A prescription for blockchain and healthcare: Reinvent or be reinvented

pwc

Introduction

The emergence of blockchain technologies offers a stark choice for some healthcare companies: Reinvent or be reinvented. Six healthcare use cases show the potential for imminent disruption by blockchain. Companies' supply chains, contract administration and credentialing processes, in particular, may look very different in just a few years thanks to blockchain.

Blockchain-based technologies offer substantial opportunities to reinvent how healthcare companies access, collect, distribute, share, leverage, monitor and audit data. Not all companies will benefit. Middlemen may become obsolete. Companies that are slow to change may lose out to ones that use the technology to cut costs and increase efficiencies.

Companies should be prepared to identify where blockchain could improve their operations and interactions with trusted partners. Paradoxically, while use of blockchain may ultimately increase trust among industry partners and competitors alike, a lack of trust may prove to be one of blockchain's biggest challenges.

Because blockchain projects are undergoing research and development, companies have just a few years before blockchain-based partnerships and programs begin to come into use. This means they have precious little time to plan, adjust and adapt. Forty-nine percent of companies are developing, piloting or implementing blockchain projects, according to a PwC survey of 74 global healthcare companies.[1]

In healthcare, three use cases—the pharmaceutical supply chain, contract administration and credentialing processes—likely contain the highest potential for near-term disruption.

Blockchain is more than just Bitcoin and its fellow cryptocurrencies.

A blockchain is a record of transactions, known as a ledger, that's distributed to many different entities instead of being kept at a single, centralized location. In general, all users on the network, also known as network "nodes," have copies of the same ledger. Participants add to the ledger by making and recording information about transactions, which are checked by other users on the network and accepted if there is a consensus.

Once a transaction has been validated, it's bundled with other transactions into a "block" of data. Each block undergoes a cryptographic algorithm, encrypting the base data and resulting in a unique signature for each block known as a "hash." These blocks are then ordered sequentially into a "chain" of blocks, with each block also containing the previous block's hash. This makes it extremely difficult to tamper with a block, as altering a single piece of data would result in a different hash value, making it evident to the blockchain's users and causing the transaction to be rejected (see Figure 1).
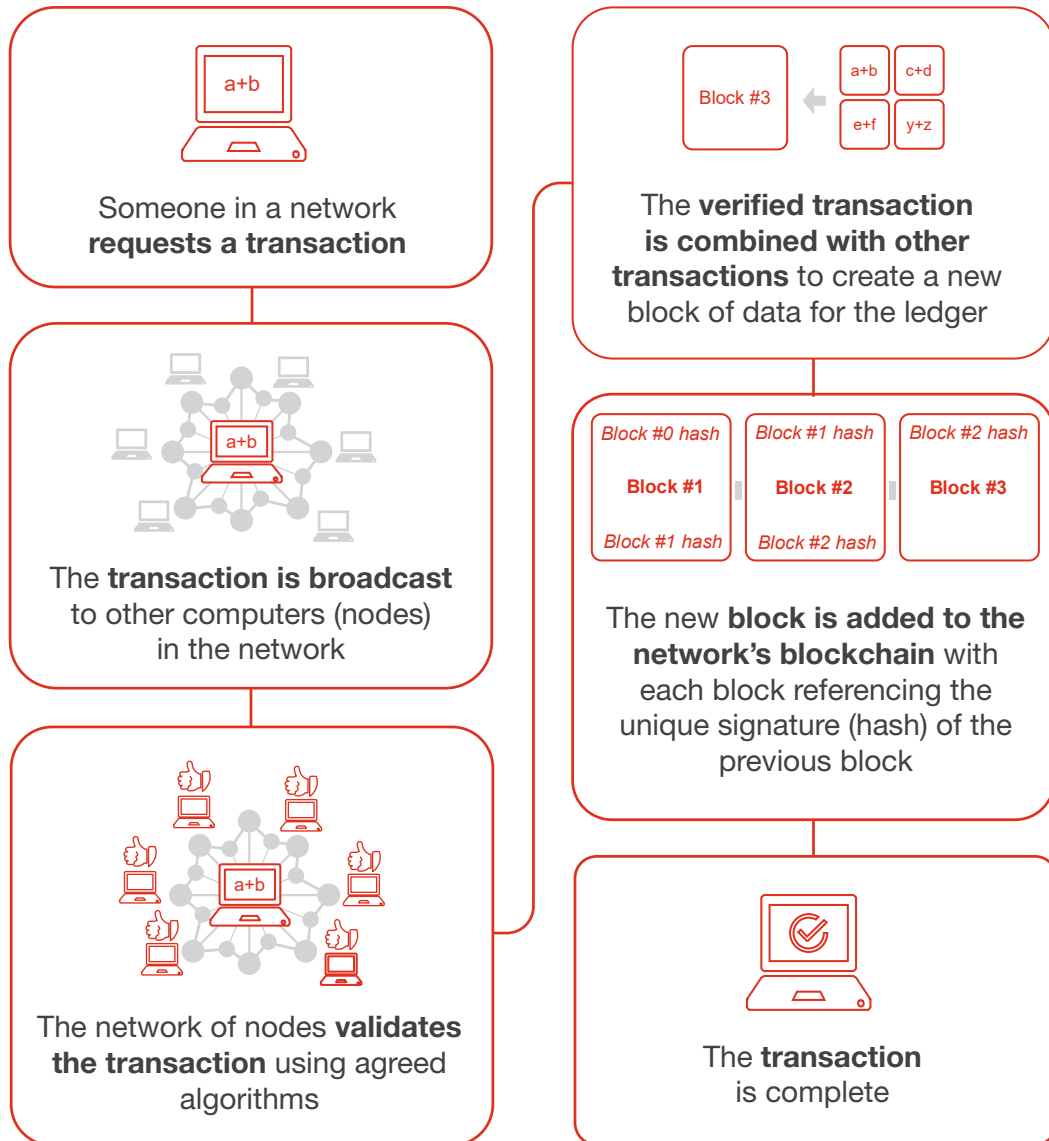
Some parts of this process can be done automatically using something called "smart contracts." These involve two entities turning a business contract into code that recognizes actions on the blockchain. For example, a smart contract might recognize that a sale of an asset by 'Company A' to 'Company B' on a certain date should be for a specific price. This simplifies processes that take significant time to check.

For more information on blockchain, please see PwC's report, **Blockchain is here. What's your next move?**

Figure 1:

What is blockchain?

A blockchain is a decentralized ledger of all transactions in a network. Using blockchain technology, participants in the network can confirm transactions without the need for a trusted third party intermediary.

Someone in a network **requests a transaction**

The **transaction is broadcast** to other computers (nodes) in the network

The network of nodes **validates the transaction** using agreed algorithms

The **verified transaction is combined with other transactions** to create a new block of data for the ledger

The new **block is added to the network's blockchain** with each block referencing the unique signature (hash) of the previous block

The **transaction** is complete

Blockchain uses in healthcare

Healthcare organizations run on many complex, data-intensive, slow, manual processes often performed by intermediaries who handle data and trust mechanisms. Blockchain could simplify and automate these processes, in some cases saving companies weeks of effort, revenue and lost opportunities (see Figure 2).

