

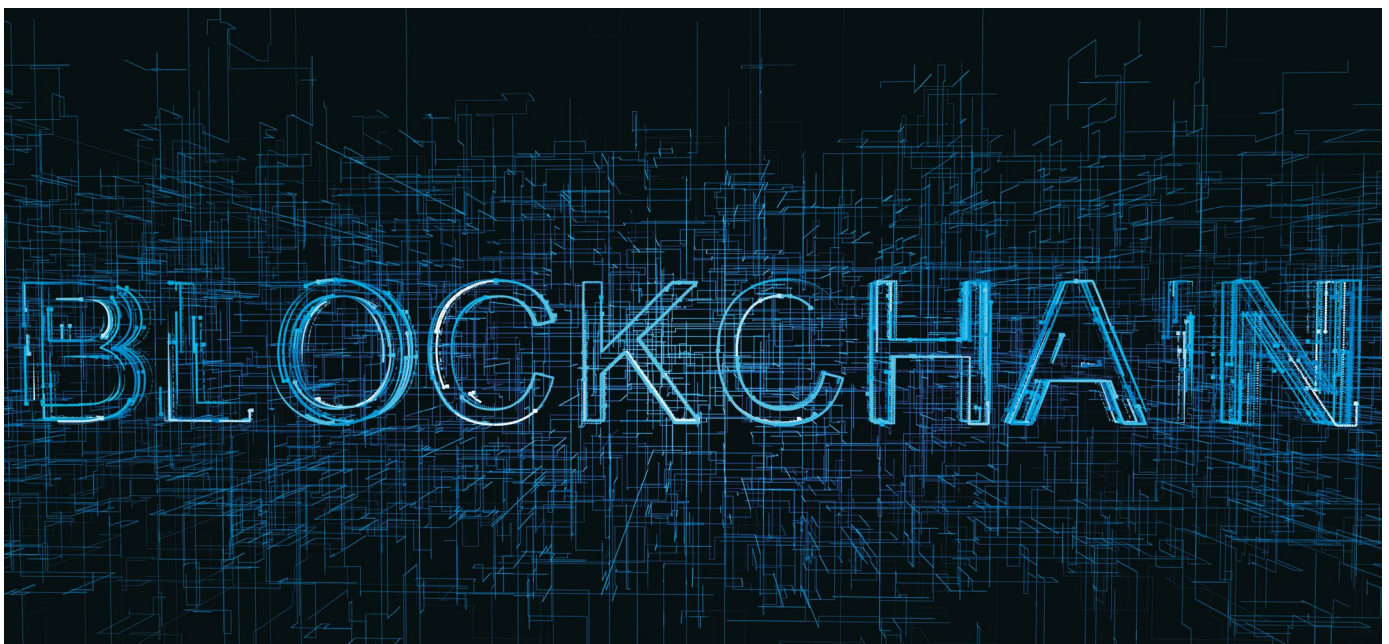
# Blockchain: A Revolution in Digital Health

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Blockchain is presented today as a mirage of solutions that for many specialists might seem limited. The future challenge will be to build trust in users in a system that will process personal patients' data via the blockchain system. This may imply, in the end, the creation of a new personalised medicine business thanks to the information's accuracy and the predictive algorithms that will be used in this context.

## ✓ Key Points

- Blockchain technology consists of a chain of digital records that are incorporated into an immutable structure that is verified by members who share the information.
- Since there is no centralised storage of information and it cannot be deleted or copied, increasing security and traceability of the information contained in the chain would make it a useful system for the digital health sector.
- Currently blockchain is limited by its novelty, but the use of cryptocurrencies will allow us to learn the dangers and eventual limitations of the system and the ways to foresee solutions.
- Blockchain offers an enormous technological hope of maintaining a single, unalterable and longitudinal record that each patient can demand at any time, securely and privately.
- Greater trust and transparency amongst stakeholders (patients, insurers, health providers, pharmaceutical companies) must be built into health data management through steps such as the GDPR (General Data Protection Regulation, 2018) in the European Union.
- For patients, blockchain offers the increase in the volume of health data that will make it possible to obtain better, faster diagnoses and more appropriate therapies and treatment regimes.





## Background

Since its inception, blockchain has proven that it has the potential to unleash a technical and economic revolution. It all began with big data's holy trinity: high volume, access and speed of information processing, which in turn increased the value of collecting and processing personal data. The next step was to place services in the cloud (cloud computing), making it possible to access all of this information from big data and process it more efficiently. And then, one day, blockchain appeared.

