Why Blockchain Technology is Important for Healthcare Professionals

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May 01, 2026

Abstract

Blockchain technology is a system of creating an immutable, secure, distributed database of transactions. Blockchains were initially created to provide a distributed ledger of financial transactions that did not rely upon a central bank, credit company, or other financial institution. The technological breakthrough, however, has been extended to transactions involving legal matters, medical records, insurance billing, and smart contracts. One primary way that blockchain technology is important to healthcare professionals in that it can revolutionize medical database interoperability. This greater interoperability can help improve access to medical records, imaging archives, prescription databases. Given that a patient's medical history is a primary cornerstone of good medicine, blockchain technology has the potential to dramatically improve medical care.

Introduction

Blockchain technology is a system of ensuring a secure, tamper-proof, and permanent record of transactions. The fundamental idea of a distributed secure ledger was invented in 2008 by Satoshi Nakamoto [1]. Initially, the technology created bitcoin, which verifies financial transactions without the requirement for a central authority, the federal reserve, a central bank, or other financial institution. Because the method of transaction verification involves a network of computers, rather than a single computer, it is very fault-tolerant. Any single computer can be added or removed from the network at any time without corrupting the ledger of transactions. Because the ledger is duplicated across all network computers, transactions are secure and immutable. A key feature of blockchain technology is that it is trust-less: transactions are processed by the network so there is no need to trust a single computer, database, or institution. The initial blockchain created bitcoin, which consists of a secure, immutable, distributed database of financial transactions. However, the technology has also been extended to create a system of secure, immutable, distributed computer programs allowing the creation of smart contracts and artificial intelligence [2].

Interoperability

Interoperability is the ability to work together in an oganized manner. Applied to electronic medical records, interoperability means the ability of large computer databases containing patient information to effectively communicate with each other and ultimately communicate the data to healthcare providers quickly in a meaningful way [3].

Even though the Internet has been has been transmitting data around the world for almost 50 years now, critically important medical data remains for the most part hidden away tightly in silos, run by hospitals, clinics, and insurance companies. This tight lock on patient records means that even when going a short distance within the same town it is difficult to access medical records from a different clinic. Although the clinic is in the same city, the silo housing medical records is just as isolated as if it was located thousands

of miles away. These silos effectively control medical records, instead of the patient controlling their own medical records [4]. Because of the hassle of transferring medical records, many patients will stay within a single healthcare system for the sole reason that their medical records are housed within that system.

Case Study

One of the biggest challenges in medicine is inaccessible medical records for acutely ill patients unable to verbalize or recall their personal information. For example, a patient was admitted from the emergency room because of an acute respiratory failure. He could not verbalize his medical history, because all of his focus and efforts were upon getting enough air. In terms of his medical history, his medical team was flying blind.

The patient was a 48 year old long haul truck driver from out of town. No family was at the bedside and no medical records were available. What medications was he on? What allergies did he have? Given all of the unknowns, the patient received the generic, one size fits all treatment for acute hypoxic respiratory failure.

Over the next several hours, his heart rate gradually increased into the 130's. Most likely, he was developing sepsis from an acute infection which was the cause of his initial breathing difficulties. In response, he was given antibiotics and intravenous fluids, again the generic treatment for what was the most likely cause of his condition. But it turns out his symptoms were due to something else entirely, that would not have been missed if old medical records had been available.

The patient just had a severe exacerbation of his chronic obstructive pulmonary disease. He didn't have sepsis at all. His increased heart rate was due to beta blocker withdrawal from not getting his routine nightly dose of metoprolol. He was eventually discharged from the hospital in good condition, back at his baseline. His hospitalization, however, was prolonged by a full day and he received unnecessary antibiotics all because nobody knew he was on a beta blocker. His old medical records were in Oklahoma, locked up safe and secure in an electronic database. We, however, were in Oregon. While his medical records were secure in Oklahoma, they were not useful. His home clinic's database had no interoperability with the clinical database at the hospital in Oregon. The result was not fatal, however, his hospitalization was prolonged and his diagnosis delayed due to poor computer database to computer database communication.

Future Directions

The next major advance in medical records is not going to be a new software program that runs on a database isolated within a single healthcare organization. The next advance will be the creation of a distributed ledger which will effectively transfer control of patient records from the healthcare organization to the individual. When medical records become as freely mobile as people, we will have made a tremendous leap forward in medicine. Blockchain technology is the key scientific breakthrough enabling this major step forward.

The process of making the medical records of individuals readily accessible requires the use of distributed databases stored on the cloud in a secure yet open manner. The records must be secure, immutable, and at the same time easily accessible. Blockchain technology is the vehicle that makes all of these goals possible [5].

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