Healthcare in the Age of Machine Learning

Operationalizing Predictive Analytics Across the Healthcare Value Chain
Healthcare organizations are eager to take advantage of the massive amounts of data they are collecting to increase efficiency, improve service and reduce costs. As more and more health data is being captured and digitized - including everything from electronic medical records to DNA sequences -- analytics investments continue to rise. 

IDC has reported that analytics is “one of the fastest-growing segments of the provider IT budget in 2016” and, in an October 2015 forecast, MarketsandMarkets estimated that “the global healthcare analytics market is expected to reach $18.7 Billion by 2020.”

Simply spending money on analytics is no guarantee of success. In a recent McKinsey Global Survey on analytics, 86 percent of executive respondents across a range of industries reported that their organizations have been “only somewhat effective in meeting the primary objective of their data and analytics programs” while one quarter said their programs were ineffective. Creating an organizational structure that supports analytics was identified as the largest barrier to analytic effectiveness. How can healthcare organizations use this knowledge to unlock the value of their big data and avoid wasted efforts and wrong turns?

Successfully deploying analytics in a healthcare environment is no simple task. While formidable challenges are presented by the industry’s complex and disjointed data landscape, the greatest challenge organizations can quickly get lost in are the technical details. Accessing the value of big data requires healthcare organizations to align the efforts of IT, data science, clinical informaticians and business users. This white paper makes the case for a collaborative, process-based approach to analytics that focuses on efficiently transforming data into tangible, business outcomes.
Advanced Analytics Moves into the Spotlight

As industry incentives shift to reward quality over volume, organizations across the value chain need to be proactive rather than reactive, emphasizing precise and personalized actions that correlate strongly with measurable outcomes. Advanced analytics can be a powerful tool to anticipate and avoid unwanted outcomes, adding value to a variety of use cases, from clinical operations and population health to revenue cycle and supply-chain management.

A 2015 Deloitte survey of health providers reported that, “As more data becomes available from sources like electronic health records (EHRs), claims, medical devices, and patients, analytics can help detect hidden patterns in information, delivering actionable insights and enabling self-learning systems to sense, predict, infer, and conceive alternatives that might not otherwise be obvious.” Putting it all together and extracting value is challenging, but some organizations are beginning to find success.

eviCore: Case Study

$1.5B leading provider of medical benefits management solutions servicing payors and other risk-bearing entities.

Define

eviCore’s client base was growing and the company wanted to scale without increasing the workload of the nurses and doctors who review cases or slowing down approval cycle times for providers.

Transform

evCore extracts structured and unstructured data, including patient records, provider notes, insurance codes and more.

Model

Predictive model created in Alpine Chorus crunches data to score claims based on likelihood of approval or denial.

Operationalize

Scores are integrated into the approval process workflows that staff uses to evaluate claims.

Act

Based on score, claims are either automatically approved or sent directly to MDs for further evaluation, saving process cycle time and resources.

Evaluate

500% process improvement achieved, next swing of pendulum will extend use of model to other claims categories and business units.
**Process efficiency and cost reduction**
Improving processes and reducing the cost of providing care are primary drivers of healthcare analytics. On both the provider and payment side, advanced analytics can be deployed to intelligently segment and benchmark services, improve targeting, identify existing inefficiencies and predict areas of potential risk and opportunity. Hospitals can use advanced analytics to personalize clinical pathway development, applying machine learning to patient segmentation to develop smart groupings that account for clinical and demographic subtleties. The same principle allows payers to optimize their networks by designing more attractive offerings precisely tailored to the needs of a particular segment.

**Precision medicine**
Advanced analytics is a powerful tool for researchers working with large genomic expression databases, allowing them to find new patterns and advance precision-medicine initiatives. Clinical genomic researchers are using machine learning to identify unique disease biomarkers, help guide the diagnostic decision making process and more precisely match treatment plans to their patients. For example, applying machine learning to prostate cancer genomic data is allowing researchers to detect subtle differences between both indolent, aggressive progression patterns as well as hormone or chemotherapy sensitivity and resistance. Pairing precise diagnostics with personalized treatments allows doctors to improve care and prevents patients from undergoing ineffective therapies.

