Unlocking the Value of Healthcare’s Big Data with Predictive Analytics

Background
The volume of electronic data in the healthcare industry continues to grow. Adoption of electronic solutions and increased connectivity are driving higher levels of information capture than ever before. Storing data, however, holds little value unless it can be accessed, analyzed and put into action. Such is the quandary of today’s healthcare environment, where there is a massive volume of data, yet few viable automated processes to extract meaning from data that is diverse, complex and often unstructured.

A recent study proposes that unlocking the value contained within big data is vital for the healthcare industry to attain its goals of improving care quality and reducing costs. By using big data creatively and effectively to drive efficiency and quality, the study estimates that the industry could create more than $300 billion in value per year, two-thirds of which would be in the form of reducing U.S. healthcare expenditures, by approximately 8 percent.

A major component of the study focused on using predictive analytics and cloud-based technologies to extract value from big data. This issue brief examines how the use of predictive analytics can deliver actionable information to transform the industry’s cost-quality equation.

The Value of Predictive Analytics
Predictive analytics is the analysis of current and historical data elements to make predictions about future events and trends. This is particularly valuable as the healthcare industry transitions toward new payment models based on care outcomes, rather than the quantity of care delivered. The advent of accountable care organizations (ACOs), bundled payment strategies and other pay-for-performance transformations make predictive modeling a vital component in assessing current performance metrics to predict future outcomes.

Using predictive analytics to assess current metrics helps organizations:

- Determine relationships between cost, quality and patient outcomes
- Identify the best clinical practices that are likely to deliver the highest patient outcomes
- Predict and assess individual and population-level health risks

As organizations respond to the changes that will result due to payment reform, the following insights will significantly influence their strategy:

- Best practices, best performers and better patient outcomes that impact enterprise performance
- Changes that impact reimbursement from ACOs and from bundled payment strategies
- Gain a better understanding of risk and how to manage it

Predictive analytics can help in finding and understanding this information.
The time is right
Recent technology improvements have made it easier to deploy predictive analytics solutions, and reduced their cost as well. The price-to-performance ratio of computer hardware has greatly improved during the last two decades. This has made technology more accessible and spawned the advent of cloud computing, which has virtually eliminated the need for organizations to buy, build and maintain large data centers to handle big data. In today’s technology environment, large cloud computing environments are readily available for low monthly subscription fees, and include robust data handling tools to manage and analyze data. In fact, the low cost and ease of use of cloud computing is greatly increasing its popularity, with the worldwide cloud computing market expected to grow from $110 billion in 2012, to $210 billion in 2016.ii

The healthcare industry also has its own unique set of drivers dictating the need for predictive analytics. Massive amounts of data are being generated due to the industry’s recent shift towards electronic health records, increased usage of biometric devices and by engaged consumers using mobile health platforms to track their health and fitness. Simultaneously, regulatory initiatives are requiring organizations to collect and submit an increasing amount of data to earn maximum reimbursement and to avoid penalties for non-compliance. Many of these initiatives are the direct result of the Patient Protection and Affordable Care Act, which has given rise to bundled payment strategies, ACOs, and Patient-Centered Medical Home models that financially reward quality care, and penalize non-performance.

Technology advances coupled with newly available data make solutions powered by predictive analytics a reality today. Predictive analytics provide organizations with powerful tools to assess current performance metrics and model “what if” scenarios to make data-driven decisions that impact financial stability and care quality. These predictive capabilities are essential for organizations to survive in an industry that is evolving into what many expect to be a substantially changed environment.

What is the relationship between historical reporting, statistical analysis and predictive analytics?
Historical reporting on key performance indicators, statistical analysis of available data and advanced analysis using predictive modeling and machine learning are three critical tools available for improving enterprise performance. Each of them, however, analyze data from a different perspective, making it important to evaluate the results in the proper context. When all three of these data analyses are combined, organizations can get a 360-degree view of a situation – past, current and future state.

