Care Customization: Applying Big Data to Clinical Analytics and Life Sciences
Big data is making a significant impact in the transformation of the U.S. healthcare and life sciences industries. As an advocate of health data transparency, the Health and Human Services (HHS) Department has been "unlocking data" in an effort to provide clinicians with clinical decision support, empower consumers and open up new opportunities for researchers and developers. HHS’s Electronic Health Record (EHR) Incentive Programs and the State Health Information Exchange Cooperative Agreement Program under the American Recovery and Reinvestment Act are generating greater amounts of data as more healthcare providers adopt EHRs and healthcare organizations share patient information.

We are only seeing the tip of the iceberg of big data. Worldwide healthcare data grew to 500 petabytes in 2012 but is estimated to grow to 25,000 petabytes by 2020—a 50-fold increase within eight years, according to IDC Health Insights. In addition to volume, data is increasing in terms of complexity and variety in the form of, for example, medical imaging, video and social media feeds—unstructured data that overall comprises 85 percent of information today. In spite of its daunting nature, big data holds the key to stakeholders creating a cost-effective, high-quality healthcare delivery system and driving personalized medicine.

At the recent Intel Innovation Summit's Care Customization: Applying Big Data to Clinical Analytics and Life Sciences panel, moderated by Ketan Paranjape, Director of Healthcare and Life Sciences at Intel, a panel of four leaders shared their challenges and visions of leveraging big data and applying clinical analytics to solve pressing problems in the healthcare and life sciences industries:

Graham Hughes, MD, Chief Medical Officer, SAS Center for Health Analytics and Insights: In the healthcare and life sciences industries, SAS leverages its analytics solutions to turn clinical and operational data into evidence-based, actionable knowledge. His team focuses on health innovation and novel applications of analytics in healthcare.

Charles Schmitt, Director of Informatics at Renaissance Computing Institute (RENCI): A research institution within the University of North Carolina that works closely with Duke University and North Carolina State University, RENCI is applying information and computing technologies in critical areas such as healthcare and life sciences.

Analytics: the key to unlocking big data

"I believe the future of healthcare is going to be powered by data and analytics," Hughes declared. "Big data without analytics behind it is just a whole lot of data," Gladden added. Healthcare organizations are taking note. A Frost & Sullivan report, released in April 2013, predicted that while 10 percent of U.S. hospitals deployed data analytics tools in 2011, at least 50 percent will adopt them by 2016.

Carolina's HealthCare System is using big data to build a 360-degree view of its patients and analytics to drive personalized medicine, according to Carew. His team recently completed a project predicting the risk of unplanned admissions by pulling data from 600 different variables on a few hundred thousand patients who were admitted to its hospitals. From the 100 variables examined, 40 were found to be highly predictive of patient risk for an unplanned readmission. Carew’s team then built tools to relay that information in real time to care managers so that appropriate, tailored interventions could be recommended for patients with those high-risk characteristics. "We’re taking our patient population, using it as a lab for doing health services research and building a better evidence base for what programs works. This helps us deliver greater value to our patients," he said.

Gaining access

With a Medicaid population that accesses multiple pharmacies and emergency departments (ED), CareSource understands the clinical and financial value of providing a 360-degree view of the patient to its providers, but only has data generated by visits and what patients choose to tell clinicians. While Carolina's HealthCare System spans the continuum of care, it too only sees data generated by the care it provides within its enterprise.
Access is also a challenge for researchers. RENCI is working on a number of projects, including conducting translational basic research using next-generation genomic sequencing data and clinical data, and using EHR data to make predictions about outcomes and to guide clinical decision support. “We’re looking at building models or coming up with new approaches,” Schmitt said. “But if you don’t have access to the data on the people outside of a particular system – which can really influence the analytical process – there’s not much you can do.”

SAS’s clients are solving the access barrier by enabling data quality, integration, aggregation, extraction and management, which then allow data to be pulled from across stakeholders, from payers’ claims data and providers’ clinical data, to get a broader, deeper picture of members and patients. These competencies are critical as healthcare organizations form accountable care organizations (ACOs) and need to share volumes and myriad types of information. According to a May 2013 IDC Health Insights study, “Business Strategy: Analytics Leads Accountable Care Investment Priority,” analytics is the top investment priority for healthcare organizations participating in ACOs, which require “timely, complete, accurate, contextual and digestible data” in order to manage population health.

Changing the culture

RENCI looks at both big and small data for ways to improve healthcare. In working with clinical and translational data researchers, who traditionally look at small amounts of data, Schmitt has seen a breakdown in processes. Clinical researchers are not used to working with IT and computing researchers and vice versa. “The processes and analyses start being challenged when you have big data because you have to have a new team in place and different technologies to deal with it,” he said. “It’s a cultural thing. IT, processes and quality control start to change when you move to automation.”

