

# Data-driven healthcare organizations use big data analytics for big gains



## Contents

- 3 An enhanced data foundation leads to insightful action
- 4 Clinical and advanced analytics transform healthcare
  - 4 Clinical analytics in action
  - 5 Advanced analytics in action
- 6 Steps to becoming a data-driven healthcare organization
  - 6 Define all data sources
  - 7 Set data quality metrics and assess and improve the quality of proposed sources
  - 7 Integrate data sources
  - 7 Identify analytics needs
  - 7 Secure and manage the data lifecycle
- 8 IBM big data and analytics solutions for healthcare

The global healthcare industry is under significant pressure to reduce costs and more efficiently manage resources while improving patient care. In addition, rising rates of chronic disease, aging populations, changing consumer expectations about how they want to purchase and receive care, and increasing access to social media and mobile technologies are transforming the way healthcare is obtained and delivered. Payment models and healthcare systems in many countries are also evolving from a fee-for-service approach to an outcomes-based or accountable-care approach that requires access to more accurate data to document and track results.

To thrive, or even survive, in this time of massive change, healthcare organizations must become data driven. They must treat data as a strategic asset and put processes and systems in place that allow them to access and analyze the right data to inform decision-making processes and drive actionable results.

Historically, healthcare organizations have operated based on imprecise or incomplete cost and care measurements and did not have the comprehensive view of clinical and operational processes they needed to identify areas for improvement. The healthcare industry has recently begun to turn to data and analytics in ways that are similar to other industries that rely on digital information to improve service and reduce costs.

At the core of a data-driven healthcare organization is the ability to analyze a wide range of big data, from within and outside its four walls, to determine what is happening right now with regard to patient, staff and population profiles, as well as financial, clinical and operational processes. Big data comprises much larger volumes, wider varieties and greater velocities of data than most organizations have previously captured, stored and analyzed. It includes data from traditional sources such as electronic medical records (EMRs) and from nontraditional sources such as social media and public health records.

Gaining access and applying clinical and advanced analytics to this valuable new data enables organizations to improve insight into risk, outcomes, resources, referrals, performance and readmissions, and to take prescriptive action. Bringing together structured and unstructured data supports more insightful analysis that enables personalized and evidence-based medicine, more efficient processes and incentives that can improve patient behavior. This paper discusses why it is important for healthcare organizations to become data driven, gives examples of organizations that are already leveraging a wide range of big data to deliver clinical and financial benefits, describes the steps organizations should take to become data driven and explores how IBM can help them reach these goals.

### **An enhanced data foundation leads to insightful action**

Healthcare organizations cannot improve what they cannot measure. The best way for organizations to ensure their long-term success is by leveraging data to:

- Gain a better understanding of actual costs and outcomes
- Identify areas where they have the most to gain from improvements
- Rigorously track performance over time

The big data that healthcare organizations need to collect and analyze may come from hospitals, ambulatory care facilities, wellness centers, referral networks, labs and imaging centers, research and other nontraditional data sources. Collecting, integrating and analyzing data can be a complex task because the data resides in many internal and external locations and its level of quality may be unknown. In addition, about 80 percent of medical data is unstructured, which further increases the challenge.

Even with all of this complexity, healthcare organizations that implement clinical and advanced analytics capabilities have a lot to gain. Some areas in which enhanced data and analytics can yield the greatest results include:

- Pinpointing which patients are the highest consumers of health resources or at the greatest risk for adverse outcomes, and then putting programs in place to optimize their health status and measure how they are doing against set targets
- Driving consumer empowerment, involvement and responsibility by providing individuals with the information they need to make informed decisions, more effectively manage their own health and more easily adopt and track healthier behaviors
- Identifying treatments, programs and processes that are not delivering demonstrable benefits or are costing too much, and then determining how to replace them with more efficient and effective options
- Reducing readmissions by identifying environmental or lifestyle factors that increase risk or trigger adverse events, and adjusting treatment plans accordingly
- Improving outcomes by examining vitals from at-home health monitors, and then proactively contacting patients when abnormalities are detected
- Managing population health by detecting vulnerabilities within patient populations during disease outbreaks or disasters, and then taking preemptive action
- Building sustainability into a health system by bringing clinical, financial and operational data together to analyze resource utilization, productivity and throughput
- Attracting the best and brightest clinicians, who can help to build and maintain an organization's reputation by offering innovative health IT systems and mobile technologies that enable collaboration and easy, secure remote access to patient records

## Clinical and advanced analytics transform healthcare

Data-driven organizations are applying clinical analytics or advanced analytics to new and diverse data sources to gain deeper, more accurate insights (see Figure 1). *Clinical analytics* bring together clinical, financial and operational data to answer questions and perform retrospective analysis about how healthcare organizations are running, the state of their patient populations and the effectiveness of programs. *Advanced analytics*, which are more predictive and forward-looking in nature, often focus on making predictions regarding at-risk patients. For example, they might help providers identify which patients require immediate intervention or additional treatment, or which patients could most benefit from particular wellness programs.

