Population health management
Beyond the EHR

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Contents

Introduction

Electronic health records (EHRs) are necessary but not sufficient for population health management (PHM). This is partly because they lack semantic interoperability, which is the ability of disparate information systems to share data and enable communications among users in a meaningful way.

EHR deficiencies for PHM

Besides the challenge of information exchange, EHRs' inflexible, structured models are not designed for PHM, lack the robust registries needed for disease management, and are physician-centric rather than person-centric.

Interoperability

Information systems must be interoperable to help clinicians and care teams deliver well-informed, coordinated, patient-centered care. Patient-generated health information and other types of exogenous data are needed to supplement clinical and claims data.

Health information exchanges (HIEs)

Despite government support, public HIEs have failed to catch on, and private HIEs haven't solved the interoperability puzzle. Fast Healthcare Interoperability Resources-based internet plug-ins promise more, but won't be widely available until 2018.

Care collaboration platform

What's needed now is a care collaboration platform fed by a data lake that aggregates and normalizes data from many different sources.

Introduction

Electronic health records (EHRs) are the locus of clinical documentation, the source of billing information, and the official record of care for medical-legal purposes. To a large extent, they organize the workflow of physicians and other clinicians. But EHRs cannot by themselves provide the IT infrastructure for population health management (PHM), because they are tied to particular providers and healthcare organizations. Lacking meaningful interoperability among disparate EHRs, they cannot supply even all of the clinical data required for person-centered care, which is the fulcrum of PHM. And healthcare organizations need many other kinds of information to manage population health effectively.

Karen DeSalvo, MD, the former National Coordinator for Health Information Technology, explained this dilemma well in a speech at the 2015 annual conference of the Health Information Management and Systems Society (HIMSS). "The EHR is one of the major drivers to advance care, but the world has evolved and advanced, and now the ecosystem is much broader than EHRs," she said. "To provide person-centered care, you need a model that's beyond episodic visits, and we need to make certain that we're allowing technology to evolve. EHRs only tell one part of the story."[1]

DeSalvo pointed this out in her explanation of the new "interoperability road map" of the Office of the National Coordinator for Health Information Technology (ONC). This roadmap sets goals for interoperability for three, six and 10 years out from 2015. By the end of 2017, ONC wants the majority of providers and consumers to be able to "send, receive, find and use a common set of electronic clinical information." By 2020, ONC plans to expand interoperable health IT and the number of users. By 2024, the office aims to have nationwide interoperability, based on a learning, patient-centered health system.[2]

Today, despite progress in recent years, the US healthcare system remains far from that ideal state. Although the majority of hospitals and physicians use EHRs, health data remains trapped—siloed by hospital boundaries, incompatible vendor systems and complex regulatory challenges. Healthcare providers cannot easily exchange data with each other, and the exchanges that do occur consist mostly of documents, rather than discrete data that can be aggregated with data from other sources and analyzed. Many patients can access their health records through patient portals, but those portals are tethered to particular providers' EHRs, making it very difficult to assemble a complete record of care. Systems designed to integrate monitoring data and other patient-generated data with EHRs are just starting to be used. Whole stakeholder segments of the healthcare ecosystem, such as skilled nursing facilities and home care services, are shut off from other segments because their information systems are incompatible.

A number of initiatives to close the interoperability gap are underway. The one that holds the most promise, according to many experts, is a new Health Level Seven (HL7) standards framework known as Fast Healthcare Interoperability Resources (FHIR). When FHIR is combined with RestFUL (representational state transfer) application programming interfaces, the OAuth standard for user authentication, a software development kit, and a graphical user interface, it could provide the basis for internet-standard plug-ins; making the exchange of discrete data between EHRs much easier. The FHIR-based standards set could also be used to expand EHR capabilities by adding outside apps.[3] But FHIR is still in an early stage of development, with sporadic adoption, and it is not expected to be ready for widespread use until 2018.[4]

Meanwhile, government and private payers are forcing the healthcare industry to pursue population health management to support value-based care initiatives on an accelerated schedule. By the end of 2018, the Centers for Medicare and Medicaid Services (CMS) says half of its payments will go to alternative payment models, such as accountable care organizations (ACOs), patient-centered medical homes (PCMHs) and bundled payment arrangements.[5] Some of the largest national health plans have announced that value-based reimbursement will comprise 75 percent of their payouts by 2020.[6] To succeed under these new payment models, organizations must manage population health and demonstrate value by delivering lower-cost, higher-quality care. And, because efficient PHM is impossible without interoperability, the latter has shot to the top of many providers' IT priority lists.