Figure 2:

Six healthcare process types that could benefit from blockchain

Use archetype	Examples	Explanation	Example of current state	Example of process with a blockchain
Supply chain and inventory management	Supply chain management, tracking and traceability of drugs, connected device management	Enabling the tracking of products throughout a supply chain using track-and-trace and serialization technologies	Companies are given information about the product they receive but are unable to ensure if the product is authentic	Company could check history and provenance of product through immutable transaction history on the blockchain
Enrollment and provider data management	Administrative simplification, network management, eligibility inquiries, benefits coordination, billing	Assisting with enrollment of providers and customers, including tracking eligibility, services offered, claims acceptance and adjudication	Long, manual and extensive process of checking references, credentials and eligibility	Enrollment criteria, credentialing and educational information could be stored on blockchains, making trustworthy information available quickly
Back office functions and payments	Smart contracts, outcome-based contracts, revenue cycle, reconciliation, health savings accounts, fraud detection, tracking copay accumulations, checking claims	Keeping track of payments, increasing ease of audits and analysis, reducing time for contracts, and reducing fraud	Contracts and payments are manually checked, reconciled and audited	Transactions coded into smart contracts, transaction information stored immutably on the blockchain
Data collection, exchange and management	Data collection, aggregation and monetization; data reconciliation and use in enterprise resource planning; portable health record management; patient consent and identification	Allowing for health data to be pooled together and distributed to necessary entities while allowing ownership of the data by patients	Data are spread throughout multiple systems and aren't available in a central way to the referenced patient	Data available to patient through the blockchain; patient can make data available to new entities as needed
Risk and regulatory	Credentialing, risk assessments, regulatory compliance	Allowing companies to more easily keep track of product recalls, audits, tracking product distributions against ethical requirements, and credentialing	Regulatory compliance information is entered by each individual entity and manually tracked	Company can track compliance information in blockchain and use smart contract logic to ensure certain actions trigger necessary reporting
Research and development	Clinical trial drug supply management, investigator payments, electronic data capture	Linking together clinical trial sites, helping keep track of investigational product, and ensuring data integrity	Clinical investigators must send data to company, which then sends payment to an investigator after a processing delay	Payments to investigators are automatically made when data is uploaded to the blockchain

Source: PwC Health Research Institute analysis

Blockchain-enabled healthcare processes

Supply chains

Supply chains in which sequential transactions move trackable physical assets through a system represent one way in which pharmaceutical manufacturers, packagers, distributors, wholesalers, dispensers and regulators could more seamlessly share information using a blockchain.[2]

With blockchain technology, each company in the supply chain would control one or several nodes. Each time a company entered into a transaction with another company in the supply chain, that transaction would be recorded and validated on the blockchain. This would simplify the transfer of data and allow product recipients to validate their provenance with greater certainty. It would also significantly simplify transaction reconciliations and data transfers.

Blockchain makes it easier to transfer, share and check data automatically, processes that now require numerous (and sometimes manual) handoffs as a product moves through the supply chain. Regulators and suppliers could benefit as well, with company- or regulator-initiated recalls or warnings instantly recorded to a blockchain, allowing a pharmacy to make sure that a recalled or suspect product wasn't inadvertently dispensed to a patient.

The FDA is in the process of implementing the Drug Supply Chain Security Act of 2013 (DSCSA), which defined a system for identifying drugs and committed to defining a system to enable "track and trace" capabilities.[3]

The law requires each pharmaceutical package (also known as a salable unit) to be tagged with identifiable serial numbers, and manufacturers must share those numbers with distributors. They, in turn, share the same data with pharmacies.

Sharing unique identification numbers for each package means the package can be tracked as it moves through the supply chain. It also can be traced back to its origin point in case of concerns about authenticity or quality. One day pharmacists may use these unique identifiers to verify products and ensure that the prescriptions they dispense to patients are authentic. Patients could be the ultimate beneficiaries. PwC estimates that $163 billion to $217 billion in counterfeit drugs were sold worldwide in 2015.[4]

These efforts still have weaknesses. Records could be altered. Barcodes could be copied and reused. Real-time tracking of products throughout a supply chain is infeasible. Blockchain could solve these problems. Companies have taken notice.

Pilot programs are in the works between major pharmaceutical companies and wholesale distributors to enhance the supply chain with blockchain.[5] Blockchain may offer manufacturers and distributors a potential solution that could address some past challenges, such as concerns about data transfer, privacy and ownership.

"I've never seen companies like this work together in such a collaborative way," said Eric Garvin, MediLedger Lead at Chronicled, a software company working on a blockchain-based supply chain system with a consortia of drug distributors and manufacturers, in an interview with PwC's Health Research Institute (HRI). "Regulatory compliance with the requirements of the DSCSA has been a common goal among parts of the healthcare supply chain, and these drug manufacturers and wholesalers saw that there were no disadvantages to collaborating, so they were willing to work together."

Blockchain doesn't just have the potential just to transform product movement—it could transform entire business relationships as well.

"Blockchain is the enabling technology, but it's really all about setting up new business processes and communications networks between companies," said Mack MacKenzie, senior director of business technology at Pfizer, in an interview with HRI. "The highest value business applications for blockchain technology often rely on creating a new way of doing business across an industry. I don't know if the technology has necessarily been the biggest challenge at all. It's been more about creating new operational models that leverage the new capabilities enabled by blockchain, thereby achieving tighter process integration that was previously impossible or impractical. There is no offering that you can buy off the shelf to do this today. It needs to be built from scratch with the collaboration of industry participants, each having a hand in defining their own role in the process to better serve patients and all stakeholders."
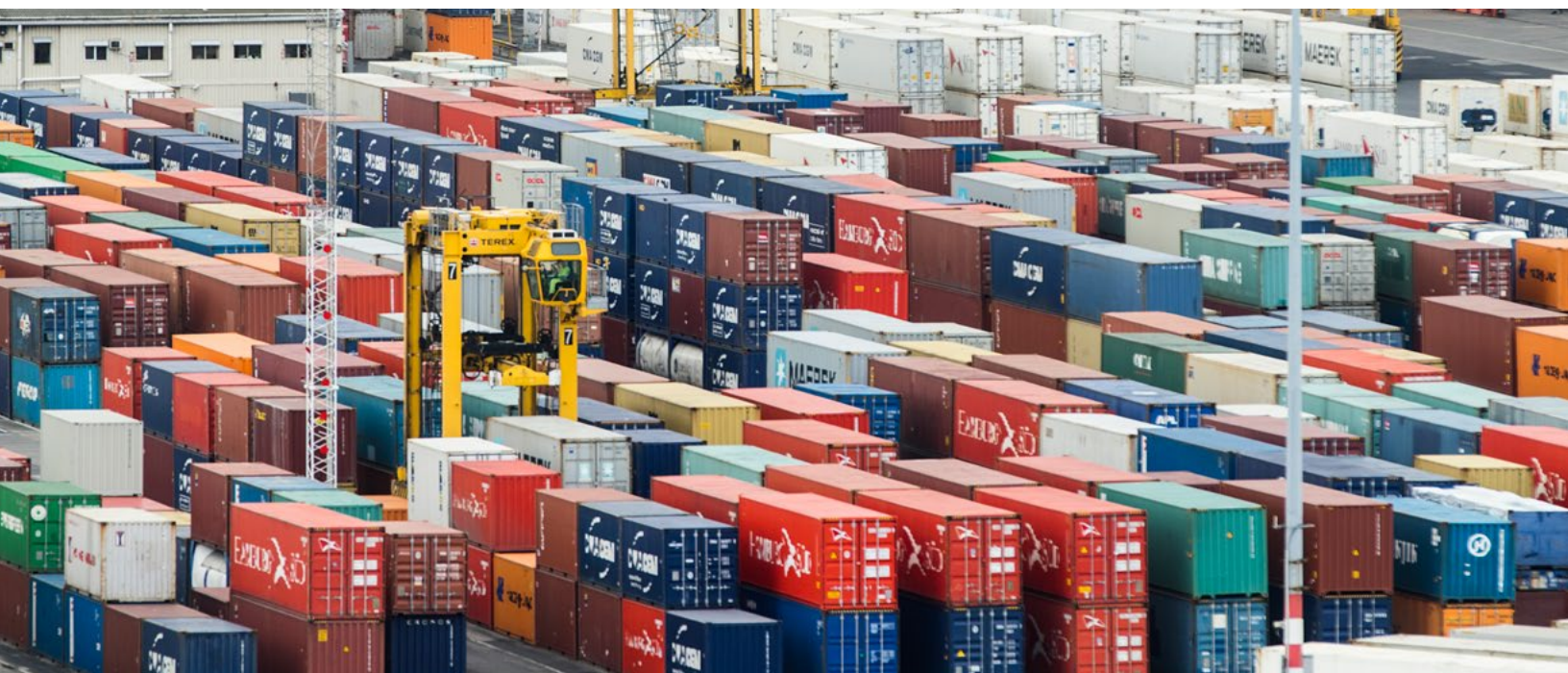
Figure 3:

