IBM Institute for Business Value

The value of analytics in healthcare

From insights to outcomes

By James W. Cortada, Dan Gordon and Bill Lenihan

Healthcare organizations around the world are challenged by pressures to reduce costs, improve coordination and outcomes, provide more with less and be more patient centric. Yet, at the same time, evidence is mounting that the industry is increasingly challenged by entrenched inefficiencies and suboptimal clinical outcomes. Building analytics competency can help these organizations harness "big data" to create actionable insights, set their future vision, improve outcomes and reduce time to value.

The global healthcare industry is experiencing fundamental transformation as it moves from a volume-based business to a value-based business. With increasing demands from consumers for enhanced healthcare quality and increased value, healthcare providers and payers are under pressure to deliver better outcomes. Primary care physician and nursing shortages require overworked professionals to be even more productive and efficient. The cost dynamics of healthcare are changing, driven by people living longer, the pervasiveness of chronic illnesses and infectious diseases, and defensive medicine practices. New market entrants and new approaches to healthcare delivery are increasing complexity and competition.

 As tumultuous as the current environment is, it is expected to become even more complex over the next several years. Among healthcare executives interviewed for the 2010 Global CEO study, 90 percent expect a high or very high level of complexity over the next five years, but more than 40 percent are unprepared to deal with it.[1] This immense complexity confronting the healthcare industry will require smarter, more informed decisions to enable the improved outcomes and better value required by market dynamics, increasing governmental regulation, and today's more demanding consumers.

Analytics can provide the mechanism to sort through this torrent of complexity and data, and help healthcare organizations deliver on these demands. To determine how to apply analytics to their current challenges, gain insight and achieve faster time to value, we asked 130 healthcare executives from around the world the following questions:

- How are healthcare provider and payor organizations applying analytics today, and how might they need to think about its future use?
- How do high performing organizations use it differently than their peers?
- What are the barriers to adoption?
- What forward-looking analytics innovations can healthcare organizations apply to meet their mounting challenges?

Through our analysis of our interviews with executives, we advanced our understanding of:

- Why analytics competency is more important than ever
- How top performing healthcare organizations are using analytics to influence outcomes, create differentiation and drive revenue growth
- The analytics sophistication model
- The barriers to analytics
- Best practices in getting started or accelerating your journey along the path to analytics competency.

Analytics

Analytics is the systematic use of data and related business insights developed through applied analytical disciplines (e.g. statistical, contextual, quantitative, predictive, cognitive, other [including emerging] models) to drive fact-based decision making for planning, management, measurement and learning. Analytics may be descriptive, predictive or prescriptive.

Why analytics now?

The daunting challenges facing the healthcare industry today make for compelling arguments to expand the role of analytics. Evidence continues to mount that healthcare is increasingly challenged by entrenched inefficiencies, including wasting more than US$2 trillion annually.[2] These inefficiencies can be attributed to several factors, including the ineffective gathering, sharing and use of information. Clinical outcomes remain suboptimal, particularly in the United States, where 96 people per 100,000 die annually from conditions considered
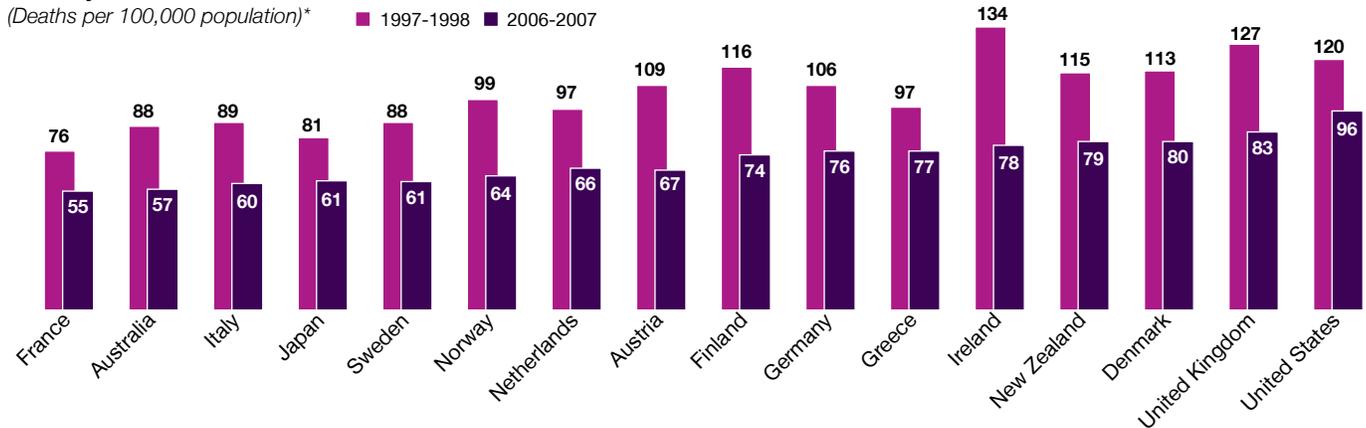
amenable to healthcare (see Figure 1).[3] Hospitals in Australia, Canada, Denmark, France, New Zealand, Spain, the United Kingdom and the United States have reported high levels of preventable errors. Error rates ranged from 2.9 to 45.8 percent for hospitalized patients, of which 7.6 to 51.2 percent were preventable.[4]

In addition to systemic issues, other factors add to the immense complexity the healthcare industry is facing. Citizens have higher expectations of their healthcare providers, have more access to information than ever before, and are demanding increasing accountability from their doctors, nurses and health plans. In fact, from the consumer point of view, health plans ranked last among 14 industries in a customer experience survey, trailing even television and Internet service providers, and well behind other insurance providers.[5]

The increasing regulatory presence of government places additional focus on accountability, governance and oversight on the industry. Market dynamics and competitive pressures require enhanced understanding of underlying trends and a path to differentiation.

