# Crowdsourcing Healthcare Provider Directory Maintenance

Humana          EY Building a better working world

## Preface

This piece of thought leadership is the culmination of work done by Humana and EY during fall 2017, and puts forth an aspirational vision of the future of provider data management by leveraging blockchain technologies to improve provider data quality. After this work was completed, Humana, Multiplan, Quest Diagnostics and UnitedHealth Group's Optum and UnitedHealthcare announced the creation of an alliance to explore the use of blockchain for provider data management.  This document is intended to highlight ideas for further discussion by the alliance, and more broadly, for the healthcare industry.

Our age of anxiety is, in great part, the result of trying to do today's job with yesterday's tools.

— MARSHALL McLUHAN

**CHAPTER 01**

# Executive Summary

The United States spends a staggering $2.1b annually across the healthcare industry chasing and maintaining provider data. Industry estimates indicate that 75 percent of that cost is duplicative.[1] Even with the effort expended, health insurance companies and claims payors that administer health plans (both referred to in this paper as plan administrators), along with many other industry actors, are unable to maintain high-quality data in their individual data silos or via small partnerships. The resources devoted toward maintenance of accurate provider data and, specifically, the related routine administrative activities known as *provider data management (PDM),* represent a persistent and widespread example of the inefficiency and waste in healthcare.

*Provider directories* provide health plan members a narrow slice of provider data, allowing members to search for "in-network" physicians whose services are covered by members' respective health plans. Roughly half of provider records listed in directories have at least one error in demographic data,[2] and coincidentally, half of provider records experience a change in 18 months.[3]  Industry-wide data quality issues have drawn the attention of regulators like the Centers for Medicare and Medicaid Services (CMS), which has resulted in new audits and sizeable penalties. Today, plan administrators work independently to curate provider data for directories. Despite providers being "in-network" for multiple health plans, each plan administrator individually maintains provider data, duplicating PDM efforts for the provider networks they offer to customers. However, for a number of reasons – both economic and consumer-experience-driven – plan administrators are becoming more willing to collaborate with their competitors both to increase internal efficiencies of performing PDM services and to increase quality of provider directories for plan members across the industry.

This paper explores how a *crowdsourced provider data marketplace* could enable plan administrators and third-party data sources to improve the quality of provider data. In this approach, to more efficiently distribute the effort and cost, duplicative efforts are replaced by crowdsourcing the curation of directory data.

Marketplaces have disrupted status quo and delivered value and efficiencies to customers in every industry, including healthcare. We now have the technical capabilities to apply a marketplace model to PDM. Core components of blockchain technologies, such as distributed ledgers and smart contracts, elegantly afford market exchanges of data, connecting all participants like buyers and sellers in digital markets. These components have potential to address current friction points, including inefficient data sharing and lack of standards, through transparency and openness, simplifying collaboration for marketplace participants.

Provider data maintenance is a reasonably low-risk, but impactful, place to start testing a *blockchain-powered* healthcare data marketplace which, if successful, could provide the technical foundation and learnings for more sensitive types of data to be exchanged. Now is the time for companies across the healthcare industry to explore how we can collaborate to "free the data" from the silos where it is currently held captive.

1. CAQH
2. CMS, 2017
3. Enclarity

**CHAPTER 02**

# Introduction to Provider Data

Because provider directories play a large role in the patient experience, health plans are required by state and federal mandates to publish directory data and maintain its accuracy.

One of a health plan member's most common interactions with his or her plan is searching its provider directory for a doctor or other type of healthcare provider who is participating in the plan's network. In fact, outside of signing up for coverage, the provider search is often a member's first interaction with their health plan. Provider directories tell a member not only whether a certain provider is "in-network," but also location, contact information and details about the provider's specialty. These important details make the directory a usual starting point for an insured patient who wants to schedule an appointment with a physician.

Because provider directories play a large role in the patient experience, health plans are required by state and federal mandates to publish directory data and maintain its accuracy. This function, commonly referred to as provider data management (PDM), is a source of significant cost and effort for plan administrators. While most administrators have an internal PDM function tasked with performing outreach to providers for the purpose of verifying directory data, many also outsource aspects of maintenance and purchase provider data from third parties. Still, success of maintaining accurate directories is limited.

