Blockchain or Distributed Ledger Technology What is in it for the Healthcare Industry?

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Introduction

The growth of data in healthcare has brought a disruptive foray of new technologies to find, manage, move and maintain digital information. Distributed Ledger Technology (DLT) or Blockchain will likely not revolutionize healthcare immediately, however, may transform it forever. DLT with its features of handling and anonymizing data, will likely enter the healthcare IT market subtly, making certain service areas of the industry more efficient. Similar to how electronic medical records (EMR)s, MPI (Master Patient Index) systems, and data analytics are slowly changing workflows by increasing the capabilities of staff in healthcare organizations, DLT will enable healthcare staff to get information in a shorter timeframe without searches, paperwork, signatures, etc.

Patient data has had three major concerns: Who owns it? Who has access to it? If they have access to it, how they can use it? These concerns are complicated by the plethora of conditions of privacy, confidentiality and security.

Distributed Ledger Technology or Blockchain

Distributed ledger technology (DLT) is a digital system for recording transaction of assets in which the transactions and their details are registered in multiple places at the same time. Unlike traditional databases, distributed ledgers have no central data store or administration functionality. Blockchain implementation can be public, open to the public, where the only protection is provided by encryption. As "everyone can see everything" on a Blockchain network. In contrast, Private Blockchains are Blockchains are organizational level implementations where varying levels of control of who can access data, who can modify data, and who ultimately has authority in the system[i]. While Blockchain may have significant potential to improve data interoperability, security, and privacy, it is important to note the boundaries of the technology. Blockchain is not a substitute for an enterprise database.

How Distributed Ledger Technology or Blockchain technology could solve the issue with Health IT[ii]?

There are two schools of thought on the use of DLT for healthcare. One professes that a Blockchain could unlock the true value of interoperability[iii]. Another, more centered on protecting data privacy, recognizes the fundamental role of the Blockchain as an access-control manager for health records and data . In broad terms, both directions support principles of integration of healthcare information across a range of uses and stakeholders. There are varying levels of control of who can access the data, who can modify the data, and who ultimately has authority in the system.
With a Distributed Ledger Technology, all participants would have access to the distributed ledger to maintain a secure exchange without complex brokered trust. Thus, establishing a "Trust Network" that would reduce the complexity of sharing clinical information among different healthcare information systems, as an intermediary to establish point-to-point sharing and "book-keeping" of what data is to be exchanged.
In Healthcare IT implementations, Master Patient Index (MPI) challenges arise from the need to synchronize multiple patient identifiers between systems while securing patient privacy. Distributed Ledger Technology could use private and public identifiers secured through cryptography, to create a singular, more secure method of protecting patient identity.
Varying data standards reduce interoperability because records are not compatible between systems. Distributed Ledger Technology could enable near real-time updates across the network to all parties.
For Population Health management, Distributed Ledger Technology could enable secure access to patient longitudinal health data across the distributed ledger.
Distributed Ledger Technology could establish low cost, near-real time, rule-based methods for accessing patient data that can be permissioned to selected health organizations.
Before initiating Blockchain projects, hospital IT leaders and decision makers, should consider whether the technology is suitable to the hospital's needs. Not all problems require a DLT solution. DLT is truly effective when multiple parties generate transactions that change information in a shared repository where intermediaries are inefficient or not trusted as arbiters of truth - If this condition is not met, a shared database may be a more appropriate solution.
For healthcare organizations that have decided to initiate Blockchain projects, the next step is to design the use cases. In this article, we will present one illustrative use case on the effectiveness of Blockchain implementations in enhancing the security, ensuring integrity of the system and maintaining the originality of the data.

Promising Uses of Blockchain for the Healthcare Industry

Because health data is dynamic and expansive, replicating all health records to every member in the network, as is in the case of traditional Blockchains, would be bandwidth intensive, wasteful on network resources and pose data throughput concerns.

Distributed ledger technology may prove effective in implementations for claims clearinghouse, provider and patient directory and care plans, as historical ledgers of patient care data, in support of Pharma and medical research and in hospitals as back office component for admission, discharge, and transfer systems (ADT). In the immediate, for healthcare to realize benefits from distributed ledger technology, the distributed ledger technology would need to function, primarily, as an access-control manager for health records and data . Likely uses for distributed ledger technology in Healthcare aim at improving medical record management, enhancing insurance claim process and accelerated clinical/biomedical research[vi].

