(intel®)

Solving Practical Problems with Healthcare Analytics

Apixio's next-generation analytics help health systems improve chart audits, build "the true state of the patient," and enhance patient care, risk management, and the bottom line

Apixio's blend of healthcare analytics and cognitive computing helps payers and providers achieve practical insights and bottom-line benefits from existing data.

Accurate Information for Personalized, Value-Based Care

In a world of value-based care, healthcare providers must understand the full picture of the patient's health so they can manage costs and risks while delivering high-quality, personalized care. For providers and payers alike, having the patient's health conditions accurately and completely coded is crucial to appropriate payment for care delivered and risks shared. Patients, who are often responsible for a growing percentage of the costs of their care, also need a clear, complete understanding of their overall health.

But the full picture of a patient's health is hard to come by. Information is locked in diverse systems with limited interoperability. Electronic health records (EHRs) include only a subset of relevant data, and crucial information is often buried in text-based case notes, scanned documents, and other unstructured data sources.

Adding to the problems, the process of assigning diagnosis codes that capture the patient's diagnoses is complex, producing results that are fraught with errors and omissions. One study found that more than 60 percent of key clinical information is missing from the coded layer of the EHR, and 30 to 50 percent of the information in the EHR's structured problem list is spurious.[1] Diagnosis codes are a key element of risk management, and these gaps and errors can affect clinical decision-making, care delivery optimization, outcomes measurement, reimbursement, and more. Health systems conduct manual chart reviews to increase the accuracy of their coding, but this process itself is expensive and slow, and is usually limited to a fraction of charts.

It's a significant problem in need of a practical solution.

Enter Apixio, a big data innovator whose breakthrough platform automates and optimizes chart reviews.

Chris Gough
Lead Solutions Architect,
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Practical Value and Captured Revenue

Apixio was founded in 2009 with the vision of pulling clinical knowledge from digitized medical records, using that knowledge to construct "the true state of the patient," and making it available for healthcare decision-making.

Today, Apixio's patented combination of healthcare analytics and cognitive computing is providing groundbreaking insights and bottom-line benefits to providers and payers alike.

San Diego-based Scripps Health Plan Services (SHPS) is one organization that's achieving practical value from

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Apixio's big data analytics. SHPS is a not-for-profit California corporation whose sole corporate member is Scripps Health, a top-ranked integrated health system[2] with four hospitals, a network of outpatient centers and clinics, and more than 2,600 affiliated physicians. SHPS enrolls approximately 93,000 members through plan-to-plan agreements with other health plans that are responsible for direct contracts for Medicare Advantage* and commercial lines of business.

Using the Apixio Hierarchical Condition Categories (HCC) Profiler* to comb through electronic health records, SHPS has found a fast, flexible, and cost-effective way to more accurately capture HCCs. Examining the charts of more than 21,000 Medicare Senior Advantage* members, Apixio identified and confirmed 750 additional HCCs. Those previously unidentified codes offer potential improvements to patient care, system efficiency, revenue, and institutional risk. Now, performance improvement leaders at SHPS are identifying new areas where they can apply the Apixio solution.

Medicare Advantage Risk Adjustment

The HCC Profiler is the first in a series of applications Apixio is building on a powerful cognitive computer platform. Focused on practical use cases for healthcare, the solution is in the sweet spot that blends big data analytics and natural language processing (NLP). Industry analysts say the global market for healthcare analytics will reach USD 18.7 billion by 2020, experiencing a cumulative annual growth rate (CAGR) of more than 26 percent between 2015 and 2020.[3] The global market for NLP solutions in healthcare and the life sciences is predicted to more than double between 2015 and 2020, reaching USD 2.67 billion by 2020.[4] Much of the NLP growth is expected to

be driven by the need to capture value from unstructured data such as clinical case notes.

The HCC Profiler is designed to increase accuracy, productivity, and proficiency for risk adjustment in Medicare Advantage coding. Using computer learning and linguistic pattern analysis, the Profiler integrates and examines structured and unstructured data in patient charts to identify HCC conditions that have not been previously coded. The Profiler then presents the data to human coders in a web-based workflow application for confirmation.

"The HCC Profiler enables organizations to streamline their HCC risk adjustment processes into simple, straightforward coder and quality assurance workflows," says Darren Schulte, CEO of Apixio. "We make it possible for them to identify codes, reduce coding gaps, and validate submitted codes faster and more accurately than ever before. They get a more accurate risk score, which means they can manage risk more effectively. They also get a more accurate picture of the patient's health and can use it to deliver better care."

While Medicare Advantage coding is an initial focus, risk adjustment strategies are increasingly important in other areas of the healthcare ecosystem. "Healthcare is moving in the direction of using diagnosis codes, whether it's Medicare fee-for-service plans, or the Affordable Care Act, which addresses the commercial population to determine capitation, and redistribution of premiums from one health plan to another," Schulte says. "Moving forward, accurate coding and risk management are only going to become more important."