Another major driver in the quest for interoperability is the formation of ACOs, which are entities composed of doctors and hospitals that contract with public and private payers to lower the cost and improve the quality of care for defined populations. While some large healthcare organizations have created self-contained ACOs across their owned assets with a common EHR, the majority of ACOs consist of multiple business entities, many of which have different EHRs. The same is true of clinically integrated networks (CINs), which are groups of providers that contract together—as ACOs or in other arrangements—and collaborate to improve quality and lower cost. ACOs and CINs have a strong business case for interoperability, but because of a variety of challenges they still find it difficult to achieve.

Public health information exchanges (HIEs) have by and large failed to create the kind of interoperability that ACOs and CINs require. Vendors of private HIEs are making more headway in building exchanges that facilitate PHM. But the very idea of HIEs may be passé, especially in a FHIR-enabled world. The MITRE Corp.'s JASON reports for the Agency for Healthcare Research and Quality (AHRQ) proposed building a patient-centered health IT ecosystem, powered by mobile apps for clinicians and patients, on top of EHR data. Such an approach, JASON noted, would allow providers to shift away from costly interfaces between proprietary systems.[7]

Alternatively, data from many different sources could be aggregated and normalized in a "data lake," an advanced type of data warehouse that already exists. The combined data could be analyzed and fed into a central registry and a smart care plan that would form the basis for collaboration by all of the care team members caring for a particular patient, including that patient and their family. Such a care plan would not only be longitudinal and comprehensive, but could also take advantage of the new capabilities of cognitive computing to boost health care to the next level. A smart care plan would combine the knowledge base in the medical literature and clinical guidelines with data-driven insights gleaned from the patterns in real-world data.

This paper explains why the current IT environment impedes the efforts of healthcare providers to manage population health; shows why the PHM infrastructure must extend beyond EHRs; defines interoperability and makes clear why it is indispensable to effective PHM; and explains why HIEs have not been and will probably not be the interoperability panacea for PHM. We also propose a care collaboration platform strengthened by a data lake that could serve as a more robust and practical basis for interoperability than the current approaches.

EHR deficiencies for PHM

A transactional system tied to patient encounters, the EHR was originally designed to maximize billing and to generate the related clinical documentation to ensure regulatory compliance, not to anchor population health management. It captures just a fragment of a patient's complex health history through semi-structured and unstructured documentation tools. EHRs also lack the robust registries needed for chronic disease management and care management across a population.

In a revealing 2015 letter to a US Senate subcommittee, the American Medical Group Association (AMGA) noted that EHRs can be used to identify and risk-stratify patients with multiple chronic conditions. However, enormous effort is required to harness EHRs for chronic disease management, the AMGA said.[8]

A paper published in *Population Health Management* in 2015 noted that EHRs lack many elements of the infrastructure required for PHM.

Organizations pursuing PHM transformation have found that their investment in certified electronic health records (EHRs) provides a necessary foundation. However, the investment in their EHR and requisite IT infrastructure is insufficient to support the technology and analytic requirements of new accountable business models.[9]

Although the leading EHR vendors have begun to introduce PHM modules, these are not equipped with the agile, tight analytics and the automated tools required to manage subpopulations and individual patients effectively. Also, because they can't pull in discrete data from non-interfaced systems critical for PHM, EHRs do not provide the timely, comprehensive, actionable information that providers need at the point of care.