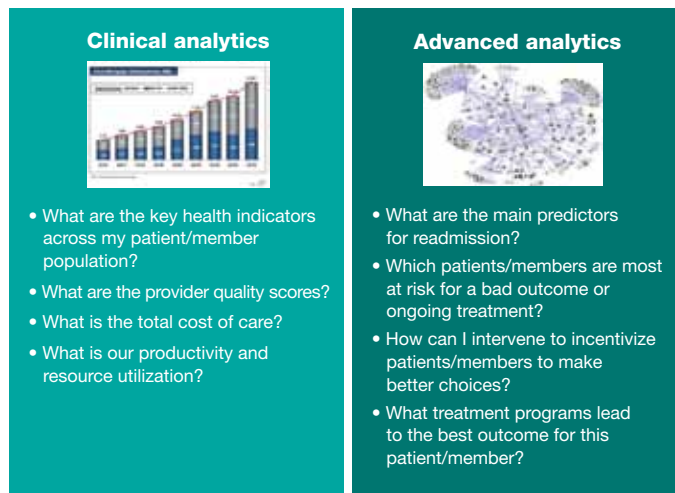


Figure 1: Clinical analytics tend to focus on operational questions and data; advanced analytics involve more predictive queries that inform prescriptive actions.

## Clinical analytics in action

- Premier, the largest US healthcare alliance, includes a network of more than 2,700 member hospitals and health systems, 90,000 non-acute care facilities and 400,000 physicians. The Premier alliance has compiled the largest clinical, financial, supply chain and operational comparative database, with information on one in four discharged hospital patients in the United States. The database provides members with the detailed comparative clinical outcome measures, resource utilization information and transaction-level cost data they need to make informed strategic planning decisions that improve processes and outcomes.

Through one Premier performance improvement collaborative of more than 330 hospitals, more than 29,000 lives have been saved and healthcare spending has been reduced by almost USD7 billion. Premier is in the process of expanding beyond hospital data to bring together data from physician offices, nursing homes, long-term-care facilities, other non-acute care settings and home monitoring devices to enable a more complete healthcare picture of patients and populations.

- North York General Hospital, a 450-bed community teaching hospital in Canada, is using real-time analytics to improve patient outcomes and develop a deeper understanding of the operational factors driving its business. North York has implemented a scalable, real-time analytics solution that provides a unified picture of the hospital's operations from a clinical, administrative and financial perspective. The solution processes data from more than 50 diverse collection points dispersed among a dozen internal systems to provide administrators and physicians with analytics-driven insights that improve business performance and patient outcomes.

- One of the largest healthcare providers in the United States is reducing costs while improving patient care by analyzing data in its EMR systems. This data includes the unstructured data in physician notes, pathology reports and other records that weren't accessible before to better understand outcomes, find the causality of care protocols and determine which care pathways lead to the best outcome. In addition, the analytics system helps enhance care decisions by enabling physicians to easily perform ad hoc queries optimized for individual patient circumstances.

#### Advanced analytics in action

- Columbia University Medical Center is analyzing complex correlations of streaming physiological data from brain-injured patients to provide medical professionals with critical information they need to treat complications proactively rather than reactively. Advanced analytics help detect severe complications as much as 48 hours earlier than traditional methods in patients who have suffered a bleeding stroke from a ruptured brain aneurysm. These patients often experience serious complications during recovery, including delayed ischemia, which is fatal in 20 percent of individuals.

