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Blockchain, Interoperability, and Self-Sovereign Identity: Trust Me, It's My Data

Jim St. Clair,[1] Ann Ingraham, PhD,[2] Dominic King,[3] Michael B. Marchant,[4] Fletcher Cotesworth McCraw,[5] David Metcalf, PhD,[6] John Squeo, MBA[7]

Affiliations: [1]Dinocrates Group LLC; [2]Exponential HealthTech Advisors, LLC; [3]Harmony Healthcare IT; [4]System Integration & Health Information Exchange, UC Davis Health; [5]Blockchain & DLT Practice, Cognizant; [6]METIL, University of Central Florida, IST; [7]CHCIO, Accenture Strategy, Blockchain Lead—Health and Life Sciences, North America, Accenture

Corresponding Author: Jim St.Clair. Jim.stclair@dinocrates.com

Keywords: Blockchain, Healthcare, Identity, Interoperability, TEFCA

Section: Discussion

THE PROBLEM

With industry adoption of electronic health records, provider organizations have been unable to escape the recurring challenge of establishing standards and incentives to fully enable provider-to-provider interoperability. This challenge is exacerbated by an emerging demand for allowing patients greater control and ownership over their medical records. Adversarial relationships between organizations limit interoperability and impact value-based care, care coordination, and the provider–patient experience.[1,2] The current interoperability processes for data exchange result in fragmentation and lack of aggregation, impacting patient identity, consent management, and access management across stakeholders. Patients lack the ability to administer and transfer consent in managing their own data. Payers risk sharing data with partners without consent. And, providers have identified "pain points" in data sharing in consent management and care coordination.[3,4] This lack of management is critical as studies have shown that "patients only visited their primary care physicians 54.6% of the time when seeking care. Where do they go for that other 45.4%? Patients receive care from other organizations where that provider may not have access to the patient's medical records."[5]

THE TECHNOLOGY

As was described in "Pragmatic, Interdisciplinary Perspectives on Blockchain and Distributed Ledger Technology: Paving the Future for Healthcare," the foundational construct of blockchain, a type of distributed ledger technology (DLT), is stored by each node in a "permissionless" or public network

(i.e., one that allows anyone to participate) or may be structured as a "permissioned" or private network (i.e., whereby participation is controlled by the originator of the network).[6] For each block on the blockchain, a hash code is computed as a combination of the data in the block, as well as the hash code of the previous block. In this way, hash codes are chained. Hash codes are easy to compute and verify by all participants of the blockchain, enabling them to verify that the blockchain data have not been altered.

Deletion of a block or changing the data on a block renders the chain of hash codes on the blockchain invalid and is easily detectable by the blockchain participants. Each node, or network participant, continuously synchronizes the blockchain as consensus is achieved according to the specific consensus protocol of that network. This consensus ensures the validity and consistency of each copy of the distributed ledger running on each node of the blockchain network.[6]

THE APPLICATION

Blockchain offers transformational opportunities in healthcare processes, including the ability to establish self-sovereign identity and a consent audit trail for the patient's digital identity. These identity systems are used primarily for authentication and authorization.[7] To date, most digital identities are issued by a company that maintains control over the identity, rather than allowing user control. This enables the service provider to control the identity and related services without the consumer's knowledge or consent. When using self-sovereign identities, every person has authority over his or her own digital identities. Self-sovereign identity can be characterized as the:

- Existence of a person's identity independent of identity administrators
- Control of their digital identity
- Full access to their own data
- Interoperable digital identities
- Protection of individual rights[8]

BLOCKCHAIN AS A SOLUTION

The fundamental promise of blockchain is to provide a seamless method for multiple entities to share data without a single entity fully controlling all of the information.[5] It has the potential to improve healthcare in innovative ways, including support for a master patient identifier (MPI) and autonomous automatic adjudication and interoperability.[4,7] Globally, blockchain technology could help with reliability, security, transparency of self-sovereign data, and consent management to inform the exchange of information across approved entities. As patients gain more control of their data and permissions for exchanging of that data, robust privacy and security considerations will be critical to maintain appropriate protections for protected health information (PHI).[9]

Healthcare Information and Management Systems Society (HIMSS) is taking an active role in education regarding the appropriate use of blockchain for patient-centric information sharing. As the industry works to address the components of trusted exchange proposed outlined in Trusted Exchange Framework and Common Agreement (TEFCA), robust patient data management will be a key component to success. Blockchain technology has the potential to be a part of the solution to reach these interoperability goals.[10]

Funding Statement

The authors declare that no funding was received to conduct this research.

