

# What Works

IN HEALTHCARE



**POWERFUL CASE STUDIES AND LESSONS LEARNED  
FOCUSING ON THE HEALTHCARE INDUSTRY**

## FEATURES

### BI, Analytics, and the New Continuum of Care

David Stodder, TDWI Research

This article explores important BI and analytics technology trends and how organizations are capitalizing on them.

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## Letter from the Editorial Director

This edition of *What Works* is a special issue focused on the healthcare industry. *What Works in Healthcare* offers a fresh, topically focused collection of customer success stories and expert perspectives about the business intelligence and data warehousing (BI/DW) tools, technologies, and methods that are central to the healthcare industry today.

Here's what you will find inside:

### CASE STUDIES

*What Works* case studies present snapshots of the most innovative BI/DW implementations in the industry today. The case studies included in this volume demonstrate the power of BI/DW technologies and solutions for the healthcare and insurance industries.

### LESSONS FROM THE EXPERTS

Included in this issue of *What Works in Healthcare* are articles from leading experts in the services, software, and hardware vendor communities. These lessons provide perspectives about BI/DW best practices and trends in the healthcare industry.

### Q&A WITH THE EXPERTS

Our Q&A with the Experts section presents answers from these same experts to the following questions: What role can BI and analytics play in enabling healthcare providers to be more patient-centered in their care? What can BI and analytics systems do to increase the information quality and timeliness of patient care?

### FEATURE ARTICLES

In "BI, Analytics, and the New Continuum of Care," David Stodder, TDWI Research director for business intelligence, presents three of the most significant changes affecting healthcare providers and others in the healthcare industry, along with four technology trends and how organizations are capitalizing on them.

Also in this issue of *What Works*: Laura Madsen writes about the future of healthcare BI; Mohan Srireddy discusses patient engagement and the metrics you should track; Jason Oliveira explores how healthcare organizations can use the BI competency center approach; and Ted Corbett focuses on the challenges faced by healthcare organizations and how better tools for data visualization can help.

We've also included one of our most popular Webinars from last year: Actionable Analytics for Healthcare Providers, presented by David Stodder, Ted Corbett of Vizual Outcomes, and David Delafield and Ralph Pascualy, M.D., of Swedish Medical Center. In this Webinar, the speakers discuss how healthcare provider organizations can overcome data challenges and accomplish financial, clinical, and patient-care objectives.

We hope you enjoy this collection of case studies, best practices, and expert insight focused on the healthcare industry. We look forward to your comments. If there is anything we can do to make this publication more valuable to you, please let us know. And please join me in thanking the companies that have shared their stories and successes, their technology insights, and the lessons they have learned.



**Denelle Hanlon**

Editorial Director, *What Works in Healthcare*  
TDWI  
dhanlon@tdwi.org

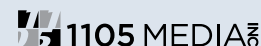
# What Works

IN HEALTHCARE



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Staff may be reached via e-mail, telephone, fax, or mail.

**E-MAIL:** To e-mail any member of the staff, please use the following form: FirstInitial.Lastname@1105media.com

**RENTON OFFICE** (weekdays, 8:30 a.m.–5:00 p.m. PT)  
Telephone 425.277.9126; Fax 425.687.2842  
1201 Monster Road SW, Suite 250, Renton, WA 98057

**CORPORATE OFFICE** (weekdays, 8:30 a.m.–5:30 p.m. PT)  
Telephone 818.814.5200; Fax 818.734.1522  
9201 Oakdale Avenue, Suite 101, Chatsworth, CA 91311

#### SPONSORSHIP OPPORTUNITIES

Scott Geissler, sgeissler@tdwi.org, 248.658.6365

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## BI, Analytics, and the New Continuum of Care

BY DAVID STODDER, DIRECTOR, TDWI RESEARCH, BUSINESS INTELLIGENCE

Healthcare providers are finding themselves in the midst of a torrent of change driven by regulatory requirements, enactment of the Patient Protection and Affordable Care Act (PPACA), patient health and demographic shifts, and changing patient expectations. Most recognize that improving data access, flow, and analysis is critical to meeting these challenges, yet this is easier said than done. This is true in particular for provider organizations that have little history of formal business intelligence (BI), data warehousing (DW), and data management technology infrastructure.

Fortunately, technology options are maturing to provide greater agility, ease of use, and rapid deployment options, which now include cloud computing and software-as-a-service. This article will explore important BI and analytics technology trends and how organizations are capitalizing on them to realize objectives.

### Healthcare Turmoil: Intelligence in Demand

The list of changes affecting healthcare providers, not to mention other players in the healthcare industry, is long. Here are three of the most significant:



## Meaningful use and quality-of-care reporting have been major drivers in the adoption of BI and analytics tools.

- 1. Transition from fee-for-service to a value-based “continuum” approach.** Guided primarily by changes in reimbursement policies by the U.S. Centers for Medicare and Medicaid Services (CMS), payers and providers are taking steps to move away from strategic, operational, and financial practices that account primarily for the *quantity* of care events. The future is about quality and outcomes; payers and providers are now focused on changing metrics and practices to ensure patients get appropriate care and institutions can follow their treatment to a successful outcome. Information and analytics will be essential to integrating the contributions of healthcare services providers, payers, pharmacies, and other participants into a “continuum of care” focused on outcomes.
- 2. Reduction in readmissions.** Also driven by PPACA is an industry-wide effort to reduce avoidable readmissions to hospitals and emergency care facilities. The continuum-of-care concept will be critical to achieving reductions; primary care practices, outpatient services, and technology for self-service health monitoring will all play important roles in keeping patients from unnecessarily returning to the hospital. Quality-of-care metrics and analytics will help organizations understand and predict readmission patterns and become proactive in addressing issues, thereby avoiding penalties. Providers are using analytics to discover better ways of treating chronic illnesses, such as diabetes, through a continuum of care rather than repeated hospital and emergency care visits.
- 3. Industry consolidation.** Mergers and acquisitions are consolidating healthcare providers into a smaller number of much larger healthcare service provider networks. Driving this development are pressures to reduce costs and gain bargaining leverage for CMS reimbursements and other concerns. Consolidation, while always challenging from an information management perspective, creates new opportunities for analytics across more and bigger data sources.

Now, let’s look at four technology trends and how organizations are realizing value from them.

**Trend #1: BI and analytics enable better response to dynamic and diverse user needs.** Healthcare providers increasingly need more agile and flexible BI reporting and analytics tools to track quality-of-care measures, meet meaningful use requirements, and manage their growing variety of facilities and specialty operations efficiently and effectively. For many, the days when single data sources and libraries of canned reports were adequate are over; today’s users need access to multiple data sources and require

greater capabilities for drill down, slice and dice, and other forms of data interaction.

Self-service BI and analytics tools are coming of age just in time. These tools allow decision makers to access, analyze, profile, transform, and share information without having to wait for IT developers to do all the work. One key demand is for more flexible dashboards and data visualization; users need clear and comprehensive views of multiple metrics and data reports as well as the flexibility to customize dashboards to fit their roles and responsibilities. They also need the ability to go one or more layers deep into the data behind the dashboard visualizations, something that canned reports typically supplied with electronic health records (EHRs) and electronic medical records (EMRs) have not allowed.

Meaningful use and quality-of-care reporting have been major drivers in the adoption of BI and analytics tools. Healthcare providers are required to meet a set of standards defined by CMS incentive programs for meaningful use of EHRs. Providers can earn incentive payments by meeting the criteria, which include delivering complete and accurate information, better access to information, and patient empowerment. BI tools can help organizations set up meaningful use metrics, take steps to achieve the information accuracy standards required by the CMS incentive programs, and use information effectively to support other initiatives.

Salinas Valley Memorial Healthcare System implemented Dimensional Insight’s “The Diver Solution” to gain visibility and detail beyond the canned reports available with its Meditech EMR system. “We would get a report from the EMR that said we had 50 orders out of 500 that were entered via our CPOE [computerized physician or provider order entry] system,” said Audrey Parks, senior administrative director in IT at Salinas Valley Memorial Hospital. More than 30 percent of medication orders entered into a CPOE is a stage-one requirement for meaningful use. “What if we were expecting that there should have been 200 orders entered? Unless we write our own SQL queries, there would be no way for us to drill down into how the EMR derived the 50 orders, or for us to verify and validate how that accounting was performed.”

The Diver Solution has enabled Salinas Valley Memorial Hospital to respond to dynamic user needs for meaningful use reporting as well as other requirements such as monitoring clinical quality measures. “Like most hospitals, we have more than one information system as part of our integrated EMR. In support of our quality initiatives, we can now reach across multiple SQL databases rather than be limited to the one Meditech EMR repository,” said Parks. “Our system empowers users to get different views of reports on

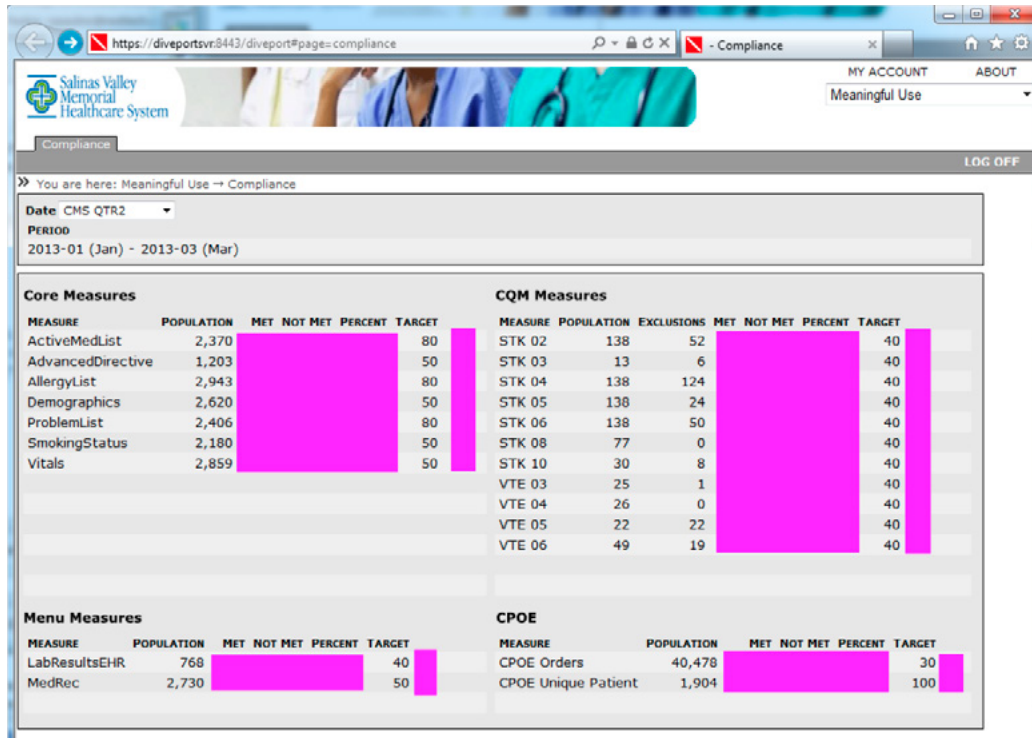


Figure 1. Example of meaningful use compliance slide from Salinas Valley Memorial Healthcare System.

their own, without having to submit requests to IT to change the sort order, change indexes, include different columns, and so on.”