Mortality amenable to healthcare
(Deaths per 100,000 population)   ■ 1997-1998   ■ 2006-2007

Country	1997-1998	2006-2007
France	76	55
Australia	88	57
Italy	89	60
Japan	81	61
Sweden	88	61
Norway	99	64
Netherlands	97	66
Austria	109	67
Finland	116	74
Germany	106	76
Greece	97	77
Ireland	134	78
New Zealand	115	79
Denmark	113	80
United Kingdom	127	83
United States	120	96

*Countries' age-standardized death rates before age 75; including ischemic heart disease, diabetes, stroke and bacterial infections.
Source: Commonwealth Fund National Scorecard on U.S. Health System Performance, 2011.

Figure 1: **Clinical outcomes remain suboptimal in many nations.**

Using analytics to gain better insights can help demonstrate value and achieve better outcomes, such as new treatments and technologies. Information leading to insight can help informed and educated consumers become more accountable for their own health. Analytics can improve effectiveness and efficiency. From managing small details to large processes, analytics can aid exploration and discovery; help design and plan policy and programs; improve service delivery and operations; enhance sustainability; mitigate risk; and provide a means for measuring and evaluating critical organizational data. Perhaps most important, it can expand access to healthcare, align pay with performance and help hold down growth in healthcare costs.

Cost, quality and access issues take toll on U.S. healthcare system

The United States is struggling to address increasing costs, poor or inconsistent quality and inaccessibility to timely care. Healthcare expenditures per capita are 2.4 times higher than that of other developed countries and are projected to increase 67.9 percent over the next ten years. Access concerns, such as the 45.7 million uninsured U.S citizens (15.3 percent of total population) are taking a toll on the healthcare system. Moreover, these challenges are exacerbated by forces that are challenging the status quo: globalization, consumerism, changing demographics and lifestyles, diseases that are more expensive to treat (for example, the rising incidence of chronic disease) and the proliferation of medical technologies and treatments.[6]

The multitude of volatile changes sweeping the industry is exacerbated by the proliferation of clinical information systems, electronic health records and connected health devices that have created an unprecedented information explosion. In the 2010 IBM Global CEO study, 93 percent of healthcare providers identified the information explosion as the biggest factor anticipated to influence their organizations to a large extent over the next five years.[7] The abundance of data that bombards healthcare professionals both facilitates and complicates the ability of healthcare payers and providers to achieve and influence desirable outcomes. However, this wealth of information is a double-edged sword. The glut of information makes it progressively more difficult to distinguish between essential data and clutter. In fact, the data paradox – the management dilemma presented by too much data and too little insight – is an increasingly daunting obstacle to creating effective analytics strategies.

Healthcare organizations are increasingly using analytics to consume, unlock and apply new insights from information. New methods of analytics can be used to drive clinical and operational improvements to meet business challenges. From a traditional baseline of transaction monitoring using basic reporting tools, spreadsheets and application reporting modules, analytics in healthcare is moving toward a model that will eventually incorporate predictive analytics and enable organizations to "see the future," create more personalized healthcare, allow dynamic fraud detection and predict patient behavior.

Top performers: "Pros" use analytics to differentiate, see the future and drive revenue growth

"Data visualization is very important. Uncertainty around reform has really heightened the urgency for simulations and scenario testing. We have had to hire new people with new skills to help with that."

Vice President, Analytics, U.S. health plan

Healthcare organizations need to use analytics to accomplish a broader range of objectives than industry at large. In a previous IBM Institute for Business Value executive report, "The power of analytics for public sector: Building analytics competency to accelerate outcomes," we called the transition from information gathering and report generation to data analysis and predictive capabilities "Going Pro," and that term remains appropriate for healthcare organizations looking to thrive in

today's environment.[8] Based on responses from healthcare executives in the 2010 *MIT Sloan Management Review*'s New Intelligent Enterprise Global Study, conducted in partnership with IBM, we looked at the differences between self-identified outperforming healthcare organizations (Top Performers) uses of analytics and the uses by other organizations.[9]

In healthcare, top performers are keenly focused on ramping up their analytics capabilities. In fact, in the recent IBM Global CIO Study, more than 90 percent of healthcare CIOs for top-performing organizations cited insight and intelligence as a key focus for their organizations over the next three to five years, compared to 65 percent of underperformers. Further, when these CIOs were asked about visionary plans to increase competitiveness, 83 percent of healthcare CIOs listed business intelligence and analytics as their top priority.[10] Outperformers stretch the envelope and apply analytics in innovative ways that enable them to stand above their peers.

