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EDITORIAL

Blockchain for Healthcare: The Next Generation of Medical Records?

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At this point last year, most of us had little idea what "Blockchain", "Bitcoin", "Cryptocurrency", or a "Hyperledger" were. However, thanks to the recent rise of cryptocurrencies in media outlets and social media, most of the public, including medical professionals, are able to catch a glimpse of a technology that could potentially improve some portions of the medical data conundrum.

What is blockchain and why would we use it in the healthcare system?

"Blockchain is a shared, immutable record of peer-to-peer transactions built from linked transaction blocks and stored in a digital ledger" [1]. To put more simply, blockchain offers a record of peer-to-peer transactions kept out in the open so that everyone can see each of the transactions.

No single central authority such as one server or computer exists to authorize or preside over the transactions, instead each peer on that network is be able to view the transactions that occurred on that plexus. Each transaction is timestamped and linked to the prior event, making it exceedingly resilient to malicious activities to alter the chain but not impossible. For example, one very unique but highly valuable opportunity is the use of blockchain for interstate medical licensure or hospital credentialing (see Fig. 1).

The idea of this technology would be to "maintain a single record of their certifications and approvals, which will streamline interstate licensure, bolster trust, and allow organizations and individuals to authenticate the professional qualifications" [2]. This would allow the physician (or other provider) to submit his identity with qualifications, such as his medical school and residency completion, among other information once to an authority on the block chain. In an ideal situation, each state board of medical examiners or other credentialing body would have access to this digital ledger, and with the permission of the candidate have access to these records that have already been collected in a digital format to review.

Public vs private blockchain frameworks

Blockchain implementations can be either public or private. In a public implementation, anyone can participate and the network is open to all. In a private blockchain, all of the participants are known. Public versions typically have some incentive to encourage participants to join the blockchain. The most widely known example of a public blockchain is Bitcoin, currently the world's largest public blockchain. In a private blockchain, all of the participants are known. Participation in a private blockchain requires an invitation. Typically, private blockchains exist on a permissioned network to further restrict participation in the network. An example of a private blockchain implementation would be if a regulatory authority were to issue licenses for participation in the network.

Will blockchain revolutionize medical record keeping and collection?

Blockchain, as is, currently lacks a number of elements needed to make it successful as a national record keeping framework to replace our current system. Many of these barriers are monetarily driven, such as the incentives to create this very large network of connected "blocks" of data. The current EHR market is valued at tens of billions of dollars, and very recently, many academic universities and other large health systems have poured millions of dollars into new vendor-led commercial health record systems in large part incentivized by the federal government [3, 4]. To ask hospital systems, community clinics, and solo physician offices to remove their current