In 2016, the Centers for Medicare and Medicaid Services (CMS) reviewed 54 Medicare Advantage organization (MAO) provider directories, auditing one-third of firms selling Medicare Advantage health insurance products. The review of a sample size of 5,832 directory entries revealed that 45 percent of the directory entries had at least one error. In response to these audit results, CMS announced a plan for follow-up reviews with penalties of up to $25,000 per beneficiary, i.e., the member of the health plan being administered, per day.[4] While not every plan administrator is an MAO, the CMS guidance sets the standard for the industry. A second round of reviews was completed by CMS between September 2016 and August 2017. Despite the threat of penalty, MAO directory accuracy had actually decreased year over year, with 52 percent of provider locations listed having at least one inaccuracy.[5]
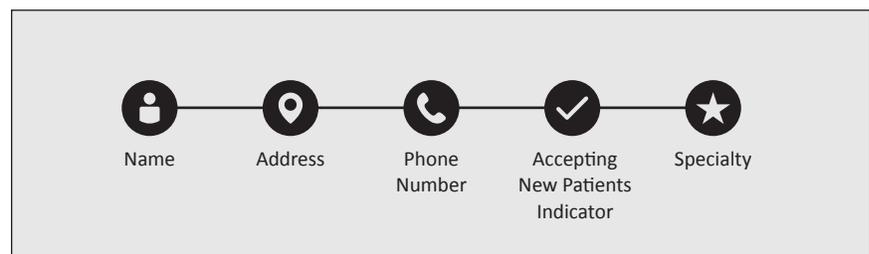


**Figure 1:** Provider Data Attributes Listed by CMS

## Cost and Effort of Maintenance

Despite providers maintaining affiliations with an average of 17 to 20 health plans at a given time, plan administrators rarely collaborate with one another to perform PDM activities.[6] This results in the duplication of maintenance costs and efforts across the industry. Today, each health plan maintains its own source of truth, and directly or indirectly performs duplicative provider outreach to verify the data and/or purchases updated data from a third party. The costs associated with these efforts can be quite high:

01    **Outreach is Time Consuming**
The process of performing outreach and collecting attestation to verify provider information takes between 20 and 40 minutes per provider.[7]

02    **Maintenance is Costly**
Assuming a conservative $12 average cost per provider per year for a health plan with 500,000 providers in the plan's network, the annual projected cost of simply maintaining provider data is $6 million.

03    **Value of Attestation Erodes**
Unfortunately, because provider demographics change frequently, the value of each attestation erodes over time.

The duplicative costs and efforts are certainly a result of the plan administrators' obligation to maintain an accurate directory (and the desire to limit liability in terms of fines for the data being inaccurate), but are also influenced by competition and technology limitations. Currently, there is no easy way for plan administrators to collaborate on the maintenance of a single record, and no set of attestation or outreach standards that would allow a plan administrator to trust another administrator's maintenance efforts.

## Data is an Asset

In financial accounting, an asset is an economic resource, or anything tangible or intangible that can be owned or controlled to produce value. Data, by definition, is an asset, and the business models of some of the most profitable companies in the world are built upon data being commoditized and sold.

For many plan administrators, provider data is seen as, at best, a requirement and, at worst, a liability. Managing provider data is a necessary component to support many enterprise functions, including provider directories and claims processing; it has never been a revenue-generating function for most administrators. The focus has been on the management of the data, and specifically, its associated cost. An industry marketplace for provider data could flip this dynamic, turning a function traditionally viewed as a cost center into a revenue opportunity – an asset.

### SHELF LIFE

The value of provider data erodes over time. Data records validated most recently will be deemed the most accurate, and therefore are most valuable. Unfortunately, the value of validation or provider attestation decreases over time as the data erodes due to changes in provider information. The more time between validations, the less valuable a record is likely to be in the market. This unique characteristic of provider data lies at the core of its quality problem.

6. Availity
7. Enclarity

**CHAPTER 03**

# Approach for a Crowdsourced Provider Data Marketplace

To address the redundant maintenance and resulting overall high cost of maintaining provider data, Humana began exploring opportunities to crowdsource aspects of the PDM function. In 2017, Humana began exploring ways in which health plans could maintain provider data collaboratively using a ***crowdsourced provider data marketplace*** to reduce the cost and effort required by individual actors across the healthcare industry. During this exploration it became clear that a wide spectrum of incentive models exist for crowdsourcing, ranging from altruistic to a dynamic data market.

