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Predictive Analytics Propels Healthcare Plan Optimization

Identifying high-risk populations helps payers optimize care plans, improve member satisfaction, and reduce fraud, waste, and abuse

This solution brief describes how to solve business challenges through investment in innovative technologies.

If you are responsible for...

- **Business strategy:** You will better understand how a predictive analytics solution will enable you to successfully meet your business outcomes.

- **Technology decisions:** You will learn how a predictive analytics solution works to deliver IT and business value.

Executive Summary

Healthcare systems around the world are transitioning from paper-based processes to digital workflows that transcend the Electronic Health Record (EHR).[2] Payers can now integrate immense amounts of structured and unstructured data to help improve the quality of patient care, while helping achieve greater cost and resource efficiencies.

Data sources include dental and clinical claims, behavioral health data, socioeconomics, pharmacy records, as well as surveys, social media, and other public data such as weather and geospatial data. In addition, telemedicine, sensors, monitors, and devices represent additional new data sources for healthcare payers. Innovations in predictive analytics are helping improve healthcare operations through the unique, timely, and dynamic connection of evolving risk factors.

An innovative predictive analytics solution based on Intel® architecture and software from industry leaders enables payers to consolidate information from a wide range of sources to give a 360-degree view of patient health and risk factors. One hospital group[1] uses a scale-out data platform powered by Intel® Xeon® processors and Intel® Solid State Drives, combined with data analytics, to identify patients with a high readmission risk. Sophisticated mathematical models leverage Intel® hardware and software performance to analyze data stored in disparate systems to provide fast and actionable insights about a patient's health and to predict healthcare outcomes. This business intelligence is helping payers collaborate with providers to reduce costs, improve quality of care, and enhance the patient experience.

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Predictive analytics solutions, running on scale-out data platforms powered by Intel® Xeon® processors and Intel® Solid State Drives, help payers improve operational efficiency and member satisfaction.

Business Challenge: Improving Care Plans for High-Risk Patients

Over the past several decades, healthcare systems globally have been transitioning from paper-based to digital workflows. While this transition is far from complete, organizations that have adopted digital workflows are finding that the data collected by key clinical applications such as Electronic Health Records (EHRs)[2] can be used to build powerful predictive models to help improve patient care and business efficiency. One emerging use case for predictive modeling, and of interest to payers seeking ways to improve both efficiency and care quality, is characterizing patient populations across a variety of factors to identify high-risk, chronic-condition patient groups, also called patient segments.

Payers providing coverage for these high-risk patients collaborate with providers, sharing data and using analytics to model scenarios that lead to better outcomes. Using this information, payers can optimize care plans that steer patients toward behavior modifications and treatments that will lead to improved health—resulting in cost savings for payers and quality improvements for providers. Intel® technology-based solutions exist today that enable payers to run powerful predictive analytics to achieve these results.

Predictive Analytics for Payers in Action

The massive amounts of data produced within the healthcare system presents a vast opportunity for those who can harness that information and use it to make healthcare easier, improve outcomes, and ultimately help save people's lives.

For example, Humana*, a health insurance company based in Louisville, Kentucky, collects, analyzes, and applies healthcare data in ways that have tangible positive benefits for people's health.[3] Humana estimates that the organization manages 1.5 petabytes of data in its analytics environment—150 times the information stored in the digitized version of all the print collections in the Library of Congress.

To maximize the value of the data it collects and analyzes, Humana focuses on "moments of influence"—the points during the care of a patient at which a healthcare provider can have the most positive impact on the patient's health. Humana then uses a sophisticated clinical platform called CareHub* to transform these analytic insights rapidly into actionable intelligence. By integrating and assessing a variety of information from medical claims and other sources, the platform identifies and predicts evidence-based gaps in care for a patient, then sends alerts to providers and members. For example, a physician could be alerted that a diabetic patient is at risk of disease progression, or that a specific drug would interfere with another medication that the patient is taking, or that a patient is due for a needed health screening.