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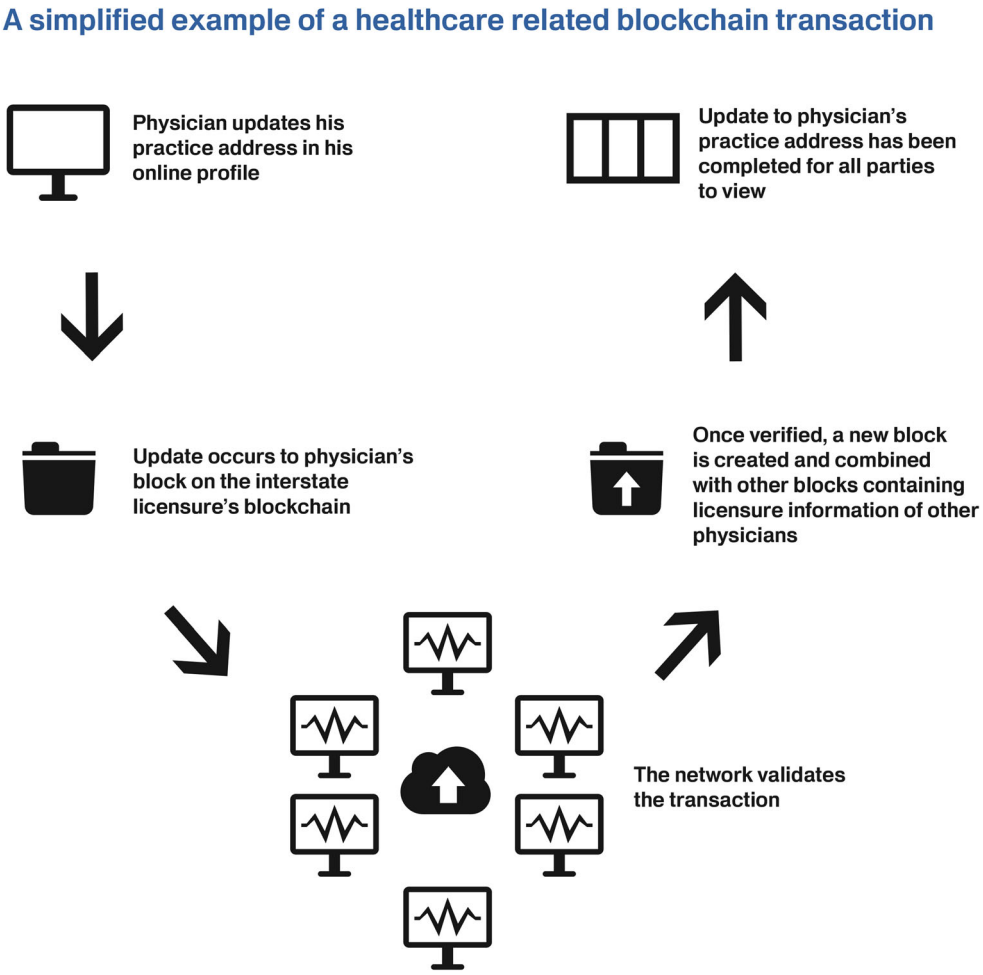

Fig. 1 Example of blockchain use in healthcare

record system and replace it with a digital ledger is a disservice to not only to patients but also medicine. To augment this event, blockchain would likely not completely replace the current system but act more so as a supplemental vehicle. For example, in each of these "blocks" would be kept a small amount of information to describe a specific patient (or procedure); however, most of the healthcare information would be kept off of the blockchain. The link embedded in that block would act as a shepherd to an off-block API that allowed you to view MRI results, X-rays, Pathology results, among a myriad of other information about that specific patient or procedure kept in a current Enterprise Data Warehouse (EDW) database.

Furthermore, additional thought would have to be developed to determine how record data would be stored on blockchain. Would blockchain run into the same types of barriers that we arrive at now; how should we store our current data? Until we find common ground – Agreeing to storing all demographic information in a nationally recognized standard format - *Hospital A* may choose to store data on the blockchain in English, however *Hospital B* will select to store it in a separate format such as German. In this same arena, maintenance of the blockchain and transaction costs would have to be taken into account. A subset of networks would have to exist potentially run by large private corporations and subsidized by the government to ensure proper functioning of the network. This could potentially skew the purpose of migrating to blockchain since a centralized body or subset of bodies would have to be involved in data governance and maintenance.

A number of niche areas do exist that could easily improve the efficiency of the current system; however, blockchain will not in its current state offer the complete answer for all of the current medical record tribulations. Initially, blockchain may be better suited as an example such as in our description above, creating a system for monitoring a pharmaceutical supply chain from distributer to store front, medication management, setting up a permissioned block chain that allows reporting of population health data directly to CMS, creating a de-identified research dataset, among many other "low hanging" opportunities. With the appropriate incentives and governance structures or a program such as the very recent Meaningful Use program, a large argument could be made in many other regions of healthcare besides the non-exhaustive list of examples above. Working towards a large scale medical record-keeping repository is goal we

should strive for; however, obtaining multiple small wins with "low hanging fruit" will allow enough momentum to be created for a national push on regulation and private sector parties to improve our national record keeping system.

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