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Getting the Best Business-Intelligence Solution for Healthcare

by Mike Doyle Vice President Health Catalyst

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In healthcare, the definition of organizational performance is changing as rapidly as the need for it is growing. Regulatory mandates, both necessitated and exacerbated by economic conditions, have created an environment characterized by fewer resources, jeopardized cash flows and diminishing margins. Improving performance is a function of providing a higher quality of care to a greater number of patients despite lower reimbursement.

There's no dearth of operational, financial and clinical data in healthcare. Information systems have been collecting it for more than four decades. Organizations have been digitizing medical records for over 10 years and can access, search and use all kinds of government and public sector data.

The result? Mountains of data that organizations could use to make informed decisions to provide safer, more cost-effective patient care, accelerate recovery and shorten length of stay and balance growing resource scarcity with effective resource utilization.

The problem, however, is getting to that data.

BARRIERS TO ACCESS AND APPLICATION OF HEALTHCARE DATA

Recently, eHealth Initiative (eHI) and the College of Health Information Management Executives (CHIME) surveyed 102 healthcare organizations – hospitals, IDNs,

academic medical centers, multi-provider practices, HIEs and community health centers – about how they're using data now, how they hope to use it in the future, what they're using to access it and the challenges they face.

Almost 80 percent of respondents felt their organization's strategic plans and priorities depended on leveraging big data and predictive analytics, although 84 percent of survey respondents believed using data and analytics still posed a significant challenge for their organization.

Only 45 percent of survey respondents have implemented flexible, scalable solutions to adapt to – and profit from – the increasing volume and availability of electronic health data. Survey respondents who had not implemented solutions listed the following barriers.

- Lack of appropriately trained staff (64 percent)
- Data ownership and/or governance issues (53 percent)
- Data integration challenges (40 percent)

When it comes to making decisions, these barriers mean organizations can't get the information they need quickly because of administrative gatekeepers and transactional systems that are not optimized for data retrieval. The data they can access comes from multiple, disparate systems, at best providing only a fragmented view.

The siloed approach to data collection, governance and ownership has been the norm. As the amount of data has multiplied and as reform becomes a reality, this approach grows even more problematic.

WHY HEALTHCARE BENEFITS FROM DATA WAREHOUSING

The recent and unprecedented changes occurring in healthcare have sent organizations scrambling to extract critical information from the mountains of disparate data they possess so that they can drive optimal performance. That's where a data warehouse comes in. A data warehouse is a must-have commodity for any organization seeking to do the following:

- Understand and manage patient populations;
- Support and defend clinical decisions;
- Allocate scarce resources;
- Reduce waste;
- Improve quality of care; and
- Optimize clinical, financial and operational performance.

But a number of organizations have yet to adopt a data-driven culture. Some rely solely on intuition to make significant business decisions. Others use spreadsheet-based decision-making tools that, while helpful, necessitate a fire-drill approach to periodic data collection and reporting.

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Survival in the new healthcare environment calls for far greater integration, automation and sophistication. Organizations must address questions that examine not only clinical, financial and operational processes but also the cause-and-effect relationships between them. For example, in today's value-based payment environment, when nurse staffing isn't optimal, the disparity threatens not only a department's bottom line from an operational standpoint, but, as a determinant of care quality, everything from Medicare reimbursement to competitive ranking scores as well. Point solutions and spreadsheets simply can't integrate different kinds of data to provide the necessary insight for improving performance.

To help answer the most critical questions in healthcare today, organizations must produce and provide access to key performance data from all domains repeatedly and reliably. This data needs to combine clinical, financial, quality, cost and patient experience information; allow the organization to see how it compares to other organizations; and show clearly the relationship between care outcomes and cost.

A well-designed, fully-implemented, enterprise data warehouse (EDW) makes data acquisition repeatable. EDWs extract critical data currently locked in electronic health records (EHRs), claims and billing systems. They automate integration of disparate data sources, freeing a company's most important asset – its people – to spend their valuable time analyzing, rather than acquiring, its second most important asset – data.

