



A booster shot for health and wellness

Your cognitive future in the healthcare industry

IBM Institute for Business Value

A healthcare renaissance

Welcome to the age of cognitive computing, where intelligent machines simulate human brain capabilities to help solve society's most vexing problems. For healthcare, cognitive computing has indeed arrived, and its potential to transform the industry is enormous. Already, cognitive systems help enable enhanced patient care, advanced discoveries and better decisions for providers around the world. Our research indicates healthcare leaders are poised to embrace this groundbreaking technology and invest in cognitive capabilities to spark a renaissance in healthcare.

Executive summary

In both the worlds of medicine and IT, there is often talk of “the next big thing.” Today, many of these conversations are broadening, as cognitive computing is touted by some as revolutionary for IT, healthcare and, indeed, society in general.

For healthcare in particular, the timing for a game changer couldn't be better. The industry is coping with upheaval triggered by varied economic, societal and industry influences. Empowered consumers living in an increasingly digital world are demanding more from an industry that is facing growing regulation, soaring costs and a shortage of skilled resources.

At the same time, the healthcare ecosystem is expanding, as new participants interact, partner and collaborate across traditional boundaries. Otherwise separate entities, such as providers, payers, social and government agencies, and retailers, are working together to create value in new ways. For example, CVS Health, a pharmacy innovation company, announced plans to create a solution that will use cognitive computing capabilities with the goal of enabling healthcare practitioners to transform care management for chronic disease patients.¹

To thrive amid the chaos of change, healthcare leaders must be smarter in how they approach data. While the digital age has brought a massive amount of healthcare data brimming with insights, organizations still struggle to unlock its full value. Advances in the pioneering area of cognitive computing can help bridge the gap between data quantity and data insights.

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95%

of healthcare executives familiar with **cognitive computing** intend to **invest in cognitive** capabilities

Cognitive-based systems can build knowledge, understand natural language and provide confidence-weighted responses. And they can quickly find the proverbial needle in a haystack, identifying new patterns and insights – something particularly relevant in healthcare.

Our research reveals that cognitive solutions are already helping healthcare organizations blaze new territory. A follow up to the “Your cognitive future” reports, this is the first in a new series of industry-specific reports based on research conducted in early 2015, which included a survey of close to 100 healthcare executives. (For more information on the research, see the Study approach and methodology section).

In this report, we examine current and future health and wellness applications and provide recommendations for those seeking a cognitive journey. We also offer insights from healthcare executives who understand how cognitive capabilities can help push the current boundaries of innovation and growth. These leaders recognize the potential to transform healthcare – and are set to exploit cognitive capabilities to do so.

Conquering industry forces

The healthcare industry is experiencing unprecedented disruption. From changing industry regulations to rising costs, healthcare providers are being bombarded by challenges and distractions. We have identified a number of disruptive forces that are shaping – and shifting – today’s healthcare arena:

Rapid digitization: Volumes of health-related data from a variety of sources have created data management and integration challenges. At the same time, the digital age presents new opportunities for providers to offer targeted consumer care, make more informed and timely decisions, and drive unprecedented levels of health and wellness innovation.

Increasing demand: A growing – and aging – world population and fast-moving epidemics like the Ebola outbreak in West Africa are increasing the demand for healthcare.² To meet this expanding need, healthcare organizations should improve operational efficiency and look for novel ways to target service and care.

Rising consumer expectations: Seeking the same conveniences they encounter in other industries, today’s patients want personalized, transparent, quality, integrated and convenient care. To provide the experience that empowered consumers demand, healthcare organizations need to gain deeper consumer insights and explore new service models.

Shortage of skilled resources: With many healthcare workers exiting the profession due to work pressures and an upsurge in retirement levels, the World Health Organization estimates a global industry shortage of 12.9 million workers by 2035.³ To improve employee retention, healthcare organizations should create a more positive working environment by fostering employee empowerment, communication and efficiency.

What is cognitive computing?

Cognitive computing is a new computation paradigm. Different types of cognitive computing solutions offer various capabilities, including...

