

## Blockchain Digital Health Care Use Cases

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### Abstract

The blockchain is a powerful piece of technology that enables many individuals to access data and exchange it with one another in a protected environment. This presents a significant challenge in the field of digital health, where it is of the utmost importance to protect patient privacy and security but where it is impossible to improve care quality without improved patient data management across the entire healthcare system, and the ability to use analytics on patient data gathered at the population level. To summarise, blockchain technology has the potential to improve digital health by making it simpler and safer to communicate patient data across extremely decentralized healthcare systems. This would result in an overall improvement in digital health.

### Introduction

One of the most significant challenges presented by this technology is the challenge of differentiating between true blockchain-based applications and marketing hype. Because there are yet relatively few practical applications on a broad scale that use blockchain technology, this is a tough endeavor to undertake. Bitcoin is the only currency that defies this rule.

The elimination of the need for a central authority is the aspect of blockchain technology that is considered the most revolutionary of its many features. Blockchain technology does this by equally distributing power among all players in its ecosystem. This is made possible with the utilization of extremely cutting-edge encryption in conjunction with the addition of various incentives (in the form of Bitcoin or other cryptocurrencies). As a result, in theory, it might eliminate the need for a third party to supervise digital transactions safely and impartially between two organizations that do not already know or trust one another. In other words, it could do away with the necessity. This idea seems to function well in Bitcoin, although it has not yet proved helpful in more typical business circumstances.

One of the most significant benefits of a decentralized system is that users, particularly consumers and companies, would have far better visibility and control over how their data is utilized. This is one of the essential advantages of a decentralized system. As a direct consequence, the decentralization of the data economy is one of the long-term goals of disruptive firms, which is made feasible by blockchain technology. This involves shifting ownership to individuals and organizations instead of businesses such as Google, Facebook, Amazon, and others that centralize enormous datasets to achieve a competitive advantage.

The implementation of blockchain technology might also make it feasible for end users to sell their data in exchange for cryptocurrency tokens via payment mechanisms that are integrated directly into the platform. This would provide end users more access to and control over their data. The monitoring ledger of the blockchain serves as the foundation for all of this, and artificial intelligence is layered on top of it to locate significant data sets and link buyers and sellers. This concept is still more theoretical than it is practical, and if it is ever put into practice at all, it may not be for at least ten years from now even if it happens at all (see Fetch.ai as an example of a start-up working on a system like this). In recent years, efforts have been made to help blockchain technology overcome some early growing pains it experienced. These growing pains include awkward user interfaces, problems with scalability, and the requirement for increased privacy to protect corporate intellectual property. In addition, it has been demonstrated that blockchain technology can address real-world problems that are far more complex and pertain to the accessibility and trustworthiness of data [2].

## **Results and Discussion:**

### **Blockchain Functioning**

- The act of keeping information and data in a way that is both unchangeable and open to ensure that no one entity may have a disproportionate effect on it [3] is known as tracking and registering.
- The process of enabling the exchange of data between several parties to provide a single source of "truth" is included under the umbrella term "data access and transfer."
- The management of identities and authorizations for authentication or verification, including the capacity to check identity features without exposing sensitive information
- Settlements: It is possible to settle accounts for income if one keeps track of the flow of products and revenue or the usage of services and assets. This makes it possible to settle accounts.
- allowing for the completion of financial transactions and payments inside the organization (real-time)
- The transaction of transferring virtual currency or tokens that have their intrinsic value from one party to another is referred to as a "token exchange." In addition, the utilization of escrow accounts with a value equivalent to that of the digital currency allows for the link of the digital currency to the traditional currency.

### **Business benefits of these capabilities**

- Security: Because the blockchain is preserved across numerous nodes and approved by a consensus mechanism, it is incredibly difficult, if not impossible, to counterfeit data or conduct DDoS assaults. This provides a high level of protection against malicious actors (distributed denial of service).

As a result of the fact that consensus procedures increase confidence by increasing transparency, which in turn decreases transaction costs, it is feasible to do away with the go-betweens who take a cut of the transactions.

- Reliability: Having a record of every transaction that is kept permanently can reduce the likelihood of being sued for fraud and lessen the risk of litigation.
- Streamlined and streamlined business procedures: Transaction processing times have the potential to be reduced when automated smart contracts are used since they do not require manual monitoring.
- The value of tokens: If a digital asset, such as a token for loyalty points, is used in a program that rewards points, for example, the digital asset may have some value in both the virtual and the real worlds.
- Without divulging personally identifying information, such as patient's medical histories, many organizations can work together on a project without compromising patient confidentiality. Several examples of this include the following: The immutability and reliability of the system are bolstered by the blockchain's decentralized and open characteristics. For instance, even if one of the parties that participated in the establishment of the system decides to withdraw their participation in it, the system will continue to operate as intended.