Reporting on key performance indicators provides a retrospective view of an organization because its analysis is based on historical data. Historical reporting enables organizations to collect, organize and report on key performance indicators. This is valuable to assess “what happened?” such as how many patients this year were diagnosed with type II diabetes? Meaningful Use clinical quality measures, and Physician Quality Reporting System (PQRS) measures are examples of key performance indicators that retrospective analytics can measure and report upon.

Statistical analysis enables organizations to understand historical performance and can help generate hypotheses to answer the question “why did it happen?” Modern tools enable testing of these
hypotheses to take the appropriate action to take advantage of the opportunities for improvement that are uncovered by deep statistical analysis. For example, statistical analysis can describe the differences in costs between alternative treatments in a population.

Lastly, predictive analytics provides a potential “glimpse” into the future, and allows organizations to model “what if” scenarios and potential outcomes. Predictive analytics analyzes current and historical data elements to make predictions about future events and trends. With predictive analytics, organizations can identify patterns within data sets to assess risks and opportunities. This is accomplished through trending and identifying relationships between data elements. Increasingly sophisticated approaches that utilize machine learning are making it possible to ask the question “what could happen?” For example, predictive analytics can use retrospective data from the organization’s existing patient population to analyze risk factors that help predict which ones may develop type II diabetes.

Significant value can be realized when these three types of analyses are combined. Continuing the examples above focused on type II diabetes, the three analyses could deliver the following:

- Historical analysis identifies patients who have type II diabetes
- Statistical analysis provides insight into why these patients may have type II diabetes
- Predictive analytics uses risk factors to estimate which patients may develop type II diabetes within a specific time frame

What types of predictive analytics solutions are available?

In general, predictive analytic solutions that are offered within the healthcare marketplace tend to focus on the following:

1. **Risk Stratification** – Assessing the current health state of patients, grouping them according to risk factors, and determining interventions to improve health and minimize costs
2. **Enterprise Performance** – Predicting how to maximize resources to improve profitability, such as focusing more staff on revenue-generating areas, and increasing usage of revenue-generating areas (e.g., operating rooms, etc.)
3. **Population Health Management** – Predicting outcomes based on interventions by applying “what if” scenarios to available patient data

Several of the industry’s most powerful predictive analytics solutions have been internally developed by large health systems and provider-owned organizations. Similarly, most of the industry’s largest payer organizations have developed predictive analytics solutions to drive long-term strategic decision-making. Although these payer- and health system-developed solutions are powerful and provide valuable information, their development, operation and maintenance require financial and staffing resources that far exceed the capabilities of most organizations.

The marketplace’s existing predictive analytics solutions are narrowly focused on specific business areas, such as clinical, financial or operations. Essentially, these solutions are assessing these business components in isolation, and ignoring the relationships that these components can have on outcomes. Additionally, these solutions rely on using structured data, and are unable to extract value from the wealth of unstructured data that forms the bulk of the clinical documentation generated at the point of
care. When clinical, financial and operational data is brought together, predictive analytics can significantly improve enterprise performance as illustrated by the following examples.

An area where predictive analytics is starting to play a major role is identifying revenue at risk and detecting areas where revenue leakage may occur. Analyzing revenue at risk using predictive analytics can lead to a direct improvement in an organization’s financial results.¹

Additionally, predictive analytics can overcome the current lack of predictability in the cost for an episode of care, such as a hip replacement or a pregnancy. Even within a local market, the cost to deliver the same episode of care varies dramatically.² Predictive analytics helps understand the reasons for the variation in costs and provides insights that can be used to make the costs more uniform.

**What are the gaps within the predictive analytics marketplace?**

Up to 80 percent of the healthcare industry’s clinical data remains unusable because it is unstructured, meaning that it is in a format that cannot be easily searched or accessed electronically. (For more details about accessing unstructured data, click here.) The healthcare industry’s unstructured data contains tremendous value. Research shows that unstructured data allows higher sensitivity and specificity when compared with patient safety indicators based on discharge coding.³ Current efforts to extract meaning from this wealth of data require manual processes, which are expensive, limiting and error-prone. Creating an automated method to analyze these vast data resources could potentially transform the industry’s efforts to improve care quality and reduce costs.

