How blockchain can cure the healthcare industry

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According to a study from CB Insights, blockchain has the potential to go big in healthcare. Thanks to its robust privacy design, interoperability and immutability, blockchain can be applied to a wide range of healthcare needs, from credentialing of practitioners to data sharing and supply chain management. However, there are also a few challenges along the way.

The healthcare industry is plagued by inefficiencies, errors, bureaucracy, and high

administrative costs. Can blockchain technology help solve some of these challenges? We believe it can and a recent study from CB Insights confirms that. From managing patient data to tracking drugs through the supply chain, blockchain could solve some of the healthcare industry's biggest problems, including compliance, interoperability, speed, privacy data and security issues. Blockchain could also enable new patient-centric business models, bringing patients to the center of the healthcare ecosystem by giving them the power over one of their most valuable resources: data. As the eco-system is built out, there will be more and more opportunities to deploy blockchain applications in the future.

Picking up pace: interest for blockchain in healthcare

A growing number of healthcare execs are expressing interest in blockchain technology. CBI's study finds that money is rushing into blockchain right now, and that while it's surging across some industries, healthcare is off to a timid start. In any application where "accessing complex data from different entities" occurs, CBI says blockchain is able to provide a consistent and standard chain of ownership and access to data. Properly implemented, it has potential for "tracking where a patient is, and what procedures/tests they've had in a secure and scalable manner." Most healthcare companies that mention blockchain do so in an exploratory or pilot project capacity. Patents that mention "blockchain" or "distributed ledger" for healthcare applications have also begun to tick upward, as highlighted in a CBI platform patent search. IBM, Walmart, Bank of America, and several others are looking at different applications of blockchain across emergency response, compliance, and data-sharing agreements.

New and efficient solutions thanks to blockchain

Blockchain technology allows for transparent, peer-managed, secure data tracking across computing devices, and creates a public, chronological database.

Why is this so useful for healthcare? Better data access models can incentivize patients and hospitals to monetize their digital assets (patient data). Also, blockchain projects are exploring ways to combine on-chain solutions (recorded on a distributed ledger itself) with off-chain ones (actions that occur off of the ledger). Transactions, emergency data, and more could be stored on a blockchain system,

while larger data storage needs could be met by private repositories. CBI's study stated that blockchain has the potential to offer new solutions in healthcare because it is:

Consistent. With blockchain, data can't differ across databases because there is one single record. This reduces issues with duplicate or tampered data and makes the data itself much more accessible, rather than trapping it in different organizations' record-keeping systems.

Append–only. Users can only add transactions to a database, making everything traceable and auditable.

Ownable. An entity can "own" data and choose who gets to access it. Instead of a company selling someone's data to a third party, that person can control where their data goes.

There are clear rules. One version of the database is used, and the rules about it are known. As many know, the lack of data standards and master records in healthcare has created fragmentation and frustration across the industry.

Decentralized. Copies of the database are kept in multiple places and no third-party needs to exist as an administrator. This reduces overhead and the need for middlemen, which the healthcare industry has in spades. In addition, this also prevents centralized systems from becoming completely locked down and inaccessible.

SHORT-TERM APPLICATIONS

Most of the initial healthcare applications for blockchain and distributed ledger technology are focused around closed consortia and back-office operations that don't involve patient data. We take a look below at just a few of them.

Managing provider information

Corporations are taking their first steps into blockchain-based projects by joining small, closed consortia that use distributed ledger systems or permissioned blockchains to keep data among the companies involved. Initial projects aim to prevent duplicated work by sharing data via distributed ledger systems. However,

none of these projects focuses on patient data, because it is so sensitive. One project has involved UnitedHealthcare, Optum, Quest Diagnostics, Humana, and Multiplan joining together to make sure their provider directories are up to date. By sharing this provider information with each other, these companies can reduce work, since data is stored and updated in a shared, accessible database.

Hashed Health is working on several projects with smaller consortia. The company is developing a credential verification system for physicians to prove they're licensed to operate in certain areas. Currently, physicians have to go through a separate credentialing process for each institution and state they plan to work in, a process that can take 30–90 days for each institution. With the help of blockchain, this process could be faster, simpler, and cheaper if there was a shared record of a physician's credentials accessible by all parties authorized by the physician. A blockchain-based system could enable that, giving physicians the private key to grant access to whichever institution is asking for credentials. Problem solved!

Drug supply chain

Another area where Hashed Health and several other companies are working on developing blockchain solutions is in the pharmaceutical supply chain. Counterfeit drugs and recalls of medicines (especially outside of the US) make traceability a high priority for the supply chain and blockchain solutions are one possible way to tackle this. Thanks to the Drug Supply Chain Security Act (DSCSA), in the next few years pharmaceutical supply chain players will have to join interoperable electronic systems that will allow them to track each drug throughout the entire supply chain.

