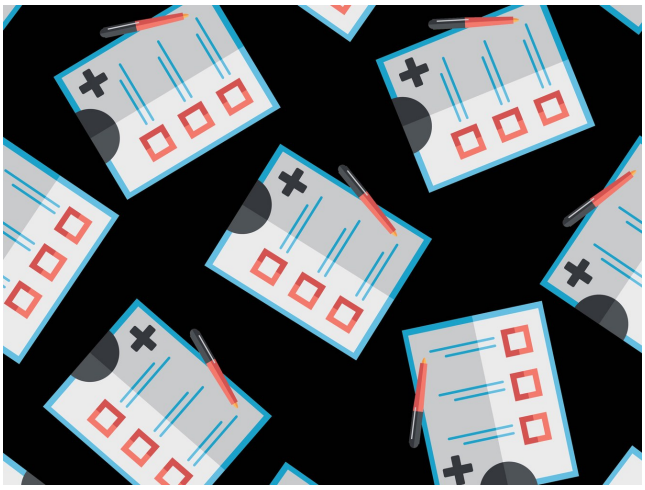
MEGAN MOLTENI SCIENCE 02.01.17 7:00 AM

MOVING PATIENT DATA IS MESSY, BUT BLOCKCHAIN IS HERE TO HELP



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THIS MORNING, SENATE Republicans moved Rep. Tom Price one step closer to the highest office of public health, rolling over a Democratic

boycott in the finance committee and advancing his confirmation as Secretary of Health and Human Services to a full Senate vote. But while Dems still have plenty of unanswered questions about the ethics of Price's financial dealings, healthcare communities are already thinking about how he might lead the agency into the future. During a confirmation hearing last Tuesday, Price came out against electronic health records, the digital histories patients make every time they see their doctor or go to the hospital. "We've turned physicians into data entry clerks," he said, arguing that the burdensome recording systems need an overhaul.

He may not be wrong. For almost a decade, hospitals have been waiting for EHRs to usher in a shiny new era of standardization and high quality healthcare. But while federal laws and incentive programs have made

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healthcare data more accessible, the vast majority of hospital systems still can't easily (or safely) share their data. As a result, doctors *are* spending more time typing than talking to patients. And it's wearing on them; physician burnouts jumped from 45 to 54 percent between 2011 and 2014, according to a Mayo Clinic study. The number one thing those doctors would change? Streamlining the EHR process. And the most popular strategy circulating among healthcare technologists is blockchain.

For a refresher, blockchain is the distributed accounting platform that makes cryptocurrencies like bitcoin possible. But wait, you say! Isn't that like what the dark internet uses to exchange drugs and cyber weapons and stuff? I don't want that near my medical records!

Breathe. OK. While blockchain is most best known for powering bitcoin, it's really a

generic tool to keep secure data in a distributed, encrypted ledger—and control who has access to that ledger. Rather than having one central administrator that acts as a gatekeeper to data—a list of digital transactions—there's one shared ledger, but it's spread across a network of synchronized, replicated databases visible to anyone with access. Which gives it unprecedented security benefits. Hacking one block in the chain is impossible without simultaneously hacking every other block in the chain's chronology.

This makes blockchain incredibly appealing to the doctors and hospitals that need secure access to a patient's entire health history. "Now is probably the right time in our history to take a fresh approach to data sharing in healthcare," says John Halamka, chief information officer at Boston-based Beth Israel Deaconess Medical Center. For the past decade,

Halamka has been responsible for health care data standards in the US, first under the Bush and then the Obama administration. He sees a blockchain-underwritten future in which a patient's every healthcare interaction goes into a ledger every provider can see. "The EHRs may be very different and come from lots of different places," Halamka says, "but the ledger itself is standardized."

Every time a digital transaction takes place, bits of code group it into an encrypted block with other transactions happening at the same time. For bitcoin, this would be a flurry of buying and selling. For EHRs, it might be all the things that happen to you on a doctor's visit (blood work, a new prescription, maybe some X-rays). Then people validate the transactions—in healthcare, likely a physician or pharmacist trusted with an access key. Then the software

timestamps each validated block and adds it to a chain of older blocks, in chronological order. The sequence shows every transaction made in the history of that ledger, whether it be bitcoin sales or a knee replacement procedure. Get it? It's a chain of blocks. Blockchain.

Halamka gives a simple example: prescriptions. Say that one medical record shows a patient takes aspirin. In another it says they're taking Tylenol. Maybe another says they're on Motrin and Lipitor. The problem today is that each EHR is only a snapshot; it doesn't necessarily tell the doctor what the patient is taking right now. But with blockchain, each prescription is like a deposit, and when doctor discontinues a medication, they take a withdrawal. Looking at a blockchain, a doctor wouldn't have to comb through all the deposits and withdrawals—they would just see the balance.

And crucially for patient privacy and security, hospitals and pharmacies don't have to send data back and forth to see it. They just all have to point to the same common ledger.

So does it work? For prescriptions, at least, initial results are promising. Halamka recently teamed up with researchers at the MIT Media Lab to test a blockchain application pilot called MedRec. Team-lead Ariel Ekblaw put the authentication log to work at Beth Israel, tracking six months of inpatient and outpatient medication data with MedRec code deployed through virtual machines at MIT. They recorded blood work records, vaccination history, prescriptions, and other therapeutic treatments, simulating data exchange between institutions by using two different databases within Beth Israel. The results were so positive that Ekblaw is already starting to plan

more pilots with larger networks of hospitals.

MedRec is still an early prototype, not ready for widescale deployment any time soon. But government health technologists see its promise. Last year, the Office of the National Coordinator for Health Information Technology—the part of HHS that helps healthcare providers adjust to new, digital paradigms—held a blockchain competition. MedRec was one of the 15 winners, along with entries from major healthcare players like The Mayo Clinic and insurance giant, Humana. And in January, the Food and Drug Administration announced a research partnership with IBM Watson to find ways to safely share data from EHRs, clinical trials, genetic sequencing, and even mobile wearables using the blockchain approach. The technology is still in its infancy when it comes to healthcare applications, but in a recent poll of healthcare

executives, IBM found that 16 percent of them intend to implement some sort of blockchain solutions by the end of this year.

Whether or not a Price-led HHS will jump on the blockchain bandwagon remains to be seen. The 21st Century Cures Act, signed into law in December, should push some of these interoperability issues to the top of the agency's agenda. But officials at the ONC say nothing is happening until the new administration reviews the finer points of the law. Price's office did not respond to a request for comment.

Halamka says no one from Trump's team has yet contacted him, but that Price's record on EHR leaves open the door for a blockchain future. "He likes the ability to see a patient's longitudinal history and he doesn't like the burdens on physicians," he says. In a way, blockchain is the best kind of distribution of

labor.

Editor's Note 12:10 Eastern: This story has been updated with the results of a Senate committee vote, following a rules suspension by GOP lawmakers.