Enhancing Risk Management at Scripps

Performance leaders at SHPS's Managed Care Operations HCC team began working with Apixio in 2013 to see if

the Apixio HCC Profiler could enhance their chart audit program. SHPS had previously used an external vendor to conduct manual retrospective audits. More recently, SHPS has hired and trained its own staff of skilled chart auditors to handle the work. Even so, the human auditors were limited to auditing 40 to 50 percent of patient charts.

Organizations such as SHPS need to ensure all HCC diagnoses documented in the medical record for capitated risk-adjusted members are submitted and accepted by the health plans and the Center for Medicare and Medicaid Services (CMS). They also need to ensure the revenue they're receiving accurately reflects the health status of their patients. Apixio's HCC Profiler enhances an organization's HCC chart audit program by helping to identify medical record documentation that supports HCC diagnoses not yet reported to CMS for specified dates of services.

SHPS worked with Apixio to analyze a Senior Medicare Advantage population of approximately 21,000 lives, looking for possible HCC conditions that were not previously reported to CMS. The population chosen consisted of members whose providers used Allscripts Professional EHR*. With relevant privacy protections in place, the performance team shared the previously identified HCC codes, and the HCC Profiler analyzed a wide range of text documents within the EHR along with the structured data, looking for additional conditions.

Streamlined Workflows

SHPS auditors use the Apixio Profiler as part of an efficient, web-based workflow to rapidly validate findings and select relevant ICD-9 codes. Once the Profiler identifies previously untapped HCC codes, certified coders review each "coding opportunity." Then, the newly documented and validated HCC diagnosis codes are

provided in a format for submission to Medicare Advantage health plans, and then to CMS to calculate each member's risk adjustment factor, which determines capitation payments. The risk scores make it possible to compare health system performance based on the complexity of the patient's medical history.

In addition to increased accuracy, SHPS benefits from the speed of the Apixio analytics and the efficiency of the overall workflow. The Apixio engine crunches through the data much faster than humans are able to do. It also helps organizations rapidly validate what the engine finds. "Apixio gives us the best data to look at, rather than us having to comb through all the progress notes, and it presents the data in a way that's quick to review," explains Linda Pantovic, director of compliance and performance improvement for SHPS.

The time savings create opportunities to transform both workflows and job responsibilities—crucial capabilities given the fast-changing demands on healthcare organizations. "By using Apixio, we're improving our auditing

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bandwidth and enhancing the ability of our coders to focus on other chart audits and other projects that we couldn't do before," says JoAnn Hayden, managed care performance improvement manager for SHPS. "Our coders have valuable skills and a wealth of knowledge, and we have an abundance of work for them. Because Apixio lets us be so much more efficient, we can use their talents in ways that improve our entire quality program and performance improvement program."

The benefits are so significant that Pantovic and Hayden are considering using Apixio to conduct audits on a concurrent, ongoing basis. Concurrent auditing would allow coding corrections to be implemented immediately rather than retrospectively. They're also looking at expanding their use of Apixio to their commercial risk adjustment programs and incorporating the Profiler's output into their provider education programs.

"The increased capability Apixio provides is invaluable," Pantovic says. "It supplies our coders with an improved ability to review the materials. It improves our auditing bandwidth and lets us reallocate resources. It helps us enhance our concurrent review process, increase our understanding of the overall risk adjustment process, and improve our provider education and training. Ultimately, it gives us an enhanced opportunity to save money. And because it's a learning platform, it continues to improve. The more information we give it, the better job it does at identifying conditions."

Powering the Solution: Cloudera Enterprise* and Intel® Technologies

To provide power and scale for healthcare analytics, Apixio designed a four-layered architecture and implemented it using open source and commercial products as well as its own patented innovations. Intel® technologies and the Apache Hadoop* solution stack provide the scalability and throughput to process massive data volumes and deliver responsive performance.

- **Mapping and ingest.** Apixio uses tools such as Informatica*, Altova MapForce*, and custom innovations to incorporate a range of data types and formats.

- **Extract-transform-load (ETL).** The ETL layer uses Cloudera Enterprise*, Cloudera's distribution for Apache Hadoop, to extract usable information from the ingested data. The ETL layer writes results to a document management system built on the Apache Cassandra* distributed database management system.

- **Intelligence.** The intelligence layer applies Apixio's sophisticated algorithms to the extracted data, looking for previously uncoded

Building Success

How can healthcare organizations increase success as they deploy big data solutions? Experts from Intel, Apixio, and SHPS share these recommendations:

- **Establish an analytics framework.** Develop an overall analytics strategy that looks toward future capabilities and demands. Healthcare data volumes will grow, and the opportunities presented by effective use of the data will grow even faster. Tomorrow's EHRs and analytics solutions will need to encompass everything from patients' DNA profiles to data from their connected health devices.