**Trend #2: Predictive analytics helps organizations prepare for the future of healthcare.** Predictive analytics methods and technologies enable organizations to take a scientific approach to data investigation. By building models and testing multiple (and sometimes quite a large number of) variables, organizations can discover patterns, trends, affinities, correlations, anomalies, and other unexpected insights in data relationships. The growth in volume and variety of data is heating up interest in predictive analytics, which thrives on big data. The goal is to discover what the future holds based on models and the interplay of variables, then use that knowledge to reach desired outcomes by adjusting strategies, processes, and resource allocation.

Potential applications of predictive analytics across research, clinical, financial, risk, and operations are numerous. Clinical care is a natural target since healthcare providers need to apply predictive and risk-assessment thinking to diagnosis and prognosis assessments for particular types of care. Integration and consolidation of patient and care data into EHRs and EMRs offer rich sources of data for advanced analytics.

Predictive analytics can also play a key role in planning how to respond to the future direction of the healthcare provider busi-

ness model. As the continuum-of-care approach takes hold, many experts see healthcare adopting characteristics of the retail business model. Indeed, in January 2013 Walmart announced that it plans to offer “full primary care services” to go along with its strong position as a retail pharmacy. Some experts envision “shopping centers for medical services” that bring together specialties such as pediatrics, oncology, dialysis, and more in a cluster that has the same pleasing experience of modern malls.

Healthcare providers, using a “hub and spoke” model, are similarly focused on placing consolidated care facilities in the right locations to reduce the number of people choosing to go first to the “hub”—that is, the emergency room at the hospital, which is expensive and should be reserved for true emergency care. The Ohio State University Wexner Medical Center is working with Farsite, a Columbus, Ohio-based data science firm, to apply predictive analytics to discover ways to improve the patient experience and reduce the load on hub facilities, in particular by locating outpatient facilities at convenient locations within communities.

“Hospitals like to think beyond five-year increments to envision 10, 20, even 50 years down the road,” said Michael Gold, CEO and cofounder of Farsite. “The Wexner Medical Center wanted to predict what demand is going to be like given a variety of trends in patient demographics, patient preferences and projected

requirements, new technologies enabling individuals to collect their own health data, and more.”

Farsite is applying gravity models that are used widely in grocery store planning as well as multilevel regression and linear regression models. “We took all the variables together and have been able to estimate changes to existing patients’ visits based on moving facilities and consolidating the right service lines, such as pediatrics and ophthalmology, together in one location. We can also do simulations to understand future demands depending on how certain patient populations are aging, moving in and out of the workforce or school, and so on.” Working closely with the Medical Center’s business units, Farsite’s data scientists have been able to identify favorable locations that will help improve patient outcomes, reduce costs, provide the proper continuum of care, and increase the patient base.

**Trend #3: Geospatial analysis offers new insights into the quality and safety of patient care.**

A growing number of healthcare organizations are tapping geographical information systems (GIS) to gain a new dimension on markets, customers, and resource allocation. “Micro” marketing analysis, for example, can enable healthcare services providers to fine-tune messages to specific communities based on relationships they can visualize by plotting data on maps. Providers can improve decisions about where to locate health services facilities, clinics, and emergency medical response fleets through geographic targeting analysis of location data about chronic disease rates, demographics, economics, and more. In addition, with many healthcare providers delivering charitable healthcare, it is important to use GIS to avoid overlaps with other safety net providers and fill in gaps where they exist.

Kaiser Foundation Health Plan employs mapping and geospatial analysis for a wide range of decisions, primarily through implementation of Esri’s ArcGIS platform. One key area is quality improvement, according to Michael S. Johnson, Ph.D., director of Utility for Care Data Analysis. “Once you’ve hit a certain level of quality within a healthcare delivery system for diabetes or heart disease patient care, for example, or to ensure breast cancer screening, the effort to get beyond that level grows exponentially if you keep trying to implement measures that are aimed at your entire patient base,” he said. “It becomes extremely important to understand who are the patients and members we are not reaching: that is, who is not getting the tests and screenings they need or isn’t keeping their blood sugar under control.”

Kaiser has been using geographical analysis to identify overlooked pockets in coverage areas. “We have medical service areas throughout Southern California, for example, that include hospitals and medical offices,” Johnson said. “All the areas are above the 95th percentile in our measure of diabetes management; we wanted to see how we could identify opportunities for improvement for that remaining 5 percent of members. We saw on a map that they were located on the boundaries of our medical services areas,

and that some were part of demographics groups that we were not effectively reaching because our communication materials were not in the right language. We would not have seen this if we had not been able to display the results geographically.”

Johnson said it has also been extremely valuable for Kaiser to see relationships by viewing its location data alongside information about specific communities’ resources for exercise, fresh food, and other health-critical needs. “Despite putting a lot of money into online tools, we don’t get a huge response,” Johnson said. “However, we do know where members live on the day they enroll. Analyzing trends based on location helps us engage with members early and more effectively, and helps Kaiser as an organization reach out and provide funding to help neighborhoods in ways that are meaningful and acceptable to the community.”

Kaiser and other healthcare providers are also implementing geospatial analysis to improve tracking of infections inside medical care facilities. Providers are drawing data from sensors placed over sinks and monitors in spaces where patient-caregiver contact is common. “It is helping providers hold people accountable and drive down the spread of infection,” said Christina Bivona-Tellez, Esri’s health and human services manager.

Providers are beginning to use GIS for more effective disease tracking in communities and to improve understanding of how disease patterns relate to members’ environments. For example, researchers have found that cases of pediatric asthma are highest among those who live in close proximity to freeways, Johnson said. Providers, governments, and other organizations are able to use this information to improve collaboration on reducing incidence of chronic respiratory illnesses in children.

**Trend #4: New data warehousing and integration options will speed access and analysis.**

Data integration will be critical to successful consolidation, not to mention other objectives. However, it can also be the source of challenging and expensive problems. Organizations are evaluating the range of options, including data federation and virtualization. This means users can work iteratively with IT to create comprehensive views of data without having to physically extract and move it into an application, data mart, or specialized data store. An added benefit of data federation and virtualization technologies is that they can give organizations a common data access layer; various BI tools can then access data, but the users of these tools are insulated from changes to the underlying data sources.

The sidebar “HealthNow Applies Data Virtualization to Increase User Satisfaction and Ease Governance” offers a case study of how a major healthcare company implemented data virtualization to overcome data access and integration problems.

## Smarter Care for More Patients

Experts estimate that PPACA enactment will bring more than 30 million new individuals into healthcare services networks. The only way organizations can address this challenge, among others discussed in this article, is through improved data access, integration, analysis, and sharing. Healthcare must and shall always be a human-centered endeavor, but it is no exaggeration to say that lives depend on successful information management and analysis practices and technology deployment.

**David Stodder** is director of TDWI Research for business intelligence. He focuses on providing research-based insights and best practices for organizations implementing BI, analytics, data discovery, data visualization, performance management, and related technologies and methods. Stodder has provided thought leadership about BI, analytics, information management, and IT management for over two decades. Previously, he headed up his own independent firm and served as vice president and research director with Ventana Research. He was the founding chief editor of *Intelligent Enterprise* and served as editorial director for nine years. He was also one of the founders of *Database Programming & Design* magazine. You can reach him at [dstodder@tdwi.org](mailto:dstodder@tdwi.org), or follow him on Twitter: @dbstodder.

### HealthNow Applies Data Virtualization to Increase User Satisfaction and Ease Governance

Healthcare organizations are under pressure to increase their information prowess for both business management and patient care. HealthNow New York, one of the state's top healthcare companies (with 815,000 members, 13,000 client companies, and 2,100 employees) had to solve its data access and integration problems so that it could use information effectively to improve health outcomes, increase operational efficiency and profitability, comply with new regulations, and safeguard information privacy and security.

HealthNow's rapid growth had created a data environment that was a "hodgepodge of legacy stores built on top of each other, with no true enterprise view," said George Yuhasz, the firm's director of Data Process and Governance. With data spread across numerous departmental and personal databases, HealthNow had conflicting definitions of attributes and data entities. Operational repository updates and data integration had to be done manually with custom scripts; the data warehousing team had to respond to reporting and data access requests piece by piece. Building persistent data extracts and other development was taking too long. Frustrated users' "shadow IT" projects threatened to create even more confusion.