- Learning and building knowledge from various structured and unstructured sources of information
- Understanding natural language and interacting more naturally with humans
- Capturing the expertise of top performers and accelerating the development of expertise in others
- Enhancing the cognitive processes of professionals to help improve decision making
- Elevating the quality and consistency of decision making across an organization.

Regulatory complexity: Due to complex and rapidly changing regulations, healthcare organizations face growing compliance costs as they struggle to deliver services within rigid limits. Improved access to data and insights could help the industry more confidently navigate the world of regulatory compliance without stifling medical exploration and discovery.

Increasing cost pressure: Healthcare costs continue to increase in part due to new technology and specialty and preventive drugs. Global spending per head is expected to rise by 4.5 percent a year from 2014 to 2018.⁴ In this environment, healthcare providers are challenged to find new ways to manage costs and efficiency without compromising service quality.

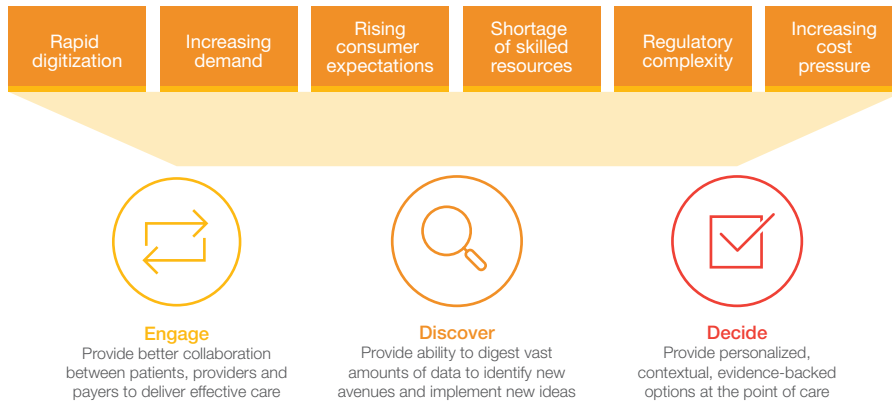
From disruption to focus

It's clear that healthcare organizations are operating amid turmoil. Although the forces challenging the industry appear varied in nature, we identified key themes among them relating to communication and collaboration, research and innovation, and decisions and personalized care.

To rise above the disruption, we suggest healthcare organizations focus on improving their capabilities to *engage*, *discover* and *decide* (see Figure 1). Increased engagement among patients, providers and payers will help improve communication and collaboration, thus facilitating more effective care. New discovery tools and capabilities can help unearth insights and ideas buried in the masses of data encountered today, thereby facilitating research and innovation. And better decision capabilities will allow for more personalized, evidence-based recommendations at the point of care, resulting in enhanced care management.

Figure 1

From disruption, three focus areas have come to light for the healthcare industry



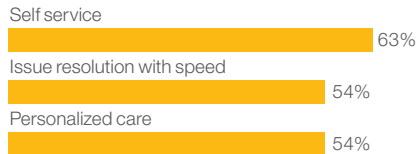
Source: IBM Institute for Business Value.

Engage: Today's consumers want more control over their health, as well as more personalized and convenient care. Although a clear majority of healthcare executives in our survey understand these demands, the majority are unable to deliver. In fact, 54 percent believe they are not effectively delivering a personalized experience, while 63 percent believe they are not providing successful self-service options. In addition, 54 percent are not satisfied with their ability to comprehensively and quickly address consumer and patient concerns.