In a recent report on PHM IT solutions, Chilmark Research observed:

Some solutions, such as EHRs, are reaching a state of maturity and will play a role in PHM initiatives as a core system for the patient record. But PHM is not about one provider, one HCO, one EHR. Population health management requires the active engagement of a multitude of stakeholders across a community, all sharing data that supports care delivery processes, regardless of care setting. ***Monolithic, EHR-centric PHM programs will prove unsustainable over the long term.***[10]

Most healthcare organizations have yet to recognize this, perhaps because of their large investments in EHR implementation. A 2015 HIMSS Analytics survey of 200 healthcare organizations found that two-thirds of them had some kind of PHM program in place, but only 25 percent of those organizations had purchased solutions from PHM vendors. The other respondents were relying on their EHRs and other internal systems.[11]

Beyond the inability of EHRs to aggregate clinical data and provide analytics for PHM, important nonclinical factors are largely absent or inconsistently captured. Even when social, employment, and family histories are occasionally captured, they are often documented in free text. This is a big omission, considering that social determinants of health (SDH) account for much more of the variations in individual health than medical care does. Clinical factors explain only 10 percent to 25 percent of these variations; the rest can be attributed to genetic factors, health behaviors, social and economic factors, and physical environmental factors.[12]

Interoperability

Traditionally, interoperability has been defined as the ability of EHRs and other health information systems to communicate with one another and to exchange information seamlessly. The goals of this HIE are to improve the quality of care, enhance patient safety, and reduce waste and redundancy. For example, here's how a *Health Affairs* health policy brief defines the purpose of interoperability:

Health information exchange brings information about the patient—regardless of where care or services have been delivered—to the clinician and the care team to enable well-informed, coordinated, patient-centered care. Supported by information from other care settings, clinicians can avoid duplicative tests, identify and address gaps in care, and avoid medication and other errors—all of which drive higher-quality and more cost-effective care.[13]

The policy brief adds that "health information exchange is also a necessary component of rapidly emerging system and payment reforms." The new models of care, such as ACOs and PCMHs, require EHRs and information sharing by interoperable systems. Clinicians and other care team members must have easy access to patient information from multiple care settings, as well as clinical decision support, to achieve the aims of these models.

All of this is true, but the kind of HIE required for PHM goes beyond the interoperability between clinical systems. Patient-generated health data from myriad sources must be included in the mix, and patients must participate in the information exchange as members of the care team. Data on SDH is also indispensable in care planning and should be shared among care team members. And, as healthcare organizations start using environmental and genetic data, as well as other data sources, cognitive computing will be even more essential to deliver comprehensive, personalized and timely interventions.

Another aspect of the above definition in *Health Affairs* requires some additional thought. Clinical decision support informed by HIE and advanced analytics can certainly help physicians make better medical decisions. Additionally, healthcare providers are starting to work more closely with behavioral health specialists, social workers and other professionals to address patients' nonclinical needs in order to address barriers that impact patients' ability to engage in their health. As we move toward a holistic, person-centered model of healthcare, person-centered clinical decision support must be informed by all the facts about a patient, not just data about their physical health and healthcare.

Finally, interoperability cannot simply be defined in terms of interactions between computer systems. The specific, process-oriented goal of HIE is to drive actions and interventions with patients. For example, if a patient with congestive heart failure is being monitored remotely, and a care manager notices that the person suddenly gained weight, that might prompt a phone call to the patient or an electronic communication with the patient's cardiologist—but only if the care manager sees the data right away and there is a process in the practice that prompts an intervention.

Patient-generated health data

Patient-generated health data, a key component of PHM, starts with the questionnaires that patients usually fill out in office visits and hospital admissions. But the variety of relevant sources is rapidly increasing as we go beyond health risk assessments, functional status surveys and depression screening to consider information from mobile health apps and remote patient monitoring as important inputs for population analytics and whole-person care.