Given the competitive dynamic among plan administrators, properly aligned incentives will likely be key to adoption of a crowdsourced approach. We expect incentive mechanisms could become more sophisticated over time, but the ***altruistic model***, as exemplified by Wikipedia, seems to be a good starting point. The altruistic model allows participants to share all of their data and provides them the opportunity to learn how the collective data set can be reconciled into "golden records." Later, ***incentivized crowdsourcing***, in which participants extracting data (buyers) are required to pay the participants sharing that information with the network (sellers), will be a step toward sustainability. At first, incentives could be very simple, with a set cost for extracting data and payment for adding valuable data. Note the key word is valuable, because not all data shared with the network will be accurate. Once incentives are introduced, participants will be acting as data buyers and sellers, leading potentially to a dynamic data market. This dynamic market would allow for both real-time price adjustment and granular pricing of specific data attributes to account for differences in value, such as the fact that a phone number may be worth more than an address.

Two main challenges exist when starting with an altruistic model. First, participants must understand which market participants are adding value to the network and which are extracting value, and each will need the ability to contribute and extract as they see fit. Second, the logic needed for determining a golden record among a vast set of currently low-quality data is very complex and, at this point, aspirational.

These challenges have guided Humana to focus first on incentivized crowdsourcing, as to allow test and learn efforts to inform creating a sustainable approach that tracks how participants add value, extract value and make buying decisions for records they deem valuable. The initial provider data set curated by the early adopters will be small so as to limit scope and enable taking meaningful small steps forward. The data set will likely include only critical demographic data elements for each provider, including name, NPI (National Provider Identifier), office location(s), phone number and new patient acceptance status. A more complex data set will then be incorporated over time.
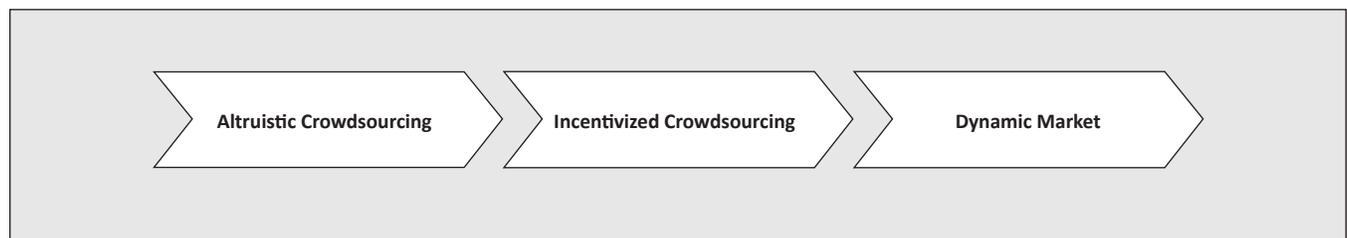


**Figure 2:** Incentive Spectrum

Introducing incentives reveals clear buyers and sellers for each transaction, opening the door to a dynamic data market.

## Sustainability May Depend on Incentives

For collaboration to be successful long-term, incentives are often necessary to motivate the desired behavior of participants. Plan administrators conceivably could share provider data altruistically; however, relying on volunteer sharing overlooks the fact that market participants are competitors that have individually invested significant resources to curate the data they possess. Because many participants may not be willing to share data for free, a collaborative approach could consider incentives to compensate for the value participants provide to the market, and to pay for the value they extract from it. Introducing incentives reveals clear buyers and sellers for each transaction, opening the door to a dynamic data market. These market dynamics provide an equitable arrangement for all participates.