**Operationalized analytics**
Integrating insights into front-line operations by pushing recommendations to either clinical or business end-users is critical to unlocking value from analytic efforts. Think smart applications that deliver real-time, patient-specific alerts on readmission risk to front-line staff along with tailored
recommendations for post-acute treatment options. Or, machine learning models that can automatically score new medical claims and either approve, deny or push outlier cases straight to the appropriate clinical decision maker, speeding up the approval process while reducing the reliance on valuable clinical human resources.

Figure 2. Realizing concrete value from big data investments requires organizations to operationalize their analytic efforts -- moving beyond retrospective, historical reporting towards prospective, predictive insights embedded directly into end-user workflows.

The Challenge of Operationalizing Advanced Analytics

The advantages of advanced analytics in healthcare are clear in theory, but in practice, organizations face tough challenges getting initiatives off the ground. Healthcare often lags behind other industries in terms of IT infrastructure, data governance and analytic
maturity. However, the technical challenges to dealing with healthcare data are not fundamentally unlike those faced by large organizations in other industries. For example, the financial services industry is building predictive models to optimize portfolio asset allocation while navigating evolving regulatory requirements and maintaining some of the highest standards of both privacy and security.

Marketing, advertising, and retail are integrating enormous amounts of demographic, mobile and social data from disparate sources in order to better segment populations and more precisely target campaigns.

An analytic strategy doesn’t happen overnight. It’s an organizational and cultural value that has to develop and mature with the business. Healthcare organizations looking to deploy advanced analytics should consider the following pitfalls that can stop promising initiatives in their tracks:

**Project vs. process-based approach**
The Deloitte 2015 survey of healthcare providers found that “while many surveyed organizations already have reporting capabilities in multiple business functions, nearly half of respondent organizations lack centralized oversight of analytics tasks and functions.” The report also noted that while respondents agreed that analytics investment is essential for VBC, “many organizations still lack a clear strategy, an effective data governance model, and effective budgeting models.” These findings reflect an analytics challenge common across multiple industries: organizations approach analytics as a series of one-off IT projects, rather than as a collaborative *business practice* that includes consistent and repeatable processes for objective-setting, data governance, oversight, measurement and continuous improvement.

**Data science that leaves real-world users out in the cold**
According to a June 2016 article in Genome Medicine, “one of the biggest bottlenecks and challenges is the availability of healthcare professionals and clinical researchers that are able

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**West County Health Centers: Case Study**
Private, non-profit Federally Qualified Health Center receiving Section 330 grant funding that provided over half a million dollars of uncompensated care for low-income and uninsured patients.

**Define**
Wanted to leverage its data to better manage population health without overburdening IT or hiring costly data science Ph.Ds.

**Transform**
To build a complete picture of the patient journey, WCHC consolidated clinical, financial and demographic datasets at the patient level.

**Model**
Alpine Chorus empowered WCHC to clinically segment its patient population and predict readmission risk.

**Operationalize**
Clinical decision-makers are able to identify patients early who are at highest risk of requiring costly services in the future.

**Act**
Proactively targeting at-risk patients with preventative services to improve overall population health and reduce the long-term cost of care, helping WCHC qualify for new forms of government funding.
to use the latest information technologies developed in the big data analytics era.” All too often, analytics is delegated to IT, implemented by IT, and then viewed by the rest of the organization as a “black box” that only data scientists can understand. When end-users have little understanding of how to access and use data insights, the full value of advanced analytics will remain untapped.

**Define**
Physicians and ICU Program Managers want to prevent sudden downturns for patients in critical condition.

**Transform**
A clinical informatician combines millions of electronic health records with bedside medical device data.

**Model**
A data scientist builds a model to identify factors that predict falling vital signs before they occur.

**Deploy**
An engineer embeds the model at the point of care to score real time data and alert the ICU team of high risk patients.

**Act**
A nurse performs targeted preventative measures to reduce the risk of decline.

Figure 3. This is an example of how a hospital moves through the process of using data science to develop an operational solution to a clinical challenge.

**Connecting Insight to Action**
In a 2016 speech the HIMSS Big Data and Healthcare Forum in San Francisco (and reported in Healthcare IT News), MD and associate professor of medicine at Mayo Clinic Jeanne M. Huddleston stated, “Creating better, safer care depends - not just on smart data-crunching - but effective deployment of those insights.” It is this “last mile” — connecting data insights to actions.
that actually boost healthcare efficiencies, automate processes or prompt better decision-making — where organizations typically fall short. Analytics, to be of any value, must be transformed into actions that produce a beneficial outcome for the organization, whether this means automating a claim approval, initiating an order of needed medical supplies, or identifying at-risk patients that should be contacted regarding preventative treatments. This requires an efficient process for accessing the right data, quickly developing the models necessary to analyze it, and finally, operationalizing insights at the point of action.