Engage

Percentage of healthcare executives that do not believe their organizations are competent in delivering consumer service



Discover

Percentage of healthcare executives citing the specific barriers to implementing disruptive innovation



Decide

Two-thirds of healthcare executives are not confident in making cost reduction decisions



Discover: Two-thirds of healthcare executives surveyed are actively pursuing product and service innovation. However, they cite insufficient skills, organizational complacency and lack of analytical tools among their greatest challenges in this area. Healthcare discovery is also restricted by the constraints of traditional capabilities. For example, rigid analytics platforms (e.g., non integrated platforms across hospital locations) and a dependency on specialized skills (e.g., health data scientists) limit innovation speed and momentum. Yet, the amount of medical knowledge continues to explode, possibly to the point where it doubles every 73 days by the year 2020.⁵

Decide: Effective decision making is important in any industry, but in healthcare it can make the difference between life and death. According to our survey, healthcare executives express diffidence in their organizations' decision-making capabilities in a number of areas. Two-thirds are not confident in their organizations' cost reduction decisions, and more than half lack confidence in decisions relating to spending and strategy. While the ever-growing amount of medical data presents exciting prospects for improved decisions, only a fraction of data is currently utilized due to existing tool constraints. Decision making in healthcare can also be difficult due to the complex regulatory environment within which the industry operates.

Cognitive opportunity in healthcare

Big data has been called the new natural resource.⁶ And this resource continues to rapidly grow in volume, variety and complexity, particularly in healthcare. For example, the genome of just one cancer patient is equivalent to half a terabyte of data.⁷ Despite the explosive growth of information across industries, less than 1 percent of the world's data is currently analyzed.⁸

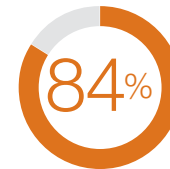
While effective for a number of applications, traditional analytics solutions cannot fully exploit the value of big data: They are unable to adapt to new problem domains or handle ambiguity and are only suitable for structured and unstructured data with known, defined semantics (the relation of words and phrases and what they mean). Without new capabilities, the data paradox of having too much data and too little insight will continue.

How can the healthcare industry bridge the gap between untapped opportunities and current capabilities? How can hidden insights that reside in data – structured and unstructured – be fully harnessed for discovery, insight, decision support and dialogue? The answer is cognitive computing. Cognitive-based systems build knowledge and learn, understand natural language, and reason and interact more naturally with human beings than traditional programmable systems.

Healthcare executives agree that cognitive computing has the potential to radically change healthcare. Among healthcare leaders familiar with the technology, 84 percent believe it will play a disruptive role in the industry, 81 percent believe it will critically impact the future of their business, and 95 percent intend to invest in cognitive capabilities.



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84% of healthcare executives familiar with **cognitive computing** believe it will play a **disruptive** role in the healthcare industry

95% of healthcare leaders familiar with **cognitive computing** intend to **invest in cognitive computing** in the future, with the majority doing so in the next 4 years



So, how specifically can healthcare organizations leverage cognitive computing to address issues currently plaguing the industry? This new computing paradigm has three capability areas that align with and specifically address the three industry focus areas previously identified: *Engage*, *Discover* and *Decide* (see Figure 2).⁹

Figure 2

There are three emerging capability areas for cognitive computing



Source: IBM Institute for Business Value.



Engagement capabilities

Cognitive systems can fundamentally change the way humans and systems interact and significantly extend the capabilities of humans by leveraging their ability to provide expert assistance. These systems provide advice by developing deep domain insights and bringing this information to people in a timely, natural and usable way. Here, cognitive systems play the role of an assistant – albeit one who does not require sleep, can consume vast amounts of structured and unstructured information, can reconcile ambiguous and even self-contradictory data, and can learn.

Because they are able to engage in dialogue with humans, these systems can understand patients based on their past medical history and bring context- and evidence-based reasoning to the interaction. Today, these types of cognitive systems help healthcare organizations offer engaging and personalized healthcare recommendations to consumers (see sidebar, *Welltok embraces cognitive to personalize the health experience*).

Future cognitive systems will likely have free-form dialogue capabilities, which could help the flow of information among individuals.¹⁰ For example, patients could engage in dialogue with the system enabled by input from providers, and doctors could more easily share patient information with appropriate providers for treatment input. Others in the ecosystem, such as a nutritionist, could simply ask for and receive patient history from the cognitive system and avoid requesting patients to supply the same information yet again. All these interactions would be in natural language, making the process easier.