Providing incentives to participants for curating provider directory data creates a multisided market. *Figure 3* shows the multisided market progression, with plan administrators and key industry stakeholders partnering on at the top level of the market to share the burden of data maintenance, while actors on the lower side of the market compete for the rewards buyers offer. This provides the industry with a mechanism for sharing costs for data in which they are mutually interested, and enables them to dynamically adjust incentives to encourage firms with PDM capabilities to improve data quality. The result is that costs are driven down for the data consumers, e.g., health plans, and quality improves because sellers are competing for the rewards.
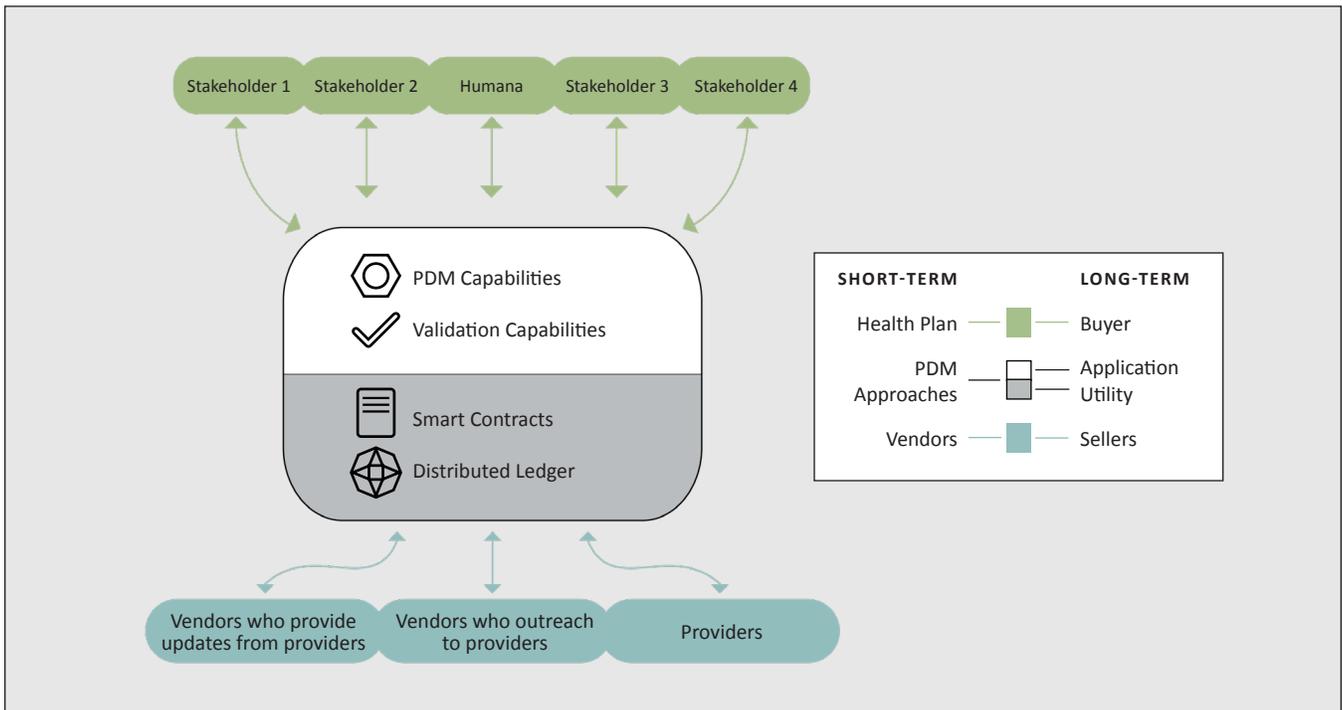


**Figure 3:** Multisided Market Progression

# Free-market forces enable an evolution among market participants.

## The Larger Vision: A Dynamic Data Marketplace

Humana's initial steps toward a collaborative, crowdsourced PDM approach are in furtherance of a larger vision: *a dynamic data marketplace*. The current ecosystem for provider data displays many of the hallmark pre-marketplace characteristics: inefficient distribution of efforts and resources, minimal competition and poor quality.

Marketplaces have thrived in ecosystems where access to goods or services was traditionally controlled by a few large players and the barrier to entry was high. When buyers and sellers are brought to a single location (or platform), the laws of competition expose inefficiencies and misaligned incentives, and ultimately force the providers of those goods and services to become more efficient (and usually, cheaper) or risk losing market share. Inevitably, free-market forces enable an evolution among market participants. Efficient, large suppliers are able to compete on quantity and price, while smaller suppliers compete on specialization and quality. In a marketplace ecosystem, the PDM function will change from a cost center to a revenue-generating function for some, and data will become an asset that is bought and sold based on the price and reputation of the supplier and buyer demand.

## Market Participants

The dynamic data marketplace includes three primary participants. The marketplace will consist of **buyers** and **sellers**. In addition, because the accuracy of the data being purchased is inherent to its value in the market, a third participant, the **validator**, provides a necessary "check and balance" in the ecosystem.

### TRANSACTION PROCESSING

*Transaction processing* will be the shared responsibility of market participants. In the near-term, the initiative's early entrant ("founding") health plans will assume this responsibility and act as the **miner**, which simply means supporting the infrastructure but may include receiving fees to cover the cost of the platform, should that be needed for sustainability.