Top performing "pros" in healthcare share multiple characteristics in their approach to analytics (see Figure 2). In analyzing healthcare responses to the 2010 MIT survey, we found healthcare pros use analytics to set their future vision, define their brand and drive revenue growth to achieve specific

Use of analytics by healthcare organizations: Framing the question

■ Healthcare high performers
■ Other healthcare
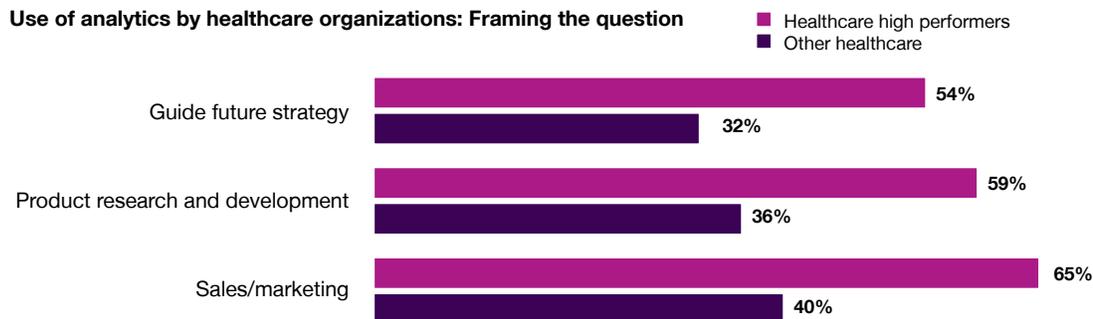
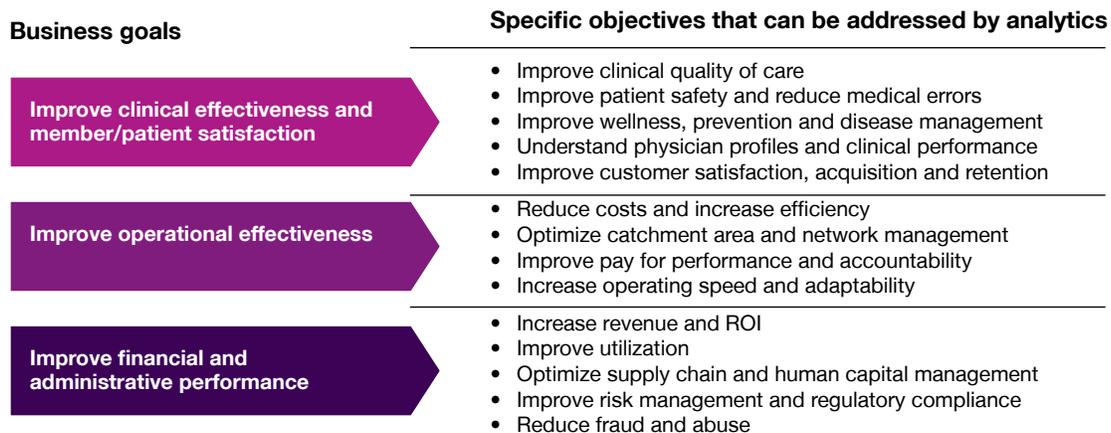Source, IBM Institute for Business Value, Analytics: The new path to value

Figure 2: **Top performing organizations use analytics to guide strategy, perform product research and sales and marketing development.**

clinical and administrative objectives. Among executives surveyed, 58 percent of healthcare high performers stated business information and analytics differentiate them from others in the industry, compared with only 36 percent of other healthcare organizations. The difference between top performers and others is even more distinct when measuring how rigorous their approaches to decision-making are. Among high performers, 42 percent said their decisions are based on rigorous approaches, compared with only 28 percent of others.

Additionally, top performing organizations use analytics to guide strategy, perform product research and development and for sales and marketing. Again, the difference between top performing organizations and others in the industry is pronounced. For example, 54 percent of top performers say

they use analytics to guide future strategy, compared to only 32 percent of others. Further, 59 percent of top performers use analytics for product research and development, compared to only 36 percent of others. And 65 percent of top performers use analytics for the development of sales and marketing, compared with only 40 percent of others.

Beyond the general application of analytics to business goals, the development and use of analytics among top performers is geared towards achieving specific objectives and priorities. As Figure 3 illustrates, analytics can be focused in a variety of ways to improve clinical quality of care, reduce costs and increase efficiency, and increase revenue and return on investment (ROI).

Business goals **Specific objectives that can be addressed by analytics**

Improve clinical effectiveness and member/patient satisfaction
- Improve clinical quality of care
- Improve patient safety and reduce medical errors
- Improve wellness, prevention and disease management
- Understand physician profiles and clinical performance
- Improve customer satisfaction, acquisition and retention

Improve operational effectiveness
- Reduce costs and increase efficiency
- Optimize catchment area and network management
- Improve pay for performance and accountability
- Increase operating speed and adaptability

Improve financial and administrative performance
- Increase revenue and ROI
- Improve utilization
- Optimize supply chain and human capital management
- Improve risk management and regulatory compliance
- Reduce fraud and abuse

Source: Interviews with healthcare executives, IBM Institute for Business Value analysis.