It should be no surprise that many people are working toward implementing blockchain technology in healthcare operations. Given the significant challenges that healthcare systems face regarding digitizing and sharing medical records, tracking prescription drugs and other medical goods in the supply chain and delivery, it should not be surprising that many people are attempting to optimize healthcare processes by implementing blockchain technology.

Because the vast majority of blockchain-based solutions are currently provided in the same manner as any other sort of software-as-a-service, implementing many of these solutions for the healthcare industry does not require in-depth first-hand knowledge of the technology.

### **Blockchain healthcare use cases in digital health**

#### **1. Supply chain transparency**

Establishing the origin of medical goods before validating their legality is a significant challenge that faces many companies, including the healthcare industry. A large number of other industries also face this challenge. Customers may be able to have complete visibility and transparency of the items they are purchasing if a

system that uses blockchain technology to trace products from the time of manufacture and at each point along the supply chain is implemented. Customers can make more educated purchasing decisions as a result.

This is a significant challenge for the company, particularly in developing nations, where the use of counterfeit prescription drugs is directly responsible for tens of thousands of deaths yearly. As remote health monitoring becomes more widespread, there will also be an increased need for medical devices. These devices are increasing rapidly, attracting shady actors' interest.

Thanks to Medi Ledger, the market-leading blockchain platform in the pharmaceutical business, companies that are a part of the supply chain for prescription drugs now have the chance to authenticate the authenticity of prescriptions, expiration dates, and other critical facts.

### **Key benefits of the blockchain (paired with AI):**

A client's capacity to track each shipment from beginning to end, including integration with distributors, manufacturers, shippers, and other relevant parties, is called "customer assurance."

To ensure patients' continued well-being, medical supplies and pharmaceuticals manufacturers must hand in some reports. It may be simpler to comply with regulations if data from the many supply chain systems are consolidated into a single platform. For example, when it detects a problem, the blockchain-based technology that FarmaTrust utilizes quickly notifies the appropriate authorities in charge of drug regulation. Enhancement of the performance of the supply chain When all of a company's data is centralized in one spot, artificial intelligence may assist firms in more precisely estimating demand and making adjustments to supply.

**Figure 1: Farm Trust's track and trace app for healthcare supply chains**



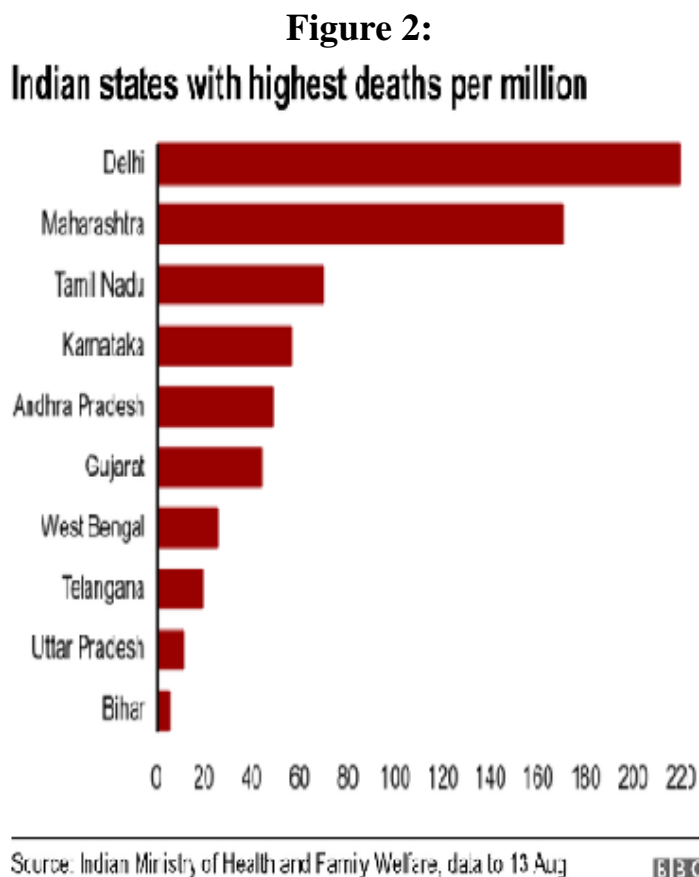
**Source: Farm Trust**

Outside the financial markets, one of the most cutting-edge applications of blockchain technology is the management and transparency of supply chains. This was made clear by the well-known partnership between IBM and Walmart to maintain food safety across the supply chain. Since the technology and the ROI have already been demonstrated, we believe this will be the most significant immediate influence blockchain will have on the healthcare industry.