HealthNow made it a goal to develop a single, common enterprise framework and data integration architecture. Rather than focus solely on building an enterprise data warehouse, HealthNow chose to make data virtualization, implemented with Informatica Data Services, a key part of its solution for enabling a reporting view of disparate data sources. "We have been able to set up virtualized access pretty quickly to give users an ability to at least ask questions and see what the data looks like, with

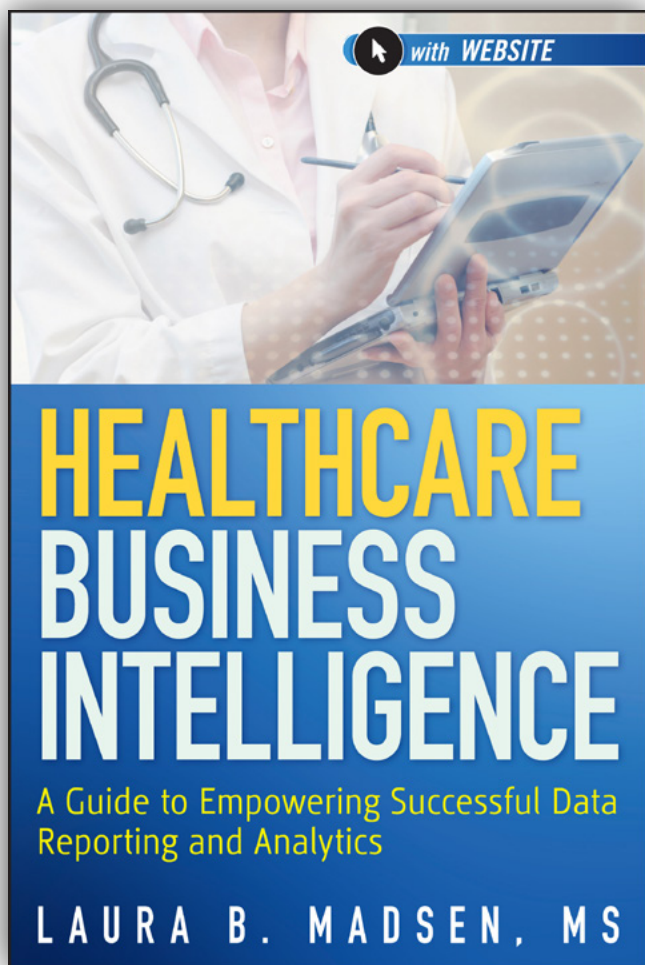
caveats in place that this mode would not necessarily perform at an industrial-strength level," said Yuhasz. "It gained traction pretty quickly from the standpoint of enabling quick prototypes of reporting layers for analytics and for doing application updates for Web services."

Yuhasz described a second advantage of virtualization: "We could say to the users, 'Okay, since we keep coming up with the need to create enterprise repositories for you to query yet finding that when we need to add fields it is taking too long, what we're going to do is start to enable you to have some heavily managed yet open environments in sandbox facilities.'" Yuhasz's group implemented sandboxes to provide access to carefully governed source data and monitor what users did with it. The sandboxes let his team put essential controls in place so that they did not become phantom enterprise data stores or the basis for shadow IT organizations.

"We did this together with users as a partnership rather than through a more typical order-taking IT service delivery model," Yuhasz explained. "It required trust between the technology and analytical teams." Yuhasz said that virtualization has enabled HealthNow to "do agile, first-pass development prototypes of what we could ultimately make persistent data repositories look like, including all the necessary security, quality, and governance measures in place."

*This was excerpted from the TDWI Best Practices Report, Achieving Greater Agility with Business Intelligence. Read the full report at [tdwi.org/bpreports](http://tdwi.org/bpreports).*





## The Future of Healthcare Business Intelligence

BY LAURA MADSEN

In the rapidly changing industry of healthcare business intelligence, determining what's next seems like a bad idea. Most of us couldn't have guessed the influx of activity and importance of data just three years ago. Now a data warehouse in healthcare is a foregone conclusion and *business intelligence* (BI) is a ubiquitous term that equates to reporting and analysis (though it shouldn't). So much of what I predicted about healthcare BI in my book *Healthcare Business Intelligence: A Guide to Empowering Successful Data Reporting and Analytics* (Wiley, 2012) has come to fruition, from the broader use of clouds to the deployment of reports and data to the device (mobile BI).

Still, we have more strides to make. I still contend that privacy and confidentiality rules will have to change in order for us to deliver contextual information to our patients. Although much of the focus of healthcare BI has been toward internal reporting to executives, administrators, and clinicians, the future will include reporting relevant, clinically contextual information to our patients so they can make more informed health decisions. An excerpt from *Healthcare Business Intelligence* speaks to this point:

The next generation of patients that is becoming part of the traditional insurance pool views and consumes information in a very different way. This is the generation that readily advertises its relationship status and clinical information to “friends” and “followers” instead of (or before) telling a healthcare practitioner. These patients seek their information through the Internet. Their technical prowess is their birthright. They have different perspectives on security and privacy. The push isn't just in how we deliver healthcare differently, which is important, but how we deliver information about health.

The future of healthcare BI is with the patient, supporting informed health decisions through shared decision making. Enabling shared decision making will require a drastic shift in how we think about providing data, and about the security and confidentiality standards that have become a barrier to sharing data. The next generation of patients and clinicians view information and privacy in a fundamentally different way, and that difference will be the last piece of the puzzle needed to achieve a radical transformation in healthcare.

Improving the healthcare system is described by the Institute for Healthcare Improvement (IHI) as enhancing patient experience of care (quality and satisfaction), improving the health of populations, and reducing the per capita cost of healthcare. It will require, among many things, a focus on transparency between the clinician and patient, as described in a recent report from *Health Affairs*:

In shared decision making, providers and patients exchange important information: providers help patients understand medical evidence about the decisions they are facing, and patients help providers understand their needs, values, and preferences concerning these decisions.

Today, other than the interaction with your physician, little information is shared with the average patient. Lab reports, the one piece of information most of us regularly receive, are usually written in a language only a clinician can understand. I shared my personal experience with this in *Healthcare Business Intelligence*:

Without the focus on easy-to-understand information, patients have to do more legwork or reach for less-than-valid sources. We have to find a way, today in BI, to make the information we provide to patients accessible. Because if we don't someone will. Here's a perfect case in point. I had my annual physical [last] summer. The physician took a lot of blood to run a number of tests. Along with a cryptic lab report I got a two-sentence letter back from my physician that said: "The results of your recent lab blood work were NORMAL. A copy of your results is enclosed for your convenience." I looked at that report a number of times over the next few weeks. Something was bothering me; it wasn't the actual results (because for the most part I didn't understand them), but then I realized that's what was bothering me—the lack of understanding. This felt like an attempt to be transparent and provide information, but it's not information if the recipient can't consume it.

Individuals have a right to create a personal health record (PHR) and incorporate that into their clinic's or hospital's electronic health record (EHR), but generally only those who deal with chronic diseases go to that extent because they become responsible for the management of both the information that goes into it as well as the management of the PHR itself (i.e., software upgrades). Reports could never replace a conversation with your doctor, but there is power in providing all of our patients the clinical and financial information they need to make informed decisions.

In the *Health Affairs* report, the barriers to sharing information were identified as overworked physicians, insufficient provider training, and inadequate clinical information systems—barriers that I believe BI can help address.

### Implications for BI

There are many implications that are obvious besides privacy and confidentiality policies. Just as important is how we present this data. The standard grid report is still ubiquitous in healthcare, or worse, the lab report that is nothing more than a bunch of numbers that have no context. For most industries, the green hole-punched paper printouts are nothing more than a historical artifact; in healthcare I still see them all the time. If the audience consists of our patients and members, then the content must be modified. We must improve the visualization to include ranges and color variations to ensure that the information we are providing is easy to understand.

Standard data designs will require a patient identifier. Originally proposed in the 1996 HIPAA law, it was quickly removed because of privacy concerns. The interest and need has never diminished, however. In early 2012, the Healthcare Information and Management Systems Society (HIMSS) stated this in a policy brief:

One of the largest unresolved issues in the safe and secure electronic exchange of health information is the need for a nationwide patient data matching strategy to ensure the accurate, timely, and efficient matching of patients with their healthcare data across different systems and settings of care.

Slowly, even some patients have come to realize that without the ability to uniquely identify themselves, sharing information among doctors and health systems is fraught with data concerns. Although these concerns are still preventing traction on the unique patient identifier, the value of the identifier to connect our health systems, reduce cost, and improve outcomes may outweigh the concerns in favor of a conservative approach to data sharing. Make no mistake: a unique patient identifier will revolutionize not only how we share data but also how we look at data. It will provide a 360-degree view of a member or patient. With a unique patient ID, we could pull data through the healthcare information exchange (HIE) and get information about a member from all the providers they've seen, the prescriptions they've had filled, and their lab results, providing clinicians more accurate data than they have had before, with ease and very high reliability.

### How to Achieve It

For the first time in healthcare, real-time data will be driven by business requirements. I have never been a proponent of real-time data in healthcare. From a payer perspective, the average claim goes through many iterations before it's considered a "final paid" claim, and showing the process doesn't seem to provide much value outside the claims operations teams. The EHR data still has so much qualitative data in it that providing a cleaned-up version of that data seems to pose serious questions. Regardless of the barriers and complexity, the value of the data will require increased data frequency.

In addition, we will have to adopt the data movement standards of the financial services industry, extracting the data from the source system as soon as a change is detected, loading it into our warehouses, and providing access. Even though we will never truly be real time—we have some considerable and complicated business rules that are required to ensure that clinical context—our goal should be zero latency. In order to truly change healthcare, we will need to quickly provide more data to more people the right way, and that's what business intelligence is all about.

What does the “right” way mean? Much research has been done on how people consume information, but very little on how patients consume clinical data. Regardless, there is still value in providing a report that tells a diabetic the trend of their A1C, and illustrate the impact of modifications or interventions based on research data that would allow them to change the trajectory of their illness. Research has shown that providing timely, relevant information, almost like bio-feedback, modifies behavior. Using the data to demonstrate not only the financial impact of a decision, but also the clinical impact, has radical potential. The epicenter of this change is in the BI departments of hospitals and clinics all over this country.

### Privacy and Confidentiality

Much of the legislation that controls protected health information (PHI) prevents innovation that could improve health outcomes and reduce cost. The unique patient identifier is just one example. However, most people do not support opening access to this data. Rather than making this a policy issue, I believe that we can continue to hold this data in a secure setting within our own health systems and potentially still improve outcomes and reduce cost, even though the effect will be diminished. A start might be an opt-in or voluntary program where individuals are allowed to grant their data rights to be shared across systems, within an HIE, and include a unique patient identifier.

