

Looking Ahead at Blockchain in Healthcare

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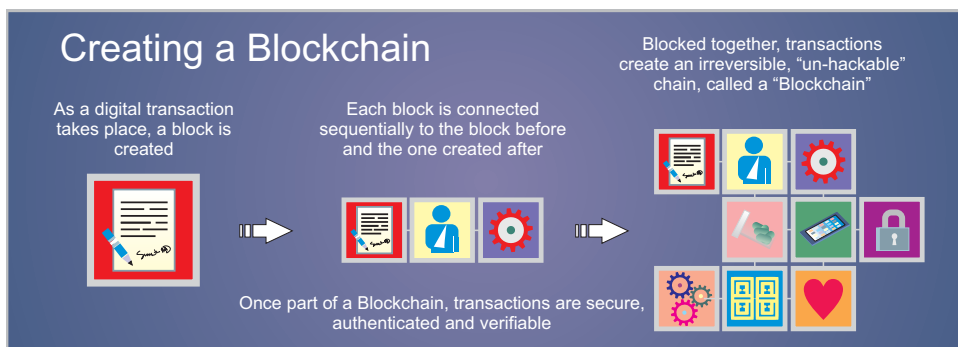
Blockchain, like other young and disruptive technologies, offers wide opportunities to impact healthcare - an industry that is primed for disruption. Despite being the largest sector of the U.S. economy, healthcare has been plagued by slow systems, wasteful financing and resource utilization, and operational inefficiencies. To address these issues, innovative solutions like Blockchain can alter the arithmetic of healthcare delivery. The solution set is wide

The distributed network of global computers stores an identical database, or "ledger", from which approved network members can add transactions - in a block.

Network members can only update the block for which they have authorization, and those updates get replicated across the network. Each block is governed by a "smart" contract, which acts like a traditional contract in establishing rules and penalties but goes further by executing the

(blocks) can include patient data, clinical process data, analytic data, and financial data, and the network members might include the patient, the provider, the payer, the lab, the pharmacy, and more.

The vision for blockchain in healthcare is to create a trusted, efficient, common database of health information that payers, providers and patients can securely (and seamlessly) share across information platforms. And with that preamble, let's look at where Blockchain is going to impact healthcare.



A Linear Health Record

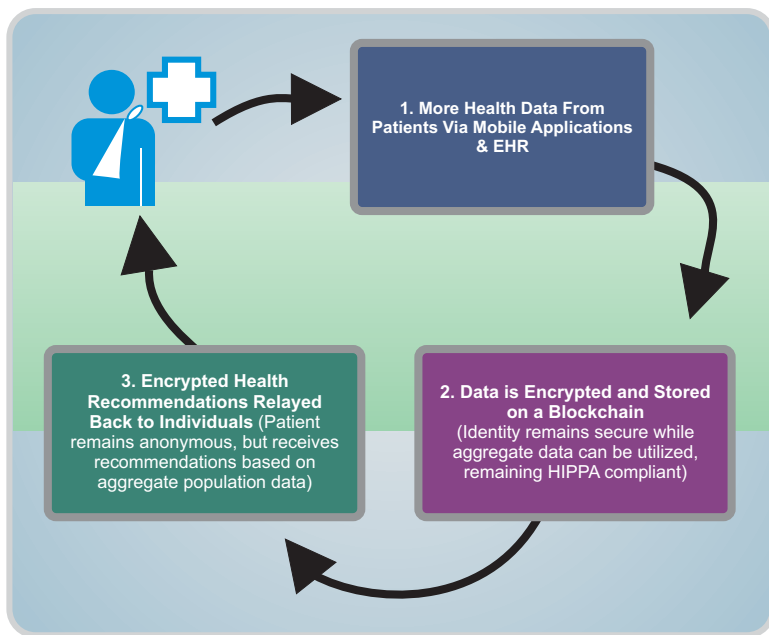
Healthcare offers a host of potential Blockchain deployments, foremost among them the potential to establish a true linear electronic medical record. A Blockchain-enabled EMR model can empower trusted parties across the spectrum of healthcare venues - hospitals, practices, clinics, payers and patients - to view and populate records from multiple databases on a shared ledger. The potential benefits of a truly comprehensive patient record extend to care coordination, clinical research, wellness and patient engagement. The flow of data, though securely encrypted, can be shared among an unlimited number of non-integrated, approved stakeholders. Below is a simple representation of this "closed loop" data-sharing model.