Improved medical record management - Implementation of Blockchain technology may clear obstacles to patients acquiring copies of their healthcare records or transferring them to another healthcare provider. Records are signed by source, allows legitimacy of records to be verified. Data are stored in the private Blockchain cloud. Blockchain may guarantee unalterable patient records, as encrypted data in the Blockchain can only be read with the patient's private key.

Enhanced insurance claim process - Implementation of Blockchain technology may provide the ability to maintain verifiable claim transactions to support healthcare financing tasks and facilitate real-time claim adjudication by replacing the health plan intermediation with transparent Blockchain technologies. In addition to increased security of patient medical insurance information, payers, private and government insurers, and individual payers have the benefits of audits facilitation and better fraud detection based on Blockchain immutability.

Accelerated clinical/biomedical research - Several firms contemplate accelerating secondary use of clinical data (ie, clinical and biomedical studies and research) using Blockchain technology. The decentralized functionality of Blockchain may imply that, each institution can keep full control of their own computational resources, while collaborating with other institutions for data sharing and analysis without ceding control. Personal patient-generated health data, which are available to researchers, are anonymized and then tracked in the research process with a timestamp. This delivers the potential to engage millions of individuals, healthcare providers, healthcare entities and medical researchers to share vast amounts of genetic, diet, lifestyle, environmental and health data with guaranteed security and privacy protection.
Patient generated data, clinical data and health record data are maintained in what is referred to as a data lake, a repository that holds a vast amount of raw data [BigData] in its native format until it is needed. A data lake architecture usually incorporates search and analytics techniques for decision-making, reporting, legislation and census. Blockchain implementations in this context can provide a complete index history of the patient's unique identifier and an encrypted link to health records. Each record is time stamped. Providers use health applications to access data, patients may use mobile devices to assign

Likely Uses	Unlikely Uses
- Payer - Claims clearinghouse - Enhanced Insurance Claim Process - Provider directory - Patient directory and care plans - Historical ledgers of patient care data - ADT back office component - Pharma/ Medical Research	• Full featured Electronic health record systems • Global patient ID software • Public Health Data Access

Figure 1 shows an illustration for promising uses of Blockchain for the Healthcare Industry.

access permission to data. The patient has control over the permissions on whom to share data with and what portions of the data. Blockchain network consensus enables the automation of claim processing through predefined inherent Blockchain features referred to as Smart Contracts [ensuring tokenization of the data and anonymization].

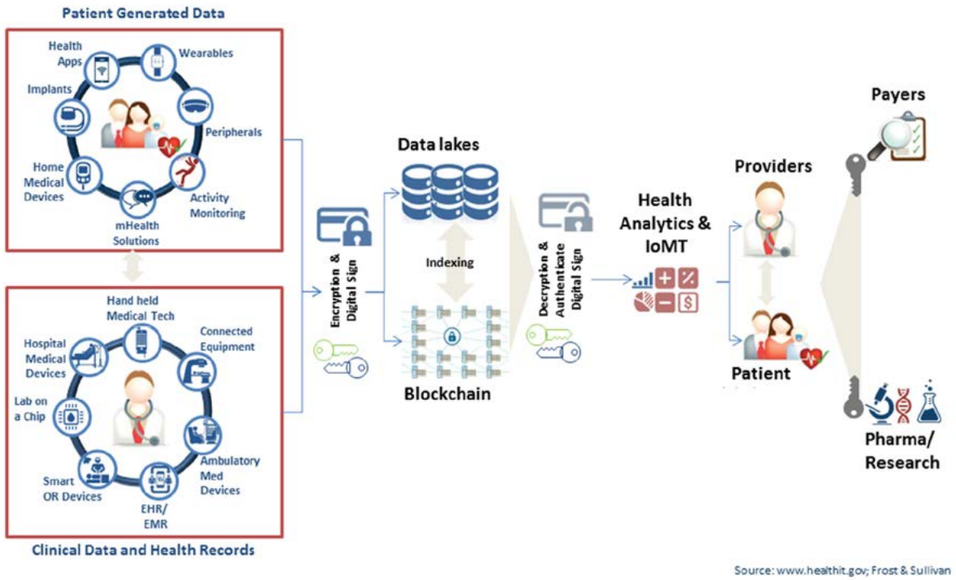

Figure 1: Promising uses of Blockchain for the Healthcare Industry

Back office component for admission, discharge, and transfer systems (ADT).