This type of real-time, data-driven clinical decision support, delivered to doctors at the point of care, directly supports them in their efforts to help patients achieve their best health. In addition, it helps strengthen the doctor-patient relationship and identifies the patients who require greater clinical resources. In the first eight months of 2014, Humana used its data insights to close 2.4 million gaps in care, and sent more than 1.5 million alerts about medication adherence or screening reminders, and more than 400,000 drug safety messages, resulting in the discontinuation of potentially harmful prescriptions.[3]

Solution Value: Early Identification of Risks Reduces Payer Costs

One of the first steps in implementing a predictive analytics program is to expand access to information across a variety of data sources such as EHRs, payer systems, clinical trials, labs, radiology, and imaging as well as information about the patient's health or socioeconomic status. Figure 1 shows some of the common data sources that can be combined to enable predictive analytics applications. This previously untapped data—along with new mathematical models and hardware and software capable of analyzing data stored in disparate systems and formats—can better determine information about a patient's health and predict healthcare outcomes.

To adapt to the market pressures facing healthcare, payers are seeking ways to improve processes, increase member satisfaction, and reduce fraud, waste, and abuse (FWA). The value from implementing a predictive analytics solution can be significant, and the opportunities for payers to benefit are numerous:

- **Care plan optimization.** In addition to helping improve the quality of care,[4] a data and predictive analytics platform can help improve clinical efficiency by anticipating and staging rapid response teams for patients with specialized needs or risks. Payers can use analytics to predict which individuals
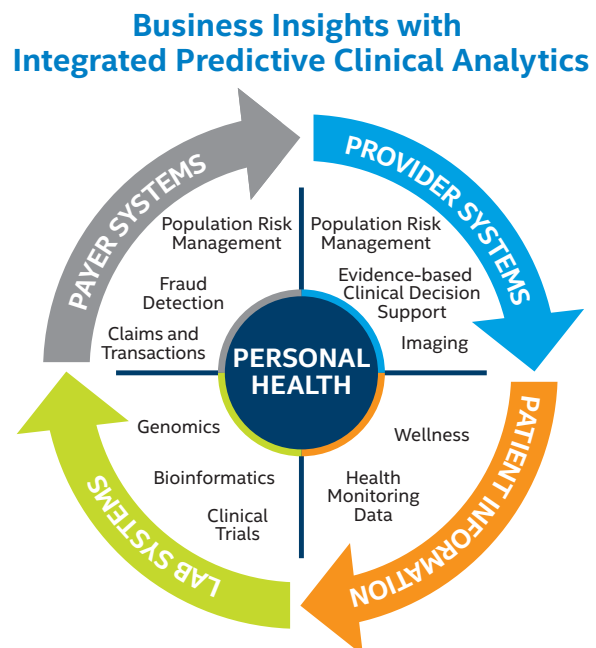

Business Insights with Integrated Predictive Clinical Analytics

PAYER SYSTEMS — PROVIDER SYSTEMS — PATIENT INFORMATION — LAB SYSTEMS

Population Risk Management
Fraud Detection
Claims and Transactions
Population Risk Management
Evidence-based Clinical Decision Support
Imaging
PERSONAL HEALTH
Genomics
Bioinformatics
Clinical Trials
Wellness
Health Monitoring Data

Figure 1. Increasingly, payers are now able to integrate disparate sources of data, which is foundational to predictive analytical insights.

are at risk for conditions such as diabetes or metabolic syndrome, and create personalized programs to help prevent these conditions from getting worse. Keeping the member population healthier benefits everyone, including payers and their members. The platform can also help prevent duplicate or unnecessary testing and make recommendations regarding bundling of services for streamlined billing and payments.

- **Member satisfaction and engagement.** Payers can use predictive analytics to identify members with a high risk of non-compliance and plan adherence to address members' specific barriers. They can analyze member profiles to pinpoint those with the highest risk of leaving the plan and create a proactive retention solution. Payers can also identify characteristics that are present in long-standing member populations, then cultivate similar behavior in other members, resulting in a stronger member retention strategy. Other uses include identifying and evolving metrics for preventable admissions and readmissions from individual patient records, and using trend analysis to anticipate changes in population health behavior as it responds to healthcare regulation. Members will appreciate a payer's ability to identify trends, define more efficient and effective interventions, and better manage population health.