Figure 3: **Analytics can address specific objectives that support organizational missions and priorities.**

Barriers to analytics adoption

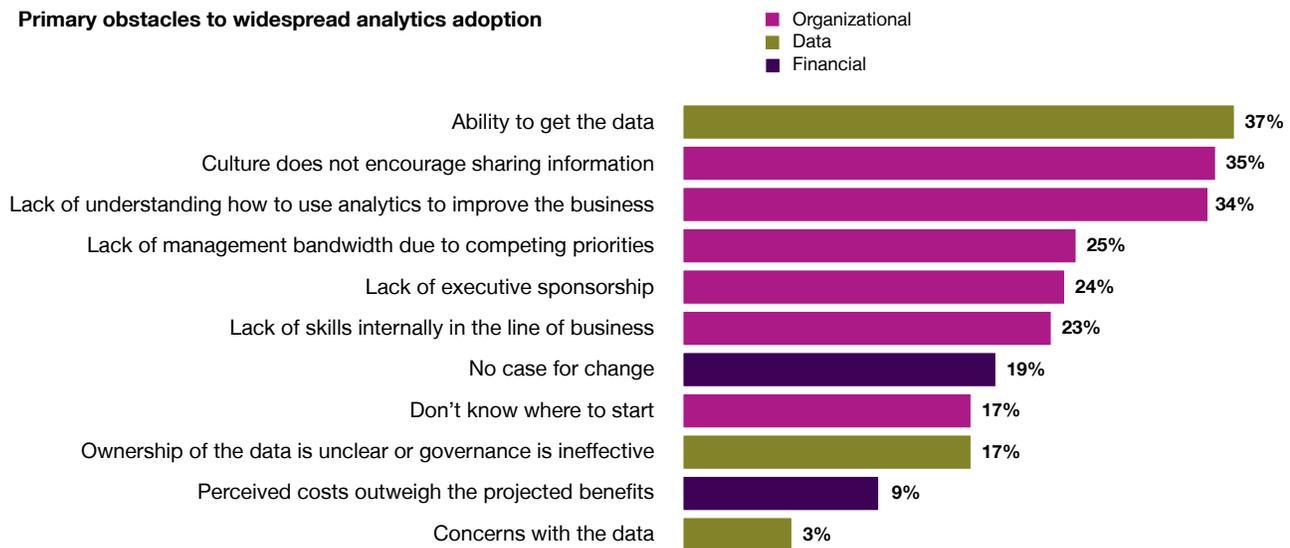*"Our executives don't know how bad the data is"*

CIO, Health System

Despite the advantages that can be offered by the application of analytics, a number of barriers can stymie or slow adoption. Even in the midst of the information explosion, the ability to get relevant data was cited by almost 40 percent of study participants as the biggest stumbling block for widespread analytics adoption.[11] This is not to imply that data is not available, but goes back to the data paradox, in which the sheer amount of data that must be analyzed inhibits the development of meaningful insights. The key capabilities in getting the right data were the ability to integrate data from multiple disparate sources and standardize it to ensure consistent definitions throughout the organization. Interestingly, high-performing organizations are more likely than underperformers to say they are not adept at capturing appropriate information: 35 percent of healthcare high performers said their organizations perform poorly in capturing information, compared to 14 percent of others.

Many of the biggest barriers to analytics adoption are organizational (see Figure 4). Chief among these is a culture that does not encourage information sharing, cited by 35 percent of our respondents as a primary obstacle. Lack of understanding

Primary obstacles to widespread analytics adoption

■ Organizational
■ Data
■ Financial

Obstacle	Value
Ability to get the data	37%
Culture does not encourage sharing information	35%
Lack of understanding how to use analytics to improve the business	34%
Lack of management bandwidth due to competing priorities	25%
Lack of executive sponsorship	24%
Lack of skills internally in the line of business	23%
No case for change	19%
Don't know where to start	17%
Ownership of the data is unclear or governance is ineffective	17%
Perceived costs outweigh the projected benefits	9%
Concerns with the data	3%

Source: Analytics: The New Path to Value, a joint *MIT Sloan Management Review* and IBM Institute of Business Value study. Copyright © Massachusetts Institute of Technology 2010.
Sample size Healthcare n= 116

Figure 4: **Most of the top barriers to analytics adoption are organizational.**

about how to use analytics to improve business is an additional barrier experienced by more than a third of our study participants. Other organizational barriers include insufficient management bandwidth due to competing priorities, absence of executive sponsorship, lack of skills internally in a line of business, and not knowing where to start the quest for analytics excellence.