BUSINESS-INTELLIGENCE OPTIONS FOR HEALTHCARE

Before delving deeper into the topic of data warehousing, it is important to outline the alternatives more clearly. Organizations shopping for healthcare business intelligence, or BI, solutions will find a multitude of available healthcare analytics options. These tend to fall into three primary categories:

	Point Solutions	Internally Developed Solutions	EDW Platform Solutions
Agility and Flexibility	Minimal; built for specific purposes	Varies	High agility and flexibility
Use across multiple Systems	None	Not usually without expert help	Yes
Time to Value	Months to Years	Years	Weeks to Months

1. Single-solution apps, a.k.a., one-solution wonders: Often called "best-of-breed" or "point solutions," these apps focus on a single goal and a single slicing of the data. Ministry Health Care's CIO, Will Weider, describes them as "extract-ware" because they receive "an extract of your data with the promise of allowing you to have the ability to analyze and monitor your data." The good part: these single-solution apps are very focused on solving a single problem, and can be straightforward to implement because they focus narrowly on a limited slice of data. Investing in one of these apps can have an affordability appeal as well.

> A healthcare enterprise data warehouse (EDW) platform serves as the foundation to run analytics applications and execute an analytics strategy for years to come.

The downside to single-solution apps is that each solves for just one thing, for example, controlling supply costs. The functionality provided by these types of solutions is limited to the out-of-the-box capabilities of the app. In healthcare, problems and solutions are often multifaceted, which exceeds the capabilities of most single-solution apps. And more complex concerns and analysis aren't possible – because one-solution wonders don't integrate with other one-solution wonders. So if you want to know how the size of your staffing and patient loads affect the hospital's supply consumption, you'll likely need an app that focuses on supply consumption and another one that looks at staffing and patients. Then you'll also need to bring in an analyst to take the information from both apps, determine how it relates, digest it, and offer his or her best guess as to what it all means to your business.

2. Build-it-yourself solutions: Organizations looking to solve very specific problems with the tools they have on hand often opt to build solutions themselves. The benefit: the organization knows exactly what it has to work with and, with the right people, can sometimes create a solution that enlists available data and produces answers to previously-identified questions. Internally developed solutions can come with a low upfront cost commitment when created by teams already employed by the organization. And rather than waiting for the solution to be finished before testing it out, internal teams have the benefit of "running it by" key decision makers for feedback then implementing that feedback mid-development before the solution is ready for rollout.

Concerns with the taking DIY route, however revolves around expertise and total cost of ownership; while the teams building these solutions may be intimately connected with a hospital's IT system and/or existing data and needs, developing complex systems that take all of this into consideration may prove to be a costly and time- and resource-intensive process. If a DIY approach is initially successful, scaling that team to meet enterprise-wide demand can be a real challenge. IT teams that traditionally take a strict waterfall project management approach may also lack the agility necessary to adapt to rapidly changing vocabularies, standards and later healthcare use cases. Inability to deliver continuing value can lead to project delays, unmet expectations and overall frustration with the costs that have gone into an internal development effort.

3. Enterprise Data Warehouse Platform Solutions: Designed for enterprise-level operation, platform solutions offer the greatest amount of analytic flexibility and adaptability. A healthcare enterprise data warehouse (EDW) platform serves as the foundation to run analytics applications and execute an analytics strategy for years to come.

For large healthcare organizations, it is impossible to provide reliable and repeatable reporting and analysis without aggregating data – typically found in hundreds of different technology solutions from various vendors – into a single source of organizational truth. An EDW serves as an analytic foundation on which organizations can build registries, drive reporting, enable population health and model clinical and financial risk.

This approach is best suited to a data-driven culture that values analytics as a business differentiator. Organizations with a commitment to a higher degree of data literacy and data management skills are very successful with a data warehouse. Across all industries, the average ROI from successful EDW projects is 431 percent.

> In practice, however, the decision to bind early can have a significant, often negative impact on the success of data warehousing projects, particularly in healthcare.

With the right architecture in place, healthcare EDW implementations can generate similarly impressive returns.

Challenges associated with adopting an EDW often include the perception that EDWs come with a slow initial time to value. Note, however, that not all EDWs are plagued by this; EDWs using a Late-Binding™ architecture, for example, have a short time to value, often spanning weeks rather than months or years. A vendor's implementation approach can also greatly affect time to value. For example, a vendor that takes an iterative route will often produce results faster than a vendor who wants to tackle multiple projects and data sets right off the block.