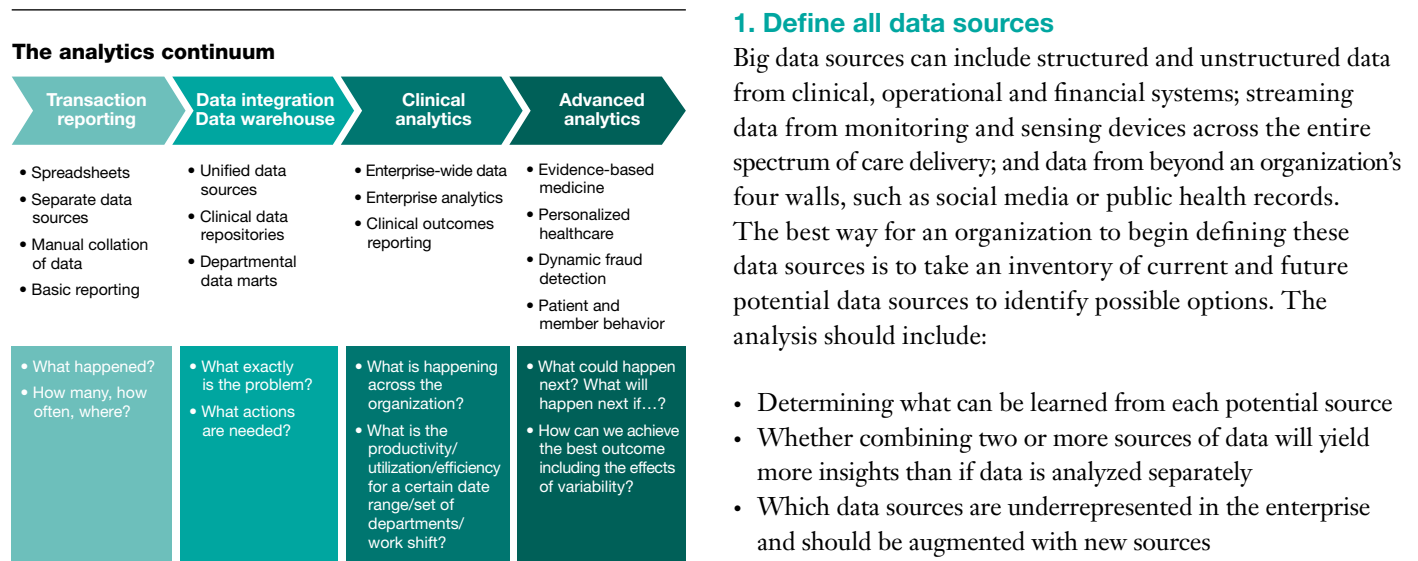
The first phase of the Columbia project used advanced analytics to examine massive volumes of real-time data streams and persistent data from patients with bleeding strokes and detect hidden patterns that indicated the likelihood of complications. In the second phase of the project, researchers worked in the neurological intensive care unit to gather patient data in real time. They tested for the previously-identified early warning signs and alerted medical professionals when a patient was experiencing a life-threatening complication that required immediate, preventative treatment.

- The Rizzoli Orthopaedic Institute in Bologna, Italy, the first Western healthcare institute specializing in orthopedic pathologies, is improving care and reducing treatment costs for hereditary bone diseases. Rizzoli is using advanced analytics to gain a more granular understanding of the dynamics of clinical variability within families where individuals show drastic differences in the severity of their symptoms. Efforts thus far have resulted in more efficient and cost-effective care, including 30 percent reductions in annual hospitalizations and over 60 percent reductions in the number of imaging tests. In the future, Rizzoli hopes to gain additional insights into the complex interplay of genetic factors and identify cures.
- The Hospital for Sick Children (SickKids) in Toronto, the largest center dedicated to advancing children's health in Canada, is improving outcomes for infants susceptible to life-threatening nosocomial infections. SickKids applies advanced analytics to vital-sign data, captured from bedside monitoring devices up to 1,000 times per second, to detect potential signs of an infection as much as 24 hours earlier than with previous methods. Although it is still too early to report on the project's success, researchers and clinicians are hopeful that it will deliver significant future benefits for many types of medical diagnostics.

Both planning and cultural and technological changes are required to create a data-driven healthcare organization. The transformation doesn't have to happen all at once; organizations can start small and build capabilities over time. The next section of this paper discusses the issues organizations need to consider and the steps to follow to become data driven.

## Steps to becoming a data-driven healthcare organization

Healthcare organizations that want to become data driven must commit to valuing data as a strategic asset, making data part of their culture, developing an understanding of the complete flow of data and acting upon data-driven insights. These organizations need to encourage and reward the sharing of data and insights, have management and executive teams who champion transformation and build programs to develop data and analytics skills across their enterprises.



*Figure 2:* As organizations become more data-driven, they move from heavily manual data management and reporting processes that address simple queries to handling bigger data volumes on a platform that supports predictive analytics and complex questions.

Progressing across the analytics continuum toward being a data-driven organization involves a shift in the type of technologies and systems involved in working with the data, as well as an evolution in the types of business questions being asked (see Figure 2).

Although most organizations will take an incremental approach to becoming data driven, all should begin the process by creating an information strategy and roadmap and by putting in place an analytics platform and data governance policies that include the following five steps.