Engage

Welltok embraces cognitive to personalize the health experience¹¹

Created by Welltok, a health optimization company, CaféWell is a platform designed to analyze a consumer's health profile from a variety of sources and offer insights on how to stay healthy, including incentives like premium reductions for healthy activities. To make the platform even more interactive and personalized, Welltok adopted a cognitive approach powered by IBM Watson.

The resulting new product, CaféWell Concierge, leverages natural language and cognitive capabilities to improve user interaction and extract additional knowledge from underlying plain text sources, such as health conversations, activity data and health benefit information. The product's cognitive computing capabilities allow for quick and accurate answers to complex questions posed in everyday language, and they enable the system to learn through interactions with users. By dynamically personalizing the health experience, Welltok empowers consumers to make positive health changes driven by user-centric, intelligent recommendations.

Discover

Cognitive computing solution supports new discoveries and insights in medical research¹²

With more than 23 million medical scientific papers available and new ones being published every few minutes, it is humanly impossible for scientists to stay abreast of an ever-growing body of material. However, biologists and data scientists at Baylor College of Medicine, a leading health sciences university, are leveraging cognitive computing to generate insights to help accelerate research, unlock patterns and make discoveries with greater precision.

Baylor College of Medicine's Knowledge Integration Toolkit (KnIT), powered by IBM Watson technology, has enabled researchers to identify proteins that modify p53, an important protein related to many cancers. The tool works by extracting information from scientific literature, automatically identifying direct and indirect references to protein interactions, which is knowledge that can be represented in network form. It then reasons over this network to predict new, previously unknown interactions.



Discovery capabilities

Cognitive systems can help users discover insights that perhaps might not be found by even the most brilliant human beings. Discovery involves finding insights and connections and understanding the vast amounts of information available around the world.

Some discovery capabilities have already emerged, such as in medical research, where robust corpora of information exist. Here, advanced cognitive capabilities have dramatically reduced research and discovery time – from months to minutes. In addition, cognitive systems designed to crunch large volumes of medical and patient information can allow physicians more time with patients (see sidebar, *Cognitive computing solution supports new discoveries and insights in medical research*).

In the near future, cognitive solutions could enable more effective and timely matching of patients to clinical trials by rapidly analyzing historical patient data across all relevant clinical trials. Evidence-based reasoning applied to both inclusion and exclusion criteria for patients could help those seeking patients for trials, and clinical research organizations conducting additional analysis could determine whether trial results could be applied to further research.



Decision capabilities

Cognitive systems aid in decision making and reduce human bias by offering evidence-based options. They continually evolve based on new information, results and actions. Current cognitive systems perform more as advisors by suggesting a set of options to human users, who ultimately make the final decisions.

These systems are helping healthcare professionals make more informed and timely decisions. For example, IBM Watson for Oncology is a cognitive computing solution that quickly analyzes patient data, fast-growing medical literature, guidelines from world-class experts and the experience of specialists – and then identifies personalized treatment options for the clinician to consider (see sidebar, *Bumrungrad's cognitive solution provides personalized cancer treatment options*).¹³

Future policies might enable the exchange of healthcare information among various organizations while still protecting privacy. Thus, cognitive systems will have access to even more historical data and analysis, making their recommendations more and more effective.

Decide

Bumrungrad's cognitive solution provides personalized cancer treatment options¹⁴

Headquartered in Bangkok, Bumrungrad International Hospital is the largest private hospital in Southeast Asia and one of the world's most popular medical destinations. In an effort to improve its quality of cancer care, Bumrungrad selected IBM Watson for Oncology, an innovative cognitive computing solution that will help doctors plan the most effective treatments for individual cancer patients.

Cancer treatment is ideally suited to benefit from cognitive capabilities because of the immense and growing amount of data involved. After analyzing a patient's individual profile, medical evidence, published research, and the extensive clinical expertise of Memorial Sloan Kettering Cancer Center, the solution presents a summary of findings for each patient case, including treatment options based on National Comprehensive Cancer Network (NCCN) guidelines for the clinician to consider.