Together with several large drug companies and drug supply chain giants, Chronicled is launching a pilot called MediLedger. This project uses a closed blockchain system (open for vetted participants to join) to track who touched what drug at what time.

By ensuring that only manufacturers can commission serial numbers and attach unique identifiers to products (which are noted by the ledger) the system makes it much more difficult for a counterfeit product to enter the chain at a random point.

The blockchain system uses zero-knowledge proofs to allow companies to ensure compliance without actually sharing data with each other. Zero-knowledge proof is a

data-sharing method that allows two parties to verify if something occurred without actually revealing specific underlying data to each other. Blockchain-based supply chain systems can also connect to RFID tags and temperature logging mechanisms to ensure that environmental requirements were met across the supply chain. If the rules are laid out clearly, this system can execute in a mostly automated fashion using Smart Contracts.

MEDIUM-TERM APPLICATIONS

Medium-term projects will move beyond pilots and involve more stakeholders. These projects will also start looking at ways to house and share patient data. It may take longer to implement these projects, because they require cooperation between more parties and the risks associated with accidental patient data leakage are high

Claims management, payment, prior authorization

The back-end of healthcare is slow, complex, and expensive. Billing- and insurance-related costs are an estimated 18% of United States' total national health expenditure The American Medical Association (AMA) found that more than a quarter of practices had to wait 3+ business days for a prior authorization (approval from a patient's insurer to cover a drug). Blockchain, aligned with data standards, has the potential to speed up some of these processes and reduce costs. One area where this might be possible is in claims management, where several middlemen are focused on standardizing data, following complex and variable procedures. A lot of this work requires accessing complex data from different entities. Payers have to know what services a patient received, and the patient's specific plan. Doctors need to know how much to charge a patient. And *everyone* wants to know where in its lifecycle a claim currently is.

Change Healthcare has built a system that follows the life cycle of a claim, tracking every transaction listed above (data submitted for review, the review itself, approval or denial and so on). The company has also improved the speed and scalability of processing transactions, which has been a bottleneck in many public blockchain projects. Theoretically, this could also be done with prior authorizations for drugs. Currently, prior authorizations are conducted by insurance companies to make sure all other options have been explored before expensive drugs are approved. This

costly process is largely rule- and checklist-based, and currently takes between 1 and 15 days. Smart contracts could speed up parts of this process by codifying a payer's rules around a drug, verifying whether every alternative was explored, and verifying whether previous drugs/tests caused adverse reactions. However, this would require easy access to a patient's medical record, which could present a significant obstacle.

Health information exchanges and research data

Data is getting more and more valuable — whether to train algorithms, find better therapeutics, or understand where clinical trials should be set up. This means existing health players have an opportunity to monetize their datasets. Right now, de-identification of data is a process that requires third parties. But as these become more accepted, we can envision a blockchain-based system that could facilitate data exchange. In addition, new regulations around how third parties use consumer data (GDPR, Consumer Privacy Acts) will force companies to develop audit and consent trails for where the data goes.

HealthVerity is one of the players in this space, combining a health data exchange with a blockchain product to manage permissions and access rights. To researchers and pharma companies, patient data is invaluable. Helping these members to better log their data and making it easier to give researchers access to it would make the data more widely usable and potentially enable better collaboration between research institutions. One area we might see this first is in genomics, where rare variants are valuable and people are particularly concerned with third parties getting access to their data or profiting off it (law enforcement, life insurance). By putting data access rights in the hands of patients, it's possible to set up incentive systems that can be monetized based on demand for data.

Research and trial design

Beyond better data sharing, blockchain offers an opportunity to improve healthcare before the treatment phase: in research and clinical trials. Effective research and clinical trials require the coordination of multiple sites and stakeholders, as well as careful management of massive amounts of sensitive data coming from different sources A blockchain can improve informed consent and structuring protocols (documents that make clear the objective, trial design, and how efficacy will be assessed). By determining early on how a study will be conducted and analyzed,

third parties can quickly see whether the original design was adhered to.

Timestamps and Smart Contracts could ensure researchers stick to study design and don't change the criteria or analysis mid-trial. This helps remove some of the biases that can occur when conducting research or clinical trials, and better ensures reproducibility and publishing of negative results (which frequently doesn't happen).

Patient consent forms could give access rights to each vetted entity as they use and attach new data, which becomes available to every participant on the ledger rather than needing to reconcile separate data collections together. This would ensure no data is lost or tampered with.