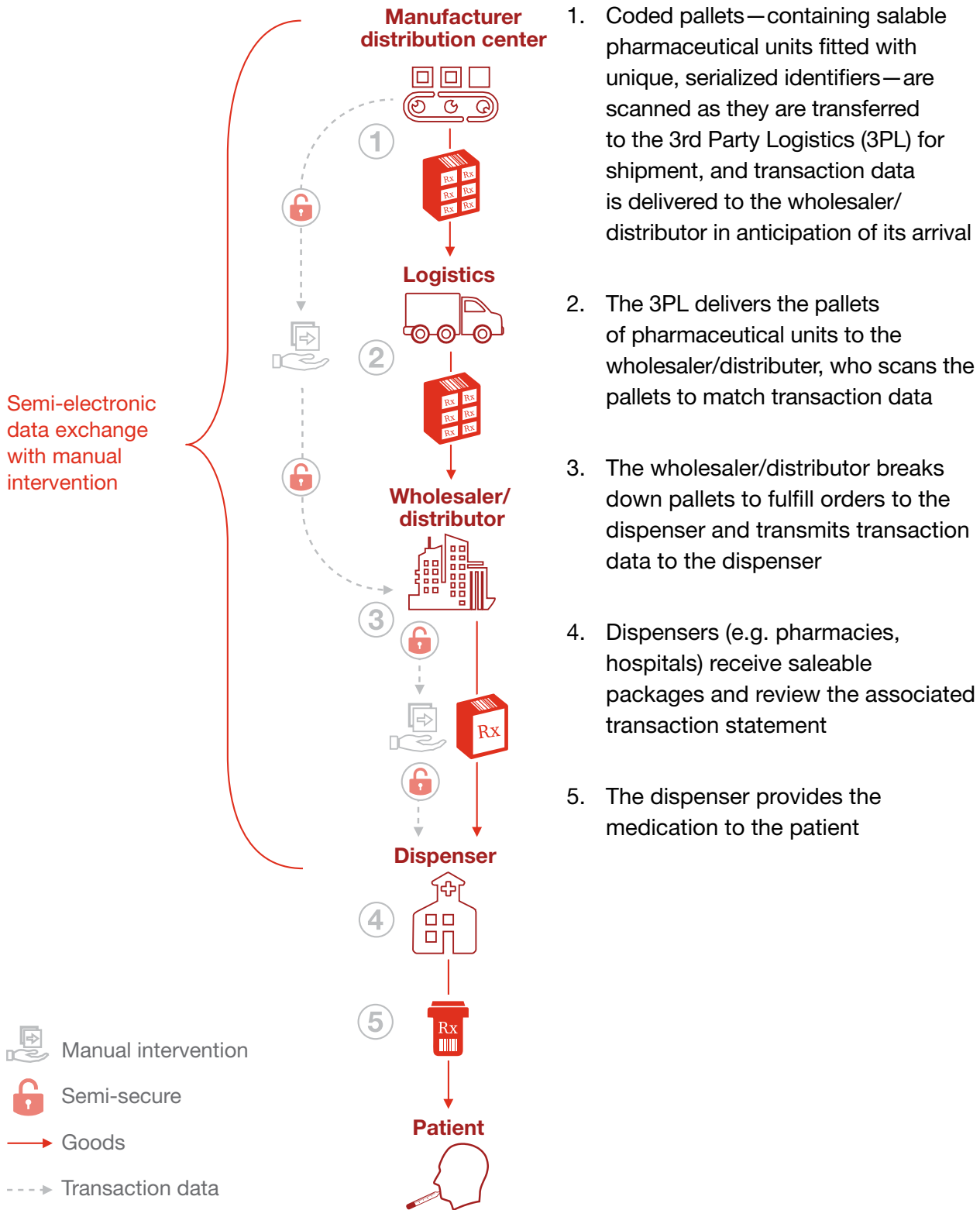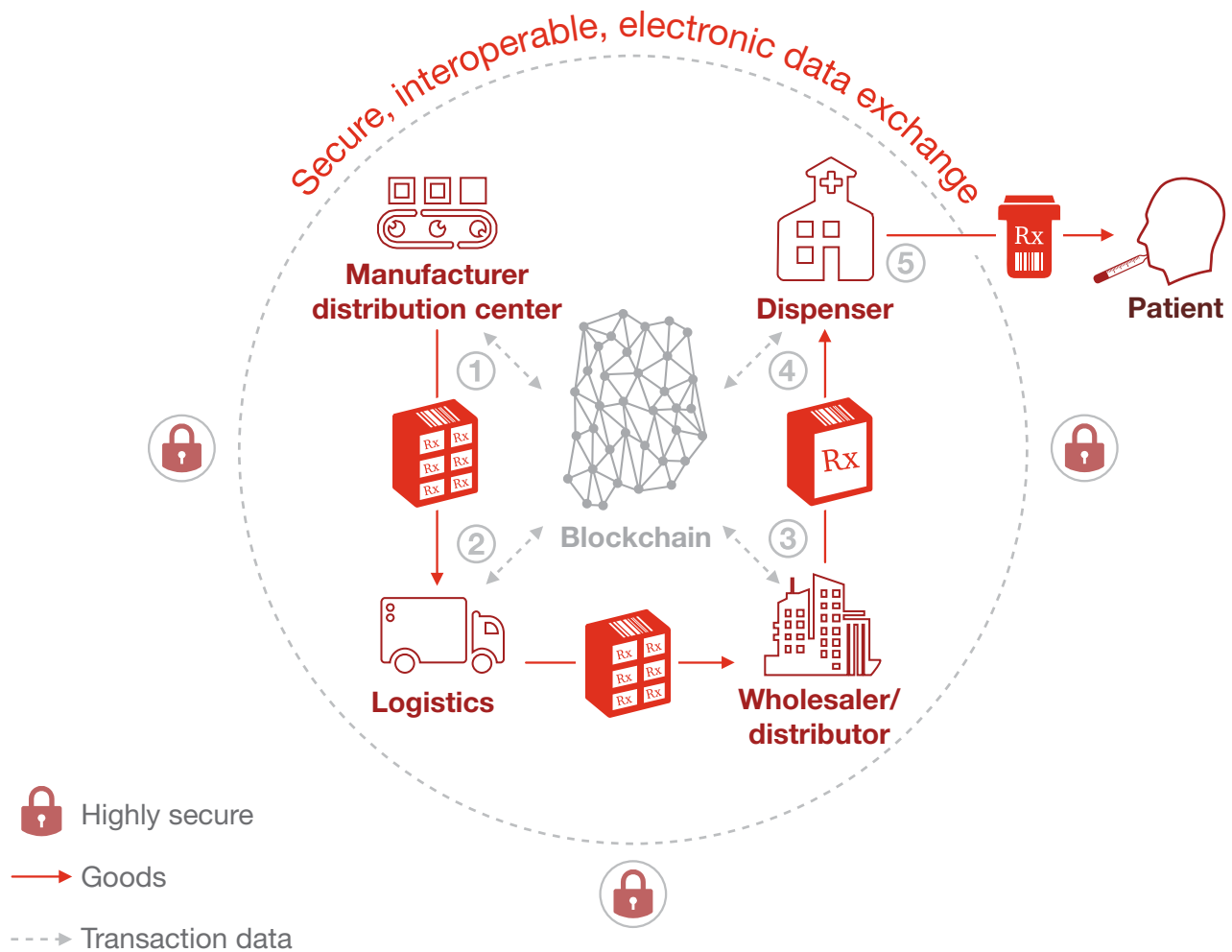# Pharmaceutical supply chain: Track and trace today