## **2. Patient-centric electronic health records**

Patients and the medical personnel who care for them typically have only a fragmented view of their medical history [1, due to the problem of data silos, which affects every healthcare system in every nation and area]. According to research by Johns Hopkins University, preventable medical errors were the third leading cause of death in the United States in 2016. These errors were brought on by inadequately coordinated medical care.

These errors may appear in patient records as acts intended to be taken but not carried out correctly or as omissions.



Creating a medical records system based on blockchain technology capable of interacting with existing software for electronic medical records and providing an all-encompassing, unified picture of a patient's information is one approach that might be taken to address this problem. It is of the utmost importance to emphasize that each new item added to the blockchain, such as a doctor's note, a prescription, or a test result, is transformed into a unique hash function, a short string of letters and numbers. This is the case to ensure the security of the blockchain. This technique ensures that the data that is kept on the blockchain is protected at all times. On the blockchain, fraudulent patient data is recorded in place of the accurate patient data that should be there. Every hash function is unique, and the only person who can provide permission to decode the data that has been hashed is the owner of the data that is being hashed—in this case, the patient.

In this made-up scenario, a transaction will be added to the blockchain whenever a patient record is modified or if a patient consents for some of their medical information to be shared with other parties.

Medicalchain is an excellent illustration of a company working closely with healthcare providers to develop electronic medical records (EMRs) enabled by blockchain technology.

**The key benefits of blockchain-enabled EMRs are:**

A comprehensive, accurate, and centralized repository for the medical records of patients that is beneficial to patients as well as medical providers.

Patients can monitor whenever an update is made to their medical records and explicitly consent to share such information with other individuals or healthcare professionals while using this service, which is provided to them by the company. The patient may also choose whether to release all of their medical information to researchers or just a subset of it, limiting the amount of time that any third party can view their medical records. If the patient chooses to release all of their medical information, it will limit the time that any third party can

view their medical records. Patients also have the option to limit the amount of time that any third party can examine their medical records. This restriction can apply to any business.

Without the need for the time and money that a middleman requires, medical insurance could be able to obtain prompt, verified confirmation of healthcare services directly from individuals. In addition to the construction of medical records stored on blockchains, Medicalchain is developing a platform that will make it possible for other businesses to construct digital health solutions on top of its basis. These possibilities consist of a medical data interchange and a virtual consulting service. Patients have the option of selling their medical data that has been anonymized through the use of the medical data exchange in exchange for med tokens. This encourages the development of technologies for analytics at the population level and other digital health applications.

The advent of patient health information that is significantly more extensive, easily shareable, and digitized will significantly impact the healthcare industry since it will make it possible to conduct more advanced analyses. For example, personalized medicine is a fascinating research subject, but there is just an inadequate quantity of high-quality data to enable significant advancement in the field. If there were access to data that was more trustworthy and widely distributed at the population level, it would be feasible to conduct a segmentation and analysis of the effects of focused therapy that was substantially more robust. This would be conceivable to do.

In addition to providing a solution for supply chain management, FarmaTrust has developed a technology that allows patients to get gene and cell therapy treatments. Some academic teams are also looking into ways to enhance personalized medicine through the combination of artificial intelligence and blockchain (see here and here).

### **3. Smart contracts for insurance and supply chain settlements**

Using blockchain-based [2] business systems, pharmaceutical corporations, medical device OEMs, distributors, insurers, and healthcare providers may each confirm their identities as organizations. They can also log information about contracts, track transactions of products and services, and track payment settlement information for those transactions. In addition, they can track payment information for such transactions. Insurers and other business partners in the healthcare industry can manage supply chains and work under totally digital and, in some cases, automated contract conditions when working in an environment like this. This has repercussions that extend beyond the management of supply chains.

They can significantly reduce disagreements regarding payment chargeback claims for prescription drugs and other products by utilizing shared digital contracts between manufacturers, distributors, and healthcare organizations that are recorded on a blockchain ledger. These contracts can be accessed by all parties involved in the supply chain. In the current arrangement, every participant uses their version of the contract, which goes against what we want to do with them. According to Chronicled, due to price structures that are prone to fast volatility, more than one million chargeback claims are filed among these players annually. The long mediation procedure that involves human arbitrators is required since more than 5 percent of those chargeback claims are contested.