The way forward

Despite the enthusiasm for cognitive, organizations should realize there is often a steep learning curve. In terms of system implementation and user interaction, cognitive systems are fundamentally different than traditional programmatic systems.¹⁵ Healthcare organizations can learn from pioneering organizations that have already implemented cognitive by following three key sets of recommendations (see Figure 3).

Figure 3

Organizations with cognitive computing experience have identified three critical action areas for success



Source: IBM Institute for Business Value.

1. Define the value

Early planning helps ensure the greatest return on investment of resources. Defining the value of cognitive to your healthcare organization is critical and includes several steps:

Find the right opportunity – Cognitive solutions are well suited to a defined set of challenges. Healthcare organizations need to analyze the specific problem to determine if cognitive capabilities are necessary and appropriate:

- Does the challenge involve a process or function that today takes humans, such as clinicians, an inordinate amount of time to seek timely answers and insights from various information sources (i.e., patient records, medical research papers, etc.) using potentially various techniques in making a decision or thinking through a problem?
- Is there a need for users to interact with the system in natural language (such as a patient who presents with certain symptoms seeking advice on next steps for diagnosis and treatment)?
- Does it involve a process or function that requires providing transparency and supporting evidence for ranked responses to questions and queries (such as laboratory results)?

Define the value proposition and chart a course for cognitive – Identify both the differentiated value provided by cognitive computing and the business value up front – from quicker decisions about treatment options to potential cost savings. In addition, establish a cognitive computing vision and roadmap with executive-level support. Continuously communicate roadmap progress with appropriate executives and stakeholders, such as clinicians, other medical professionals, payers and perhaps patients.

Be realistic about value realization – The benefits of cognitive computing systems are not realized in a single “big bang” at the time of initial deployment. Rather, these systems are evolutionary and improve and can lead to increasing value over time. Communicate this reality to stakeholders and specify benefits for the payer, hospital, patient, etc. Consider using a phased rollout or deploying the solution to a subset of trusted users who understand the technology’s evolutionary nature.

2. Prepare the foundation

Prepare the foundation for a successful cognitive computing solution implementation by focusing on the following:

Invest in human talent – Cognitive solutions are “trained,” not programmed, as they “learn” with interactions, results and new pieces of information and help organizations scale expertise. Often referred to as supervised learning, this labor-intensive training process requires the commitment of human subject matter experts. Rather than a busy clinician, perhaps consider an enthusiastic newly qualified doctor or other medical professional, and be sure to also include appropriate health informatics talent.

In addition to domain expertise, a cognitive implementation also requires expertise in natural language processing, machine learning, database administration, systems implementation and integration, interface design and change management. There is an additional intangible “skill” required for team members: intellectual curiosity. The learning process never ends – for the system, the users and the organization.

Build and help ensure a quality corpus – Cognitive systems are only as good as their data. Invest adequate time in selecting data to be included in the corpus, which might include structured (e.g., patient records) and unstructured data (e.g., clinical notes) from multiple databases and other data sources and even real-time data feeds and social media. Data will likely emanate from new and untapped sources as well (e.g., call center recordings, blogs, patient advocacy groups, etc.). In addition, invest in records digitization to secure the future of your organization's corpus, focusing on both historical and new documentation.

Consider policy, process requirements and impacts – Assess any potential impact on processes and how people work. Because users interact with cognitive systems in entirely different ways than traditional input/output systems, processes and job roles could be impacted. In addition, consider if any data policy changes are necessary. Obtaining necessary data could test the boundaries of existing data-sharing policies and might require new or modifications to existing policies, regulations and agreements, particularly in healthcare, where security and privacy requirements are stringent.

3. Manage the change

Compared to traditional programmable systems, cognitive systems are a whole new ball game. As such, change management is more critical than ever, even more so in an industry already experiencing so much change across its ecosystem.

Ensure executive involvement in the cognitive journey – Executive involvement should begin with active participation in defining the cognitive vision and roadmap and continue throughout the journey. This includes executive participation in regular reviews of incremental progress and value realization.