Manufacturer distribution center

Semi-electronic data exchange with manual intervention

1

Logistics

2

Wholesaler/ distributor

3

Dispenser

4

5

Manual intervention

Semi-secure

Goods

Transaction data

Patient

1. Coded pallets—containing salable pharmaceutical units fitted with unique, serialized identifiers—are scanned as they are transferred to the 3rd Party Logistics (3PL) for shipment, and transaction data is delivered to the wholesaler/ distributor in anticipation of its arrival

2. The 3PL delivers the pallets of pharmaceutical units to the wholesaler/distributer, who scans the pallets to match transaction data

3. The wholesaler/distributor breaks down pallets to fulfill orders to the dispenser and transmits transaction data to the dispenser

4. Dispensers (e.g. pharmacies, hospitals) receive saleable packages and review the associated transaction statement

5. The dispenser provides the medication to the patient

Pharmaceutical supply chain: Track and trace with blockchain

1. Coded pallets—containing salable pharmaceutical units fitted with unique, serialized identifiers—are scanned as they are transferred to the 3rd Party Logistics (3PL) for shipment, and transaction data is uploaded to the blockchain

2. The 3PL brings the pallets of pharmaceutical units to the wholesaler/distributor, who scans the pallet to review transaction data and validate the transaction in the blockchain

3. The wholesaler/distributor breaks down the pallets to fulfill an order by the dispenser and transmit transaction data to the blockchain

4. The dispenser scans the case and uses transaction history on the blockchain to authenticate products

5. The dispenser provides the medication to the patient

In addition to easing the movement of physical product, a blockchain-enabled platform could greatly simplify how products are paid for and reimbursed as part of the contract administration process used by group purchasing organizations (GPOs), manufacturers and distributors.

The contract administration process is considerably complex. A contract between a drug manufacturer and a GPO involves multiple steps, including adjudication, disputes, chargebacks and rebate payments. Each form, such as the electronic data interchange (EDI) 844 product transfer account adjustment form, requires dozens of data elements from each party.[6]

A core challenge of the current system is ensuring that all parties simultaneously have up-to-date information about pricing and contracts. A wholesaler purchasing a drug is unaware if that product is going to an independent pharmacy, retail chain or health system. All such entities can have different pricing and contract terms, leading to chargebacks and contract disputes.

End-to-end, the contract administration process can involve a half dozen back-and-forth processes between a manufacturer and wholesaler and take more than 45 days, according to companies interviewed by PwC.

A blockchain-based system could dramatically shrink this process to one to two days with smart contract architecture, PwC estimates. Smart contracts code business processes on a blockchain and trigger automatic actions in response to certain other actions. For example, validating the sale of a specific dose of a medical product to a specific vendor—such as a hospital—could trigger a specific sale price that previously was set by the contract. In addition to reducing how much time the process takes, this system could largely automate that process.
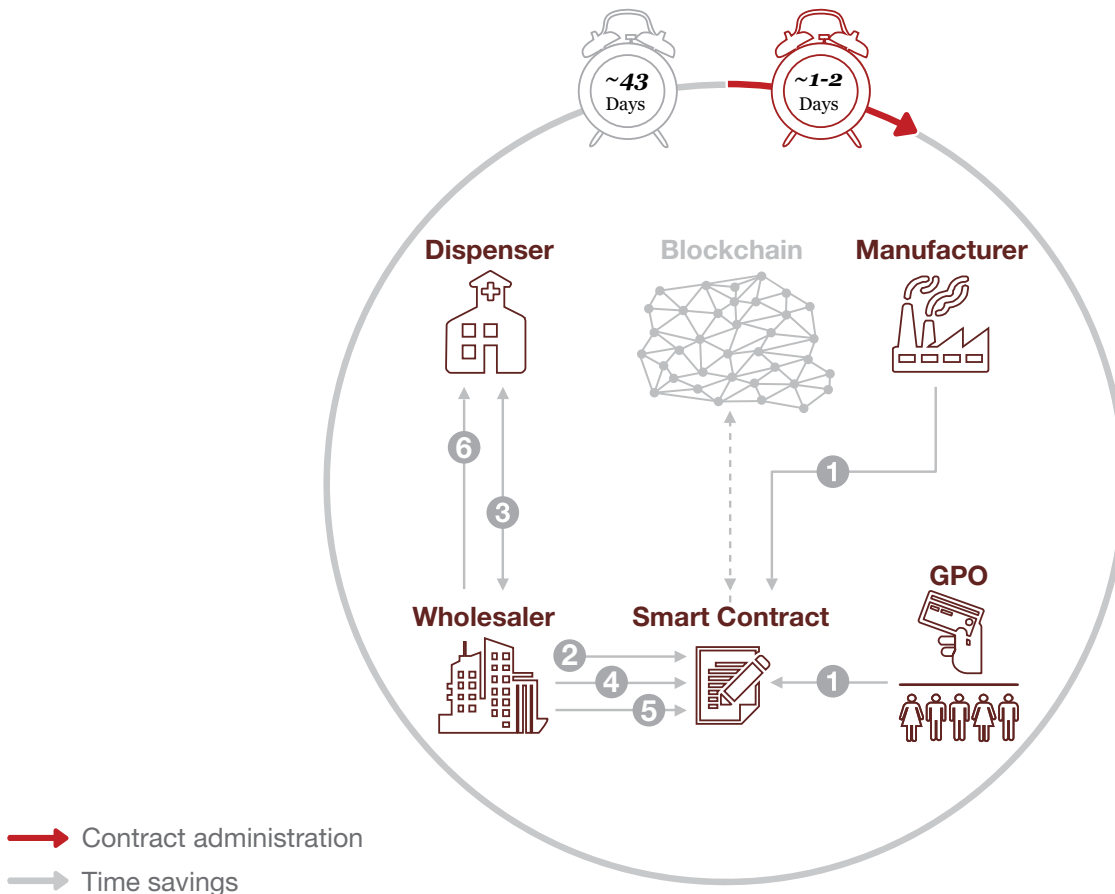
Figure 5:

Group purchasing organization (GPO) contract administration today

→ Contract administration
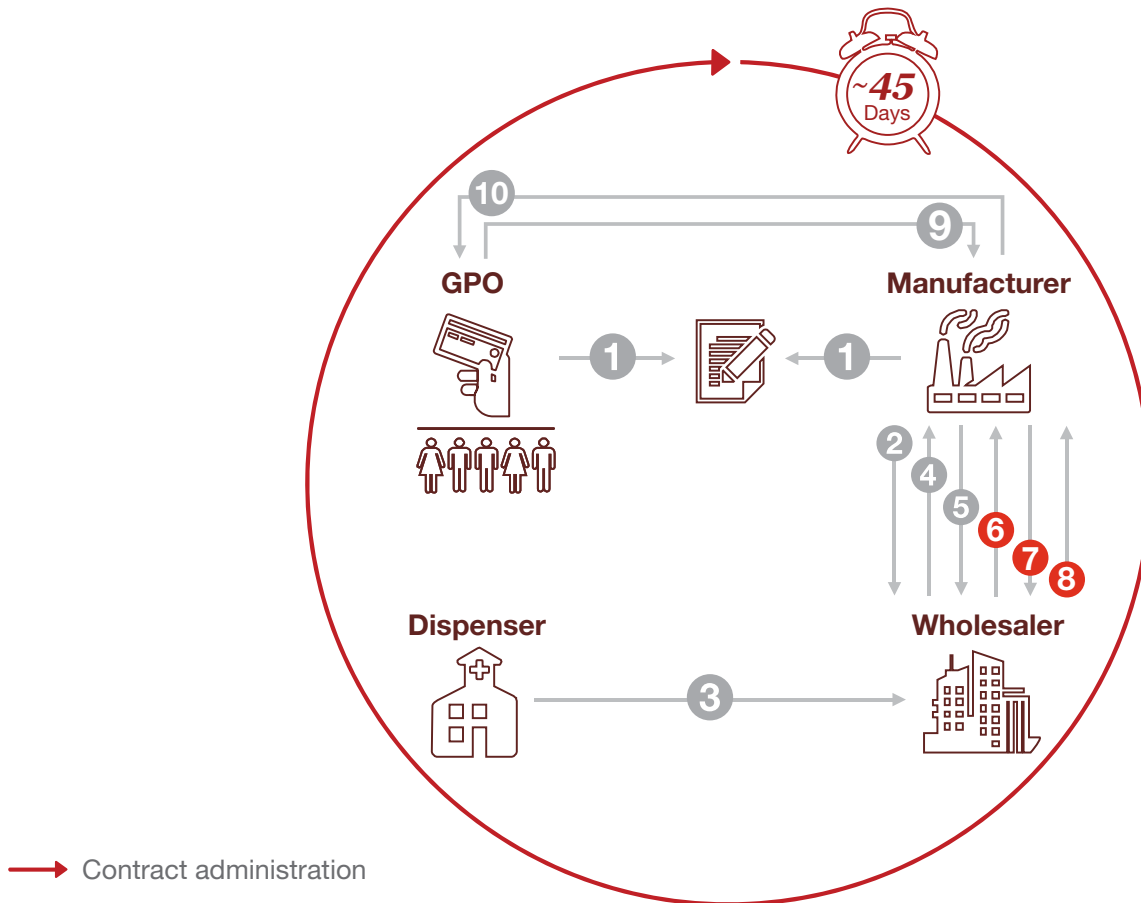
1. GPO and Manufacturer contract for discounted pricing

2. Manufacturer sends contract details to Wholesaler using electronic data interchange (EDI) document type 845 or 832

3. GPO member (e.g. dispenser) purchases product at contract price from Wholesaler

4. Wholesaler validates eligibility and allows purchase, then requests chargeback from Manufacturer (EDI 844)

5. Manufacturer adjudicates and reconciles chargeback request with contract data; Manufacturer issues chargeback payment or rejects chargeback (EDI 849)

6. Wholesaler resubmits chargeback data or disputes adjudicated transaction

7. Manufacturer readjudicates chargeback

8. Wholesaler and Manufacturer go to dispute resolution

9. Manufacturer calculates and pays GPO rebates and admin fees at end of quarter

10. GPO reconciles and acknowledges rebate and admin fee payments based on manufacturer data

Figure 6:

Group purchasing organization (GPO) contract administration with blockchain

Dispenser · **Blockchain** · **Manufacturer**

~43 Days · ~1-2 Days

Wholesaler · **Smart Contract** · **GPO**

→ Contract administration
→ Time savings

1. Pharmaceutical manufacturers and GPOs create and authorize a smart contract on the blockchain that contains membership and pricing information

2. Wholesalers with GPO membership are provided necessary permission to access the smart contract and transact using negotiated rates

3. Dispensers purchase product from the wholesaler at the contract price

4. Wholesalers pre-validate the sale using the smart contract to authorize the purchase

5. Wholesalers report and record the sale on the smart contract

6. Product is shipped to the dispenser

Provider and payer credentialing

A blockchain-enabled system would permit data relevant to the provider and payer credentialing process to be shared and updated in real time. Processes that take weeks or months could be accomplished in days.

A clinician who joins an office, physician network or hospital must first have his or her credentials—educational history, licensures, regulatory history and more—confirmed, which could require contacting more than a dozen entities and take months. Delays can lead to significant revenue losses.

The clinician also must be enrolled in a payer's network to accept insurance payments, which also takes months. During these waiting periods, the clinician earns little or no money for their employer or practice. This is not an uncommon occurrence. Physician turnover rates were about 7 percent in 2016, according to Select International Healthcare.[7] The New England Journal of Medicine has found that 25 percent of newly hired physicians leave within three years.

Those costs don't even take into account another system wide burden that blockchain could simplify: Credentialing and directory updates to list locations where a physician sees patients and whether a physician is enrolled with a certain insurer or is taking new patients.

This inefficient process is costly to providers and payers. The Council for Affordable Quality Healthcare estimates that payers spend more than $2 billion a year maintaining provider databases, 75 percent of which could be eliminated by establishing a single source of truth, such as a blockchain.[8]

Each physician in a practice submits an average of 18 applications for credentialing each year. That requires 80 minutes—including 69 minutes of staff time and 11 of physician time—per physician. Payers then spend time and money verifying these claims. The National Association of Medical Staff Services (NAMSS) estimates that most physician credentialing takes more than 120 days, while health plan enrollment takes 60 to 180 days.[9] For the purposes of HRI's analysis, we have adopted conservative estimates.

"If you're a larger healthcare provider or medical group, you may have contracts with three dozen or more health plans," said Robert Tennant, director of health information technology policy at the Medical Group Management Association, in an interview with HRI. "Imagine getting quarterly requests for information from these health plans to confirm that the directory information for each physician is up-to-date. Some of them send these requests by email; others by letter. Every one of them looks different. These providers want to treat patients—they don't want to sit around and fill out the same information over and over again."

Blockchain could simplify this process by allowing one update to reach multiple payers, Tennant told HRI.

Patients often suffer from lack of access to complete, up-to-date information regarding which physicians are covered by their health plans. NAMSS estimates that 12 to 18 percent of provider directories are out of date or incorrectly list a provider as participating in a plan.[10]

Regulators, too, desire accuracy in provider directories. A recent CMS audit of Medicare Advantage online provider directories found that 52.2 percent contained inaccuracies.[11] According to CMS' 2019 call letter, it will begin taking enforcement actions against some Medicare Advantage organizations that don't correct serious provider directory deficiencies.[12]

Figure 7:

Payer/Provider credentialing today
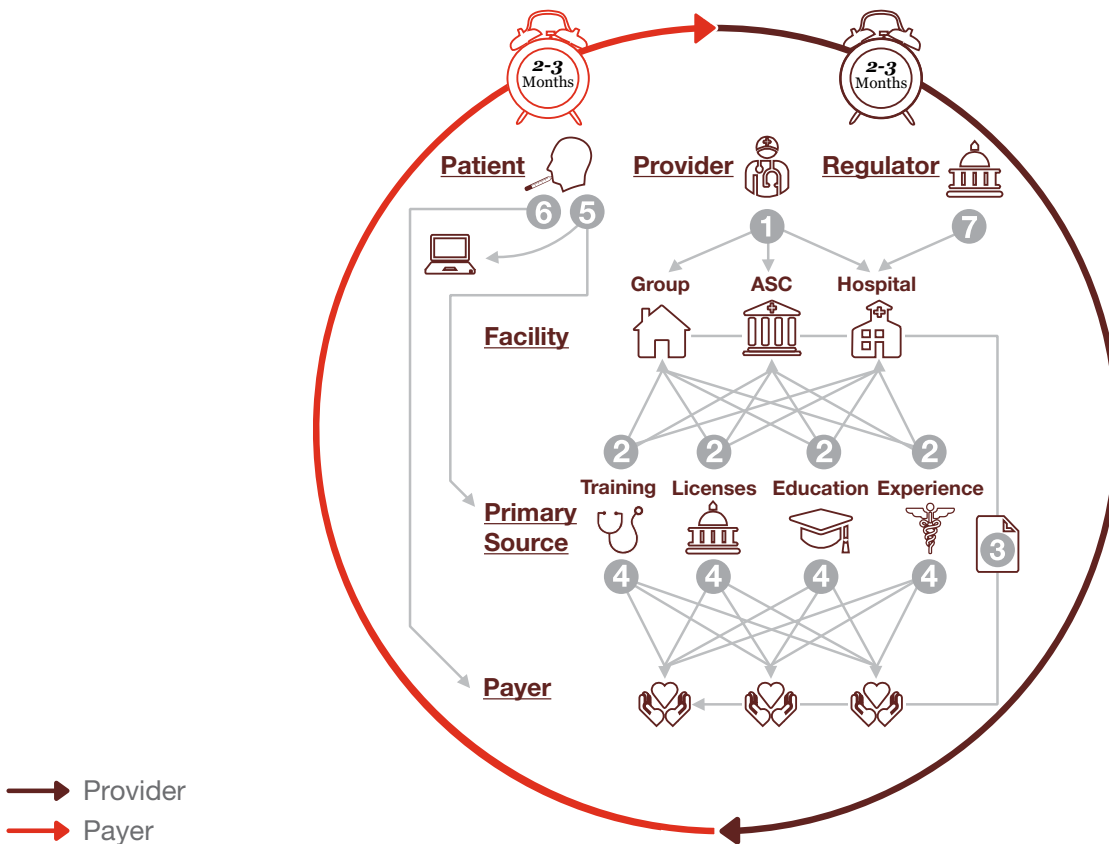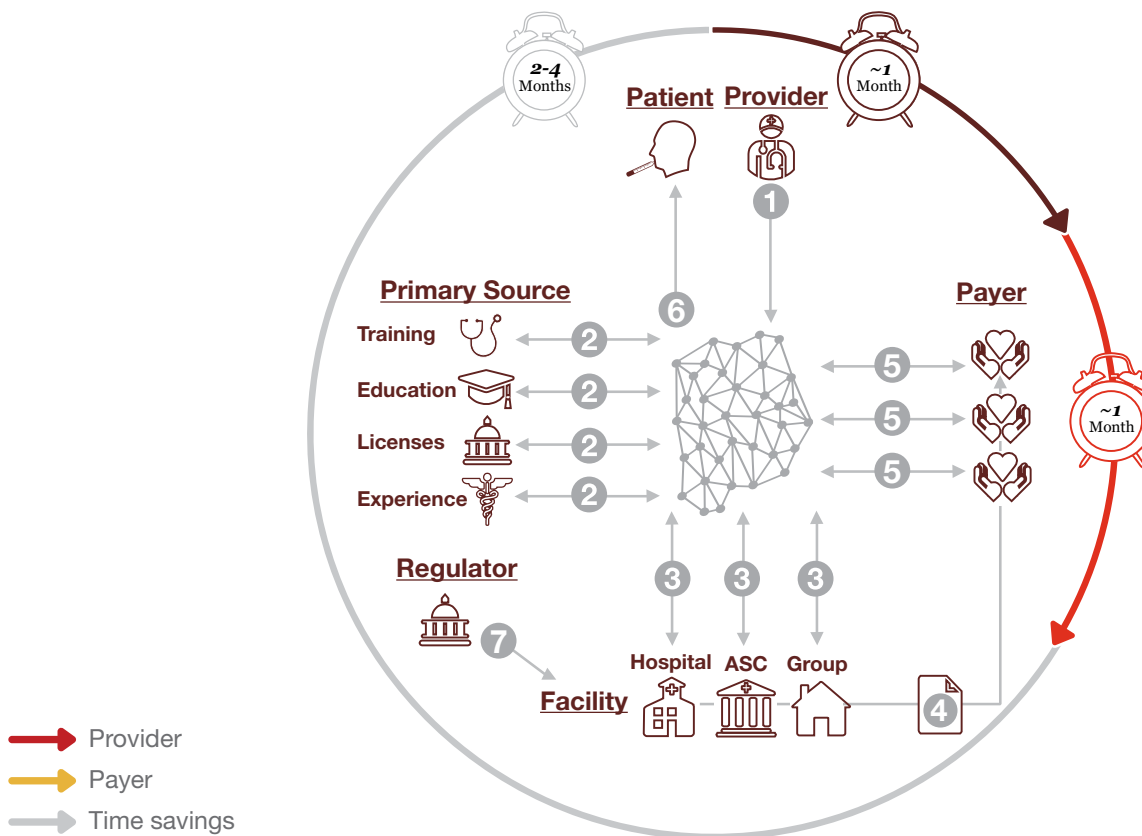

Provider Credentialing

1. Provider/health professional submits background information (i.e. educational history, certifications, licenses, malpractice insurance, etc.) to health facility (i.e. hospitals, ambulatory surgical centers, physician groups)

2. Medical staff or contracted 3rd party verifies data with primary source (i.e. educational institutions, hospital programs, state licensure boards, CMS and drug control agencies) and accepts or rejects the provider based on finding

Provider Credentialing

3. If accepted, the enrollment application is submitted to the payers

4. Payers verify data with primary source and either accept or reject the application based on finding

5. Patient checks various internet sources or accessible primary sources to verify provider background

6. Patient contacts the payer to verify that the provider is in-network

7. Government regulators periodically audit provider credentialing processes

Figure 7:

Payer/Provider credentialing today

Provider Credentialing

1. Provider/health professional uploads background information (i.e. educational history, certifications, licenses, malpractice insurance, etc.) to the blockchain

2. Primary sources authenticate provider background information in the blockchain

3. Health facilities verify provider data on the blockchain using primary source verification, and accept or reject the provider, uploading the result to the blockchain

Provider Credentialing

4. If accepted, the enrollment application is submitted to the payers

5. Payers verify data via the blockchain using primary source verification and either accepts or rejects the application, uploading the result to the blockchain

6. Patient verifies that the provider is in-network and has necessary credentials using blockchain

7. Government regulators periodically audit provider credentialing processes

Moving ahead on blockchain, together

While 49 percent of healthcare technology executives surveyed by PwC in its 2018 global blockchain survey said their companies were developing blockchain solutions, many also said they understood they would need to work through challenges on the way to implementation.[13]

A blockchain involves multiple participants and no single owner. Constructing a governance structure agreeable to all parties can take time and effort. Forty-three percent of technology executives at companies surveyed by PwC said their ability to progress further with blockchain had been hindered by a lack of governance structure.[14]
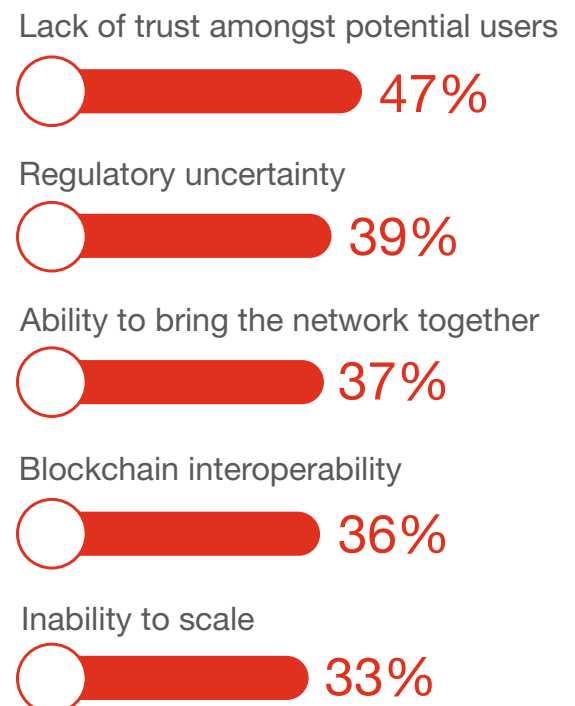
Data sharing can be inherently difficult for healthcare companies. Just 29 percent of payers and providers have executed data-sharing agreements regarding cybersecurity, and 36 percent have developed access-management policies, according to PwC's 2017 Global State of Information Security Survey.[15] And that's for an obvious use case—cybersecurity—that is well-understood and can represent an existential threat for companies.