- **Fraud, waste, and abuse (FWA).** Predictive analytics helps ensure that payers are billed appropriately for services. All too often, payers pay claims that are fraudulent, then spend precious time and resources seeking restitution. Payers can break the "pay and chase" cycle by taking a proactive stance on FWA with predictive analytics, identifying fraudulent claims prior to payment and targeting investigations through pattern analysis and by determining which providers have the highest FWA risk. Link analysis can reveal connections between providers and criminal activity.

Integrated Predictive Clinical Analytics Reference Architecture

Application	Application	Application
Visualization Data visualization applications		
Analytics Platform Analytics, streaming frameworks, and machine learning libraries		
Data Processing Data ingestion, ETL, cleansing, and storage		
Scale-Out Platform Intel® Xeon® Processors and Intel® Solid State Drives		

Internal Data
- Electronic Health Records
- Claims data
- Lab data
- Prescriptions
- Genomics

External Data
- Socioeconomic data
- Geospatial information
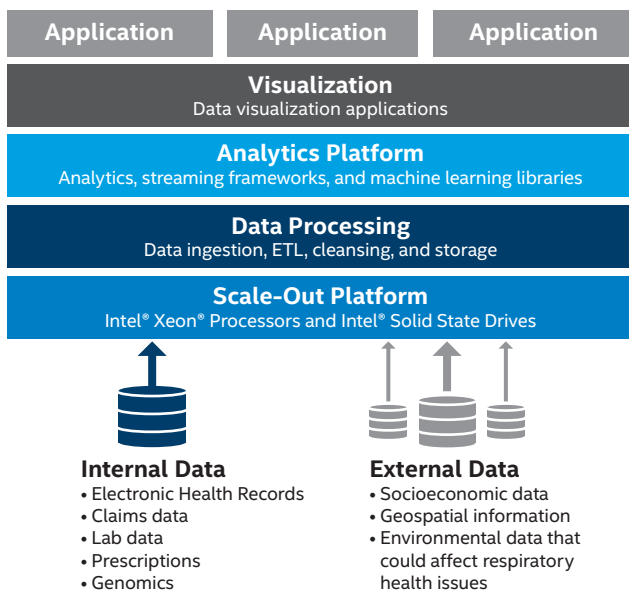- Environmental data that could affect respiratory health issues

Figure 2. The predictive analytics reference architecture provides a method for analyzing disparate data sources that helps deliver insights into clinical data.

Collaborating to Create an Improved Predictive Analytics Ecosystem

Intel works with many industry leaders, such as Cerner*, ProKarma*, CDW*, Big Cloud Analytics*, Cloudera*, Oracle*, Pondera Solutions*, Cybraics*, and SAP*, to develop new data source interconnects and mathematical models to more accurately identify the high-risk factors that bring recently released patients back to hospitals. Cloudera, for instance, innovated a new data repository for patient lifestyle information and unstructured data outside of traditional Electronic Health Record (EHR) systems. This makes available new contributing factors that help determine the risk of patients returning to the hospital. Cloudera Enterprise*[5] has been jointly developed with Intel to optimize the speed at which the analytics can return insights from these new data sources.

Solution Architecture: Enabling Predictive Analytics

The predictive analytics reference architecture stack consists of layers containing offerings from a variety of vendors. As shown in Figure 2, the data repository layer includes customer data sources that may contain both structured and unstructured data, with data repositories that are both internal and external to the enterprise. Examples include EHR data that contain demographics, treatment and diagnosis codes, claims data, clinical notes (unstructured), call center logs, and external data such as environmental data or social media data.

The predictive analytics reference architecture includes the following components:

- Powerful Intel® architecture-based servers

- A data processing layer that performs data ingestion; Extract, Transform, and Load (ETL); cleansing; and storage. Alternatively, organizations can use a NoSQL database approach that uses indexing during data ingestion to maintain data context.

- A scale-out analytics platform that allows multiple processors and storage servers to share the system load

- Data visualization tools, such as fraud detection as a service from Pondera Solutions*

Using sophisticated mathematical models, powerful servers, and advanced software applications, payers can analyze extensive amounts of data stored in a wide variety of formats. The resulting insights into patient risk and resource allocation lead to cost-efficiency gains, member satisfaction, and reduced FWA.