- **Select practical use cases.** Don't feel you need to boil the ocean. Select a handful of workflows or business challenges that can be improved by getting more accurate information faster. Conduct pilots or small-scale projects to deliver practical benefits as you develop expertise.

- **Attend to data security.** Ensure protected health information and other sensitive data is handled appropriately. Choose vendors that implement a robust security strategy.

- **Modernize your infrastructure.** If you'll be deploying on-premises or private cloud infrastructure, choose powerful, industry-standards-based platforms that will provide the scalability, throughput, and reliability for healthcare analytics.

- **Choose vendors that are committed to your success.** "You want them to have a strong analytic background and a great solution, but you also need someone who will work through any barriers with you," says JoAnn Hayden. "When we identify a concern, Apixio is proactive in jumping on it and handling it. They have the ability to go above and beyond, and that's given us great flexibility. When one of our health plan companies moved a deadline up, Apixio worked right alongside our team to help us meet it."

- **Work collaboratively.** "Allocate the right resources and put the right expertise in place," says Linda Pantovic. "You be the subject-matter experts, and let the vendor be the extraction and analytics experts. Let them be true collaborators."

conditions. The algorithms use Cloudera Enterprise and draw on Apixio's foundation of more than 2 million patient years of data. "At this stage, we're also extracting information that wasn't easily accessible from the data," explains Vishnu Vyas, director of research and development at Apixio. "We might review an image that has a lab result on it, and we'll use OCR scanning to extract the value and store it as structured data. We take all the knowledge and analysis we've done previously, and apply it to each patient's chart. We make predictions, draw conclusions, and determine a confidence level."

- **Workflow and presentation.** The platform presents its results as a concise summary to a workflow system that human coders use to assess the validity of the newly identified condition codes. User responses are folded back into the intelligence layer, "training" the system and enabling the algorithms to learn.

Apixio runs its pipeline on powerful Intel® Xeon® processor-based servers, choosing them for their combination of exceptional performance and throughput, high core and thread counts, and large memory capacity. "So much of what we're doing is computationally intensive, and the work of folding user responses back into the intelligence layer to train the system is especially demanding in both compute and memory," says Vyas. "The Intel Xeon processors give us the horsepower and capacity for everything we do."

For its database, the Apixio developers started by using MySQL*. They moved to Hadoop and worked their way through several Hadoop variants before deciding on Cloudera Enterprise. "As we started seeing the scale of clinical data, we were

realizing that the real value was in the unstructured data, which is 10 times bigger by volume than structured data in healthcare," recalls Vyas. "The moment we started working with real customers, we realized we needed to move to Hadoop."

Apixio's business growth and its need for industrial-strength Hadoop processing drove the adoption of Cloudera Enterprise. "When we first moved from MySQL, we were on open source Apache Hadoop," Vyas says. "That was fine when we were just experimenting, but when we had to run tens or hundreds of machines at a time, setting up a job and bringing it down was more difficult on raw Apache Hadoop."

Vyas and his team moved to a commercial distribution of Hadoop, but found the tools it provided for configuring and monitoring the system were immature, and the monitoring wasn't always reliable. "Cloudera has more mature tools," Vyas adds. "It has an accessible interface with the Hadoop User Experience* (HUE*), which lets you run various Hadoop tools inside your browser. It's much better than anything else out there."

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Big Data, Big Value from Existing Information

Some of the most impactful use cases for big data in healthcare focus not on acquiring more data but on looking more deeply into existing data volumes. "Big data is one tool in an arsenal of tools," says Vyas. "The term may have been overused in the marketplace, but the reality is that big data is a very powerful tool. With the intelligence of our analytics and the power of our platforms, we're providing ways to answer questions we couldn't even ask before. We can examine structured and unstructured data, and that's extremely powerful."

That power is increasingly valuable for organizations striving to deliver personalized, value-based care. "The intelligence Apixio provides is all in service of increasing the transparency of information and understanding the true state of the patient," Vyas says. "For value-based care, doctors, payers, and even patients need the best version of the true state of the patient so they can manage risk and make the best decisions based on

the whole patient history. That's a big data problem."

Through its use of data analytics and cognitive computing, Apixio's HCC Profiler helps turn structured and unstructured healthcare data into practical clinical and business value. In addition to the diverse benefits that arise from faster, more accurate chart audits, the HCC Profiler contributes to a more complete patient record. It gives providers and patients a firmer basis for planning treatments and optimizing health, and provides a foundation for further analysis.

"Making unstructured data structured gives you more opportunities to do more analytics, both reactive and predictive," says Pantovic. "You're better able to assess how well you're doing as a system. You can do more preventive care and see how that affects outcomes down the line. With Medicare fee-for-service moving toward value-based care, it's all going to depend on what's on the claim form. Our ability to add more diagnosis codes to the claim form adds valuable information."