For those less familiar with the notion of blockchain, this technology consists of a chain of digital transactions (chained digital records) that are incorporated into an immutable structure that is confirmed and verified by the members who share the information. There is no centralised storage of information and it cannot be deleted or copied. Much of the fundamental characteristics of the blockchain reside in its ability to increase the security and traceability of the information contained in the chain, which makes it essential for the digital health sector.

Blockchain includes the potential to revolutionise the health sector, since it places the patient (user) in the centre of the scene, allowing her or him to directly control the information protocol at all times, as well as being able to customise the distribution of the personal data on the shared network.

The companies that are in charge of exploiting this technology will have to find a way to adapt to the current operating conditions that the use of blockchain entails in the sector, but notably they will have to provide trust and transparency to users. A similar example can be a pedagogical step that has

been taken in the European Union with the GDPR (General Data Protection Regulation 2018), which has created awareness among users about the importance of managing personal data.

In blockchain, we host the enormous technological hope of maintaining a single, unalterable and longitudinal record that each patient can demand at any time, securely and privately. This respect is appropriate between the patient and the doctor and the insurance company, as well as any other actor in the health ecosystem.

## Applications and Benefits

Blockchain has the vocation to be present in most layers of the health ecosystem. The benefits that exist are multiple. The system will make it possible to unify the multiple identities of the patient through different health platforms, giving the user the possibility to decide and control (consent) the access and processing of information by any actor (Despotou et al. 2020).

By unifying the information, registers can be made compatible throughout the different platforms, thus facilitating the interoperability between the systems, a situation that is currently a real obstacle. Faced with user concerns about the way their data is processed, the blockchain system allows for the removal of certain intermediaries, and the user maintains direct access to the distribution list.

Transaction costs can be reduced as a consequence of the reduction in intermediation. Blockchain allows an update of the patient's information through the different networks where the information has been hosted.





Thanks to blockchain, the use of smart contracts can be extended in a generalised way by different service providers in a consistent manner.

Other applications of blockchain consist of being able to ensure the validity of drug supply chain, notably in developing countries, in order to avoid the circulation of counterfeit products. This can also help to guarantee the quality of the product and the respect for the cold chain, for example.

### Consent, Control and Access

This giant step could be revolutionary for the patient. Blockchain will allow for patient identification and authentication and will store their personal information (eventually potentially sensitive genetic content) (Zhang et al. 2018) on a large number of health platforms. Annotations, certifications, exam results as well as a registry of medical prescriptions will also be stored on the blockchain. The system can also ensure the monitoring of patient treatments, reminders and, of course, payments for services (transactions through smart contracts). Blockchain access will come with one important caveat: Consent. Patients may give (or deny) access to different borrowers, or allow limited access to certain information, in relation to particular treatments or pathologies.

### Some Limitations

Currently the blockchain system presents some limitations, however it is likely that, over time, market players will learn how to circumvent these specific limits.

One of these limitations is linked to the novelty of technology. The system will most likely still have to operate for about ten years in order to fully adapt to the specific characteristics of the market. The use of cryptocurrencies (and, for instance, NFTs - non-fungible tokens - more recently) will allow us to learn in detail the dangers and eventual limitations of the system and the ways to foresee solutions.

An important obstacle that blockchain finds in the digital health sector is linked to the mistrust that large pharmaceutical companies generate in a large population of patients. Not only as a consequence of the great benefits of these companies, but also because of their dominant positions in

the drug market and, little by little, their access to personal data (Campillo 2020). Added to this is the lack of transparency in their processes and the monopoly that they naturally exercise in the management of pathologies.

It should also be noted that the mere use of the blockchain does not free operators from cybersecurity compliance. Risks persist, especially at the level of user terminals and providers. Complementary protocols should be established, especially since the current databases will remain in force for a longer time, and it will be necessary to guarantee a certain level of compatibility and security between both systems (Evangelatos 2020).

### Conclusions

Blockchain may allow democratisation of the circulation of patients' personal information, as well as increasing the user's power over the consent and ultimate control of such information. At the same time, it is likely that by increasing the level of data in circulation, this could lead to fairer and more dynamic health services. An example to consider will be the next rollout of vaccine passports, which may serve as both a balanced opportunity for all citizens to re-engage in society, but also a restriction on some people's individual freedoms (Murphy 2021).

Blockchain could also provide an opportunity for greater trust and transparency in health data management. Companies must create solutions that acknowledge the importance of respecting personal data, while also being able to be utilised properly by patients. The greater the trust in the system, the more value will be created from the multiplication of data units shared by users via blockchain. For patients, the increase in the volume of health data will make it possible to obtain better, faster diagnoses and more appropriate therapies and treatment regimes.

The key to true revolutionary success of blockchain will be for healthcare professionals and technology developers to reconcile the technological potential with the need for security and privacy of patients' personal data.

### Conflict of Interest

None. ■

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