THE RIGHT EDW ARCHITECTURE AND BI FOR HEALTHCARE

Though data warehouses differ, two basic qualities should prevail:

Early Binding	Late Binding
Data transformed at start of process	Data remains in original state until final stages
Business rules required for data-driven decision making remain static/consistent for long periods of time	Business rules required for data-driven decision making regularly change
Time to implementation: months - years	Time to implementation: weeks

First, a well-implemented data warehouse should support a large number of business intelligence use cases. For example, if an organization's quality data warehouse, research data warehouse and operational data warehouse each loads data in its own way, the result will be multiple versions of the truth, frustration and a waste of valuable resources. The underlying data should be consistent for quality, operations, research or any other analytic needs, and the flexibility to mix and match data sources and data elements from different feeds for different purposes should be a design goal of any healthcare data warehouse.

Second, a good data warehouse should ensure appropriate data access and security. There are valid organizational reasons to be wary of granting access to an enterprise data warehouse to research users, for example. The data warehouse should adhere to HIPAA's strict rules regarding the use of medical data for research. In order to support a diverse and thriving user base, a data warehouse must have a good governance structure and an architecture that supports sophisticated security rules.

One type of EDW architecture is "early binding." Prevalent in several industries, these traditional data warehouses extract data from source systems and bind it to business rules. This platform architecture applies business rules or data-cleansing routines very early in the data warehouse development lifecycle.

Early-binding approaches, utilizing enterprise data models, are appropriate for business rules or vocabularies that change infrequently or in cases where the

ADDITIONAL BENEFITS OF AN EDW

Beyond storing data for access and analysis, EDWs can have additional benefits, including the following reported by healthcare organizations that have adopted Late-Binding™ EDWs:

"We retained the cancer services for a large self-insured employer because we could show them the cost of care and the outcomes of care, transparently, using the EDW data. The competing healthcare provider could not. $23M per year retained."

"Our EDW was instrumental in it achieving Stage 1 Meaningful Use self-certification. [Our team] led the effort to develop a dashboard to monitor the readiness of our hospitals and physicians, and the EDW was the basis from which all data was pulled to be sent to a third party vendor for calculating the clinical quality measures. Millions would have been lost without the EDW."

"The EDW was able to catch data quality issues: a report looking at averages caught an 'average' that was waaayyy off when the Surgical Record showed a patient payment (refund) of approximately 15 million dollars! Many people were involved in following up to see if a check was mailed to the patient. "

organization needs to lock down data for consistent analytics. In practice, however, the decision to bind early can have a significant, often negative impact on the success of data warehousing projects, particularly in healthcare.

Because of the unique requirements of healthcare analytics, a particularly effective warehousing approach for the healthcare industry is the Late-Binding™ architecture. This platform architecture delays the application of business rules (such as data cleansing, normalization and aggregation) to data for as long as possible so organizations have time to review and revise data, form hypotheses and determine optimal analytic uses. Late-Binding™ is especially ideal for what-if scenario analysis and best suited to ever-changing healthcare data and evolving use cases.

Ideally suited to healthcare, this unique approach delivers:

Data modeling flexibility: Late-Binding™ data warehouse architecture leverages the natural data models of the source systems by reflecting much of the same data modeling in the data warehouse.

Data flexibility: Because the EDW does not bind data from the outset into a comprehensive enterprise model, an organization can use that data as needed to create analytic applications with the platform. For example, an analytic application for quality improvement might contain clinical data, patient satisfaction data and costing data. An application for operational purposes might contain staffing levels and clinical data. An analytic application for research might combine clinical outcomes data with a research registry. The more data an organization feeds into the warehouse, the more options it has for using the data. The organization loads the most useful sources of data first and then follows a roadmap to incorporate more data sources over time.

Changes saved: Late-Binding™ architecture retains a record of the changes to vocabulary and rule bindings in the data models of the data warehouse. This provides a self-contained configuration control history that can be invaluable for conducting retrospective analysis, and power forecasting and predictive analytics.

Iterative approach: Late-Binding™ architecture allows for the delivery of project-based value more rapidly by making it easier to break what is often detailed, high-intensity technical work into manageable chunks. Successful iterations early on in the project allow users to build momentum and celebrate success sooner and to realize success before committing additional resources and/or embarking on the next project.