Below is a description of how a hospital (or healthcare organization) may likely adopt Blockchain into its infrastructure[vii]. We propose, as an illustration, a use case of a network of public hospitals using different and disconnected electronic medical record systems (EMR). The public hospitals, in lieu of normalizing their systems, which can be a costly endeavor, with often unsurmountable challenges, have implemented Blockchain technology to identify patients going to the hospital and clinics and determine whether were part of the network. The hospital IT team has setup a Blockchain with nodes at each of the hospitals and clinics, plug-ins and interface engines were used to connect the Blockchain with the different EMR systems at each point of care setting. For our case, we consider a patient who has moved from one city to another and now seeks admission in the local clinic in the public/ national hospital network.

1. The patient's ADT information is transmitted to the MPI.
2. The MPI queries the Blockchain for patient information. [If the MPI finds no record of the patient, suggesting that the patient is a new patient in this hospital. Noticing this, staff asks if the patient wants to self-register and quickly enrolls the patient through a web interface on the intranet that connect to the Blockchain].
3. The patient directory information, with care plan data, in the Blockchain, are returned to the ADT system as a response.
4. ADT messages are sent during the admission time and discharge time respectively to the Blockchain.

The clinic staff admit the patient for the procedure or checkup. After the completion of the intervention, the patient is now waiting to be discharged.

5. The Blockchain automatically updates the patient records and care plan. [In our hypothetical case, the Blockchain adds a recommendation to put the patient into an ER diversion program after noticing that the discharge message was for a minor diagnoses and this has marked three ER visits for minor diagnoses in the last month].

Similarly, on the payer's side of the data interchange, each of the hospitals and clinics used the interface engine to connect their claims system and providers to the Blockchain. Payers were able to connect directly to the national record for the patient and process insurance claims and payments, while avoiding costly processing workflows and delays in duplicate records management. Hospital management was able to make a dashboard of cost vs. quality measures. Patients received access to portals connected to this Blockchain, they are able to view their medical and financial records. The Blockchain was able to provide information with a single source of truth.

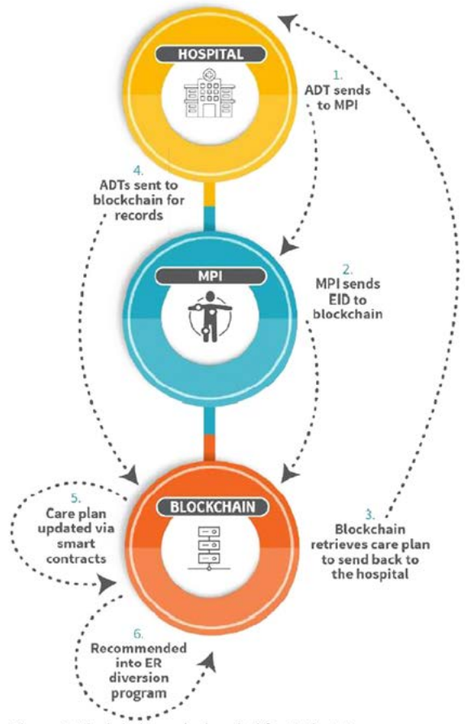

Figure 1. Blockchain use by hospital for Patient A

Conclusion:

Blockchain or distributed ledger technology (DLT), has the potential to become the backbone for digital health, incorporating data from patient-based technologies and the electronic medical records to provide a pool from which authorized users, such as providers and patients, have access. All data are stored in a decentralized manner, with no single entity storing or having singular authority to access. This technology has already made its impact in improved medical record management, enhanced insurance claim processes and accelerated clinical/ biomedical research.

Until more rigor is placed on managing public keys and protecting against data loss due to hacks or otherwise, issues related to transparency and confidentiality may prohibit the use of DLT in public healthcare data settings. Whereas, private Blockchain implementations, with some level of control over access, would likely be the norm in healthcare settings. The growth of the distributed ledger technology and its premise to fuel incremental innovations that eventually become indispensable for proper data stewardship for the proper use of patients, providers, payers, Pharma, medical researchers and public health analysts while respecting the privacy, confidentiality and integrity of the data asset.

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ii- https://www.healthit.gov/sites/default/files/4-37-hhs_blockchain_challenge_deloitte_consulting_llp.pdf
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