PRIMARY PARTICIPANTS

### The Buyers

The majority of the **buyer** market for provider data will be made up of plan administrators and other firms that need to maintain accurate provider information. Buyers can make standing offers to the seller market to purchase data for the providers in their respective networks. The standing offer will define the provider data being requested (complete or individual data fields), the price the buyer is willing to pay and specific data validation requirements. When a buyer's offer is accepted by a seller, the seller transmits validated data to the buyer and collects the stated fee.

### The Sellers

The **seller** market will be made up of plan administrators primarily, but also existing third-party data providers (e.g., clearinghouses), as well as potentially new market entrants possessing an inventory of data that can be packaged and sold. When a seller exercises a standing offer, should its data pass the validation process, the seller collects the stated fee and transmits the data to the buyer.

### The Validators

**Validators** will consist of entities or individuals willing to verify that the data being offered by a seller is accurate. For the short-term, verification is likely to be accomplished using traditional methods: outreach via phone and fax or, if a validator has a platform used by providers, online attestation. A validator will attach its own attestation to the data and collect a validation fee prior to the data being transmitted to the buyer.

**See Figure 4 for an example of the market-place transaction life cycle.**

| ACTORS | STEP 1 | STEP 2 | STEP 3 | STEP 4 |
|---|---|---|---|---|
| **Buyer** HUMANA | *Shares Truth* -2 Coins | | | *Pays Rewards* -72 Coins |
| **Seller** VENDOR A | *Reads Truth* Free | *Proposes Update* -2 Coins / *Pays Escrow* -20 Coins | | *Collects Reward* +50 Coins / *Retrieves Escrow* +20 Coins |
| **Validator** VENDOR B | | | *Validates Record* -2 Coins | *Collects Reward* +20 Coins |
| **Miner** | *Records Action* +2 Coins | *Records Action* +2 Coins | *Records Action* +2 Coins | *Records Action* +2 Coins |

*Steps in a Successful Flow*

1. **Buyer** (Humana) shares latest provider demographics (Truth) as well as a reward for A) the firm who finds an issue or suggests an update (Seller) and B) the firm who validates the proposed update. This information is shared with participants via "writing to the shared ledger" so there is no minimal cost paid to the miner for supporting the infrastructure.

2. **Seller** finds the data quality issue and proposed an update. This seller could be anyone seeking the reward. Note that the validation cost would be put into escrow and in the event the update is incorrect that cost would be paid by the Seller.

3. **Validator** reviews the proposed update and decides if the record does in fact require an update and then the reward is paid by the Buyer. The Validator could be the Subscriber (Humana) or some set of trusted third parties looking to obtain the reward. This part of the process would likely be automated as the process matured.

4. **Buyer** pays the Validator and the Seller for their contributions to the process. The Buyer then has an opportunity to share an updated provider demographics (Truth) as a new standing offer to restart the process for a future update when made available.

**Figure 4:** Example Marketplace Transaction Flow

# Why Blockchain?

Blockchain technologies have the unique ability to distribute ownership of the approach to the participants, which eliminates the need for a central intermediary. This shared ownership is highly desirable to competitors looking to collaborate. The advantages of blockchain technologies shared below make them particularly suited to support distributed data marketplaces:

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**An expanded discussion of the benefits provided by blockchain technologies is available in Appendix A.**

## 01
### *Encourages a Network Effect*

Blockchain approaches share ownership and require a network effect to thrive and deliver value. This means that the value of the approach to the participants is relational to the number of participants. The participants have an ownership role and benefit from its success. This intrinsic network effect encourages the industry to work together, because a single shared approach is more valuable than competing disconnected approaches.

## 02
### *Standardization*

Blockchain technologies impose data and transaction standards on participants, which creates rules of the road. This has significant benefits in terms of interoperability because every participant is now able to benefit from shared roads. These blockchain-powered "shared roads" distribute data and logic. The standardization of logic via smart contracts enables participants to transact with one another and, in most cases, automate aspects of the transaction.

## 03
### *Transparency*

Data recorded on a blockchain is distributed to all participants (with some exceptions). While this requires participants to be careful with the data they are sharing, it makes it easier for plan administrators to collaborate on the maintenance of less sensitive information, like provider directory data.

Absent innovation in current maintenance practices, the PDM function would be expected to become more centralized, all but ensuring that the current poor quality and high cost structure will be maintained.