Pooled smart contracts might be managed using a technique like this to handle patient medical insurance contracts. According to the figures provided by Curisium, just ten percent of claims are ever contested. Suppose this data has been digitized and is easy to access, as is the case with other use cases. Insurance companies can apply more advanced analytics to optimise health outcomes and costs in that case. This will allow for greater cost savings.

### **4. Medical staff credential verification**

It is possible to utilize blockchain technology to track the experience of medical practitioners in a manner that is analogous to how the provenance of a medical product is monitored. By maintaining a record of their employees' qualifications, reputable healthcare organizations and institutions may be able to shorten the time



it takes to fill open positions. R3 Corda is a blockchain technology utilized in developing this approach for confirming medical credentials. ProCredEx of the United States developed this method.

**The key benefits of the blockchain system are:**

- A certification procedure that is both speedier and more efficient for applicants throughout the entirety of the hiring process for healthcare organizations
- It is an opportunity for healthcare organizations, insurers, and medical schools to make money from the information they already possess on the credentials of both current and past staff.
- Transparency and assurance for partners, such as businesses that subcontract locum tenens work or newly developed models of virtual health care that inform patients about the credentials of the medical experts who will be treating them.

**5. IoT security for remote monitoring**

One of the most significant advancements in the field of digital health has been the proliferation of technologies that allow for remote monitoring. These systems use a wide variety of sensors to keep track of patients' vital signs to assist medical staff in gaining a better knowledge of their patient's health and to make it possible for them to provide more proactive and preventative treatment. In our previous articles on 5G and edge computing in digital health, we looked at several exciting use scenarios, one of which was remote monitoring.

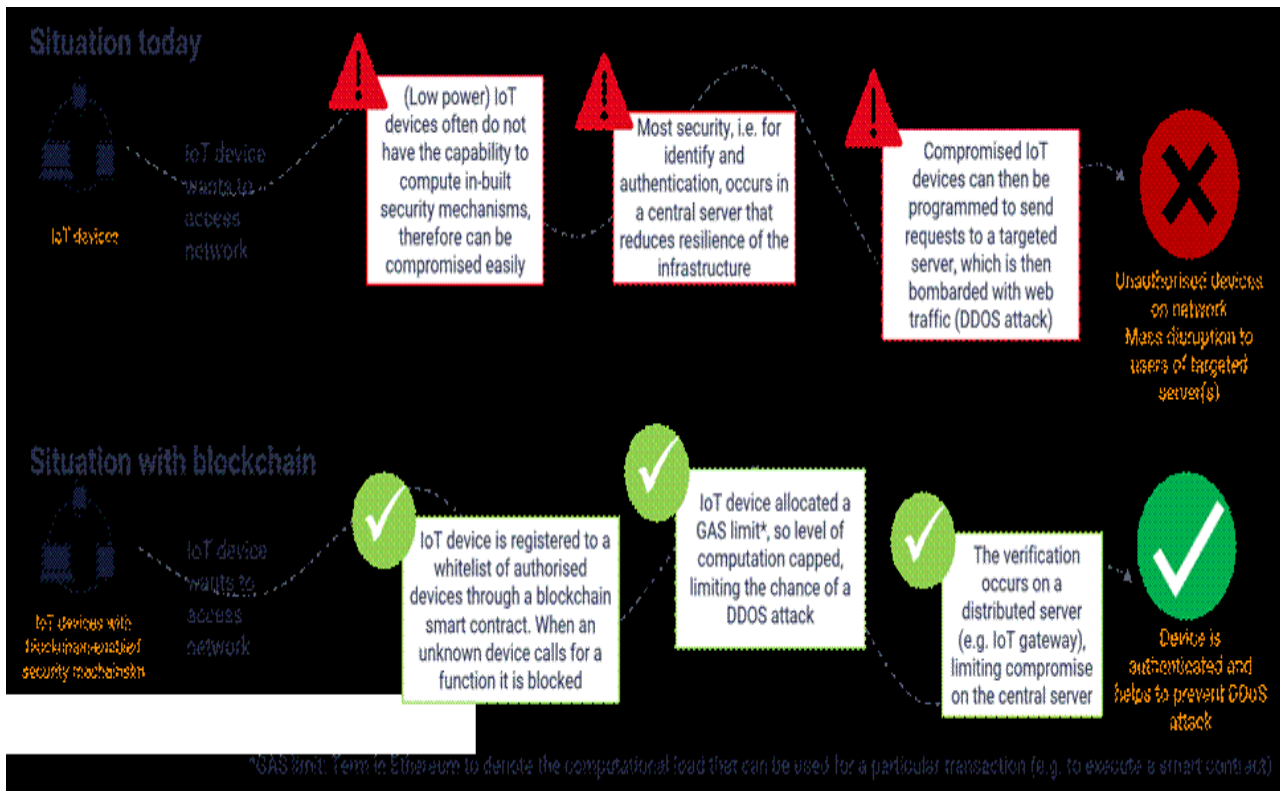
Security is a major concern in the Internet of Things (IoT) healthcare sector,[10] both in terms of ensuring that patient data is kept private and safe and that it is not altered to offer incorrect information. When a connected device may be relied upon in emergency scenarios, such as alerting a caregiver that an older person has fallen or suffered a heart attack, the systems that support the connected device must be particularly resistant to DDoS or other assaults that interrupt service. This is because these types of attacks can cause the device to malfunction. This is because it is possible to rely on the connected gadget in the event of an emergency and receive a notification from it.