Companies interested in blockchain should think about how data would be handled, shared and structured. A data architecture that works for one company may not work for another partner, so thought also should be given to data interoperability—and how multiple blockchains might need to work together in the future. And because data is encrypted, a company that loses an important password might place itself at risk of catastrophic data loss.

Figure 9:

Trust and uncertainty are limiting the growth of blockchain – for now

Which of the following will be the biggest barriers to blockchain adoption in your industry in the next 3-5 years?

Lack of trust amongst potential users

47%

Regulatory uncertainty

39%

Ability to bring the network together

37%

Blockchain interoperability

36%

Inability to scale

33%

31%
Of companies told PwC that cost was the primary reason their organization had not progressed further with blockchain.

Source: *PwC Global Blockchain Survey, 2018*. 74 healthcare companies. Percent of respondents ranking issue in top 3 choices.

Companies also require expertise to implement blockchain projects, and that expertise is scarce. Sixty-one percent of healthcare companies reported their blockchain projects were challenged by a lack of appropriate blockchain skills on the team.[16]

But despite these hurdles, there are some indications that blockchain development could become easier as the technology becomes more commonly used in the healthcare industry.

One company working to advance the technology is Health2047 Inc., a healthcare venture formed by the American Medical Association to commercialize solutions to several major healthcare problems, including data liquidity.

"If we curate a blockchain platform that allows others to work on it and with it—that has a development platform and toolkit that goes with it—that will make a big difference," said Charles Aunger, managing director at Health2047, in an interview with HRI. "Right now, companies need to create a lot of the basic infrastructure themselves. I don't know many companies who actually want to create and run blockchain infrastructure. They want to run applications on top of blockchain."

Once that infrastructure is in place, "the end result will be greater amounts of disruption since the technology is more accessible," Aunger added. "When it's accessible, more people will build on top of it."

Larger healthcare companies may accelerate this process if they adopt a particular approach, which could push their suppliers, partners and customers to buy into that same infrastructure and develop a complementary ecosystem. These actions could be crucial given a lack of trust among participants today.

How to implement a blockchain in healthcare

Ultimately, blockchain should be thought of as part of an overall technology strategy in which it is one piece of a larger transformation. Companies shouldn't just have a hammer—blockchain—and be in search of a nail. They should give ample thought to the motivation behind an implementation. Some companies may be reluctant to upgrade a healthcare system that works adequately, if sub-optimally, to a blockchain-based one that works great and delivers stronger results.

One helpful way for companies to start thinking about blockchain in their business is with a question: What is the smallest, clearest case for a blockchain in their business or industry?

Healthcare organizations should use that case to find partners, work out technological issues and solve specific business problems. Some companies can start internally, working to replace existing processes and inviting trusted third parties to improve those processes.

They also should consider how their competitors might use blockchain and consider jump-starting efforts if they haven't already. In some cases, other technologies may be more cost-effective and beneficial depending on the necessary applications.

Thirty-four percent of healthcare executives told PwC that they determined blockchain was sometimes or often the wrong technology for the project for which it was tested, and 52 percent said they determined the effort didn't justify the results.[17] Companies should consider the infrastructure they will have to build to support each blockchain, in addition to the blockchain itself.

The biggest hurdle to implementing blockchain may be finding suitable partners. In most traditional business transformations involving technology, a company needs only itself to start building. In the case of blockchain, multiple partners are often necessary. Those partnerships don't form overnight; they require trust, alignment of objectives and a willingness to work together. Healthcare companies may benefit from using existing third parties, such as collaborative industry trade bodies or consortia, to build out neutral infrastructure.

Scaling a use to all partners can be very challenging, especially in industries that have thousands of participating companies, such as product distribution or care delivery. It also can be challenging given the legal and regulatory risks of a particular subsector. Blockchains must be set up in a way that permits auditing and prevents price-fixing while still adding value. They also should be set up with the knowledge that new entrants may wish to join a blockchain consortium in the future. Companies should consider the rules governing their blockchain to ensure they don't create incentives for anti-competitive behavior.