The growing importance of patient-generated health data is shown by its inclusion in the stage 3 criteria for the government's Meaningful Use EHR incentive program. Under this scheme, which has been replaced for physicians by the Advancing Care Information component of the Merit-Based Incentive Payment System (MIPS),[14] both eligible professionals and eligible hospitals must incorporate patient-generated health information into their EHRs for at least five percent of patients seen during the reporting period. The information could include screening questionnaires, medication-adherence surveys, intake forms, health-risk assessments, functional-status surveys, or other data sources.[15]

An ONC-sponsored report on patient-generated health information notes that collecting this kind of data "can strengthen the patient-provider relationship, provide opportunities for shared decision-making and amplify the voice of the patient." In addition, the report notes, patient-generated data can increase patient engagement by educating patients and getting them to participate more actively in managing their own care.[16]

The first goal of ONC's interoperability roadmap is that "individuals have access to longitudinal electronic health information, can contribute to that information, and can direct it to any electronic location." Because the actions of individuals greatly impact health outcomes, the document says, "the health IT ecosystem needs to put greater focus on (1) incorporating patient-generated health data across health IT products and services, and (2) ensuring the availability of tools for individuals to use a broad range of longitudinal electronic health information to manage their health and make more informed health-related decisions."[17]

The use of remote patient monitoring is not yet widespread, but it is growing, partly because of Medicare penalties for excessive readmissions. According to a 2015 HIMSS survey, 37 percent of hospitals used remote patient monitoring. By 2018, the report predicted, 51 percent of hospitals will adopt it.[18]

Mobile monitoring is in a nascent stage. While over a third of physicians have prescribed mobile health apps to their patients, the majority of these are related to diet and fitness, and few doctors prescribe apps with the expectation of getting data back from patients.[19] But an increasing number of providers—mostly big academic medical centers and integrated delivery systems—have adopted Apple HealthKit and other platforms that allow them to integrate mHealth data with their EHRs.[20]

Linking to other key players and data sources

Today, healthcare organizations and ACOs aggregate clinical data from hospitals, physicians, labs, and imaging centers. But many other parties have electronic information relevant to patient care. These include post-acute care (PAC) providers such as nursing homes, rehab facilities, and home care agencies; reference labs and imaging centers not interfaced with the systems of particular hospitals or practices; retail pharmacies; behavioral health specialists; vision care providers; and dentists.

PAC providers have electronic information systems that they use for documentation, internal communications, and quality reporting to CMS. Some of these providers have robust EHRs, but in most cases, their systems are incompatible with those of hospitals and physicians. Moreover, PAC providers are ineligible for Meaningful Use incentive funds.[21]

Some hospitals and ACOs exchange structured care summary documents with PAC providers. According to an American Hospital Association survey, 38 percent of hospitals said they sent these care summaries to PAC providers, but only 16 percent of hospitals received such documents from skilled nursing facilities and home care agencies.[22]

The poor communication between hospitals and PAC providers is increasingly becoming a critical issue because of payment bundling. In some of these arrangements, promoted by both CMS and private payers, hospitals receive a single payment for a hospitalization and a period of post-discharge care.[23] When hospitals can't share information with PAC providers, they find it difficult to control the cost of care. As a result, their financial results under bundling arrangements will be suboptimal.

Health information exchanges

In 2004, when President George W. Bush inaugurated the government's campaign to make EHRs universal within a decade, interoperability was considered essential to the overarching goal of improving health care quality and lowering costs.[24] The 2009 HITECH Act, which authorized the government's EHR incentive program, also emphasized interoperability.[25] As part of the effort to achieve interoperability, ONC spent USD 564 million to establish statewide health information exchanges.[26] ONC was also instrumental in creating Direct Secure Messaging, which can be used to send patient data from one provider to another.[27] The Meaningful Use program required the exchange of clinical summaries at transitions of care, and ONC mandated that certified EHRs include Direct messaging.[28]

Despite all of these initiatives, interoperability is still very limited. In a 2014 survey by the American Hospital Association, 57 percent of hospitals said they were able to exchange data with hospitals outside their systems. Sixty percent said they could share data with physicians outside their organizations.[29] But in a recent poll, 83 percent of physicians and 40 percent of hospitals said their EHRs' interoperability was poor. Many blamed EHR vendors for refusing to facilitate two-way information exchange.[30]