### Hard, but Not Impossible

Bringing BI to the patient may seem to increase the complexity of an already barrier-laden industry, but I believe that improving shared decision making and patient engagement will simplify healthcare, and in the long term, address the triple-aim of enhancing quality, improving outcomes, and reducing cost. It does, however, present some midterm complexity in managing the data that is relatively new to many of us.

First, we will need to increase the frequency of this data, and that requires changes to our extract, transform, and load (ETL) layers so that data will be brought over as changes occur in the source systems. We will still have to apply business rules for usability on the front end, but the good news is that many of our current business rules may still apply.

Significant changes will likely occur in the data model as a result of the potential implementation of a unique patient identifier. For those health systems that have already adopted an enterprise master

patient index (EMPI), that change may be minimal. In the meantime, an EMPI would be a good midterm step until a national unique patient identifier is the norm.

Finally, and perhaps most impactful, is how we provide information to our patients. The data visualization standards in BI have vastly improved in the last two to three years as BI vendors have adopted visualization best-practice standards from the likes of Edward Tufte and Stephen Few. These standards will become even more important as we begin the process of presenting clinical data to a nonclinical audience. The challenge will be to provide the right information, but not too much information, to support an informed, shared decision between clinicians and their patients.

The future of healthcare is still anyone's guess; the changes in the industry are rapid and vast. The future of healthcare BI will shift with the healthcare industry. However, the healthcare industry has rapidly adapted to increasing data and information requirements and found significant value. The next development will come from shifting patient opinions about privacy, confidentiality, and engagement in their own care, meaning that the future of healthcare BI is with the patient.

**Laura Madsen** is founder of the Healthcare Business Intelligence Summit, international keynote speaker on healthcare BI, and author of the book *Healthcare Business Intelligence: A Guide to Empowering Successful Data Reporting and Analytics* (Wiley, 2012). She brings more than a decade of experience in BI and data warehousing for healthcare as well as a passion for engaging and educating the BI community. Laura leads the Healthcare Practice for Lancet, a leading BI consulting firm headquartered in Minneapolis, Minnesota.

*This is an adapted version of chapter 8, “Future Trends in Healthcare BI,” from Healthcare Business Intelligence: A Guide to Empowering Successful Data Reporting and Analytics by Laura Madsen.*

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## Making a Case for Patient Engagement

BY MOHAN SRIREDDY, DECISIONPATH CONSULTING

With recent healthcare legislation, we've seen increased interest for better use of medical information. One common challenge for healthcare providers is knowing where to start. Medical devices generate a lot of data, some of which is captured in patient records management systems. The rest may be stored in harder-to-access locations or may be lost. There's a strong desire to coordinate care across providers, Medicaid, and insurers to reduce the overall cost of treatment, which requires free movement of data and systems that can digest large volumes of data and identify emerging trends. Business intelligence (BI) systems provide the foundation and framework for bringing together this disparate data, and present it in an easy-to-use fashion.

In this article, I focus on just one of the areas drawing attention in the healthcare community: patient engagement. Patient engagement refers to the shared responsibility between patients, healthcare practitioners, and healthcare administrators to co-develop pathways to optimal individual, community, and population health. Studies show that patient engagement leads to better health outcomes. Adults with complex health needs who are engaged in their care (e.g., self-managing a health condition or participating in treatment decisions) have better quality and experience of care.

### Patient Engagement: A Two-Way Street

Patient engagement needs to go beyond sharing data with patients. BI systems convert data into actionable information. Businesses in other industries have used performance metrics for a long time to help motivate and encourage desired behaviors among employees

and customers. Similarly, a BI environment can provide scorecards to promote desired behaviors among patients. Alerts can be used in conjunction with metrics such as weight, blood pressure, and diabetes-related measures to help patients adjust their actions and control their health. The BI environment can bring information from different sources, such as nutrition plans, home-monitoring data (e.g., weight, blood pressure, insulin levels), and current prescription information, and combine it with information from health exchanges to provide a holistic view to the care provider.

Accessibility of patient data is a start, but patient engagement can be more than just a one-way flow of information. It is an opportunity to open and maintain communication channels through new technology while not taxing the care provider. An engaged patient is more likely to actively manage his or her health and focus on preventive care versus treatment as an illness progresses. The care provider can be presented with an overview of patients' health records with exceptions highlighted.

Imagine a group of patients at high risk for cardiac problems who are under the care of a cardiologist. If the care provider had more frequent access to the test results of patients' risk factors (e.g., blood pressure, weight, smoking, alcohol consumption, cholesterol level) than the usual biannual checkup, and if the information highlighted which patients were out of normal ranges, the care provider could be more active in monitoring those patients or offering counseling to change risky behaviors. Plus, the patients could see how they are progressing in their care and management compared to other patients in a similar risk group.

Simply implementing a patient engagement system is not a solution. Many technology projects fail because they don't properly engage the user community, and don't first change internal processes and culture. All BI system implementations need a change management initiative to bring about the necessary cultural change. The same best practices that apply to corporate BI projects also apply to implementing a successful patient engagement program. It's important to develop a road map and implement change initiatives in small increments and iterate frequently.

### Assessing the System: Measuring More than the Patient

Once a patient engagement system is in place, it is important to measure and track both immediate and long-term engagement metrics, such as:

- Immediate metrics that show greater engagement:
  - Duration of visit
  - Frequency of visit
  - Percentage of repeat visits
  - Date of most recent visit
- Long-term metrics that show improvement in quality of care:
  - Beneficial trends in patient health indicators
  - Number of hospital admissions per patient
  - Number of minor vs. major illnesses per patient

BI creates a foundation for the easy exchange of information. Once a foundation is in place with the right architecture, a multitude of benefits can be derived. BI can help with the management and insight of provider productivity, care costs, and payment reimbursement imbalances, and give providers better data access when negotiating with private insurance companies. It can also be the foundation for supporting analytics for evidence-based care. Patient engagement can be a differentiator for the provider and the catalyst to bring changes that more actively engage patients in all aspects of their care.

**Mohan Srereddy** is a principal consultant at DecisionPath Consulting. Mohan has over 16 years of experience in both traditional IT and business intelligence roles. He has helped organizations in healthcare, insurance, real estate, defense, distribution, and retail industries start, evaluate, and expand their BI/DW initiatives. You can reach him at [mohan.srereddy@decisionpath.com](mailto:mohan.srereddy@decisionpath.com).



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## CASE STUDY

## Valence Health Eases Clinical Integration Pains with Analytics

### Commentary by Todd Stockard

*Cofounder, Senior Vice President, Financial and Data Management Services, Valence Health*

When Valence Health cofounder Todd Stockard left the benefits and actuarial group of a large consulting firm more than a decade ago, he left on a mission. Along with cofounder Phil Kamp, his aim was to help groups of independent doctors and hospitals leverage the economies of scale that come from clinical integration without the burden of sharing a common health-care information platform. To do this, they used business analytics to develop a set of analytical and information delivery tools and services that deliver patient-centered, data-focused support—helping doctors and hospitals manage risk, achieve financial success, and deliver a higher quality of healthcare services to the population.

Nearly 15 years later, with a staff of 120, Valence Health is a turn-key HMO administering the financial, actuarial, data analysis, claims payments, customer service, and medical management of many provider-sponsored health plans across the United States.

Valence also has a clinical integration practice that works with non-risk-assuming groups of doctors and hospitals, giving them the tools to become an integrated system and allowing them to collectively negotiate enhanced reimbursements from healthcare plans.

“Seven or eight years ago, the Federal Trade Commission (FTC) said to doctors and hospitals, ‘You can’t collectively negotiate with health plans unless you’re either assuming financial risk or you’re clinically integrated’—which they qualified as creating care guidelines, collecting data, and measuring performance against those guidelines,” explained Stockard, who is now senior vice

president of financial and data management services at Valence Health.

“We know that with the amount and type of data that we have access to, the sky is the limit for predictive modeling, risk adjustment, and population-based studies.”

#### Todd Stockard

*Cofounder, Senior Vice President, Financial and Data Management Services, Valence Health*

“While the evidence-based guidelines are out there, the challenge for these doctors and hospitals is how to collect data from disparate data sources to measure compliance against those guidelines,” continued Stockard. “The health plans won’t provide it because it would be used to negotiate against them. So we developed tools that sit upon the billing systems in a given medical community, pull the data out, and push it to us on a daily, weekly, and monthly basis. We also get data from labs, hospitals, and ancillary providers to create a virtual regional health information organization (RHIO). We scrub it, link it, and apply guidelines using data management and analytical tools, then serve it back to the individual doctors.

“The ROI for doctors is enormous,” explained Stockard. “As result of being clinically integrated through our process, physicians have been able to negotiate rate increases of between 15 and 20 percent with health plans. Before, individual doctors had no leverage in negotiations. In one

region, doctors were getting 110 percent of Medicare prior to clinical integration. Once they cleared the FTC hurdle and negotiated together, they got 130 percent of Medicare. Clinical integration facilitates the assumption of financial risk, allows doctors to compete for more market share, and also provides patients with better access to more informed care.”

#### Seeing Patients Across Providers

Essentially, Valence is providing the benefits of an electronic medical record (EMR), allowing independent practices to see what is happening with a patient across providers. Using a chronic sinusitis guideline as an example, Stockard said, “If somebody shows up in a primary care office three times with that diagnosis, and the guideline says they need an ear, nose, and throat (ENT) referral and a CT scan, we now have the data from everyone in town and can look for that patient at the ENT encounter or look at the radiologist data to see if the CT scan happened.”

Additionally, Stockard pointed out that Valence can now provide alerts about patients before they visit a practice, so doctors have the information they need to ensure compliance with care guidelines. For one client, Valence used analytics to mine patient data to let doctors know which children needed certain immunizations. They provided doctors with a registry that was integrated with an interactive voice response (IVR) system to make outbound calls to patients requiring immunization.