Getting cultural acceptance to enable analytics to drive decision-making is one of Gladden’s major barriers. With the volumes of data continually growing, the old process of clinicians making decisions based on interactions with patients is nearly impossible. Gladden’s team created an algorithm that analyzes Medicaid member information to determine whether members should be in a high-risk case management program or not. His team compared the results of the algorithm and those from a referral system and “unequivocally” found that the former had “far better results” than the latter. “It’s not an easily accepted conclusion, but that’s only the beginning of what we’re going to see,” he said. “The technology is already there to some extent. It’s a question of getting the company and the culture willing to accept those kinds of changes.”

Privacy and security equals trust and control

SAS clients face privacy and security issues as they try to statistically de-identify or obfuscate data in order to aggregate it and make the information meaningful at the population level. Researchers, however, do not want data to be de-identified. “We want identifiable data so we can link everything,” Schmitt said. Trust, then, is crucial. To develop trust, Schmitt’s group is looking at tracking data to verify who has accessed it. “A lot of issues around data sharing and trust really come down to building enduring relationships with your patients,” Carew said.

Hughes is seeing a trend in which brokered or federated consent models give patients control to determine what aspects of their data will be shared with which entity and to understand why the data is being shared or utilized. Patients may be more willing to share their data or have their data be utilized if the end result is personalized care for them.

Reengineering HIT systems for big data

Carolina HealthCare System is building clinical decision support in a number of areas, which is helping the health system to reduce variations in care. “Even though the analytics may not have the best predictive power, if you’re helping providers to consistently improve on how they care for unique patients, then you’re going to drive better results,” Carew said. In order to get at the data quickly, especially in situations where ED physicians are treating patients and need near real-time clinical decision support, Carew’s team moved its data warehouse to a massively parallel hardware platform.

A movement is unfolding across industries to aggregate and manage all data within an enterprise information management platform, according to Hughes. SAS is leveraging commodity hardware and blade technology to cost-effectively distribute complex analytic queries. Transforming queries into recommendations and getting them into the clinical workflow in real-time requires data sourcing, acquisition, aggregation, extraction and transformation, and massively parallel structures. “We’ve re-engineered many of our algorithms from the ground up to take advantage of these highly parallel, multi-threaded, memory-intensive environments so we can do real-time analytics at scale,” he said.
Hughes advises that while it is now possible to opportunistically analyze all the data, organizations should start with use cases that have clear business value. Maintaining and managing the infrastructure is key; however, while large organizations have the resources to manage the infrastructure, many organizations do not. To meet this need, analytics is increasingly being offered securely through the cloud as a service or hosted model.

Building necessary skills
Healthcare providers across the U.S. are challenged with hiring experienced IT professionals to handle the evolving healthcare environment. Global professional services company Towers Watson released a survey in April 2013 in which 67 percent of the more than 100 healthcare providers and hospitals responding reported difficulties in attracting experienced IT workers. The situation is exacerbated when healthcare organizations seek people who understand the healthcare industry, have the right combination of skills to work with big data and analytics, and ask the right questions to solve the problem at hand. While CareSource is working with graduate students on internships and research assistantships through a local university, Gladden pointed out that only a few good programs exist that currently train in analytics.

In the business environment, people who want answers oftentimes are not adept at asking the right questions. While Carew looks for people with analytical skills and training in hard quantitative fields, he also wants to know if they ask the right questions, can define the problem and are skilled at translating a business or clinical problem into an analytical problem and produce analytical results for the business or clinical solution.

Hughes believes that decision making within an organization needs to transition from HiPPOs—the highest paid person’s opinion—to geeks, who rely on data and evidence. “The opinion needs to be data justified,” he said. “We’ll hopefully see more geeks move into these roles of accountability and leadership.” Gladden, on the other hand, sees the need for both. With HiPPOs and geeks operating in different worlds, he believes they provide checks and balances in terms of asking the right questions and choosing projects that make sense to pursue.

Key takeaways
There is a competitive imperative to getting started on a data analytics initiative, according to Hughes. To help healthcare organizations develop a strategy, the four panelists offered their key best practices:

- Make a commitment to be an evangelist within the organization
- Ensure that the organization’s culture accepts analytics as a critical part of the workflow
- Get organizational strategic support to help identify two or three key projects
- Put together a team of experts with the appropriate skillsets to understand and act on the data
- Ensure that the data being accessed is high-quality data
- Centralize the data and make the patient the center of the data source, rather than the provider, payer or facility
- Build a 360-degree view of the patient with the data

Hughes pointed out that once organizations settle on a project and determine what organizational assets and supplementations are needed, they can build an analytical infrastructure at the technical and organizational levels that will lead them into the next 15 years. “If you don’t get started on that in the next five years,” he warned, “you’re going to be out of business.”

Carew emphasized that all the work being done, to cost-effectively deliver high-quality care and improve clinical outcomes, is for the patient. “The one important thing that we always do is put patients first – anticipate their needs and do the right thing always,” he said. “Analytically driven, personalized care delivery will be the key to providing value.”

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