## Trust and Credibility

One useful and, some would argue, necessary element of a successful marketplace is the ability of market participants to establish a reputation. In popular marketplaces for consumer products, reputation is established through customer reviews and ratings. With increased competition for sellers and increased optionality for buyers, reputation, particularly over time, becomes a competitive advantage and key differentiator for market participants.

Given the low quality of provider data today, the marketplace participants will likely be more comfortable initially with data that has been validated through traditional outreach, thus participants will probably continue to engage in traditional internal quality control in the short term. Over time, however, we expect buyers in particular to rely more heavily on a seller's reputation for accuracy, and rely less on validation or internal quality controls. The desired effect is that the aggregated maintenance effort across the industry decreases and becomes concentrated with the few sellers that demonstrate a knack for providing the highest-quality data. As a result, sellers with the best reputations could reap the reward of controlling more market share. Reputation can have an effect on price as well. Sellers with more credibility could, in theory, demand a higher price. Ultimately, a reputation mechanism imposes accountability. Participants providing high-quality data will be rewarded, and those providing low-quality data will be penalized.

### SPECIALIZATION ("LONG TAIL")

Today, most plan administrators have agreements with one or more of the industry's limited number of vendors specializing in PDM services. Plans are contractually obligated for services from the vendor(s) for a period of time (perhaps one year), and receive a significant portion of their provider data updates from these PDM vendors. Absent innovation in current maintenance practices, the PDM function would be expected to become more centralized, all but ensuring that the current poor quality and high cost structure will be maintained. In particular, one practice perpetuated by long-term vendor agreements is the buying of provider data at the "form" level (i.e., all relevant data fields in the aggregate). The quality of data at the form level is normally mixed, with some sources being very good at specific attributes. For example, one vendor may have very-high-quality phone numbers while another is better providing high-quality addresses.

In the marketplace model, long-term agreements and "form" level maintenance are replaced with per-record agreements and "field" level maintenance. Sellers will be encouraged to specialize in specific data attributes, such as geographic location, provider specialty or phone numbers. These dynamics may also encourage nontraditional players with unique access to certain provider data fields to enter the market, increasing competition and eventually driving down costs. Like other industries disrupted by marketplace models, a "long tail" emerges to serve the diverse needs of the market.

# Our End Game

The decision to develop a marketplace for provider data first, before addressing other applications, was intentional. Dozens of healthcare applications are appropriate for a data marketplace, but the provider data use case was a strategic choice in that provider directory data is public and relatively benign, making experimentation with a new approach reasonably low-risk. However, with the quality of provider data being a systemic issue, a collaboration to improve accuracy and decrease waste is a cause from which the entire industry can benefit.

As you can see in *Figure 5*, provider data is our starting point; it is not the end game. The future promises to bring the exchange of higher-value, higher-risk data types in the underlying utility data marketplace. With an established, proven data market infrastructure, we will have a better chance of succeeding with more sensitive, impactful data types including, for example, personal health information.
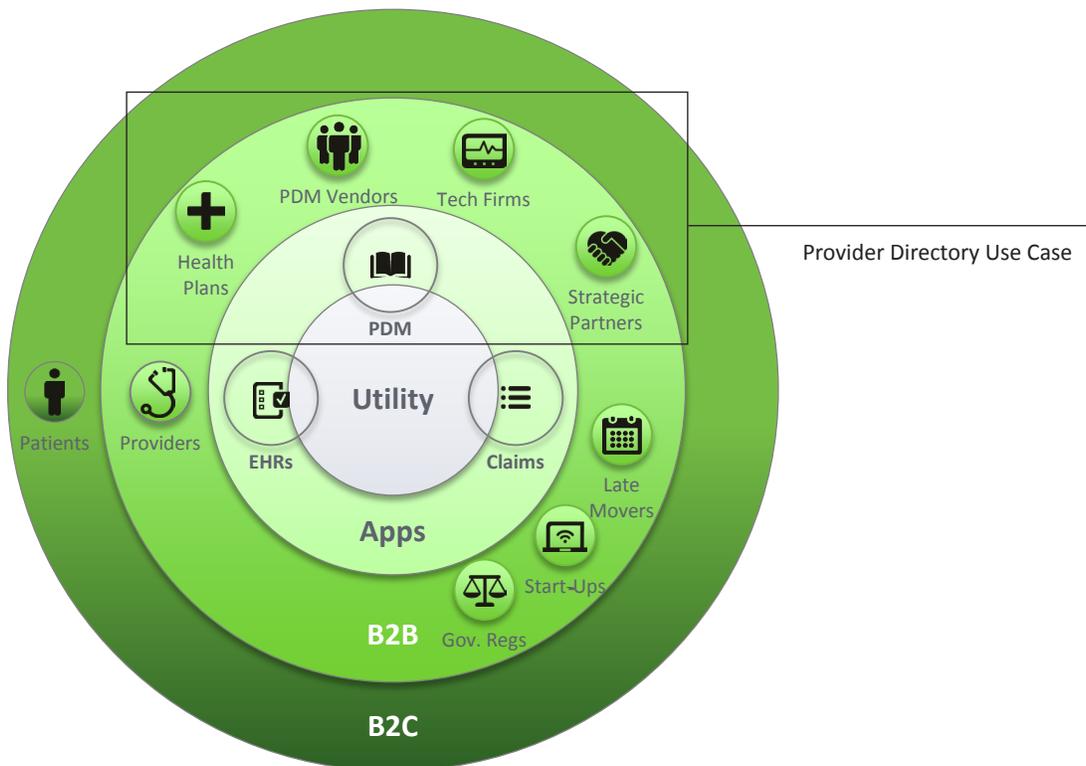