ONC has also criticized vendors for not making it easier for their customers to exchange information. The agency, which also found fault with some healthcare providers, said in a 2015 report that these EHR companies had intentionally engaged in information blocking.[31] Shortly after this report was released, several EHR vendors—including Epic, the largest one[32]— announced they would no longer charge fees to providers for exchanging information.[33]

Other kinds of information blocking may also become historical artifacts. Under the 21st Century Cures Act, which the US Congress passed near the end of 2016, EHR developers must attest, as a condition of product certification, they have not and will not engage in information blocking. The law specifies fines and even decertification for EHR vendors who violate this prohibition.[34]

Despite the claims of some vendors that they're now interoperable, most data exchanges between disparate EHRs still require dedicated interfaces or Direct Secure Messaging.

Regional HIEs have not alleviated this situation very much. A 2013 study found that just 10 percent of ambulatory practices and 30 percent of hospitals participated in one of the 119 operational public HIEs then in existence.[35] A 2014 RAND Corp. review of HIE-related studies found that most public HIEs were facing hard financial times. Only 25 percent of them considered themselves financially sustainable.[36]

Some observers thought that this might change with the emergence of ACOs and CINs, which could use HIEs to share health information among their members. But the facts point in a different direction. A recent survey found that an increasing number of providers and payers were shifting to private HIEs and that 90 percent of hospitals viewed private HIEs as a better investment than participation in public exchanges.[37]

In a 2015 report on PHM software, Chilmark Research predicted that PHM would change the role of both public and private HIEs. But these entities have a long way to go. Currently, the report said, most HIEs provide hospital-derived data to a community, rather than a bidirectional data flow between inpatient and outpatient sites. This approach does not align well with PHM, "which requires a more fluid and interactive data flow across a range of care settings," the report noted.[38]

In addition, Chilmark pointed out, HIEs have not been architected to handle the wide range of data that will be required to facilitate PHM. Most HIEs can't handle claims data, and they have not positioned themselves as gateways to coordinate care across a community. In fact, they lack the functionality to support care management and coordination. And the clinical data repositories (CDRs) of HIEs have been designed to store and retrieve specific kinds of data, rather than a wide range of information, Chilmark noted. As a result, those CDRs "will provide insufficient data for the deep analytics required to support PHM programs."[39]

Public HIEs have other drawbacks: Many of them require physicians to leave their EHR workflow and go to a website to view data from other providers. They provide access only to certain kinds of data, such as a patient's diagnoses, medications, allergies, and lab results, which may or may not be what a clinician is seeking. Most problematic in the context of economic viability, HIEs must build interfaces with many disparate EHRs. That is increasingly looking like an outmoded and unnecessarily costly approach.

The third JASON report describes an interoperability model in which diverse EHR systems can "push" and "pull" data via web interfaces. FHIR, the previously mentioned HL7 standard, can serve as the basis for such a system, the report notes.

Because the [FHIR] resources carry agreed-upon atomic data, it is possible for any EHR system to add a RESTful web interface and with proper authentication facilitate the interchange of information in a form that can then be processed for future use.[40]

Health IT blogger Adrian Gropper, MD, has forecast that the advent of FHIR and web-based plug-ins will mean the end of document-based methods of data exchange such as Direct messaging and Blue Button. When this new technology is fully developed, he also predicts, there will no longer be any need for HIEs.[41]

Care collaboration platform

Gropper's predictions may eventually come true. But meanwhile, there is an urgent need for interoperability to support population health management. What is required is a care collaboration platform that aggregates, normalizes and analyzes data from many different sources, including non-clinical sources such as social services and behavioral health care. This online platform would enable all members of a care team—including patients—to work together across care settings and business boundaries.

A care collaboration platform needs a method of aggregating and normalizing data from many disparate sources very quickly. Such an infrastructural component must be able to scale easily and must be flexible enough to pull up data in response to any clinical or financial requirement.