“We’ve turned our service from a retrospective view to a proactive alert system that contributes to keeping the population

## CASE STUDY

healthy, versus only being able to see where mistakes might have been made,” he said.

With the enactment of healthcare reform law in the U.S., Stockard said it's just back to the future for Valence. “When we started, our vision was that healthcare providers needed to take control of their destiny,” he explained. “Healthcare reform is saying the same thing 15 years later. The concept of accountable care organizations (ACOs), and pushing more accountability back to the providers, is what our business model is all about.

“Providing this type of technology makes Valence unique in the market,” he said. “Others offer only registry-based products, forcing practices to do manual chart extractions and enter them into Web-based tools and forms, with analysis done on patient data samples. That amount of manual work interferes with practice workflows and requires a lot of administration time to maintain FTC compliance.

“With Valence's products and services, clients need only log onto the site to look at the data we have prepared. We have the health plan management services that help clients go from A to Z—become integrated and ultimately become a health plan—while providing access to state-of-the-art health plan management technology. We are focused on giving doctors access to critical information at the right time.”

For Valence, that means collecting and cleaning data for approximately 10,000 U.S. doctors, at nearly 4,000 practices each day, to provide information on the day's patients and measure doctors against 90 caregiving guidelines.

“We know that with the amount and type of data that we have access to, the sky is the limit for predictive modeling, risk adjustment, and population-based studies,” mused Stockard. “We're just starting to scratch the surface in how we analyze data. The next evolution for us will be benchmarking relative to national norms and population insight and what doctors can anticipate relative to the population.”

- For free white papers on this topic from SAS, download [“Implementing Data Governance in Complex Healthcare Organizations: Challenges and Strategies”](#) or [“Using Analytics to Navigate Healthcare Reform.”](#)
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## LESSON FROM THE EXPERTS

## Embracing Big Data: Five Strategic Imperatives You Must Address

**Commentary by Dr. Graham Hughes**

Chief Medical Officer, SAS Center for Health Analytics and Insights

### The Opportunity

When healthcare historians reflect on the current decade, there is little doubt it will be documented as a pivotal era in our nation's history. Whichever way you look at it, PPACA and HITECH have created an unprecedented opportunity for data-fueled healthcare transformation.

Of course, some will try to maintain the status quo, but those who have chosen to seize the opportunity are developing multi-year road maps to address the following five imperatives:

- 1. Manage financial risks and incentives** associated with emerging payment models
- 2. Proactively manage quality and outcomes**, rather than just report on quality measures after the fact
- 3. Improve efficiency of care delivery** by identifying and eliminating waste
- 4. Engage patients as unique individuals** to anticipate and respond proactively to their health needs
- 5. Establish a robust information management and analytics foundation** that treats enterprise data as an essential asset that supports organizational excellence

### The Challenge

The majority of organizations are inadequately prepared for the new era of accountability being fueled by healthcare reform. Their digital infrastructures are focused on supporting transactions rather than transformation, while data remains siloed and chaotic, not synthesized and curated. To make well-informed, data-driven decisions, the current and emerging enterprise data needs to be managed effectively. As the focus shifts to a broader view of the health needs of both the individual and the population, traditionally distinct data sets



(such as claims data and clinical data) will need to be brought together. Couple this with the opportunity to use emerging and nontraditional data sets, such as those captured by digital home monitoring, health 2.0, social media apps, and consumer-related data that has been used for years in other industries, and the opportunity quickly begins to look like an overwhelming “big data” challenge.

### The Solution

It helps if you have the right analytics technology to support each stage of organizational growth, from visual exploration and reporting to forecasting, predictive modeling, optimization, and point-of-care workflow integration. However, there are some key indicators of success to keep in mind: the level of C-suite support, tight alignment with top-level business strategy, a focus on front-line value at the point of care, and a clearly articulated approach to each of the imperatives outlined above.

Consider the following questions as you continue to refine your analytics strategy:

- How will we perform under one or more value-based payment contracts? How is that likely to evolve over the next five years?
- How can we optimize both revenue and margin, based on multiple, potentially conflicting contract payment models?
- Where are the greatest areas of variation for both care and cost? What's behind that variation?
- How does our performance compare both regionally and nationally?

- What patterns do we see in readmissions that can lead to successful interventions?
- How well do we predict the risk of complications, length of stay, or readmission for individual patients—and how do we disseminate that information to care teams?
- What do we know about the level of risk in the populations we serve today and in the future?
- What interventions are most effective at engaging specifically targeted cohorts of patients?
- What data do we need to improve care and control costs?
- What is our strategic approach to information governance, security, and data quality?

Answers to these questions will help you start necessary conversations about analytic imperatives within your organization. Plus, you'll be able to assess how far along you are on your journey from a reactive to a predictive healthcare organization—one that's fully prepared for success in this new era.

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## CASE STUDY

# Optimizing Patient Flow at Johns Hopkins Hospital

## Commentary by

*Doug Brooks, Director of Finance, Department of Medicine, Johns Hopkins University*

*Hetal Rupani, Senior Project Analyst, Johns Hopkins School of Medicine*

*Murali Padmanaban, IT Manager, Financial Systems Administration, Johns Hopkins University*

Johns Hopkins Hospital wanted to serve more patients while preserving its excellent level of care. In 2012, the hospital was ranked number one in the U.S. in 16 different specialties, according to U.S. News and World Report.

Demand for Johns Hopkins Hospital's services is strong. The hospital's outstanding reputation means that many patients across the U.S. choose it for their medical needs. Because of its urban setting, the hospital naturally serves a large population, frequently through its adult and pediatric emergency departments (ED).

Moving patients through the ED effectively is a critical capability for the hospital. A 2010 review of ED figures indicated that 34 percent of all adult patients and more than 50 percent of pediatric patients were admitted through the ED.

## A Fractured View Leaves Opportunities for Efficiency

Patient flow, particularly from the ED, was an area the hospital felt had potential to improve. Decreasing time to admittance would require a real-time view of inpatient bed supply and demand and an understanding of barriers to patient discharge across the entire hospital.

Doug Brooks, director of finance for Johns Hopkins Department of Medicine at Johns Hopkins University, notes that teams within the hospital often work independently, making it difficult to gain the necessary holistic view.

"We knew parts," Brooks said of the view across departments. "We could check out different systems and different data sets to find that information, but it was slow."

The Department of Medicine used six different data sources to report on patient

flow. "It would take a month; it would take a week. Sometimes it would only take a day," said Brooks. Unfortunately, even the next-day reports didn't help teams proactively manage patient flow.

Hetal Rupani, senior project analyst at Johns Hopkins School of Medicine, describes the process of running those reports as a real challenge.

"I would be pulling my hair with Microsoft Excel, Microsoft Access, updating my report every month, running the same query again and again and troubleshooting why the query was not running," she said.

## There Has to Be a Better Way

Instead of tinkering with her existing reporting systems, Rupani wanted to get to the root of the problem.

"We were looking for a solution that could actually help us analyze our data more effectively," said Rupani. "Instead of getting feedback from different users [and putting it into] the reporting format with all the numbers, we wanted to look at the process and fix it right then and there."

An effective solution would have to be adopted not just by technologists and data analysts, but also by doctors, nurses, administrators, and others on the front lines.

The team knew that mobile access across multiple devices would make a big difference in user adoption of any new solution. Nurses and doctors were unlikely to carry a laptop around, but many were already using tablet devices.

"I think the ease of access and ease of carrying a small device in your hand rather than a big laptop makes a big difference," said Rupani.

## A Trusted Colleague Puts Them on the Right Path

Rupani began experimenting with Tableau Software after receiving a report from another department in the form of a packaged workbook.

She was able to download the free Tableau Reader to open the workbook and interact with the report. The experience piqued her interest. "When I got the report I wanted to know more about Tableau," Rupani said.

Adding to her desire to learn more, the report was from an esteemed source: the central data warehousing department at Johns Hopkins. "I really respect the senior director of that department and I trust his judgment about the products he purchases," she said.

The hospital decided to adopt Tableau Server. It has integrated Tableau Server with its custom internal portal so any user with the right credentials can access Tableau dashboards through connected devices, including tablets.

The hospital is blending several data sources for its dashboards. "We bring all of this data into a data repository," explained Murali Padmanaban, IT manager of the financial systems administration at Johns Hopkins University. "That's what feeds into our Tableau dashboards."

## Real Time Is the Best Time

Now users across different departments are looking at the same real-time data and making decisions based on facts rather than guesses about patient bed availability and need.

"For example, we're able to call an emergency meeting at eleven o'clock and

## CASE STUDY



**Johns Hopkins Hospital (including the Wilmer Eye Institute and Johns Hopkins Children's Center) is a 913-bed teaching hospital offering general medical and surgical services. The not-for-profit hospital was founded in 1889 and is located in Baltimore, Maryland.**

everyone is looking at the same data at the same time," said Brooks. "Nobody has to prepare or publish a report. People are looking at it and we can create a plan of action at that moment."

### Anywhere Access on Users' Preferred Devices

Because users can view and interact with Tableau visualizations on a variety of mobile devices, caregivers at Johns Hopkins are able to keep up with changes in patient flow through their tablets, devices they were already accustomed to carrying. This has made user adoption much easier for the hospital.

"Almost everyone carries a tablet nowadays, so having an app and making it accessible is just incredible; it makes it easier to access information," said Padmanaban.

Implementing Tableau has made a difference that has been felt across the hospital. "All of the information so far has been used by everyone, from senior leadership of the hospital itself down to the shift coordinators who are responsible for finding beds for the patients," said Brooks.

"This dashboard has brought everybody together," he added. "Everybody is looking at the same data at the same time, and acting in a unified fashion."

### The Eyes Are the Window to the Data

The visual way information is presented in Tableau helps end users key in on important information much faster than they would if they were looking at a collection of numbers in a spreadsheet, said Padmanaban.

"What Tableau does better is visualization. If you look at Tableau, it is meant for eyes," he said. Through visualization, data trends and outliers are easy to see.

"It's just implicit. It's what stands out," Padmanaban said.