### 1. Define all data sources

Big data sources can include structured and unstructured data from clinical, operational and financial systems; streaming data from monitoring and sensing devices across the entire spectrum of care delivery; and data from beyond an organization's four walls, such as social media or public health records. The best way for an organization to begin defining these data sources is to take an inventory of current and future potential data sources to identify possible options. The analysis should include:

- Determining what can be learned from each potential source
- Whether combining two or more sources of data will yield more insights than if data is analyzed separately
- Which data sources are underrepresented in the enterprise and should be augmented with new sources

The resulting definition should serve as the foundation for all analytics initiatives. It must be revisited as new data sources become available; if kept current and accurate, it can provide an organization with significant benefits for many years.

## 2. Set data quality metrics and assess and improve the quality of proposed sources

All new and established data sources must be carefully examined to assess data quality levels and determine the appropriate type of corrective action. Assessments should compare data sources to established data quality targets and track improvements.

Once data quality issues have been addressed, data must be normalized to standardize formats, structure and quality of all data sources—including variability in reference data, such as how gender, phone and code sets are handled. Because normalized data will be used for many types of initiatives, organizations may want to master data types, such as location, providers and patients, and make them available to all data sources. For most organizations, applying a common healthcare data model will also benefit analytics initiatives.

## 3. Integrate data sources

After an organization understands how it plans to use and analyze different data sources, it can determine the best platform for integrating its data. Platform choices will depend on a number of factors, such as whether data is structured, unstructured or both; whether data is streaming or stored historically; or if reports or exploratory analysis will be required. For example, some organizations will integrate data and route messages, images, text or streams of data to an existing data warehouse, while others will require a high-performance analytics warehouse designed to handle increasing data volumes, real-time queries and analytics against structured and unstructured data.

## 4. Identify analytics needs

Understanding the analytics requirements will help an organization to define priorities and determine which visualization and statistics are best suited to the task. Analysis

may range from basic reporting on current data to identifying trends or predicting future events. For example, basic operational reports or regular executive reports require a different set of data sources and analytics environment than more complex exploratory visualizations used by data analysts to predict readmission risk, spot key variances and findings, or validate hypotheses or unexpected outcomes.

## 5. Secure and manage the data lifecycle

Healthcare organizations must implement security measures to protect their big data, associated hardware and software, and clinical and administrative information from internal and external risks. At a project's inception, the data lifecycle must be established to ensure that appropriate decisions are made about retention, cost-effectiveness, reuse and auditing of historical or new data. To build trust in big data analysis results and gain buy-in from business and clinical users, data lifecycle management must encompass an understanding of data lineage, including the quality enhancements used and when improvements were routed back to source systems.

By implementing these steps and laying the foundation to extract valuable insights and transform the way healthcare is delivered, healthcare organizations will be able to:

- Identify factors that can help reduce the growth of chronic diseases and advancement of diseases
- Improve care for aging populations whose health is particularly affected by environmental and societal factors
- Meet consumer expectations for better service and a more personalized experience through social and mobile engagement models
- Achieve more insight into patient outcomes and care
- Meet compliance and reporting requirements for outcomes-based or accountable-care payment models

## IBM big data and analytics solutions for healthcare

IBM can help healthcare organizations navigate the journey to reducing costs and improving care quality and outcomes through better analytics. Drawing on years of experience in the healthcare industry, IBM has a team of experienced consultants and leading products and solutions that can help cross-organization teams assess data sources, develop a roadmap and strategy, and implement a flexible and scalable big data platform with clinical and advanced analytics capabilities.

IBM has more than 8,000 employees dedicated to healthcare, has completed more than 3,000 successful healthcare transformation initiatives, and holds more than 600 patents in the life sciences, healthcare and medical device fields. As an active participant with its healthcare clients and partners, IBM is working to lay the foundations of a 21st-century healthcare system by redefining value and success in healthcare and helping to build a smarter healthcare industry.

For more information, visit: [ibm.com/big-data/healthcare](http://ibm.com/big-data/healthcare)



---

© Copyright IBM Corporation 2013

IBM Corporation  
Software Group  
Route 100  
Somers, NY 10589

Produced in the United States of America  
February 2013

IBM, the IBM logo and [ibm.com](http://ibm.com) are trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at "Copyright and trademark information" at [ibm.com/legal/copytrade.shtml](http://ibm.com/legal/copytrade.shtml)

This document is current as of the initial date of publication and may be changed by IBM at any time. Not all offerings are available in every country in which IBM operates.

THE INFORMATION IN THIS DOCUMENT IS PROVIDED "AS IS" WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND ANY WARRANTY OR CONDITION OF NON-INFRINGEMENT. IBM products are warranted according to the terms and conditions of the agreements under which they are provided.



Please Recycle

---