**How blockchain systems could help secure remote monitoring IoT devices:**

The use of blockchain cryptography ensures that only authorized parties can access personally identifiable information that has been recorded on the blockchain in the form of a unique hash function [7]. It is almost hard to update patient data once saved on the blockchain ledger as a hash function. This is because doing so would need access to all previously stored versions of the data. Suppose the source data are altered in any manner. In that case, the resultant hash function will be unique, and the user will be required to possess a certain set of cryptographic keys to decode the hash function and obtain the source data in their original form. Most connections made through the Internet of Things are now directed through a centralized server. On the other hand, the decentralized nature of blockchain makes it possible for Internet of Things devices to communicate with one another directly. Because of this, a DDoS assault or a man-in-the-middle attack is extremely difficult to execute [10].

While research on these use cases is still in its early stages, it is unclear which technique would be the most successful [6]. Blockchain may improve the security of IoT devices utilized in the healthcare business. [5]. Blockchain technology should be investigated by digital health organizations who are searching for ways to ensure the security of remote monitoring equipment [9], but this should only be done as a part of a much larger and more comprehensive end-to-end security plan.

**Figure 3: How blockchain can improve IoT security**



## Reference:

1. K. Nagarathna "Blockchain-based Malware Detection using Machine Learning Algorithms for IoT enabled E-Health Applications." Vol.10, Issue 11, Pages: 73-82, DOI: 10.48047/IJIEMR/V10/I11/12
2. MazinAlshamrani "IoT and artificial Intelligence implementations for remote healthcare monitoring systems: A survey," (<https://doi.org/10.1016/j.jksuci.2021.06.005>), 2021
3. SUDEEPTANWAR1, QASIMBHATIA1, PRUTHVIPATEL1, APARNAKUMARI1, PRADEEP KUMAR SINGH 2, AND WEI-CHIANGHONG3 "Machine Learning Adoption in Blockchain-Based Smart Applications: The Challenges, and a Way Forward"
4. Manoj M K, Thippa Reddy Gadekallu, Sivarama Krishnan S, Neeraj Kumar, Saqib Hakak, Sweta Bhattacharya "Blockchain-based Attack Detection on Machine Learning Algorithms for IoT based E-Health Applications," (<https://doi.org/10.1016/j.jksuci.2021.06.005>), 2020
5. Nasir El Bassam, Distributed Renewable Energies for Off-Grid Communities (Second Edition) Empowering a Sustainable, Competitive, and Secure Twenty-First Century, (<https://doi.org/10.1016/B978-0-12-821605-7.00007-6>) Chapter Twenty-Blockchain 2021, Pages 447-450
6. D. Jeyabharathi, D. Kesavaraja, D. Sasireka, Handbook of Research on Blockchain Technology, Chapter 7-Cloud-Based Blockchain for Enhanced Security (<https://doi.org/10.1016/B978-0-12-819816-2.00007-1>), 2020, Pages 171-181
7. Madhusudan Singh, Shiho Kim, Advances in Computers Volume 115, Chapter Four - Blockchain technology for decentralized autonomous organizations, (<https://doi.org/10.1016/bs.adcom.2019.06.001>), 2019, Pages 115-140
8. A. Haleem, M. Javaid, Additive manufacturing applications in industry 4.0: a review, Journal of Industrial Integration and Management, 4 (4) (2019 Dec 4), Article 1930001
9. S. Perera, S. Nanayakkara, M.N.N. Rodrigo, S. Senaratne, R. Weinand, Blockchain technology: is it hype or real in the construction industry? Journal of Industrial Information Integration, 17 (2020), Article 100125
10. Jamil, F.; Hang, L.; Kim, K.; Kim, D. A novel medical blockchain model for a smart hospital's drug supply chain integrity management. Electronics 2019, 8, 505