The reference architecture shown in Figure 2 provides four primary benefits:

- It accommodates many different data types and formats (structured and unstructured data), which directly address the disparate data storage issue.

- It is flexible enough to support new applications and analytics to discover new insights or improve predictive models by combining multiple datasets today and in the future.
- It is easily scalable, using innovative data processing software such as Apache Hadoop* and Intel® Enterprise Edition for Lustre* software.
- It is based on open source technologies to help avoid vendor lock-in, making the solution cost-effective for the long term.

At the foundational scale-out data platform layer, a tuned cluster of servers, networks, and storage is used to ingest, connect, and store the data at a speed for direct analysis. Ideally, this architecture uses the analytics performance and query compute capacity of Intel® Xeon® processors and Intel® Solid State Drives for big data technologies such as enterprise data warehouses, Hadoop, massively parallel platforms, NoSQL containers, and in-memory data warehouses. Predictive analytics layered on one or more of these big data platforms provides a dynamic range of intelligence that opens and interconnects new data sources.

An analytics platform layer includes advanced analytics applications, scalable machine learning libraries, and streaming frameworks such as Apache MLlib*, SAS*, or Apache Spark* and Spark Streaming*. The visualization layer includes applications such as Tableau* or Qlik*, which make it easy to combine multiple views of data to get richer insight. Finally, the business logic and application layer uses the underlying platform capabilities to implement business use cases.

Conclusion

The digital transformation and growth in data collection that are occurring throughout healthcare systems around the world have created an unprecedented opportunity to apply predictive analytics to help improve operational efficiency and care delivery. Healthcare leaders, industry partners, and Intel are using predictive analytics built on scale-out data platforms to combine information from a wide range of sources and gain a more complete picture of patient health and risk factors.

This information can aid payers in collaborating with providers to optimize care management, identify and mitigate health risks, improve member satisfaction and engagement, and reduce FWA. As the healthcare industry becomes even more competitive, predictive analytics will play an increasingly important role in how successful payers promote high-quality, cost-effective care.

Find the solution that's right for your organization. Contact your Intel representative or visit **intel.com/ healthcare**.

Solutions Proven By Your Peers

Intel Solution Architects are technology experts who work with the world's largest and most successful companies to design business solutions that solve pressing business challenges. These solutions are based on real-world experiences, gathered from customers who have successfully tested, piloted, and/ or deployed these solutions in specific business use cases. Solution architects and technology experts for this solution brief are listed on the front cover.

Learn More

You may also find the following resources useful:

- Intel and Cloudera Use Predictive Analytics to Help a Large Hospital Group Reduce Readmission Rates—Use Case
- Intel and Cloudera Help a Large Hospital Group Allocate Resources by Predicting Patient Length-of-Stay—Use Case
- Penn Signals Big Data Analytics Helps Penn Medicine Improve Patient Care Case Study
- Humana: Harnessing the Power of Big Data
- Predictive Analytics and Interactive Queries on Big Data White Paper

[1] Intel and Cloudera Use Predictive Analytics to Help a Large Hospital Reduce Readmission Rates, 2015, intel.com/content/www/us/en/healthcare-it/solutions/documents/predictive-analytics-reduce-hospital-readmission-rates-white-paper.

[2] Electronic Health Record (EHR) and Electronic Medical Record (EMR) are synonymous. This solution brief uses the term EHR.

[3] Harnessing the Power of Data, humana.com/about/public-policy/humana-improves-healthcare/making-healthcare-easy/harnessing-power-data.

[4] Healthcare Informatics, UCHealth Deploying Predictive Analytics Tool to Improve OR Utilization and Enhance Patient Care, healthcare-informatics.com/article/uchealth-deploying-predictive-analytics-tool-improve-operating-room-utilization.

[5] For more information about Cloudera Enterprise, see cloudera.com/products.

[6] The State of Predictive Analytics in U.S. Healthcare, modernhealthcare.com/assets/pdf/CH105920628.PDF.