

5 ways Ingestible Electronics are the new 'best thing' in healthcare



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Key Points

- Ingestible electronics are small devices that are swallowed and remain in the digestive tract
- They are also known as 'smart pills' because they can perform highly advanced functions, e.g. sensing, imaging, and drug delivery
- They are being used to monitor medication adherence, diagnose digestive disorders, and detect cancer early
- Ingestible electronics have the potential to enable remote monitoring and facilitate personalised medicine
- Challenges around safety, reliability, privacy, and informed consent need to be addressed

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In recent years, there has been much buzz around ‘ingestible electronics’ and how they will transform healthcare. Essentially, ingestible electronics refer to small devices or biosensors that are swallowed like a pill and then remain in the digestive tract for an extended period, collecting and transmitting data about the body’s various systems.

Also known as ‘[smart pills](#)’ because they look like pharmaceutical capsules, ingestible electronics – or ingestibles – can perform highly advanced functions such as sensing, imaging, and drug delivery. These devices can include biosensors or image, PH, or chemical sensors that can quickly and accurately obtain information that would be difficult otherwise. Key benefits include:

- Removing the need to perform painful, invasive, or costly procedures such as endoscopy (tube with a camera inserted down the throat) or colonoscopy
- Reducing the chances of infection
- Transmitting information in real-time due to wireless communication capabilities
- Numerous uses for long-term sensing due to advances in batteries and on-board



memory

While this may sound like something out of science fiction, the reality is that ingestible electronics are already making a significant impact in the world of healthcare, and their potential for transforming the industry in the years ahead is immense. In this post, we’ll look at a few ways that ingestibles are already being used and the impact they’re likely to have in the future.

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1. Monitoring Medication Adherence

One of the biggest challenges in healthcare today is ensuring patients take their prescribed medications. This is particularly true for patients with chronic conditions who may need multiple medications daily for years or even decades. Ingestible electronics can help solve this problem by monitoring medication adherence and transmitting data to healthcare providers in real time.

A study published in [eBioMedicine](#) on the effectiveness of ingestible sensors for improving adherence for HIV patients on antiviral medication found significantly higher levels of adherence and acceptance with patients who took the ingestibles than those who had not.

2. Diagnosing Digestive Disorders

Digestive disorders can be challenging to diagnose, and many patients must undergo invasive procedures to get an accurate diagnosis. Ingestible electronics can make this process much easier by providing detailed information about the digestive tract, allowing doctors to identify potential issues quickly and accurately.

3. Early Detection of Cancer

One of the most promising applications of ingestible electronics is early cancer detection. By collecting data about the digestive tract and other parts of the body, these devices can help doctors identify potential signs of cancer long before symptoms become apparent. This could lead to earlier interventions and better outcomes for patients.

4. Personalised Medicine

As ingestible electronics become more advanced, they will be able to collect increasingly detailed data about the body's various systems. This data can then be used to develop personalised treatment plans for individual patients based on their unique needs and medical histories.

For example, [continuous glucose monitoring wearables](#) have proven positive outcomes for patients with diabetes and cardiovascular illnesses. As an emerging technology, ingestibles could provide

additional insights into an individual's response to dietary changes and medication, enabling subsequent treatments to be personalised accordingly.

5. Remote Monitoring

One of the reasons why [health technologies such as telemedicine](#) and healthcare apps are gaining momentum is because they move the point of care to wherever the user or patient is.

Ingestibles take this one step closer by changing how patients are monitored from the inside out. By transmitting data to healthcare providers in real-time, these devices enable patients with chronic conditions or other health issues (e.g. internal bleeding) to be monitored remotely. This allows doctors to intervene quickly if necessary but removes the need for patients to be kept under observation in a medical setting.

Inherent challenges with an Internet of Medical Things (IoMT)

The [Internet of Medical Things](#) (IoMT) refers to connected devices that can wirelessly send medical information to facilitate treatments remotely. This generates an enormous and continuous stream of data, leading to valid concerns regarding ethics, privacy and security.

Concerning medication adherence in particular, some have dubbed them '[snitch pills](#)' in reference to their ability to alert doctors, pharmacists, caregivers, or even probation officers to whether medication is being taken. For people who are wary of, and resistant to, being 'under surveillance', this negatively impacts their receptivity to using them.

These challenges must be addressed before ingestible electronics become a standard part of healthcare. Ingestible biosensors need to be safe, reliable, and easy to use, and there are also important ethical considerations around issues such as privacy and informed consent.

Ingestible electronics are evolving healthcare from the inside out

While ingestible biosensors might seem like a bitter pill to swallow for some, the benefits (i.e. disease prevention and detection, as well as remote patient monitoring) are undeniable and are likely to play an increasingly important role in healthcare in the years and decades to come.

If you're designing or developing healthcare technologies and looking for solutions to improve care provision, please get in touch with us. Our multi-disciplinary team of experts thrives on innovation-driven solutions and is yet to meet a challenge they can't beat!

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