"Integration is very critical. It is the only way we can get done what we need to do. We have a lot of vertical solutions and data sets for specific problems. We can't connect clinical data to claims data."
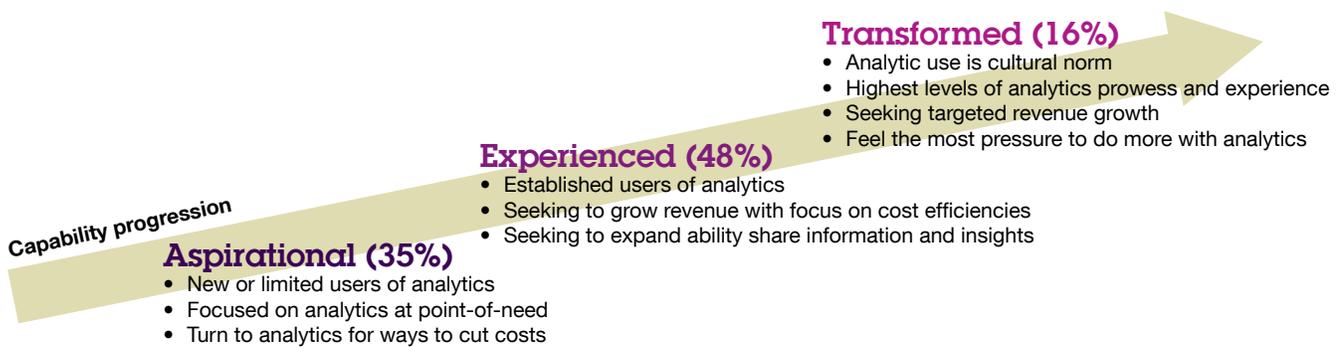
Vice President, Health Analytics, U.S. Health Plan

Other barriers surrounding the data include questions about ownership of the data or ineffective data governance, as well as concerns with the quality and integrity of data. The remaining barriers cited by our study participants were financial: the organization has not made a financial case for change, or the perceived costs outweigh the projected benefits.

The analytics sophistication model

Organizations that know where they are on the analytics sophistication spectrum are better prepared to turn challenges into opportunities. Research by the *MIT Sloan Management Review*, in partnership with the IBM Institute for Business Value, revealed three specific analytics capabilities segments – Aspirational, Experienced and Transformed – each with its own set of challenges and opportunities (see Figure 5).[12]

Transformed (16%)
- Analytic use is cultural norm
- Highest levels of analytics prowess and experience
- Seeking targeted revenue growth
- Feel the most pressure to do more with analytics

Experienced (48%)
- Established users of analytics
- Seeking to grow revenue with focus on cost efficiencies
- Seeking to expand ability share information and insights

Capability progression

Aspirational (35%)
- New or limited users of analytics
- Focused on analytics at point-of-need
- Turn to analytics for ways to cut costs

Source: Analytics: The New Path to Value, a joint *MIT Sloan Management Review* and IBM Institute of Business Value study. Copyright © Massachusetts Institute of Technology 2010. Sample size Healthcare n= 116

Figure 5: **As organizations advance in analytics sophistication, they encounter new priorities, activities and roadblocks in their use of analytics.**

About a third of healthcare organizations are aspirational, farthest from achieving their desired analytic goals. Almost half have gained some analytic experience. They are looking to go beyond cost analysis and descriptive historical reporting. Few healthcare organizations have substantial experience using analytics across a broad range of functions and view analytics as a cultural norm.

The journey to analytics competency follows defined paths that ultimately allow organizations to modify and manage relationships, as well as motivate and modify behavior As organizations advance along the analytics sophistication scale, they will need to acquire different and sophisticated methods to generate meaningful insights.

Today, most healthcare organizations are extensive users of descriptive analytics. They are using reporting tools and applications descriptively to understand what has happened in the past and to classify and categorize historical, usually structured data. Forward-thinking organizations are also focusing on data warehousing and the end-to-end information lifecycle to create financial and operational dashboards, clinical data repositories and departmental data marts. The explosion in the amount of structured and unstructured clinical data makes data warehousing an essential foundation for turning data into actionable information.

As their analytics capabilities mature, healthcare organizations are looking more toward predictive analytics techniques, which take an understanding of the past to predict future activities and model scenarios using simulation and forecasting. Enterprise analytics, evidence-based medicine and clinical outcome analytics can all be supported by these more advanced capabilities. For example, analytics can enable the compilation of information about trends, patterns, deviations, anomalies and relationships and reveal insight.

Three levels of analytics capabilities[13]

Aspirational: These organizations are the farthest from achieving their desired analytical goals. Often they are focusing on efficiency or automation of existing processes, and searching for ways to cut costs. Aspirational organizations currently have few of the necessary building blocks – people, processes or tools – to collect, understand, incorporate or act on analytic insights.

Experienced: Having gained some analytic experience – often through successes with efficiencies at the Aspirational phase – these organizations are looking to go beyond cost management. Experienced organizations are developing better ways to effectively collect incorporate and act on analytics so they can begin to optimize their organizations.

Transformed: These organizations have substantial experience using analytics across a broad range of functions. They use analytics as a competitive differentiator and are already adept at organizing people, processes and tools to optimize and differentiate. Transformed organizations are less focused on cutting costs than Aspirational and Experienced organizations, possibly having already automated their operations through effective use of insights. They are most focused on driving customer profitability and making targeted investments in niche analytics as they keep pushing the organizational envelope.

Transformed organizations were three times more likely than Aspirational ones to indicate they substantially outperform their industry peers. This performance advantage illustrates the potential rewards of higher levels of analytics adoption.