ranging: Blockchain can secure sensitive research and clinical data while ensuring its responsible access among a broader range of involved stakeholders. It promotes a true linear patient record and the Internet of Healthy Things - which includes wearables, nearables, invisibles and sensors. It creates an efficient framework of asset and supply chain management and establishes the security and authenticity of medications. It is a rich field for innovation - companies like IBM, Oracle, Microsoft and Change Healthcare are developing Blockchain solutions to augment patient health records, asset management, licensing and credentialing, data sharing, revenue cycle and more.

agreed terms and automatically enforcing those obligations - without the need for a third-party intermediary. With smart contracts, member identities are validated, and unauthorized transactions made by any user on any of the computers in the network can be easily flagged and rejected. Applied to healthcare, these digital transactions

What is Blockchain?

For most of us, Blockchain is an obscure technology best known as the lever of cryptocurrencies like Bitcoin. Put simply, Blockchains are peer-to-peer (P2P) systems of three main components: a distributed network of computers; a secure, shared transaction ledger; and digital transactions.



Some early deployments demonstrate Blockchain's value in establishing this data-sharing framework across healthcare verticals, and within a circle of stakeholders. MedRec, a decentralized record-management system, gives patients and doctors an immutable log of healthcare records. The company uses Smart Contracts to map patient-provider relationships where the contract shows a list of references detailing the relationships between nodes on the Blockchain. It also puts control of these relationships in the hands of the patient, giving them the ability to accept, reject, or modify access with healthcare providers such as hospitals, insurers, and clinics.

Guardtime has launched what it's calling the world's first comprehensive Blockchain-supported Personal Care Record Platform, MyPCR. The system will focus heavily on patient adherence to a personalized treatment plan, continuous monitoring and verification.

Asset Management

Medical-device tracking represents another near-term opportunity for Blockchain to disrupt healthcare. From deployment to decommissioning, persistent tracking allows the efficient utilization of devices, prevention of unnecessary shrinkage and repurchasing, and fraud analytics. In concert with RFID/RTLS location-tracking solutions, a "smart contracts" Blockchain approach to asset tracking offers several benefits. The irreversibility and tamper-proof qualities of Blockchain prevent a malicious user from changing the location history of a device or deleting it from the record, in addition to preventing medical device theft and costly shrinkage.

In a related application, Blockchain can mitigate the risks of a compromised supply chain. These risks include the threat of failing to secure and distribute medical commodities, adverse events associated with supply-chain breaches, and increased morbidity and mortality to the medical consumer. With a Blockchain-enabled supply chain, every time a product changes hands, the transaction is documented, creating a permanent history of a product from manufacture to sale. A number of large data-management companies, including Microsoft, IBM, SAP, and Oracle, have made investments in Blockchain and supply-chain management.

Pharma

Within the pharmaceutical industry, Blockchain can help address the growing risk - particularly in the global south, associated with counterfeit, unapproved and fake drugs. Blockchain-enabled drug tracking leverages the irreversibility of the Blockchain to develop tracking and chain-of-custody from manufacturer to patient. AmeriSource Bergen and Merck are collaborating on a Blockchain-enabled chain of custody model showing where the drug was manufactured, where it has been since, and when it has been disbursed to patients.

Within clinical trials, integrating Blockchain technology can address issues ranging from the tracking and sharing of data to the need for transparency and privacy for patients. Blockchain technology can directly increase the quantity and quality of patients recruited for clinical trials - the distributed ledger could allow individual patients to store their medical data by anonymous methods, making it visible to trial recruiters. It can create a layer of de-identified data that researchers can tap to recruit patients. MIT's Project Enigma provides an early example of Blockchain applied to data sharing and security-layered programs like clinical trials.