Natural language processing (NLP) is unlocking the ability to utilize these vast stores that are currently going unused. NLP is an enabling technology that allows computers to derive meaning from human, or natural language input. Text passes into an NLP system and coded features are returned that can be used by predictive analytics solutions.

With the proper interface, predictive analytics using NLP technology can get richer information into the hands of decision makers. This enables decision makers to drill into data, ask questions, get answers and make data-driven decisions. Recent technology innovations have enabled predictive analytics solutions to take advantage of NLP deployed in a cloud environment. This allows organizations to leverage NLP to substantially improve predictive analytics capabilities without having to install and maintain the solutions themselves.

**Predictive modeling with NLP**

There are numerous situations where organizations can use predictive modeling with NLP to assess risk and identify issues that impact care quality. For example, organizations can delve deeper into data to determine the root causes leading to 30-day hospital readmissions. Diagnoses, procedures, test results and clinician notes can be analyzed to identify potential actions that were contributing factors leading to patient readmission. By identifying these issues and taking corrective action, organizations can reduce scenarios where 30-day readmissions occur and avoid the financial repercussions of such events.

¹ Using data analytics to identify revenue at risk, HFMA, September 2013
² Claiming the $1 trillion price in US health care, McKinsey and Company, September 2013
For quality measurement, electronic health record (EHR) solutions often fail to accurately assign quality measures to patients\(^6\). This illustrates the need for a complementary solution, such as NLP that can extract quality data, to increase the accuracy of quality measurements.

In another example, providers participating in the Medicare Advantage program can use predictive modeling with NLP to model the Hierarchical Condition Categories (HCCs) within the populations they serve. Accurately assessing HCC risks within a population can help provider organizations earn higher capitated payments, so more resources can be devoted to improving care quality.

**Conclusion**

Healthcare organizations that leverage the power of predictive analytics have the potential to gain deeper insight into the factors that impact clinical quality and costs. With this actionable information, organizations can better predict and manage clinical and financial outcomes, and drive improvements in processes and practices to elevate care quality while avoiding unnecessary costs. These are the components necessary for the industry to focus on rewarding high-quality care, instead of paying for the quantity of care delivered.

For those looking to move ahead with predictive analytics, it is suggested that organizations approach their efforts with a dual-phase strategy that initially focuses on creating the infrastructure to address simpler – but high-value – initiatives, and later delve into more complex endeavors. For example, near-term initiatives could focus on improving revenue outcomes by proactively managing revenue at risk. Another example would be using predictive analytics to identify patients at risk of readmission within a 30-day window.

Long-term initiatives should focus on more advanced areas, such as improving clinical and financial outcomes taking into account value-based payment models such as ACO, episode-based care, and patient-centered medical homes. These initiatives require access to clinical, financial and operational data – both discrete and unstructured – to improve enterprise performance by delivering actionable opportunities to improve current practices while predicting future scenarios.

The organizations that will be the most effective competitors in the future will be the ones who fully leverage the wealth of data they possess. Predictive analytics are the key to unlocking the value in healthcare’s big data.

*Written by Health Fidelity*

**About Health Fidelity**

Health Fidelity, Inc., based in Palo Alto, Calif., is a healthcare big data company providing industry leading cloud-based healthcare natural language processing (NLP) and unstructured data management solutions. Leveraging the longest standing clinical NLP technology with the most peer-reviewed literature and scientific citations, the company’s REVEAL product is the world’s most accurate, reliable and studied NLP technology in healthcare. It enables application developers and healthcare organizations to utilize vast amounts of unstructured clinical data to improve quality and efficiency of
the care delivery process. Health Fidelity draws on its deep domain knowledge and understanding of medical language to unlock actionable information from this unstructured data.

For more information about Health Fidelity and its solution partner program, visit www.healthfidelity.com. For more information about REVEAL, please contact Health Fidelity at partnerships@healthfidelity.com.

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iii JAMA 2011;306(8).

iv JAMIA 2012:19.