Conflict of Interest

David Metcalf disclosed his participation in Johnson & Johnson Wellness and Prevention projects; Managing Partner in Global Blockchain Ventures and Merging Traffic. No other authors stated any conflicts of interest.

Contributors

All authors are members of the HIMSS Blockchain in Healthcare Task Force. Jim St. Clair, Ann Ingraham, Dominic King, Michael B. Marchant, Fletcher Cotesworth McCraw, David Metcalf, and John Squeo were involved in the original draft preparation.

Jim St. Clair, Ann Ingraham and Michael B. Marchant were responsible for review and editing of the article.

REFERENCES

1. Yoder L. Care coordination and transition management: Critical roles for medical-surgical nurses. *Medsurg Nurs*. 2017 Jul [cited 2019 Dec 26];26(4):225–8. Available from: https://www.amsn.org/
2. Dhalla IA, Tepper J. Improving the quality of health care in Canada. *CMAJ*. 2018 Oct 01;190(39):E1162–7. doi: 10.1503/cmaj.171045
3. Leeming G, Cunningham J, Ainsworth J. A Ledger of Me: Personalizing healthcare using blockchain technology. *Front Med* [Internet]. 2019 Jul 24 [cited 2019 Dec 26];6(171):1–10. Available from: https://www.frontiersin.org/articles/10.3389/fmed.2019.00171/full. doi: 10.3389/fmed.2019.00171
4. Bordersen C. Blockchain: Securing a new health interoperability experience. *Semantic Scholar* [Internet]. 2016 [cited 2019 Nov 4]. Available from: https://pdfs.semanticscholar.org/8b24/dc9cffeca8cc276d3102f8ae17467c7343b0.pdf
5. Randall D, Goel P, Abujamra R. Blockchain applications and use cases in health information technology. *J Health Med Informatics* [Internet]. 2017 Jul 20 [cited 2019 Nov 4];08(03):1–4. Available from: https://www.omicsonline.org/pdfdownload.php?download=open-access-pdfs/blockchain-applications-and-use-cases-in-health-information-technology-2157-7420-1000276.pdf&aid=91911. doi: 10.4172/2157-7420.1000276
6. Ribitzky R, St. Clair J, Houlding DI, et al. Pragmatic, interdisciplinary perspectives on blockchain and distributed ledger technology: Paving the future for healthcare. *BHTY*. 2018 [cited 2019 Dec 26];1. Available from: https://blockchainhealthcaretoday.com/index.php/journal/article/view/24. doi: 10.30953/bhty.v1.24
7. Bhargav-Spantzel A, Squicciarini AC, Bertino E. Establishing and protecting digital identity in federation systems. *J Comput Secur* [Internet]. 2006 Jun 23 [cited 2019 Nov 4];14(3):269–300. Available from: http://content.iospress.com/articles/journal-of-computer-security/jcs261
8. Der U, Jähnichen S, Sürmeli J. Self-sovereign Identity − Opportunities and challenges for the digital revolution [Internet]. arXiv.org. Cornell University; 2017 [cited 2019 Nov 4]. Available from: https://arxiv.org/abs/1712.01767.
9. Nichol P. National ONC Blockchain Challenge explores micro-identities to improve healthcare interoperability [Internet]. The Next Generation of Health IT. CIO.com; 2016 [cited 2019 Nov 4]. Available from: http://www.cio.com/article/3107004/health/national-onc-blockchain-challenge-explores-micro-identities-to-improve-healthcare-interoperability.html
10. Zhang A, Lin X. Towards secure and privacy-preserving data sharing in e-health systems via consortium blockchain. *J Med Syst*. 2018;42(8):1–18. doi: 10.1007/s10916-018-0995-5

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