Ultimately, organizations will want to be able to take advantage of the full scope of capabilities of prescriptive analytics to provide decision makers with sophisticated alternatives (insights created with speed, scale, currency, breadth and depth) to be able to influence optimal future outcomes. These capabilities can facilitate personalized medicine, help in dynamic fraud detection and assist in behavior modification to improve healthier lifestyle choices.
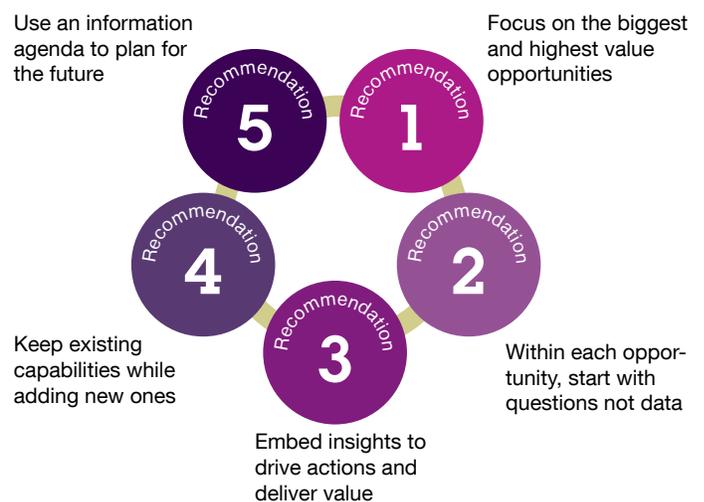
Healthcare executives we interviewed agreed that new analytics techniques must be put in place to respond to the increasing complexity in today's environment. For most organizations today, data visualization, historic trend analysis and forecasting, and standardized reporting are the analytics elements that provide the most value. Over the next two years, however, that is likely to change. While data visualization will always be a critical element, increased emphasis will be placed on simula-tions and scenario development and analytics that are applied within various business processes.

Advanced analytics systems provide accurate information quickly

The ability of Watson, IBM's new intelligent supercomputer to analyze the meaning and context of human language, and quickly process vast amounts of information to suggest options targeted to a patient's circumstances, is an example of technology that can assist physicians and nurses in identifying the most effective courses of treatment for their patients. In less than 3 seconds, Watson can sift through the equivalent of about 200 million pages, analyze the information, and provide precise responses. With medical information doubling every 5 years, advanced health analytic systems technologies can help improve patient care through the delivery of up- to-date, evidence-based health care.

What the future demands: Best practices in getting started or accelerating your journey along the path to analytics competency

It takes big plans, followed by discrete actions, to gain the benefits of analytics. But it also requires some very specific management approaches. Based on 2010 MIT study data, IBM's engagement experience, case studies and interviews with experts, we have identified a framework for healthcare analytics driven management transformation that can help organizations drive value (see Figure 6).

Use an information agenda to plan for the future

Focus on the biggest and highest value opportunities

Keep existing capabilities while adding new ones

Within each oppor-tunity, start with questions not data

Embed insights to drive actions and deliver value

Source: Analytics: The New Path to Value, a joint *MIT Sloan Management Review* and IBM Institute of Business Value study. Copyright © Massachusetts Institute of Technology 2010.

Figure 6: **The path to value operationalizes analytics.**

Focus on the biggest and highest value opportunities

Search for your organization's biggest and highest priority challenge. Focus on a clear priority is necessary to align organizational efforts, no matter your analytics sophistication. Change is hard for most, so select an initiative that is worthy of sustained focus that can make the biggest difference in achieving your organization's desired outcomes. Desired outcomes suggest "what's important" and "why" – and drive healthcare organizations to act. The highest value opportunities, whether operational or clinical, must be well-defined to frame the most important questions, as well as affirm the right outcomes. Indicators of both performance and progress will need to be designed and measured to shape outcome objectives

Within each opportunity, start with questions, not data

Start attacking the selected high value opportunity area by gaining insight into the problem space through questions you would like answered. They will lead to a better understanding of the information that is needed and the data that can be used to generate that information. Many aspirational healthcare organizations begin their journey with large, domain specific datasets – patient registration, lab or drug data or structured coded data – and learn the limitations of starting with data and not questions. As organizations advance in sophistication, they shift their data focus from collection to use. That, in turn, creates the focus on the data that needs to be collected and made available, as well as the information processes that must be managed and shared. It also helps to "redefine the enterprise" based on desired outcomes. Analytics leaders are fostering appropriate information sharing through data governance, standards adoption, new approaches and best practices. Creating new analytics-enabled insights depends on strengthening the information foundation.

Embed insights to drive actions and deliver value

Analytics has no value unless it is acted upon. Strong linkages among information production and knowledge translation, change management and quality improvement are hallmarks of more advanced analytic organizations. Part of the analytics challenge is to make the new insights real for organizations and a catalyst for management action. Many of the most effective analytic initiatives embed small, action-oriented analytics into key decision points of specific business processes that are used by large number of employees. Conversely, effective, predictive analytics and simulations may also be aimed at senior executives, who have to make complex, strategic decisions that can have major impact on the organization's service lines and its care venue ecosystem.

Learn from the best practices of others. Analyzing patterns is a cornerstone of effective analytics in healthcare. But being able to predict future behavior can be a significant differentiator. Many organizations use data analytics in other powerful ways, such as in risk management, scenario planning and simulation models.