### Turning Data into Stories

Converting dry numbers into dashboards and interactive visualizations that allow users to quickly see problems and trends has been a valuable aid to communication for the hospital. "To me, data is data," said Padmanaban. "But to a front-end user, it's completely different."

Brooks noted that Tableau gives data power users the ability to tell the story of the data. "It gives creativity to the people that need it the most," he said.

### Great-Looking Data Makes People Look Good, Too

According to Rupani and Brooks, implementing Tableau has added a bit of sheen to their professional reputations.

"I partially owe it to Tableau for my professional growth in the organization," said Rupani. "Tableau has helped put me in front of the senior leadership."

Brooks agreed. "It's really brought the Department of Medicine to the forefront of hospital leadership's attention. We have really gained a reputation as being an innovative department."

- For free white papers on this topic from Tableau Software, download "[Four Steps for Improving Healthcare Productivity Using Dashboards and Data Visualization](#)" or "[Three Ways Healthcare Providers Are Transforming Data from Information to Insight](#)."
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## LESSON FROM THE EXPERTS

## Visualize the Path to Healthcare Savings

By **Kathleen Goepferd**  
Tableau Software



In a recent white paper, "[The 'Big Data' Revolution in Healthcare: Accelerating Value and Innovation](#)," McKinsey & Company estimated that data-driven insights could enable up to \$450 billion in reduced U.S. healthcare costs without compromising outcomes.

The authors identified the following pathways to these potential savings:

- **Right living:** Encouraging patients to make healthier choices
- **Right care:** Ensuring that patients receive the most appropriate, timely care
- **Right provider:** Selecting providers with the best skill set match and proven outcomes
- **Right value:** Continuously improving cost-effectiveness of care
- **Right innovation:** Improving not just care and therapies, but innovation centers as well

As the title of the white paper makes clear, harnessing the power of data is the key to success. Innovative data visualization tools can help you capture your share of these savings.

### Right Living

Data visualization can help you quickly identify and provide increased support to patients making less desirable choices.

Jennifer Hayden, IT analyst at Louisiana Breast and Cervical Health Program, is using data visualization to identify patients missing recommended follow-up exams.

"Who are the women who are extending their time longer than the recommended 18 months for rescreening mammograms? We dig deep into patient info for quality control, finding trends, and working on program evaluation," she said.

### Right Care

The move from a fee-for-service payment model to an outcome-driven reimbursement model makes tracking and managing quality metrics crucial. Using data visualization to

identify problems more quickly allows you to enact improvements before your reimbursement is affected.

Southern Maine Medical Center (SMMC) data analyst Jonathan Drummey has made data visualization a core part of the community hospital's quality initiatives, using a tool to visualize quality measures that affect reimbursement from Medicare.

"We can identify where we're performing and also where we're not meeting the target. That way, we can address it in a timely fashion before the end of the measure," he said. "Being able to act on it on a more timely basis lets us actually meet the measure in a better fashion."

### Right Provider

You can steer patients toward the most suitable provider and identify providers with the best outcome measures using data visualization.

Kaleida Health, the largest healthcare provider in Western New York, used data visualization to identify a trend of Medicaid patients making emergency room visits for non-emergency health problems such as headaches and fevers. The project took only a day but identified a great opportunity for savings. "The next thing you know, it was a local news story, using the data that we pulled from our data visualization tool," said Jennifer Kuebler, corporate analyst at Kaleida.

SMMC is using data visualization to easily understand and manage large quantities of quality metrics for its hundreds of physicians. "We're tracking over 1,500 metrics at this point ... our data visualization tool lets us take in all of that data, identify outliers, and help performance improve in the hospital," Drummey said.

### Right Value

Data visualization can help you identify opportunities to improve efficiency and deliver savings. For example, Seattle Children's used data visualization to identify ways to improve efficiency, effectively increasing capacity.

"For all intents and purposes we created more beds, even though we didn't physically build them," said Drexel DeFord, senior vice president and chief information officer at Seattle Children's.

### Right Innovation

Finally, data visualization can help streamline R&D productivity, lowering costs of development and speeding time to market. Biotech consultants Advanced Bio-Logic Solutions (ABLS) attribute roughly 25 percent of the cost of developing a drug to the enrollment of subjects in a clinical trial study.

"Using a data visualization tool helps clients to make decisions on the fly," said ABLS CEO Jeff Epstein. "When you can make better, more active decisions on the fly and have oversight of the clinical research organizations or multiple sites that you're conducting, then it will absolutely increase the enrollment process."

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## Q&amp;A WITH THE EXPERTS

A business intelligence or data warehouse implementation can be a formidable undertaking. In this section, leading business intelligence and data warehousing solution providers share their answers to the following questions:

**Q:** What role can BI and analytics play in enabling healthcare providers to be more patient-centered in their care? What can BI and analytics systems do to increase the information quality and timeliness of patient care?

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**SAS**


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**A.** We are moving rapidly toward an era where the boundaries between electronic medical records (EMRs) and analytics-based clinical decision support are beginning to blur. It is now feasible for vast quantities of cross-continuum, patient-specific data to be assembled and made available to analytic engines in real time, or very close to it. Those analytic engines are in turn capable of applying machine learning and other advanced analytic techniques to generate patient-specific insights nearly instantaneously. They can present those insights back to care teams to inform future actions—not just to review prior performance.

Data from traditional data, such as claims, administrative, and EMR, is now being supplemented with data from a variety of other sources, including an increasing array of clinical and home medical devices, socioeconomic and behavioral consumer data, and text documents and social media. So the world of big data in healthcare is already upon us. It is incumbent upon us to learn best practices from other customer-centric industries, collaborate to deliver value-based care, and begin to explore how we can best control big data to achieve the triple aim of better health, better healthcare, and controlled costs.

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**Tableau Software**


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**A.** Information is powerful, but despite the headlines trumpeting the “era of big data,” the truth is that data is only useful once it is turned into knowledge. BI and analytics take the important step of converting raw data into actionable insight.

Now that health information exchanges (HIEs) are becoming a reality, integrated BI systems can offer caregivers a bird’s-eye view of a patient’s entire care profile. With patient consent, information that patients log into life-tracking tools can be included to further enable knowledge-driven, patient-centered care.

To improve information quality, understand the importance of working with clean data. Make sure that any data sources that feed your BI tool are providing accurate and consistent information. Where possible, use standardized terminology and metrics. Identify an executive sponsor who can mediate data “turf disputes,” and act as a champion promoting efforts that meet meaningful use parameters.

Finally, using data visualization tools can harness the power of the human eye to identify patterns and deviations for everything from surgical outcomes to inpatient time to admission. The ability to see and quickly respond to dips in quality metrics is vital, particularly in light of changing reimbursement models.



## Data “Government” Models for Healthcare

By Jason Oliveira

### Abstract

**The U.S. healthcare provider industry, which represents roughly 17 percent of gross domestic product, is on the trailing end of the adoption curve of business intelligence (BI) approaches. Now that enterprise information management and analytic technologies are starting to become prevalent, healthcare providers need to reorganize their BI support services, resources, and data governance.**

**Healthcare organizations are unique business entities that present challenges for optimally organizing governance, people, and services for next-generation BI. Learning from other industries that have adopted the concept of the business intelligence competency centers (BICC), this article explores the available options and evaluates which service and organizational model best fits healthcare providers and similarly complex organizations.**

### Introduction

BI, performance management, and enterprise data warehousing have become more strategic in healthcare organizations. Hospitals, health systems, payers, home health, and physician practices are all struggling to find ways to manage and support BI deployments across multiple entities, departments, and functions, as well as to support the multiple missions of patient care, research, and academic medical education.

This article explores what can be learned from industries that have adopted the BICC approach to the organization of services and what can be applied to healthcare organizations.

Because form must follow function, we examine several of the unique operational realities of complex healthcare organizations. Given these realities, we identify governance and services organization models to consider. Finally, given a set of “optimal fit” criteria, we discuss why a BICC is a good fit for the typical healthcare provider organization seeking to mature its BI disciplines.

### Healthcare Realities

I have worked in the U.S. healthcare sector for my entire 27-year professional life. One of my professional objectives has been to learn from other industries and associations, such as TDWI, and apply that knowledge to benefit my healthcare-provider clients. Along the way, several realities of the unique business model and operational makeup of healthcare organizations have presented challenges to strategic BI efforts. These challenges may also exist in other industry organizations.

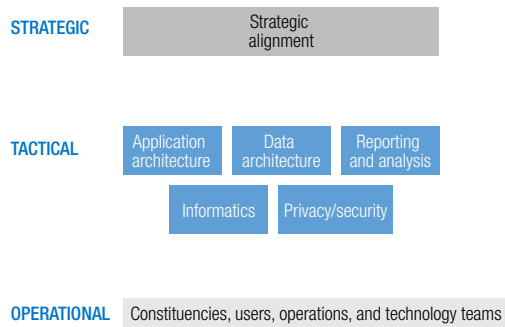


Figure 1. Three tiers of data "government."

### Variation in Constituencies

The typical healthcare organization is a manifestation of diverse missions and constituencies that are all hungry for data and actionable insights. The patient-care enterprise (i.e., the hospital) seeks to improve performance—better quality, safe care, for more people, at a lower cost/reimbursement—in the face of dramatic healthcare reform such as Obamacare. Researchers are advancing medical science through bench and translational research. All the while we are training the medical students who will be the next generation of care providers within the halls of our patient-care business.

These enterprises run the gamut of financial, supply chain, human capital, quality measurement, safety, production function, capacity, and throughput analytics that largely mirror the performance goals of any business entity in any industry.

However, healthcare is further colored by several unique realities, including the prevalent not-for-profit status; intense state and federal regulation; privacy laws restricting the sharing of patient data; an orientation toward public good over profit; and the independence of the professional workforce (that is, physicians are often not employees of the hospital, and clinical researchers are employees/faculty of a university, yet both practice on the hospital's patients).

In addition, few healthcare organizations own the entire production function—they are a care community of many independent clinical professionals with little data shared across organizational boundaries.