Companies also should consider the infrastructure needed to implement and run the blockchain so that smaller entities aren't frozen out by large start-up or data maintenance costs. In the healthcare supply chain, where more than 4 billion prescriptions are dispensed each year, the amount of data stored on the ledger could be especially daunting.[18]
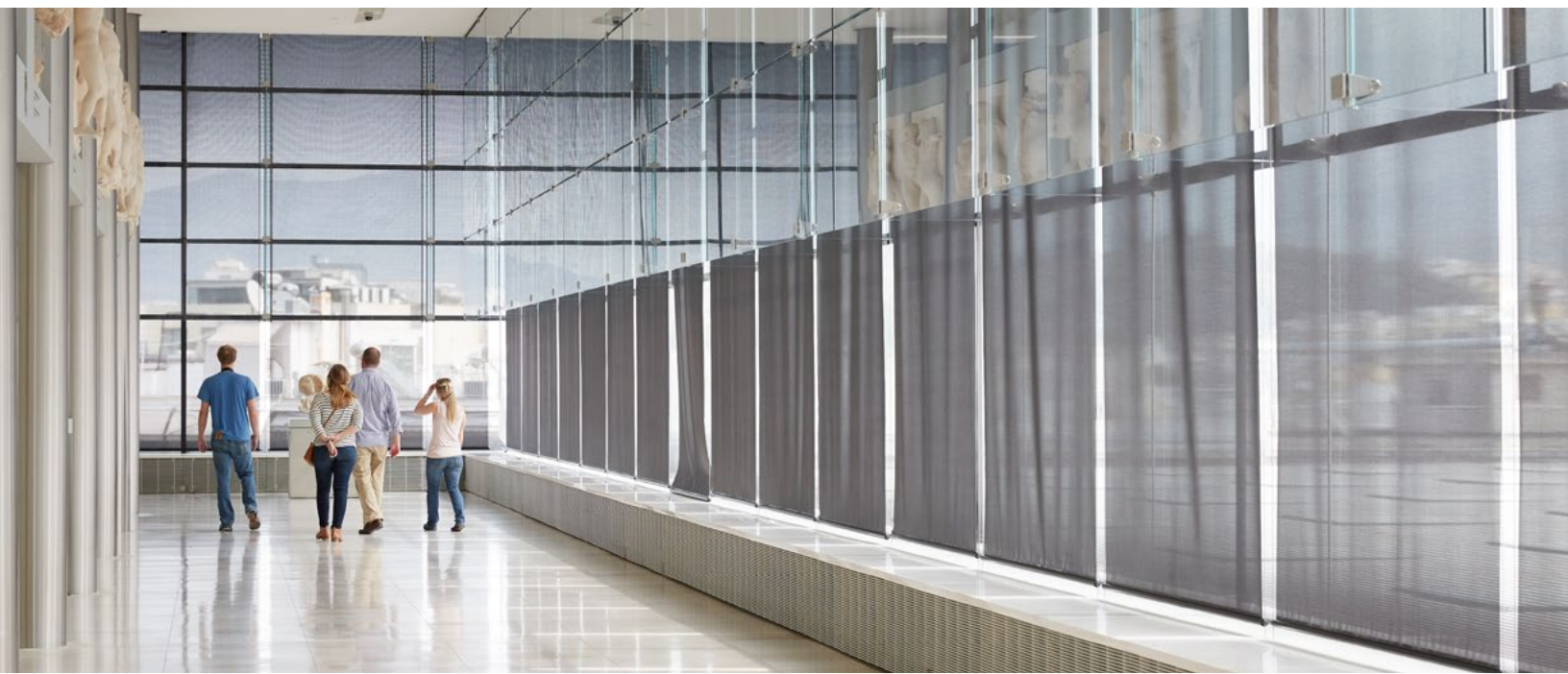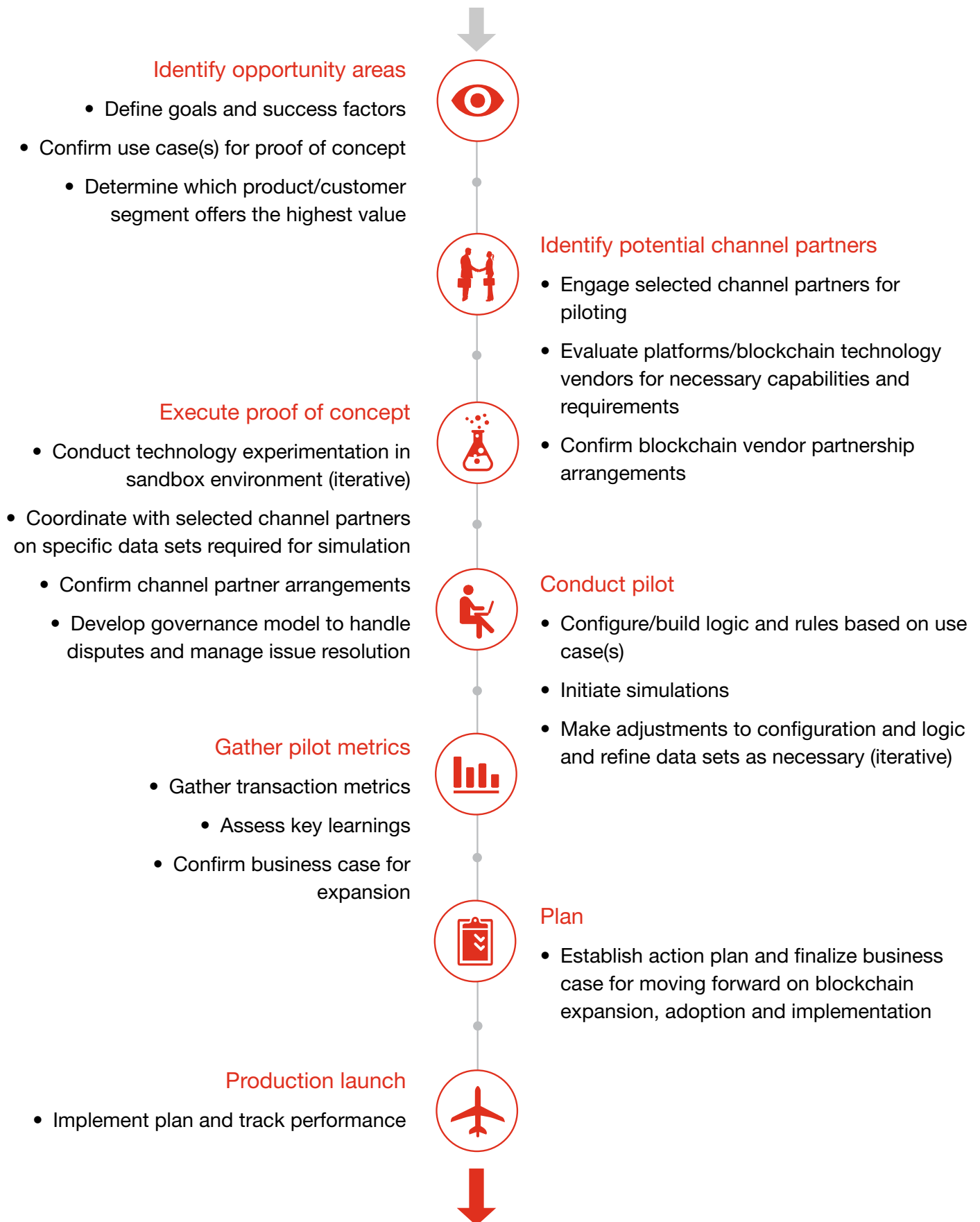
Figure 10:

Journey to a successful blockchain implementation

Identify opportunity areas

- Define goals and success factors
- Confirm use case(s) for proof of concept
- Determine which product/customer segment offers the highest value

Identify potential channel partners

- Engage selected channel partners for piloting
- Evaluate platforms/blockchain technology vendors for necessary capabilities and requirements
- Confirm blockchain vendor partnership arrangements

Execute proof of concept

- Conduct technology experimentation in sandbox environment (iterative)
- Coordinate with selected channel partners on specific data sets required for simulation
- Confirm channel partner arrangements
- Develop governance model to handle disputes and manage issue resolution

Conduct pilot

- Configure/build logic and rules based on use case(s)
- Initiate simulations
- Make adjustments to configuration and logic and refine data sets as necessary (iterative)

Gather pilot metrics

- Gather transaction metrics
- Assess key learnings
- Confirm business case for expansion

Plan

- Establish action plan and finalize business case for moving forward on blockchain expansion, adoption and implementation

Production launch

- Implement plan and track performance

Final thoughts

The introduction of blockchain technology into the healthcare industry won't occur overnight, nor will many of its benefits be immediately realizable. Rather, major transformations begin with small steps.

Those steps offer healthcare companies an opportunity to consider the short- and long-term disruptive potential of blockchain before it disrupts them first.

Blockchain will be disruptive, but that disruption in healthcare won't affect all companies equally. Companies should determine how blockchain might affect their operations and those of their partners. The greatest impacts are likely to be felt by intermediaries, including those who check, transfer, process or hold data for other healthcare companies. Blockchain has the potential to develop from a fringe technology into a major protocol for healthcare ecosystem players to record and communicate transactional information.

In some sectors, disruption of the status quo is already underway, and companies have just a few years before full-scale blockchain implementations begin to appear on the market. Though a first-mover advantage isn't as big of a consideration, since an ecosystem-level approach is needed to implement blockchain, first movers will be able to set the standards by which data will be transferred, shared and checked, and will be better suited to move quickly to recognize efficiencies when that ecosystem is established.

Endnotes

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[13] PwC global blockchain survey. May 2018. 74 healthcare respondents. "Which of the following will be the biggest barriers to blockchain adoption in your industry in the next 3-5 years?"

[14] PwC global blockchain survey. May 2018. 74 healthcare respondents. "Which of the following will be the biggest barriers to blockchain adoption in your industry in the next 3-5 years?"

[15] PwC. The Global State of Information Security Survey 2017. October 2016. "Does your organization formally collaborate with others in your industry, including competitors, to improve security and reduce the potential for future risks?" "Which of the following activities has your organization completed related to external data sharing?"

[16] PwC global blockchain survey. May 2018. 44 healthcare respondents. "For your organisation's blockchain projects, have you faced any of these challenges?"

[17] PwC global blockchain survey. May 2018. 44 healthcare respondents. "For your organization's blockchain projects, have you faced any of these challenges?"

[18] Kaiser Family Foundation. "Number of retail prescription drugs filled at pharmacies by payer." 2018.
https://www.kff.org/health-costs/state-indicator/total-retail-rx-drugs/

About this research

In addition to the original research contained within the paper, PwC's Health Research Institute also relied upon survey data collected as part of PwC's 2018 Global Blockchain survey. The surveyed was fielded April through May 2018 and included 600 respondents from 15 territories. Respondents were business executives with technology responsibilities. Reflective of the distribution of respondents globally, 31% work in organizations with revenues of $1 billion or greater.

About the PwC Health Research Institute

PwC's HRI provides new intelligence, perspectives and analysis on trends affecting all health-related industries. HRI helps executive decision-makers navigate change through primary research and collaborative exchange. Our views are shaped by a network of professionals with executive and day-to-day experience in the health industry. HRI research is independent and not sponsored by businesses, government or other institutions.

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Special thanks