosis

An ultra-sensitive, wearable sweat sensor may improve the diagnosis and treatment of cystic fibrosis, diabetes and other conditions. A wristband-type wearable sweat sensor collects sweat, measures its molecular constituents, and electronically submits the results for analysis and diagnosis. High levels of chloride, for example, are an indicator of cystic fibrosis, whereas high levels of glucose could be an indication of diabetes.

Conventional methods for diagnosing cystic fibrosis (a genetic disease that causes mucus build-up in the internal organs and is most commonly diagnosed in children) are time-consuming, uncomfortable, and require patients to visit specialised centres. Wearable sweat sensors are beneficial in that:

- Sweat collection isn't an uncomfortable or invasive procedure
- Testing and analysis of results happen in real time – making it much easier for children to be evaluated
- People living in under-served communities or remote areas can be diagnosed
- The wearable is robust, easy to use, and doesn't require a skilled clinician on site to administer the tests, thus moving the primary point of care to where the patient is
- It enables personalised care and precision healthcare: a baseline for each individual (i.e. people have different 'sweat signatures') can be established

As with most other diseases wearables detect, those using sweat sensors still need further development and testing before conclusive conclusions can be drawn. Some of the shortcomings of wearable sensors include:

- Although levels of biomarkers in sweat correlate with blood, they are still less accurate than direct blood testing
- Physiological differences between individuals and the preparation of the sensor can affect the final results
- Wearable sensors require higher sensitivity and selectivity when measuring multiple biomarkers simultaneously
- The complexity of the manufacturing process, which cannot be continuously mass-produced, has yet to be conducive to large-scale applications for human health

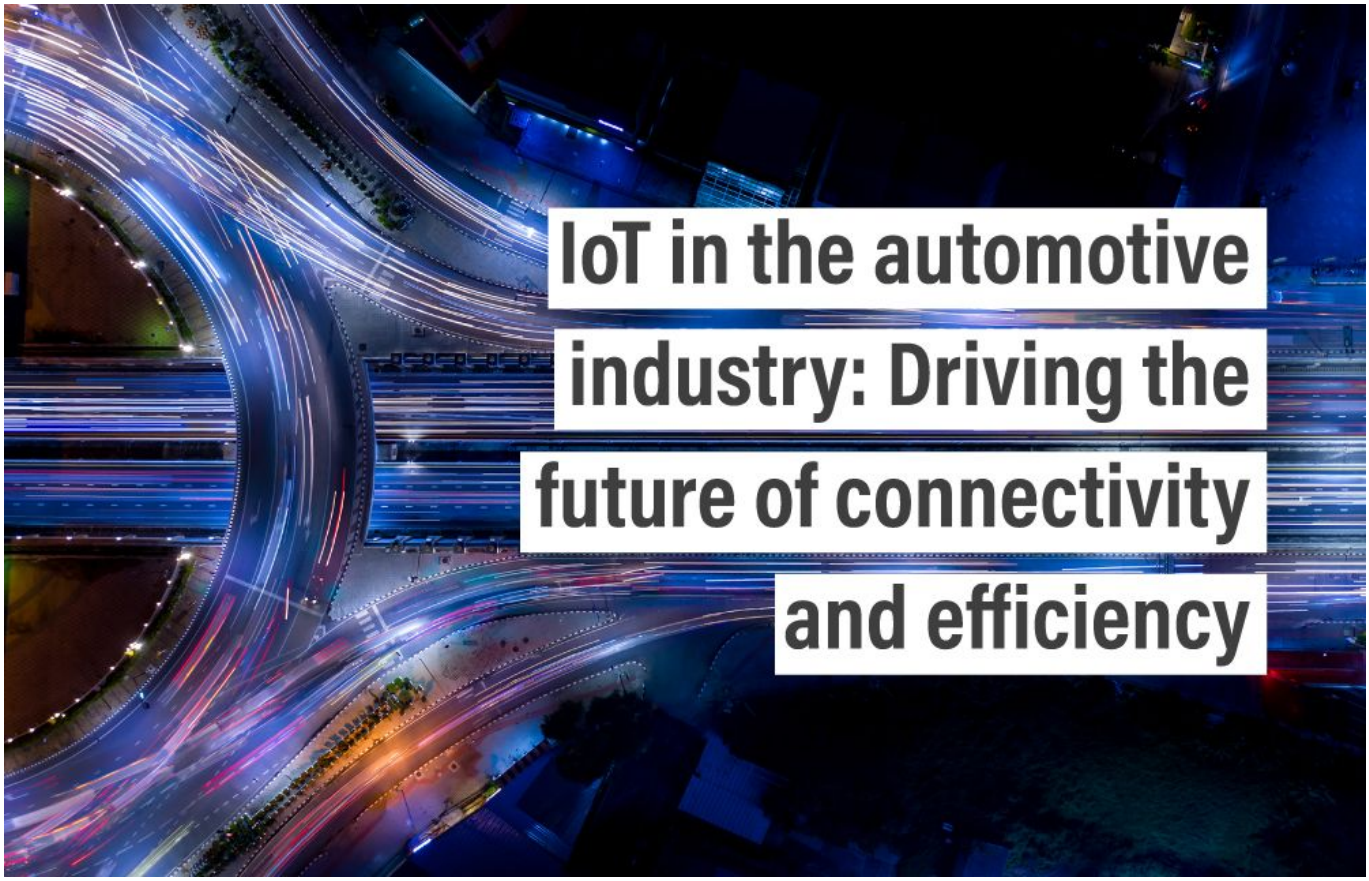
Final thoughts on diseases wearables detect

From heart and kidney diseases to infectious diseases, diabetes, cystic fibrosis and even cancer, the range of diseases wearables detect has a positive impact on the future of healthcare. Not only does it reflect a substantial shift from the conventional hospital-based model to a home-based personal healthcare management system, but it could also signal a significant reduction of diseases which are preventable or treatable with early detection.

In addition, although wearables for disease detection are still in their early stages of development and are by no means a substitute for in-person care, there's much to be said for wearables that facilitate and promote a healthier lifestyle. Exercise, stress, and sleep trackers help users manage their health proactively, and personalised nutrition apps enable a balanced diet – all of which are essential for preventative healthcare.

While there are challenges and limitations to be overcome, the future of wearable devices for disease detection isn't just bright; it's vital. And we haven't yet touched on the role that artificial intelligence, machine and deep learning will play…So watch this space as we continue to explore current and future digital health trends, as well as the opportunities that these new frontiers present!

What are your thoughts on the possibilities for wearables in disease detection? Please share them in the comments below, or let us know if there's a topic we should place on our radar.



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