Healthcare Finance

Health insurance processes like claims processing, client onboarding and underwriting could also benefit from a Blockchain approach. Smart contracts could automate these processes and decrease the time and resources needed to execute the terms and conditions of value-based contracting by establishing a process that eliminates the traditional claims clearinghouse and reconciliation layers. Both payers and providers may be able to use Blockchain as the basis for more stable, predictable, revenue cycles. Blockchain's ability to create validated identities and accurately record tamper-proof transactions makes it easier to conduct payer-provider transactions, and to collect patient payments. Early developers include Gem, Pokitdok, and Change Healthcare. Blockchain-based systems could help minimize fraud with validated identities. It could reduce administrative costs for billing by eliminating the need for intermediaries with automated and efficient processing. From a population health perspective,

by connecting payers and providers with more timely, complete patient data, health plans could develop more sensitive risk-stratification protocols that identify patients likely to incur high costs.

Data Sharing

Data sharing represents another great opportunity, but also one of the largest privacy challenges. Blockchain could enable a new model for health information exchange (HIE) by making electronic medical records more efficient, disintermediated, and secure. With a centralized ledger and "clean" data repositories, medical research, clinical trials, treatment protocols and personalized medicine can all become vastly more effective. Blockchain can create a data-sharing environment that keeps health data private and secure while embracing the ever-expanding nodes of data and catalog of connected medical devices. Blockchain offers an opportunity for interoperability in healthcare systems via a decentralized ledger where, while the user interfaces may be different, the central ledger will be identical across all providers.

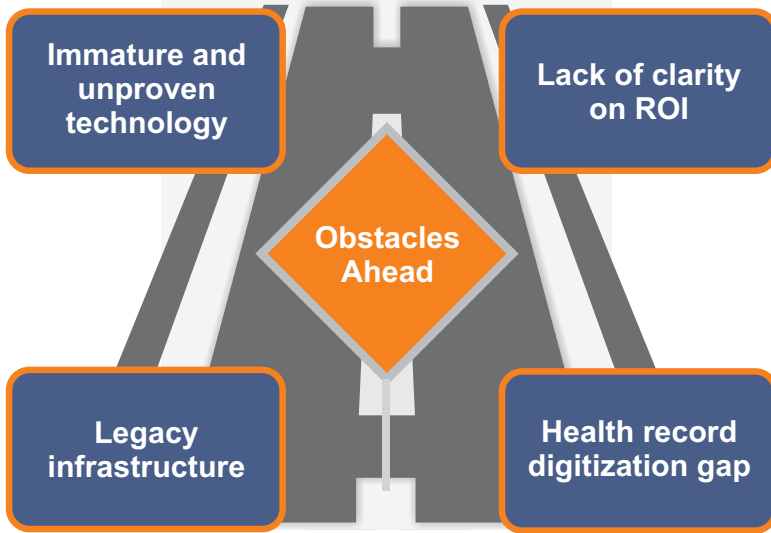
Other Blockchain Applications in Healthcare

Beyond those applications already described, the range of possible Blockchain applications in healthcare continues to evolve - sometimes in unexpected ways. Here are a few examples:

Medical Research: doc.ai is a platform that collects and manages health data securely in one place and helps accelerate medical research with the power of artificial intelligence. Doc.ai's Blockchain-based infrastructure enables aggregating all imported data on edge devices (e.g. a cell phone). It is decentralized, anonymized and encrypted, protecting shared data in a fully anonymous and HIPAA compliant way.

Medical Tourism: Medipedia.io is a blockchain-based project that seeks to develop a digital healthcare delivery system that links medical tourism patients to healthcare organizations and institutions.

A.I.: BotChain is a decentralized bot registration, identification, and audit platform, a Blockchain-based platform for ensuring certainty and security in A.I. Autonomous Agents for business.



increase and the volume of data logged and referenced to will add to this scalability problem. Although speed and data storage capacity are constantly evolving, any Blockchain solution that handles large amounts of patient data in real time likely will need to be faster than is currently found in enterprise environments.

Incentivizing people to join the Blockchain network will be another hurdle. Scalability and human-centered design will be key to driving adoption, and the more people who join the network, the more robust the entire Blockchain solution becomes. But there is a wrinkle: the incentives of stakeholders - the payer, the provider and the healthcare consumer - are not always aligned.