A permissioned blockchain could give all the members of a clinical trial or study a timestamped, real-time view into what data and transactions were happening to a study participant at a given time since they each have a copy of the shared database. This removes the data reconciliation process and makes it easy to walk through how a study was conducted end-to-end, which is good for auditors and people who want to reproduce the study.

LONG-TERM APPLICATIONS

In the long run, the true benefit of a blockchain-based ledger are decentralized patient records as a platform. Giving patients the ability to easily access their health records, as well as grant providers comprehensive access, would change the shape of healthcare. There are lots of obstacles to overcome before this goal can be reached. Clearer regulations, more ways to create and capture data outside of the existing EHR system, and figuring out more secure ways to store massive amounts of data are just some of the issues that will need to be addressed.

Universal identities, patient health records, DApp services

The lack of interoperability in the healthcare system is a massive issue, causing duplicative work and a bad patient experience at best and medical errors at worst. A survey from the Ponemon Institute found 86% of medical errors were due to patient misidentification. Meanwhile, a Black Book survey estimated costs of repeated care due to duplicate records at an average $1950 per patient and $800 for emergency

departments. Cybersecurity is also a massive issue, considering how expensive healthcare data breaches are. Most health record breaches happen because someone delivers information to the wrong place, or people access records they are not supposed to have privileges to access, according to a Verizon Enterprise report.

A blockchain ledger would create audit trails of who accessed a health record, creating more accountability. A decentralized patient health record system could better capture data and give better data access controls to patients. Patients could give keys to their data to whoever they want authorized. This would threaten any business model that is dependent on hoarding data as a moat. It would also mean that companies would have to better demonstrate the kind of value they would give patients directly in exchange for their data (as opposed to buying it from third parties that collect and de-identify the data). Pharma companies, for example, rely on this kind of data to better inform marketing campaigns and areas they should be targeting for clinical trials.

In January 2017, Du announced a partnership with NMC Healthcare to implement electronic health records using blockchain, a project in which Estonian blockchain technology startup GuardTime is also involved. The project was slated to launch in Q1'18, but the application has not been released yet. As a rule, a decentralized personal health record is likely more doable in countries which have existing unique patient identifiers which the US still lacks.

Estonia and India have recently established these identifiers, though there are concerns that this could negatively impact citizens' privacy and potentially expose sensitive information in the event of a breach. Once decentralized patient records are common, a decentralized application (DApp) layer for different services will be much more feasible, since data access will be much easier. These ecosystems would need groups of miners and token incentives to verify each transaction in the network, including the exchange of services for currency or data.

Challenges to implementing blockchain in healthcare

We've established that blockchain has the potential to disrupt the healthcare industry, so let's take a brief look at the challenges lying ahead. Some think that unlocking blockchain's potential for healthcare will be a slow process, and change is

unlikely to come fast. Regulations around patient privacy make it difficult to get stakeholders on-board or provide third parties access to relevant information. GDPR in the EU is also potentially at odds with blockchain projects (see more on this topic here), though it could also be a catalyst for improved compliance solutions.

Lack of data standards means blockchain projects are being worked on in siloes. Existing healthcare stakeholders are disincentivized to solve many of the problems blockchain aims to tackle. It took a $30B+ incentive system via the HITECH Act and many years to switch hospitals to electronic medical records. Moreover, scalability is still an issue with most blockchain projects and storing data on a blockchain is expensive. Despite these challenges lying ahead, many are confident in the potential blockchain has for the healthcare industry.

Our expert's take on this matter

Here's what Dragos Rautu, CTO Ingenium Blockchain Technologies, had to say on how blockchain could disrupt healthcare: "In my opinion, the healthcare industry is one of the most relevant use cases where blockchain technology could be used. Here, of course, we are talking about using a consortium blockchain owned by hospitals, private clinics or medical research institutes. When we talk about business and blockchain, we should almost always think about private or consortium blockchains.

I don't think there's a country where the medical data of a patient is stored all in one place. Take the United States, for instance, where the data is all over, in hundreds of EMRs, and the patient does not have his/her medical records in one place. By using blockchain technology we can ensure the immutability of a patient's medical records, the patient would own the data and only with his/her consent others could access that data. As a parent you will be able to manage your child medical record and when the child reaches the legal age, and then he/she will own the data. Summing it up, I believe that every participant in a business model will have something to win if blockchain technology is applied to the healthcare industry."

Join us at the MindChain regional conference, taking place between 21–22 February, in Cluj-Napoca, dubbed Romania's Silicon Valley due to the unique mix of tech companies and strong student community. With a 30-strong panel agenda featuring international speakers and key figures on the Blockchain scene, MindChain will bring forward the latest use cases for Blockchain and AI across a comprehensive mix of industries, such as retail, finance and banking, real estate, transportation, as well as emerging areas such as art, entertainment and media.

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