This fragmentation of the healthcare production function is directly mirrored in the legacy of health-system BI solutions and services. Over time, different departments and functions representing different user constituencies (all too numerous to list here) have grown to support the data and analytics needs of their specific user constituencies. Each department, in turn, has its own data mart solution, analytical tool set, data collectors, data quality controls, master data, and analyst professionals supporting it all.

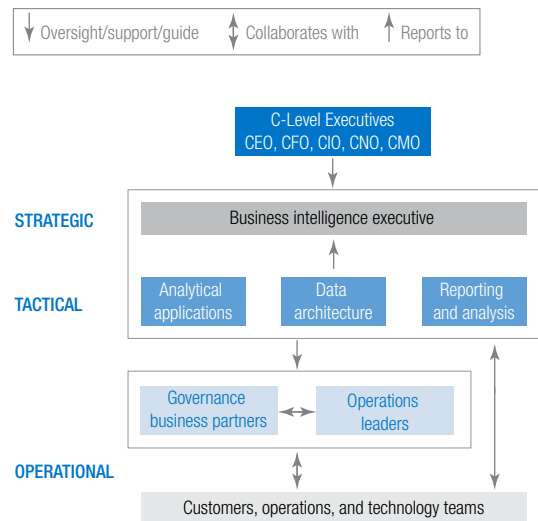


Figure 2. The "benevolent monarchy" form of data government.

Each user may also operate in multiple domains and may need to access multiple support services and teams. Doctors wearing their clinical-process-improvement hats need to go to the quality department. The same doctors conducting clinical research need to go to a School of Medicine research data administration team for support. They also need to manage their practices' revenue, costs, and productivity and thus turn to yet another practice management analytics team for help and support. All the while, the same patient data that enables these three different use cases is duplicated and managed in silos.

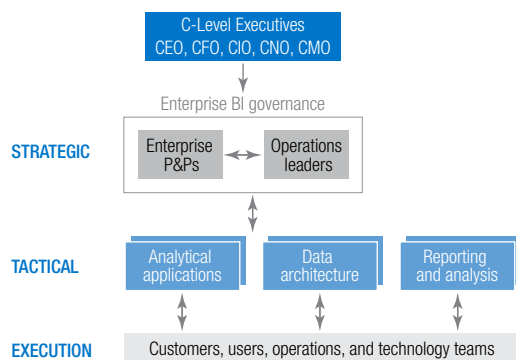
### Follow the Money

Another dynamic is that some constituencies have a place to go for support, but many do not. Several user constituencies have revenue from large clinical service lines (cardiology and oncology, for instance), and therefore have the wherewithal to create their own data and analytical fiefdoms.

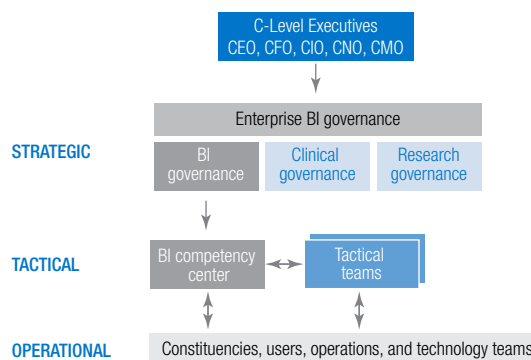
In the absence of any enterprise services and solutions, an adverse consequence is that smaller departments and breakeven functions do not have the same access to required data and analytical resources and solutions that could be used to improve their performance. The performance of the entire organization suffers in this environment of "haves and have-nots."

### Data "Government" Models

Recognizing that the current state is not optimal, many health systems are striving to design a better way. They quickly discover the need for data governance to foster the enterprisewide recognition that data is an asset that requires rigor and discipline in the management of its life cycle across every use case and constituency. As shown in Figure 1, three tiers are universal, whatever the model of organizing your BI "government."



**Figure 3.** The “independent confederacies” form of data government.



**Figure 4.** The “federation of states” form of data government.

- **Strategic:** The alignment of BI to corporate strategy, goals, and objectives is embodied in some form and framework of governance.
- **Tactical:** Much functional expertise is required to design, lead, guide, and participate in the building of the BI architecture and delivery of analytical services.
- **Operational:** The tactical functions are applied to specific projects in tight integration with the user constituencies and operations of the organization.

The interaction between governance and services organizations becomes an exercise in how best to shuffle, delegate, and assign resources to the various boxes in the three tiers. When presented with a complex ecosystem of data management and analytics constituencies, interests, missions, and services, how can we best organize and govern ourselves for success?

The next sections use the history of the formation of the U.S. government as an analogy to describe three political systems for data governance and for providing analytical services to multiple constituencies.

### Political System #1: The Benevolent Monarchy

In a benevolent monarch governmental system, a dedicated and accountable executive manages a dedicated resource team—an enterprise BICC (see Figure 2).

In this model, executive leadership—or delegated governance bodies—provides active support and guidance to ensure alignment of analytics with strategies. A BI executive (the benevolent monarch) takes a full-time leadership position as the BI and chief knowledge officer. This is not the part-time function of a CIO or other existing executive.

The tactical production function in this model provides analytical data management and services for the entire organization, and reports to and is managed by the BI executive. This tactical team defines and drives standards and architecture—and therefore a de facto adherence to standards. Business partners, data stewards, and operational teams collaborate to execute data management/analytics projects to satisfy business requirements.

In short, a single, permanent function and leadership governs both the strategic and tactical layers of services and resources on behalf of the entire organization and its body politic. It is a concentration of oversight, resources, and enforcement of policies and procedures into a single, controlling, benevolent government body for all things related to BI.

### Political System #2: Independent Confederacies

The independent confederacies model (see Figure 3) can be thought of as virtual governance over many independent tactical teams and resources. Each constituency (i.e., research, clinical, quality, finance) thinks of itself as a state governed by its own “constitution” of choice in lieu of an enterprise governing or services function. Access to services and data across constituencies, as increasingly demanded by healthcare reform, needs to be negotiated, coordinated, and taxed for each project. Each confederacy has its own money (data), laws (data policies and procedures), and armies (data management and analytical services teams).

Enterprise BI governance comes through the part-time contributions of operations leaders charged with strategic planning and establishing minimal enterprisewide data standards. They seek to guide and influence the many operations, BI functional teams, and technology teams—a congress of the confederation. All standards and attendant responsibilities to implement them are distributed across the constituencies and their tactical teams. Access to the tactical teams is

CRITERIA	DESCRIPTION	MONARCHY	CONFEDERACIES	FEDERATION
Ensures alignment with the “states”	Ability to represent, be responsive, and be the voice of disparate operations, needs, and missions	Low	High	Moderate
Ensures adherence to standards and policy	Ability to drive compliance and use of established data policy, standards, and solutions	High	Low	Moderate
Cultural fit	Suited for adoption by existing healthcare culture; may need to shift culture to realize full value	Low	High	Moderate
Systemness	Degree to which the model achieves economies of scale and avoids conflicting, disparate, duplicative consumption of resources and effort	High	Low	Moderate
Increases data services maturity	Experts, incubation, advanced analytics, and innovation responsively service users’ information needs	Moderate	Low	High
Minimizes interference with existing structures	Degree to which reorganizing resources is deemed disruptive	Low	High	Moderate

**Table 1.** Criteria to evaluate the fitness of each data government model.

largely uncontrolled by demand governance and is negotiated project by project.

The interaction with, and enforcement of, any enterprise data policies is more distant, making it more difficult to appreciate the enterprise good of data governance. Team members could deem it as an overbearing interference by big government that does not understand local requirements. Data stewards, if any exist, typically serve a single department and source system, versus addressing enterprise-wide data issues.

It should be noted that this model is the typical current state of many health systems and describes how they approach data governance and the organization of BI tactical teams today.

**Political System #3: Federation of States**

The third and final data government model, a federation of states (Figure 4), is characterized by a blend of virtual governance and a dedicated enterprise BI services team. The emphasis is on integrating best practices across the functional silos and collaborating with the tactical teams through a BICC that “concentrates” user-facing access to analysis services. This enterprise “federal” function is, in turn, governed by an enterprise BI governing body.

Within an existing enterprise governance structure (for example, IT or performance excellence), a BI governing body brings together executives and operations leadership charged with strategic planning and guiding the BI architecture development and services. They collaborate with the other subject area governance bodies to ensure alignment of BI solutions and services to various business needs.

A BICC takes on operations-facing services such as architecture design, a chief data steward, skill-set development, and other shareable services. The goal is to drive enterprise design, economies of scale, consistency, and enforcement of enterprise data policies. The domain-specific tactical teams (the “states”) retain application, data

mart building, project management, and domain-specific analytical support for their unique and local constituencies.

This data government model mirrors the federation-of-states approach of today’s United States of America. Enterprise governance and the BICC act as a federal government that provides laws, regulations, policy enforcement, and a common, shareable foundation of enterprise data assets and services. The many tactical teams, in turn, deliver constituency-specific implementations of data and analytical services by tapping into the shareable enterprise resources, funding, and expertise.

**A New Order for a New Age**

Table 1 describes how each of these three data government models align with different fitness criteria.

If driving standard enterprise policies for data and analytics is paramount and achieving a pure theoretical state of economies of scale is important, then the benevolent monarchy approach works best. There are several examples of this model in U.S. healthcare and in “command and control” cultures such as for-profit hospital chains and faith-based systems.

The model will need to navigate the politics of the different constituencies and seek to keep divergent fiefdoms happy in terms of responsiveness and delivering domain-specific expertise and solutions. This task is easier said than done, unfortunately, given the realities of many U.S. healthcare organizations with multiple missions and a workforce of independent professionals.

If it is paramount to have perfect alignment with the many different constituencies within a complex portfolio of funding streams, and sensitivity to arms-length relationships with multiple independent organizations, then the confederacy model is best. It introduces the least amount of conversion trauma while seeking to collaborate and cooperate toward shared enterprise objectives. Adopting this model



will mean suffering the inherent inefficiencies and higher total cost of ownership of duplication, negotiating politics, and divergent data and analytical architecture fiefdoms.