One solution that meets all of these criteria is the data lake, an advanced type of data warehouse that can aggregate data much more quickly than traditional data warehouses do. Data lakes use the Hadoop software framework or another non-relational framework for distributed storage and distributed processing of large datasets in cloud-based computer clusters. Because these clusters are relatively inexpensive and easy to add, they make data lakes very scalable.

A data lake, which can accommodate many types of data, stores data in its native format until it is needed. Each data element has a metadata tag for easy retrieval. This method allows far more flexibility than the conventional data warehouse approach because data is not bound to business rules or vocabularies when a particular query is received or a function

must be activated. Consequently, the software program's data interface does not need to be rewritten to accommodate new kinds of queries or use cases. Any report can quickly be assembled by using configuration files that identify the business rules at run time.

As a result, responses are ad hoc rather than predetermined. Instead of taking months or years to rewrite the program for a new kind of report, as is typically the case in a conventional data warehouse, reports based on new requirements can be delivered in less than 24 hours. While that is sufficient for most purposes of PHM, admission/discharge/transfer alerts and some other kinds of data—such as remote monitoring data that shows the need for a quick response—need to be available in less time than that. Clinical decision support at the point of care must also reflect the latest lab results and other new data.

It is possible to aggregate and analyze data from many different sources in near-real time. But this can happen only if EHR vendors start using the same standards in the same way, so that there is a common format to represent, say, medications or allergies. Today, EHRs use different terms to represent the same concept, so semantic interoperability is lacking. To normalize the data coming into the data lake from different systems, it must be mapped to common terminologies such as SNOMED, LOINC and RxNORM.

ONC has already started requiring the use of standard nomenclature in EHRs. Its 2014 edition certification criteria include the use of SNOMED-CT, LOINC, RxNorm and the CVX code set. The 2015 edition requirements—just now being applied—add the latest versions of these clinical terminologies, plus the National Drug Codes (NDC), the Vaccine NDC Linker, and the CDC Race and Ethnicity code set.[42] The goal is that EHR developers will start to use these terms and codes in their products in a standardized manner, making the mapping of data simpler and faster.

Conclusion

It's important to understand the history, as well as the current climate and challenges, that have forced the healthcare industry to look beyond the EHR for population health. EHRs and HIEs cannot adequately support PHM for all the reasons enumerated in this paper. Yet the need for effective PHM is growing quickly as value-based reimbursement increases as a percentage of provider revenues. One solution to this dilemma is to use a care collaboration platform that draws data from a comprehensive data lake.

Summary

– Traditional EHRs were not designed to anchor population health management. They capture a fragment of a patient's complex health history and lack the robust registries needed for chronic disease management and care management across a population.

– EHRs are unable to properly account for social determinants of health. Social, employment, and family histories are rarely captured; and when they are it's often in free text, and therefore not visible within most systems.

– PHM requires interoperability beyond clinical systems. Systems must be able to collect newer types of data such as patient-generated health data, social determinants of health, environmental and genetic data. They must also connect the teams of people responsible for delivering care.

– EHRs may not be compatible beyond the hospital walls. Most data exchanges between disparate EHRs still require dedicated interfaces or Direct Secure Messaging. The growing popularity of bundled payment arrangements will require better communication between hospitals and post-acute care settings.

Key Takeaway

Interoperability is possible. It is possible to aggregate and analyze data from many different sources in near-real time, using a platform that uses a flexible data lake model to standardize, store and report patient data.