**Figure 5:** The Data Market Serves as a Foundational Industry Utility

**CHAPTER 04**

# Appendix A: Why Blockchain?

This paper identifies the current problems with PDM as being (i) a lack of payer collaboration, (ii) an inability to handle the data's high frequency of change and (iii) low provider engagement. Presumably, the technology component of any viable approach would need to address these problems, directly or indirectly. Blockchain technologies may seem like an intuitive choice, given its perceived benefit as an infrastructure and standards on a peer-to-peer (P2P) network, but what, specifically, about blockchain technologies make them particularly suited for provider data management?

## Consortia Foster Collaboration

Today, despite most providers having affiliations with 20 or more plan administrators, each administrator manages provider data independently, which results in silos. Silos exist because plan administrators lack trust in the quality of one another's data, but even if they trusted the quality enough to share data, they are currently impeded by the lack of common collaboration platforms. blockchain technologies have unique applicability to support consortia-backed approaches because they provide a shared, potentially autonomous platform that is "trustless" – meaning that assurance is provided by the platform, not by trusted third parties – which, for the first time, allows participation in a common approach with shared administration. By adopting technologies that indiscriminately distribute information, all participants on the platform have access to the historical record of decisions made by participants, including the logic and the details used to make that decision. This level of transparency enables trust. It also drives openness since each participant has the same level of access without relying on an intermediary or centralized system. This is a subtle but psychologically impactful benefit of leveraging blockchain technologies.

The following points provide more details on why blockchain technologies are positioned well for this use case:

01   *Standardized Workflows with Smart Contract Automation*

Running the marketplace on a smart-contract-enabled-blockchain platform will allow for a standardized process for buying and selling data to which parties are bound and a trusted, transparent approach for managing payment. By imposing consistent and transparent logic on every attestation and marketplace transaction, plan administrators can begin automating aspects of the maintenance and purchasing workflows that ordinarily would have been completed manually or in a much more ad-hoc fashion. The use of a smart-contract approach with human-readable logic allows even nontechnical participants to easily verify and approve the code that controls marketplace interactions. This will improve the ability of administrators to handle the frequency of provider data change at an ecosystem level. An example of how smart contracts could facilitate a provider data management approach is as follows:

A        Buyers will be able to configure smart contracts that outline requirements, which could include: Identifier (NPI), source of the information (Humana), format of the information ([JSON FHIR Practitioner](#) v3.0.1), timeliness of the data (validated and attested to after January 1, 2018) and trusted validators.

B        Sellers will then be able to see all buy orders with the requirements that were specified in the smart contracts and will give information on providers by executing the smart contract to realize the reward. Sellers can also put a small amount of money in an escrow account to hold funds that will cover the validation costs, which a seller would forfeit in the event the data they provide is found to be inaccurate.