If an organization recognizes that the strategic response to health-care reform requires far more intense collaboration and integration across once-independent domains while retaining what makes the individual domains so good at what they do, then the federal government model approach works best.

## Conclusion

In my role as a strategic business advisor who facilitates my clients' consideration of these governing models, I have found that it is often "self-evident"—to borrow a phrase from the Declaration of Independence—that the federal model, although imperfect, is the optimal fit.

Modern healthcare organizations need to organize and govern themselves as a federation of states. The challenging part of redesigning the data governance and services organization is the actual manifestation of the model—with real people, real reporting relationships, and real politics.

- Where should the BI governance committee/council reside? It could be something new; formed within an existing governance body such as IT, quality/clinical transformation, or performance excellence; or an additional agenda item for an existing executive council (requiring no new governance body).
- Where should the BICC live within the organization? It might be an extension of the IT function as an enterprise architecture team concept; it might report to the CEO outside of IT or to the chief medical officer; or it might have a dual-reporting matrix function that ensures fairness (real or perceived) in support of different constituencies.

- Should existing analysts be moved from multiple departments into the new BICC, or does the BICC require all new hires along with the attendant increased costs?

These are just a few of the questions and permutations that must be designed and aligned with an individual organization's culture, legal formation, diversity, and existing governance and analytical teams.

Healthcare organizations are responding to a convergence of environmental drivers including healthcare reform, lower reimbursement, accountability to coordinate care, and caring for chronic diseases. These require a new kind of business intelligence that is inclusive of integrated enterprise data assets and new types of analytics that cross multiple domains of research, clinical excellence, cost containment, and revenue integrity. The old order of divergent, independent, and duplicative analytical solutions and services teams is no longer tenable. The BICC adopted by other industries in conjunction with mature enterprise data governance is the new order for a new age.

**Jason Oliveira** is a specialist leader of health systems consulting at Recombinant By Deloitte. Contact him at [jaoliveira@deloitte.com](mailto:jaoliveira@deloitte.com).



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## Q&A: BI Helps Healthcare Meet Huge Challenges

Healthcare is on the cusp of massive change, much of it tied to how data is collected, stored, and analyzed. In this interview, Vizual Outcomes founder Ted Corbett discusses the challenges faced by healthcare organizations and how better tools for data visualization can help. “The need for robust analytical tools to address the various users in a healthcare organization is now critical,” Corbett says.

**BI This Week:** What transformations are we going to see in healthcare in the next few years, and how will it affect the use of business intelligence by healthcare providers?

**Ted Corbett:** Healthcare is on the cusp of massive changes in how hospitals and providers are compensated by commercial payers and Medicare. Traditionally, hospitals and providers have worked on a fee-for-service approach, in which they are paid when a patient goes to the doctor or hospital. There is little incentive for providers to help keep people well and out of the doctor’s office or hospital.

With healthcare reform, ideas such as accountable care organizations (ACOs) and “capitation” are gaining traction. Under these models, providers and hospitals agree to care for a specific population and are paid an agreed-upon amount for their care. If the population stays out of the hospital, the providers still get paid.

This represents a shift in risk from the payers to the hospitals and providers. Traditionally, the data to assess risk was housed either with CMS (Centers for Medicare and Medicaid Services) or commercial payers. Understanding these risks will require more data and analysis than has been used to date. In fact, the need for robust analytical tools for the various users in a healthcare organization is now critical.

### How are BI, analytics, and big data challenges different in healthcare than in other fields?

One of the biggest challenges in delivering BI to healthcare organizations is that business intelligence is a relatively new idea for most organizations. Through electronic medical records and “meaningful use” (a term referring to effective use of electronic health records within a healthcare organization), organizations are now stockpiling vast quantities of data that they haven’t had access to historically.

Despite all of this data, organizations aren't sure how to get access to it or make sense of it. The traditional approach of using Excel spreadsheets and manual processes are time-intensive and leave executives and administrators waiting in long lines to get access.

Electronic medical record (EMR) vendors have delivered many bolt-on data warehouse and reporting capabilities, but those solutions still require extensive training and expertise to get access to data. Healthcare companies are buried under a sea of reports, and users don't have the skills or time to integrate and transform data into actionable information.

In addition, healthcare leaders, doctors, and nurses have extensive experience in patient care, but not in using computers and technology to make decisions. In many cases the training required is not about something as sophisticated as how to use big data—it's about basics, such as how to leverage browsers and spreadsheets.

Leaders struggle with how to prioritize analytics when faced with strained budgets due to EMR adoption, meaningful use, and looming ICD-10 conversions. (ICD-10 refers to a revision of the system of disease codes used by physicians and hospitals.)

BI and analytics are a new concept to many healthcare organizations. Often, organizations don't have the staff, budget, or expertise to plan and adopt solutions that have been in place for 20 years in other industries such as financial services, retail, and technology companies.

### **How big a challenge is HIPAA and related security issues when we talk about BI in healthcare?**

Securing patient data is a core tenet of all healthcare BI and analytics efforts. Specifically, there are 18 elements of personal health information (PHI) that need to be protected for patients. One challenge organizations face is how to remove those core elements while still providing relevant information for analytics.

All healthcare organizations are mandated to deliver the minimum necessary amount of information for operations, researchers, and others to analyze patient data. Traditionally, many healthcare organizations use Microsoft Excel spreadsheets and Access databases to house critical data for analytics. This approach puts many organizations at risk, however, because sensitive personal health information (PHI) is then housed on computers across the organization and on laptops and USB drives.

The use of a centralized business intelligence architecture and modern BI tools can help minimize risk by keeping all PHI behind the scenes, removing key PHI information while still enabling analysts and researchers to analyze trends and track operational performance.

With a centralized architecture, all key elements can be preserved in a warehouse, and security and privacy controls can be put in place. In my experience both at Seattle Children's Hospital and Swedish Health System, we have delivered robust reporting and analytical capabilities without exposing any PHI to end users.

We can devise ways to show providers how many patients they've seen, as well as [necessary treatment and diagnosis] codes, time-stamp information about patient flow, and financial performance. All of that can be analyzed without exposing any PHI. If a user needs to know specific patient-data related elements, existing controls can be leveraged.

### **When we use the term “users” in healthcare BI, what different groups are we talking about, and what are the different challenges in reaching each?**

There are several different user groups, all of whom require access to more data to help make fact-based decisions, each with their own considerations. These include:

- **Executives:** They want information delivered in a highly summarized format, either e-mailed or printed for review. Executive users usually don't have the time or aptitude to use robust online reporting tools.
- **Clinical administrators:** Mid-level managers struggle to summarize information for executives and deliver detailed information to providers who are generally skeptical of any information delivered. These leaders don't have the technical skills or time to conduct analysis on their own but are asked to provide vastly different types of answers.
- **Providers:** Doctors and nurses who care for patients every day want to know more about their own performances and how they relate to similar providers. Providers are demanding and detail oriented but often cannot get information on their own due to time or technical capability.
- **Analysts:** Most healthcare organizations have analysts everywhere. They collect data in spreadsheets and deliver answers to providers, clinical administrators, and executives, generally through the use of traditional Microsoft Office tools such as Excel, Access, and PowerPoint. Many are trained in how to pull data from core system reporting tools such as Business Objects or Crystal Reports, but cannot create reports on their own.
- **IT analysts or developers:** These users are inundated with requests from users above them. They often have the technical capabilities to write queries but lack the functional knowledge to act independently. They struggle to keep up with the demands of all of the users listed here and are stymied by the lack of time, tools, and resources to meet growing demand.

### **How does unstructured data fit into the picture with healthcare and BI?**

Unstructured data is an important component because it houses some of the richest data in the hospital system. Providers enter vast quantities of data into clinical notes, either through telephone transcription or directly online. These notes serve as the basis for patient care, medical coding, and billing. Unfortunately, there is little consistency across providers in note format, which makes it difficult to access this rich store of information.

Providers don't have time to enter all of the data required into structured databases, so the clinical note provides a large and critical piece of the puzzle. Many technologies, such as optical character recognition (OCR) and natural language processing, are in the research and development stages to help harness this data. Until such technologies are more advanced, most data used in BI in healthcare comes from billing and coding systems.

### What are some examples of innovative things being done with analytics in healthcare?

What excites me most in healthcare is what can be done by getting data into the hands of users who can directly affect change. As director of knowledge management at Seattle Children's Hospital, I brought in Tableau Software to help improve self-service access to data. My team enabled power users by providing initial training, then turned them loose while helping empower them with better, cleaner, integrated data.

My favorite story is about the business manager of the operating room, who met with the chief of surgery once a month prepared with several spreadsheets and presentations. Inevitably, the chief would say, "Why are you telling me this? All I want to know is x and y." She'd return the next month with the answers to the previous month's questions, and the cycle would continue.

When the business manager started using Tableau, along with a data mart of clinical and operational data, she began attending the meeting with nothing prepared. She'd open the computer and say, "What do you want to know?" After a lively discussion, that useless 15 minutes a month turned into hours of productive conversation, enabling the chief of surgery to make actionable decisions in a more timely way.

### Can you briefly describe your consulting firm, Vizual Outcomes, and its focus? Why healthcare and BI?

Vizual Outcomes, a Tableau Software partner, is a consulting company focused on delivering expertise in BI and Tableau-based solutions to healthcare and research organizations. I started Vizual Outcomes because I love using Tableau and helping to solve challenging problems in a dynamic and important industry. Prior to joining Seattle Children's Hospital, I spent about 10 years in consulting, delivering BI solutions to a variety of companies and industries, most outside of healthcare. I enjoy learning about new organizations and how I can help harness the power of tools like Tableau to transform data into actionable decisions.



*This article appeared in the March 12, 2013, issue of [BI This Week](#).*



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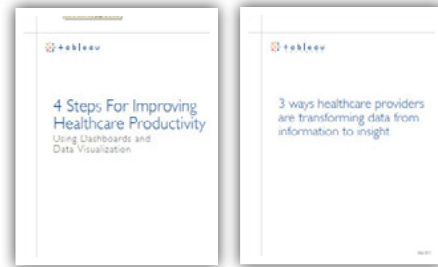
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