IS BLOCKCHAIN READY TO UNLEASH INNOVATION IN HEALTHCARE?

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Technologies – such as artificial intelligence, machine learning, and blockchain, which dominate today's headlines – hold tremendous potential to help providers improve the quality and efficiency of their work and share electronic medical records seamlessly and securely. But is this something health systems and payers should be focusing on now… or later?

In this Q&A, Charlie Hoban, Partner in Oliver Wyman's Health & Life Sciences Practice, chats with John Halamka, MD, MS, Chief Information Officer of Beth Israel Deaconess Healthcare System, and a professor at Harvard Medical School. John was instrumental in creating Beth Israel Deaconess' first electronic medical record, and on the national level, helped shape the Meaningful Use program. John's also editor of a new peer-reviewed journal, *Blockchain in Healthcare Today*.

Charlie Hoban (CH): With the massive funding fueling health information technology (IT) innovation, who will drive innovation? Are we shifting toward more of an open innovation model?

John Halamka (JH): So, I travel the world. About 400,000 miles of travel a year. Not fun, but very educational. What have I learned as I look at every society? Innovation is happening by 26-year-olds in their garages. They may not have healthcare domain experience, but they partner with people who understand healthcare workflow. They create apps that make a substantial difference.

And so with Epic, Cerner, Meditech, eClinicalWorks, and Athena, their job will be to get bills out, keep us compliant with every changing regulation, but leave innovation to this ecosystem of developers who will create cloud-hosted services and apps that will layer on top of those existent incumbent transactional systems.

CH: The healthcare market has been difficult for new players to break into. How will the pivot to an open innovation model occur?

JH: I'm starting to see niche applications that fundamentally change the workflow for physicians. They think, "Wow, you mean I'll be twice as productive, I'll get home and have dinner with my spouse for the first time in three years, and my quality scores will go up? I can tolerate the risk of adopting that new app."

At Beth Israel Deaconess, we have already deployed about a dozen apps in our curated app store. They address issues in the surgical workflow, the medical workflow, or the ambulatory workflow. For example, a group of surgeons said to us: "You know how hard it is to book an operating room slot while I'm on vacation or sitting at a restaurant?" And we thought: "Why don't we create Open Table for the operating room? I'd like an appendectomy for two, 7:30, near a window." They book an operating room time slot in literally five seconds on their phone.

That's the kind of thing that a surgeon is going to say, "This is so darn convenient. It addresses all of my needs and saves me time. It has very little risk. I will use it."

CH: **Health systems and payers wrestle with where and when to invest their finite IT budgets. Should the industry invest in artificial intelligence and machine learning now, or wait until these advanced analytical approaches are more mature?**

JH: In 2018, machine learning and deep learning are real, and are changing workflow in positive ways. Suppose you need your appendix out, but you're a young, thin, healthy guy with no comorbidities. How much time do you need in the operating room? You get two hours. Why? Because since 1850, everybody who's needed an appendectomy gets two hours. It's just a block.

What do we do next? Well, Beth Israel Deaconess has a strategy to focus on machine learning approaches rather than traditional analytic approaches. We recently moved the hosting of many clinical applications to Amazon Web Services, which enables us to use cloud-hosted machine learning applications with our data. We trained the system with 2 million patient surgical experiences, then asked the system to predict operating room (OR) times for new patients. By delivering the right care at the right time in the right setting for the right duration, we can free up 30 percent of the OR schedule.

CH: **Do you see blockchain solving some of the big problems in healthcare, like electronic health record interoperability?**

JH: So, I hear pitches from blockchain startup companies every day. I've learned to recognize certain red flags. Blockchain is a public ledger not run by a corporation or a government. Blockchain is decentralized, operated by thousands of independent actors, and cannot really be falsified or changed, because there are certain cryptographic mechanisms used to ensure data integrity. What are the possibilities of a public ledger that you write to once, could never erase, and is pretty much guaranteed to be accurate? Well, the United States has 50 states and, therefore, 50 different sets of privacy laws and 50 different consent policies, at least because state laws preempt HIPAA.

So, what if I wanted to get your medical record? What do you consent for the purpose of my using it for treatment, payment, operations, clinical trials, or clinical research? As part of a pharmaceutical post market surveillance, what's your preference?

Well, imagine you put up a public ledger, viewable by all, that said, "Here are my consent preferences." Then anyone who wanted to exchange your data would reference your preferences on the blockchain and respect your preferences. That's potentially, a good case.

But regarding another kind of case, what if there is such an assertion where a plaintiff attorney says, "I need the entire medical record of this person's lifetime going back 18 years." You say, "Beautiful. Here it is." And the plaintiff attorney says, "Oh, no. This is fake. It's been altered. Things have been deleted or changed. The doctors went in and did something to protect them from future litigation."

Well, blockchain remembers a public ledger. I'm not going to put a medical record in that public ledger in this particular use case. What I would do is use a cryptographic technique called a hash where I could take the entire medical record of a person and do a mathematical transformation of it and reduce it to a series of letters and numbers that's totally unique. What does that mean? Well, if the medical record were ever deleted or changed in any way, the hash value would be different. What if every time a doctor signs off on a whole medical record, we do this mathematical transformation and digest and post the hash to the blockchain?

Then, 20 years go by. Somebody asks, "Was the medical record changed?" We say, "Look, the hash we did 20 years ago matches the hash of today, proving it could not have been altered along the way."

And I've used this in multiple production systems. I've been doing working with the Bill & Melinda Gates Foundation in South Africa to track HIV test results and to keep patients and families informed. We use blockchain in a very similar way to make sure that the data isn't altered or deleted in any way, and patients can trust it.

CH: Are there other applications where we might see blockchain as a repository for clinical data?

JH: The MedRec pilot project, which Harvard and MIT did at Beth Israel Deaconess, does something like this. We'll put medical data in the blockchain, but we've put pointers to the medical data. What does that mean? If you have a doctor's office visit or a hospital visit, we put a pointer in the blockchain that says you had a visit. We don't say what it's for or what it's about. Therefore, blockchain could be a mechanism for unifying your lifetime medical record by simply keeping a directory of where you've been.

MedRec also used a smart contract, which allows you to decide who can access that directory. Maybe the answer is the three doctors who are caring for you, or your children, or some other person in your family who does care navigation. But not the public. So, blockchain has potential as a pointer system, with contracts for deciding who can look at those pointers.

CH: Do you see blockchain as a high priority for your organization? Should health systems and payers focus on it now, or later?

JH: In any IT plan, you have to separate out what you need to do today for operational requirements versus what you need to do long-term, such as what to implement in the next six quarters because of, say, a regulatory requirement or a unique business requirement, versus

what's more speculative. So, I would put blockchain in the category of: no, it's not an operational imperative for the next six quarters. But it's absolutely something to learn about and keep on exploring.

KEY TAKEAWAYS

- We are going to reward innovators who can solve real problems in simple, compelling ways. This opens the field to a broad community of innovators.

- Blockchain is a public ledger not run by a corporation or a government. Blockchain is decentralized, operated by thousands of independent actors, and cannot really be falsified or changed, because there are certain cryptographic mechanisms used to ensure data integrity.

- Blockchain can play a big role in interoperability, but not as a repository. We won't put medical records in the blockchain, but we can use pointers and hashes as mechanisms to create linkage and permission management.

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