Keep existing capabilities while adding new ones

Healthcare analytics is not a destination, but a journey that is never completed as organizations move along the sophistication spectrum from Aspirational, to Experienced, to Transformed capabilities. New analytic competencies are always built on a foundation of existing technical, data, operational and business capabilities. This creates the fundamental requirement for analytics initiatives to be scalable, both in its technology architectures, and in its human resource requirements. As adoption spreads, there is a growing demand for a greater variety of skills and deeper, more specialized expertise. There are a variety of hybrid centralized and decentralized analytic organizational structures that make sense for different kinds of organizations to achieve this scalability and flexibility.
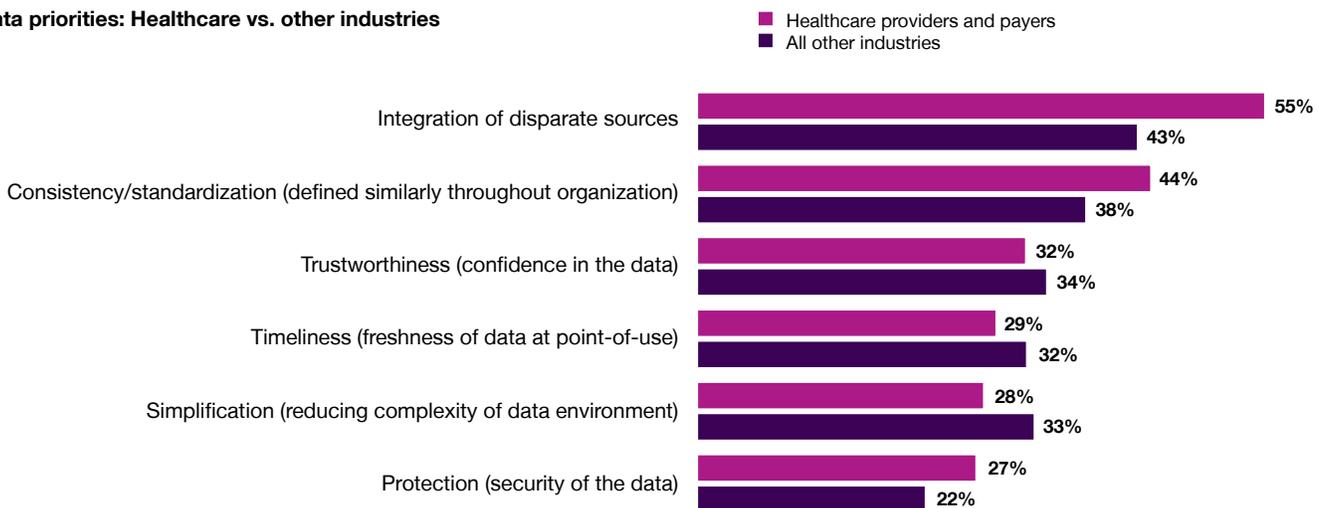
Use the information agenda to plan for the future
Most organizations will build up analytics through many concurrent projects conducted across the organization in stages over time. These projects will bring diverse human resources to bear, who will need to work together and change as they learn what works and what doesn't. Without an integrating vision for how the pieces need to work together at a foundational level, the end result could be either an environment so complex that it cannot meet enterprise needs or one so costly to maintain that the organization must stop and simplify.

No matter what the analytic sophistication, an analytics vision and information agenda is a necessary tool to align the efforts of the many stakeholders, who will need to mold both struc-

tured and unstructured data into an integrated, consistent and trustworthy information foundation. Every phase of implementation needs to align its data foundation to an overall information agenda that accelerates the organization's ability to share and deliver trusted information across all applications and processes.[14] As a result, integration of disparate information is a necessity, as are consistency and standardization of data throughout the organization (see Figure 7). An information agenda that includes a shared approach to governance, data architecture, data management and analytic techniques and toolkits will go a long way toward accomplishing the journey quickly and efficiently.

Data priorities: Healthcare vs. other industries

■ Healthcare providers and payers
■ All other industries

Category	Healthcare	All other
Integration of disparate sources	55%	43%
Consistency/standardization (defined similarly throughout organization)	44%	38%
Trustworthiness (confidence in the data)	32%	34%
Timeliness (freshness of data at point-of-use)	29%	32%
Simplification (reducing complexity of data environment)	28%	33%
Protection (security of the data)	27%	22%

Source, IBM Institute for Business Value, Analytics: The new path to value

Figure 7: In healthcare, more than other industries, integration is a high priority.

Getting started, or building momentum

Underperformers will fall even further behind if they fail to learn from how their more successful peers are using analytics. It all starts with defining issues and desired outcomes. Asking the right questions not only illuminates the data that matters, but also brings objectives and targets into focus – both from a performance and progress perspective

By learning from top performers and following the path to action, healthcare organizations can establish a high functioning analytics competency that meets three critical management needs. First, it reduces time to value. Organizations can achieve value creation early and they do not require perfect data across all domains or full-scale transformation before starting. Second, it helps overcome the most significant organizational impediments and increases the likelihood of transformation that is both sufficient and enduring. Third, it enables a greater focus on achievable steps.