Peer-to-Peer Insurance: A game-changing concept in insurance. The concept: policyholders pool themselves together. If there is a claim, they all contribute financially to that claim. If there are no claims, then premiums are reduced. Blockchain technology maintains the ledger of claims and premiums paid. This entire concept and technology takes the traditional insurer out of the picture. Dynamis provides an early example of this Ethereum-based platform.

Obstacles

And now for the reality check. Today, electronic health records reside within a spaghetti soup of legacy systems, non-standardized data sets, and unaffiliated stakeholders. Integration with existing

systems will be very challenging. Regulatory concerns alone will likely slow implementation. And because of the nature of healthcare transactions, patient-record management requires large amounts of digital storage and frequent data transactions, which are each rate-limiting steps of Blockchain systems. To counteract the inevitable data duplication, the Blockchain will require anonymized identifiers to identify patients across all systems and inputs. Further, a Blockchain technology solution requires participants being able to communicate via disparate data sources. This will require some form of data standardization.

The sheer volume of data generated in healthcare environments is only set to

Equally challenging is the need to address privacy and data-protection considerations unique to the healthcare industry as illustrated by the need to comply with policy frameworks in the USA such as the Health Insurance Portability and Accountability Act (HIPAA), the HITECH Act, and numerous benchmarks established by the Centers for Medicare and Medicaid. Finally, Blockchain is a new technology whose proof points are still in the development stage, and as an industry, healthcare is notoriously reluctant to adopt disruptive technologies.

A Blockchain Model For Healthcare

Conceptually, a Blockchain model for healthcare would incorporate the following characteristics, as illustrated below:

4 Key Dimensions of Blockchain

Shared Ledger An append-only distributed system of records shared across a business network	Smart Contracts Business terms embedded and executed in a transaction database	Consensus All parties agree to the validity of a transaction and commit it to Blockchain	Privacy Transactions are secure, authenticated and verifiable

Additionally, any Blockchain for healthcare would need to be public, and would need to include solutions for three key elements: scalability, access security and data privacy.

Scalability

A distributed blockchain ledger that contains health records, documents or images would have data storage implications and data throughput limitations.

Access Security

The increasing numbers and capability of connected medical devices present additional risks for access security.

Privacy

Security and Privacy (in compliance with regulations like HITECH and HIPAA) must

be baked into any Blockchain solution.

Final Assessment

The healthcare industry is drowning in data - clinical trials, patient medical records, complex billings, medical research, retail devices, and more. Data integration, data sharing, and data standardization solutions like Blockchain can mitigate - though not eliminate - the challenge of exponential growths in recorded health data. That said, the benefits of Blockchain technology include: reducing or eliminating fraud, errors and malicious activity; establishing a foundation of trust, data integrity and secure data sharing; improving asset management and supply chain; enabling complex clinical and financial transactions, and boosting information systems interoperability; and streamlining care

processes with measurable improvements to patient outcomes.

But Blockchain's ability to impact healthcare will depend on the industry's willingness to invest in technical infrastructure - and to surpass an industry culture that is insular and reluctant to adopt new technologies. Blockchain is costly and there are some concerns regarding its integration with existing technology. Most likely, adoption and implementation of Blockchain in healthcare will be incremental and evolutionary, as business models gravitate towards clinical collaboration and data normalization. And a fundamental principle of technology adoption applies to Blockchain applications - focus on the problem, not the platform.~

About the Author:

Rick Krohn is an expert in Connected Health corporate strategy and business development, strategic marketing and multi-channel communications, technology-enabled transformation, alliances, new products and new ventures, digital innovation, project management and thought leadership, whose consulting experience spans the healthcare, telecommunications, education and technology fields. He is the author of more than 100 articles on a wide range of health technology topics and two HIMSS books detailing Connected Health Innovation. His latest book, titled Connected Health: Improving Care, Safety, and Efficiency with Wearables and IoT solutions, is available from CRC Press. A new book on Blockchain in healthcare will be published by CRC in spring 2019. He can be reached at: rkrohn@healthsen.com