Communicate the cognitive vision at all levels – Because cognitive computing is new and not completely understood by most, regular communication at all levels (business managers, IT staff, clinicians, patient representatives, etc.) is critical. Address any fears, uncertainties and doubts head on, and leverage executive sponsors to reinforce the value of cognitive to the healthcare organization's mission.

Continue to raise the cognitive IQ of the organization – Education is critical to assuring cognitive is understood and adopted. Of particular importance is managing expectations related to system-generated recommendations. Cognitive systems are probabilistic and not deterministic. While accuracy rates will improve as a system learns over time, the rate will never reach 100 percent. Educate stakeholders early on about accuracy rates, and conduct regular reviews on incremental improvements.

Ready or not? Ask yourself these questions

- What opportunities exist to create more engaging and personalized experiences for your consumer and the wider healthcare ecosystem?
- What healthcare data aren't you leveraging that, if converted to knowledge, would allow you to meet key objectives and business requirements?
- What is the cost to your organization and the wider healthcare ecosystem associated with making non-evidence-based decisions or not having the full array of possible options to consider when actions are being taken?
- What benefit would you gain in being able to detect hidden patterns locked away in your data? How would this accelerate research, consumer services and the like?
- What is your organizational expertise skill gap in cognitive computing? What would change if you could equip every employee to be as effective as the leading expert in that position or field?

For more information

To learn more about this IBM Institute for Business Value study, please contact us at iibv@us.ibm.com. Follow @IBMIBV on Twitter, and for a full catalog of our research or to subscribe to our monthly newsletter, visit: ibm.com/iibv

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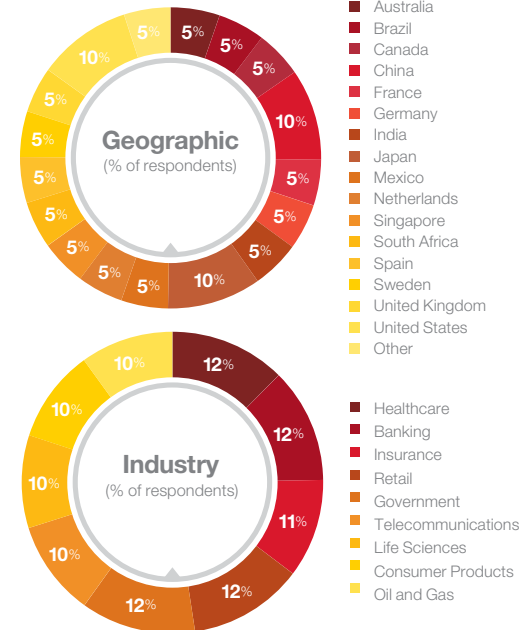
Contributors and acknowledgments

The authors offer thanks to the following individuals for their contributions: Neha Aggarwal of IBM Global Business Services and Todd Kalyniuk, Aditya Pai and Michael Holmes of IBM Watson Group.

The authors also would like to recognize the report's executive stakeholders: Jay Bellissimo, General Manager, Cognitive Solutions, IBM Watson Group; Shanker Ramamurthy, Global Managing Partner, Business Analytics & Strategy, IBM Global Business Services; Rob Merkel, Partner and Vice President, Watson Group Healthcare Leader, IBM Watson Health; and Sandip Patel, Global Industry General Manager, Insurance, IBM Global Business Services.

Study approach and methodology

As a follow up to the initial IBM *Your cognitive future* research study, we conducted additional research in early 2015 to dive deeper into select industries and explore opportunities for cognitive computing. Through a survey conducted by the Economist Intelligence Unit, IBM gained insights from more than 800 executives from around the world representing a variety of industries, including healthcare, banking, insurance, retail, government, telecommunications, life sciences, consumer products, and oil and gas. The study also included interviews with subject matter experts across IBM divisions, as well as supplemental desk research.



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Route 100
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Produced in the United States of America
September 2015

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