Population Health Management: Beyond the EHR

The role of an Electronic Health Record

Act as the main source of clinical documentation

Support information required to support billing

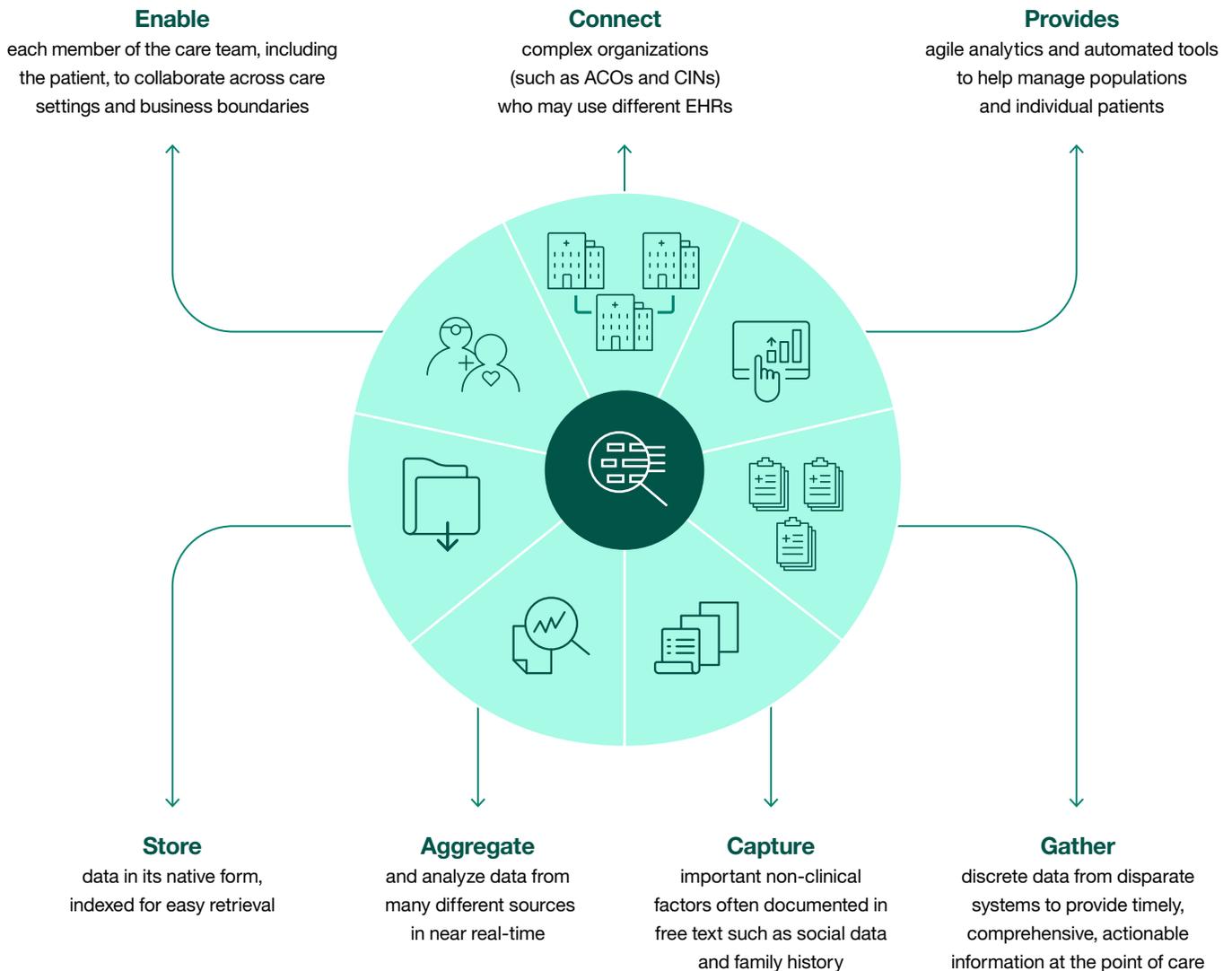Provide official record of care for medical-legal purposes

Organize the workflow of physicians and other clinicians

Use semi-structured and unstructured documentation tools to capture patient's health history

Traditional EHRs were not designed to anchor population health management

IBM® Watson Health™ supports the vision of Population Health beyond the EHR

Enable
each member of the care team, including the patient, to collaborate across care settings and business boundaries

Connect
complex organizations (such as ACOs and CINs) who may use different EHRs

Provides
agile analytics and automated tools to help manage populations and individual patients

Store
data in its native form, indexed for easy retrieval

Aggregate
and analyze data from many different sources in near real-time

Capture
important non-clinical factors often documented in free text such as social data and family history

Gather
discrete data from disparate systems to provide timely, comprehensive, actionable information at the point of care

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