C        Validators will be able to see all proposed data that requires their attestations. Because authenticity of the data source is critical to the quality of an attestation, there is a need for participants to trust the source of information. A key feature of blockchain approaches is the use of public-key cryptography to sign attestations in an un-forgeable manner. Once validators attest to a seller's data, the seller who proposed the update will see its trust rating increase along with its account balance. If the validator determines the seller's request is incorrect, the seller's escrow fee will be used to pay the validation fee and the seller's trust rating will decrease.

D        Once the requirements have been met, the buyer will be given access to the data it has purchased.

A blockchain also provides significant security advantages over centralized databases through its decentralization and cryptography. The immutable nature of blockchain makes it easy to identify data that has been tampered with. In order to change data that has already been written into the blockchain, every participant on the network would have to approve the update, rendering it virtually impossible. Furthermore, blockchain implementations do not rely on centralized servers, making it much harder than with traditional databases for malicious actors to hack into the system, as would-be hackers would need to control more than half of the nodes running information before they could damage the network.

02    *Increased Transparency*

Blockchain technologies provide the ability for all participants in the network to see and independently verify all network activity. In the case of provider data, the network activity includes the addition of an attestation, or a flag, and the subsequent purchase and sale of a data asset. Multiple buyers can be notified when a seller proposes an update or when a party validates information, allowing all participants to have up-to-date data and market information. This levels the playing field by allowing all participants access to the same data, creating a foundation for highly competitive, market-driven approaches with equal access to market demand (buyers requesting data) and supply (sellers fulfilling requests), as well as the historical record, which includes pricing and seller credibility.

03    *Attestation through Signature Capture*

Sellers and validators will attest to the validity of the data by signing it with their private keys, creating digital signatures. An "attestation chain" will be created over time, enabling buyers to see both who has attested to the validity of the information and when the attestation was recorded.

04    *Low Barriers to Entry*

As highlighted earlier, the use of blockchain technologies imposes consistency and standardization across all participants. A new participant is bound by the same rules and formats as existing participants. In the early stages of the platform, participation will likely be limited to a few "founding" participants, likely including plan administrators and third parties that hold reliable data. However, as the approach matures, any party that holds reliable data would have the ability to buy, sell and validate data in the marketplace.

05    *Ease of Innovation on the Platform*

The adoption of a shared, transparent smart-contract platform will foster the development of new workflows, features and data sets without any new deployments of software binaries or hardware. New approaches can be authored in "near-real-time" to capitalize on market opportunities.

06    *Commoditization of Operational Resiliency*

Operational continuity concerns, including replication, disaster recovery and high availability, are blockchain platform features that no longer require dedicated expertise, expense and staffing.

**CHAPTER 05**
# Bibliography & Acknowledgments

America's Health Insurance Plans (AHIP). (2017, March 7). *Provider Directory Initiative Key Findings - AHIP.* Retrieved February 26th, 2018, from ahip.org: https://www.ahip.org/provider-directory-initiative-key-findings.

Availity. (2017, June 28). *Availity Releases Survey on Payer-Provider Collaboration Gaps.* Retrieved May 7th, 2018, from https://www.availity.com/about-us/news-center/payer-provider-collaboration-gaps.

Baltic, S. (2014, February 24). *Monopolizing medicine: Why hospital consolidation may increase healthcare costs.* Retrieved February 26, 2018, from modernmedicine.com: http://medicaleconomics.modernmedicine.com/medical-economics/content/tags/hospital-employment/monopolizing-medicine-why-hospital-consolidation-?page=full.

CAQH. (2016, September 16). *CAQH White Paper Calls for Industry Collaboration to Solve Provider Data Challenges.* Retrieved February 26, 2018, from https://www.caqh.org/about/press-release/caqh-white-paper-calls-industry-collaboration-solve-provider-data-challenges.

Centers for Medicare & Medicaid Services (CMS). (2017, January 13). *Online Provider Directory Review Report.* Retrieved February 26, 2018, from cms.gov: https://www.cms.gov/Medicare/Health-Plans/ManagedCareMarketing/Downloads/Provider_Directory_Review_Industry_Report_Final_01-13-17.pdf.

Centers for Medicare & Medicaid Services (CMS). (2018, January 31). *Online Provider Directory Review Report.* Retrieved February 26, 2018, from cms.gov: Centers for Medicare & Medicaid Services.

Enclarity. (2014). *A business case for fixing provider data issues*. Retrieved February 26, 2018, from lexisnexis.com: https://www.lexisnexis.com/risk/downloads/whitepaper/fixing-provider-data-issues-whitepaper-wp.pdf.

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