Granular security: The Late-Binding™ architecture's security infrastructure keeps data secure while enabling appropriate access for different types of users. For example, the system could be set up to grant a researcher access only to data marts that have been de-identified. Additionally, researchers approved for access to patient data could be granted access to only the specific data about patients in their study. Late-Binding™ architectures also support a flexible security model for adding users to or removing users from security groups that map to particular data marts. Researchers might be limited to only de-identified data, finance users could have limited access to clinical data and clinical departments may have only limited access to financial data.

"The EDW also allowed a way to view the financial data from different systems side-by-side; using this information [one company] was able to renegotiate from regional to system-wide contracts for payer reimbursements – resulting in big $s."

"We were surprised when people started using the [EMR user log data in the EDW], such as for clinical PCP, to see who had last updated the field. This is now a formal report that comes out and allows management to track policy compliance and discover employee education opportunities."

REALIZING RAPID ROI THROUGH ANALYTICS

A "just-in-time" approach to data binding resolves many of the problems encountered in traditional data warehousing methodologies. The Late-Binding™ architecture, combined with a set of sophisticated analytic applications, for example, has enabled Health Catalyst's client organizations to realize measurable value within months of deploying specific solutions.

Choosing a BI solution that provides a rapid time-to-value in healthcare is critical because current cost-reduction pressures won't wait for complex data-integration strategies. Adopting an iterative approach, however, allows an organization to recognize ROI from different phases of implementation before committing further investment in the solution.

PREPARING FOR THE FUTURE

From meaningful use and new models of care such as ACOs, to value-based reimbursement and readmission penalties, healthcare increasingly needs business intelligence solutions that can aggregate all of its data, including clinical and financial, so it works together. For a majority of healthcare organizations, an EDW – and especially a Late-Binding™ one – is the best place to start. It helps ensure reliable, repeatable access to enterprise-wide data needed to spur the evolution to data-driven decision-making.

EDWs will be crucial to healthcare's transition to activity- and outcome-based costing and payment and will be foundational to information technology's ability to correlate care quality and cost. This level of robust business intelligence will mean the difference between surviving and thriving in the new healthcare model.

References

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Mike Doyle, *Vice President, Health Catalyst*

Mike Doyle joined Health Catalyst in May of 2013 as Vice President. He has been connected with the Health Catalyst senior leadership team since 2006. Prior to Health Catalyst, Mike led the Enterprise Data Warehouse (EDW) program at Allina Health as Director of Healthcare Intelligence, helping Allina grow its EDW program from a nascent clinical improvement initiative to an enterprise-wide strategic asset in heavy demand by thousands of users across all of Allina's 11 hospitals and 100+ clinics. Prior to his work with Allina, Mike was employed on the Northwestern Medicine campus in Chicago, beginning as a Systems Administrator at the Medical School and eventually leading the Analytics and Systems Integration team at Northwestern Medical Faculty Foundation. In addition to his experience building strong technology teams, Mike has experience in technical roles such as database administrator, web programmer, data architect and business intelligence developer. Mike holds a Master of Music degree from Northwestern University and a Bachelor of Fine Arts degree from Carnegie Mellon University.

About Health Catalyst

Based in Salt Lake City, Health Catalyst delivers a proven, Late-Binding™ Data Warehouse platform and analytic applications that actually work in today's transforming healthcare environment. Health Catalyst data warehouse platforms aggregate and harness more than 3 trillion data **points** utilized in population health and ACO projects in support of over 22 million unique patients. Health Catalyst platform clients operate 96 hospitals and 1,095 clinics that account for over $77 billion in care delivered annually. Health Catalyst maintains a current KLAS customer satisfaction score of 90/100, received the highest vendor rating in Chilmark's 2013 Clinical Analytics Market Trends Report, and was selected as a 2013 Gartner Cool Vendor. Health Catalyst was also recognized **in 2013** as one of the best places to work by both Modern Healthcare magazine and Utah Business magazine.

Health Catalyst's platform and applications are being utilized at leading health systems including Allina Health, Indiana University Health, Memorial Hospital at Gulfport, MultiCare Health System, North Memorial Health Care, Providence Health & Services, Stanford Hospital & Clinics, and Texas Children's Hospital. Health Catalyst investors include CHV Capital (an Indiana University Health Company), HB Ventures, Kaiser Permanente Ventures, Norwest Venture Partners, Partners HealthCare, Sequoia Capital, and Sorenson Capital.

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