Getting Started — A Blueprint for Success

Putting data into action, consistently, doesn’t happen by accident. To set themselves up for success, healthcare organizations need a blueprint to ensure that people and technology are organized to deliver the greatest possible value from advanced analytics.

Alpine sees this process as a pendulum, swinging forward through steps to drive data to the point of action as quickly as possible, and backward to measure results and capture feedback for continuous improvement. These steps include:

**Define the objective**

Whether you’re a health system that wants to identify the best strategies to improve population health, an insurer looking to simplify patient communication, or a benefits manager that wants to automate its claim evaluation process, it’s critical to begin with the business problem in mind, specifically focusing on the action that will be initiated by analytic insights. (For example, clinicians will contact patients at-risk for developing Type-2 diabetes about a prevention program.) Key questions to ask during this step include: What data sources will support this objective? Who will use the insight? What applications and systems do they use to do their jobs?
Transform and Model data for analysis
This is where the IT experts come in to help deal with issues such as siloed information, inconsistent taxonomies and integration. Once data is ready for analysis, analytic models should focus on efficient operationalization rather than perfection — models can be tested and refined over time. The goal is put data to work as quickly as possible. Oftentimes the most traditional machine learning techniques like regression and clustering are enough to solve a business problem, while highly complex algorithms only add to analytic cycle time and expense without adding value. Although there is a place for sophisticated models, sometimes organizations waste a lot of time and money building complex models when a simpler approach would do.

Operationalize analytics that empower end-users
Whether doctors or nurses, administrators or claims processors, office managers or equipment suppliers — to act, using analytics to improve outcomes across the organization, and for the patients they serve.

Alpine Chorus: A Platform for Operationalizing Health Data
The Chorus Platform helps healthcare organizations solve clinical and administrative challenges with data by providing a repeatable process for operationalizing advanced analytics. Unlike other solutions that focus primarily on algorithms, Chorus brings machine learning, data and people together in a centralized environment, enabling all stakeholders to take part in the process of transforming health data into action.

The Analytic Service Provider

Central Analytics Group
• Core Competencies in BI & Predictive Analytics
• Train other business units in basic skills for self service analytics

Figure 4. Developing a Culture of Analytics: An example of how a centralized analytics group can collaborate with individual clinical units.
Chorus begins by helping decision makers define the problem they’d like to solve. Through the Alpine Core analytics engine, Chorus then provides the data transformation and modeling capabilities that enable advanced analytics to be run quickly and efficiently on large volumes of data at scale. Finally, Chorus helps operationalize and connect data insights to action by extending outputs directly into the end point systems and applications the healthcare stakeholders use daily.

**Collaborative platform**
Chorus provides a collaborative environment that engages clinical, business and IT stakeholders in the data science process. The platform is designed to help users define their analytic objectives in terms that can be translated into machine learning models, and to organize the processes and people (ranging from data scientists, application developers, clinicians, claims processors, administrators and more) that need to come together to deploy successful solutions.

**Simple-to-deploy analytics**
Chorus’ analytic engine, Core, provides standard, proven algorithms for regression, classification, clustering, and more in a simple-to-deploy, drag and drop environment. With Core, healthcare organizations can build and operationalize analytic models quickly and with little IT involvement. Core also offers extension capabilities that enable customization of models if and when more complex analysis is required.

**“Last mile” integration**
Chorus’ Touchpoints SDK allows healthcare organizations to push analytic outputs directly into the applications that doctors, nurses, business managers and other healthcare contributors rely on daily to do their work. With Touchpoints, analytics can be integrated into existing workflows and applications in forms that are immediately recognizable, such as a mobile alert, so that end users can easily benefit from machine learning and predictive analytics without having to be a data scientist or trained on an unfamiliar system.

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**About Alpine Data**

Alpine Chorus is the world’s first collaborative, code-free solution for Advanced Analytics on Big Data and Hadoop. With Alpine, data scientists and business analysts can work with large data sets, develop and collaborate on models at scale without having to use code or download software. Leaders in all industries, from Financial Services to Healthcare, use Alpine to outsmart their competition. Maybe you should too. Find out more at: [www.alpinedata.com](http://www.alpinedata.com)