Blockchain technology for immunisation documentation in India: findings from a simulation pilot

Joy C Liu, Sinchan Banerjee, Anshul Bhagi, Aurobindo Sarkar, Bhrigu Kapuria, Shrey Desai, Venkatraman Sethuraman, Sumeet Patil, Somalee Banerjee

Published Online March 11, 2021

Kaiser Permanente Oakland, Oakland CA, USA (JC Liu MD, Somalee Banerjee MD); **Proffer, New York, New York and New Delhi, India** (Sinchan Banerjee MS, A Bhagi MBA); **ZineOne** (A Sarkar MS); **UNICEF** (B Kapuria MBBS); **Society for Education Welfare and Action-Rural (SEWA), India** (S Desai MD); **Argusoft, India** (V Sethuraman); **NEERMAN, Mumbai, India** (S Patil PhD, Somalee Banerjee)

Correspondence to: Somalee Banerjee, Kaiser Permanente Oakland, 3600 Broadway, Oakland, CA 94611, USA
somalee.banerjee@neerman.org

Abstract

Background Immunisation documentation in India has historically been fragmented over a number of systems. To reduce errors and wasted vaccinations for one of the largest and most complex public vaccination systems, data storage has migrated to electronic application-based data records. However, the system remains fragmented. There has been much interest in the global health sector about the use of blockchain technology to build secure, immutable databases for complex data in fragmented environments. As part of the Indian government's innovation initiatives, our project aims to describe a blockchain immunisation system to store immunisation data, pilot its use in India, and assess strengths, limitations, and feasibility of blockchain immunisation.

Methods A connector database—Anveshan—was developed for the state of Gujarat, India, to: (1) remove data fragmentation; (2) enable aggregate analysis to allow tracking of dynamic data; (3) track data changes; and (4) enable fault tolerance so data can be accurately preserved for long periods of time. Although live piloting was not possible because of the COVID-19 pandemic, a simulated pilot was done. A report including lessons learned, benefits and challenges of blockchain application to immunisation documentation, and recommendations for future usage was delivered.

Findings Results from the simulation showed that the Anveshan database was able to decrease data fragmentation by querying across both supply and delivery databases. Aggregate analysis capability was increased through development of a dashboard user interface that allowed policymakers and immunisation programme staff to receive real-time query feedback. Data changes could be tracked and private data encrypted by incorporating disincentives for inappropriate data modification. Blockchain technology properties increased fault tolerance, which make data less corruptible. Although blockchain technology offers benefits for data storage, it does not facilitate improvements in data collection and quality, which remain a significant challenge in India. Multiple health-care stakeholders would need to work together and have access to live data to ensure nationwide scalability.

Interpretation Our findings show the challenges and benefits of a private blockchain system and identify areas requiring continued improvement for immunisation documentation in India. One important consideration in infrastructure design on a nationwide scale is the design of the blockchain system itself. This study is an important first step to show that evidence-based design innovation using blockchain can help countries such as India to address complex public health-care delivery conundrums.

Funding India Grand Challenges grant (Bill & Melinda Gates Foundation and BIRAC, Government of India).

Declaration of interests
We declare no competing interests.