So to get started, consider the following questions:

- What are the highest value "make or break" issues of quality, cost or access that will enable you to be a competitive, sustainable healthcare organization?
- Do you know what questions you want to answer?
- How will you generate the answers and embed these insights into clinical and business processes?
- Do you have an information agenda that both addresses this transformational opportunity and that optimizes analytic investments over time?
- What are the cultural impediments that could derail any analytics initiative and what are you going to do about it?
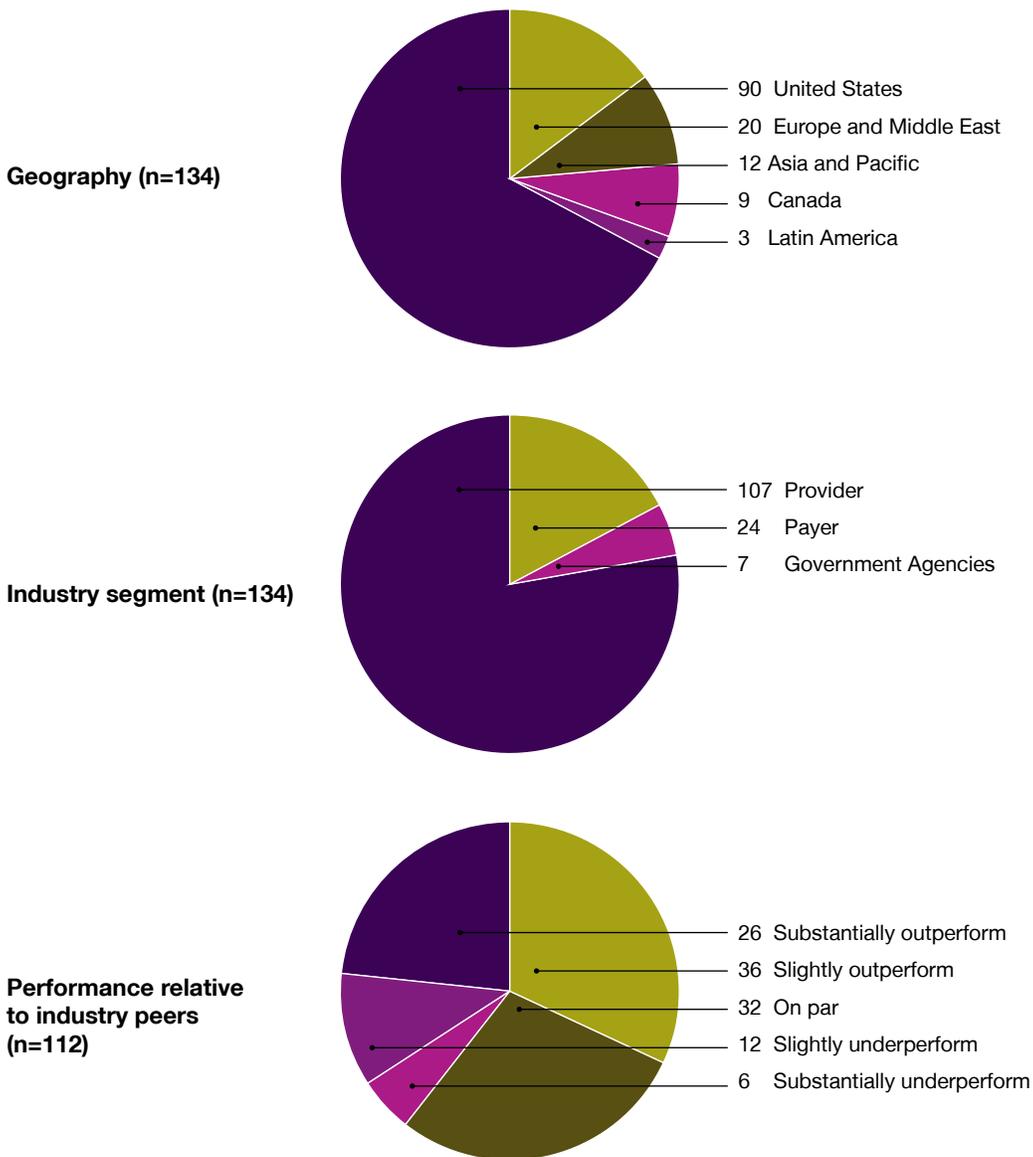
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Appendix A: Survey breakdown

Geography (n=134)

90 United States
20 Europe and Middle East
12 Asia and Pacific
9 Canada
3 Latin America

Industry segment (n=134)

107 Provider
24 Payer
7   Government Agencies

Performance relative to industry peers (n=112)

26 Substantially outperform
36 Slightly outperform
32 On par
12 Slightly underperform
6   Substantially underperform

About the authors

James W. Cortada has over thirty years of experience working with governments. He leads the Government and Health Industry teams at the IBM Institute for Business Value, where he has developed thought leadership studies on various managerial issues, including on the future of public administration. Jim is the author of over two dozen books on the use of information and over a dozen studies for the IBM Institute for Business Value. Jim can be contacted at *jwcorta@us.ibm.com*.

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9 The dataset is an extract from the full response set from the MIT survey. Respondents from the industries of "Healthcare Payer" and "Healthcare Providers" equaled 116 out of 2,920 respondents overall.

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