CTI DATA

A Data Analytics Framework for Healthcare Organizations

Healthcare Analytics and Insights at the Speed of Change

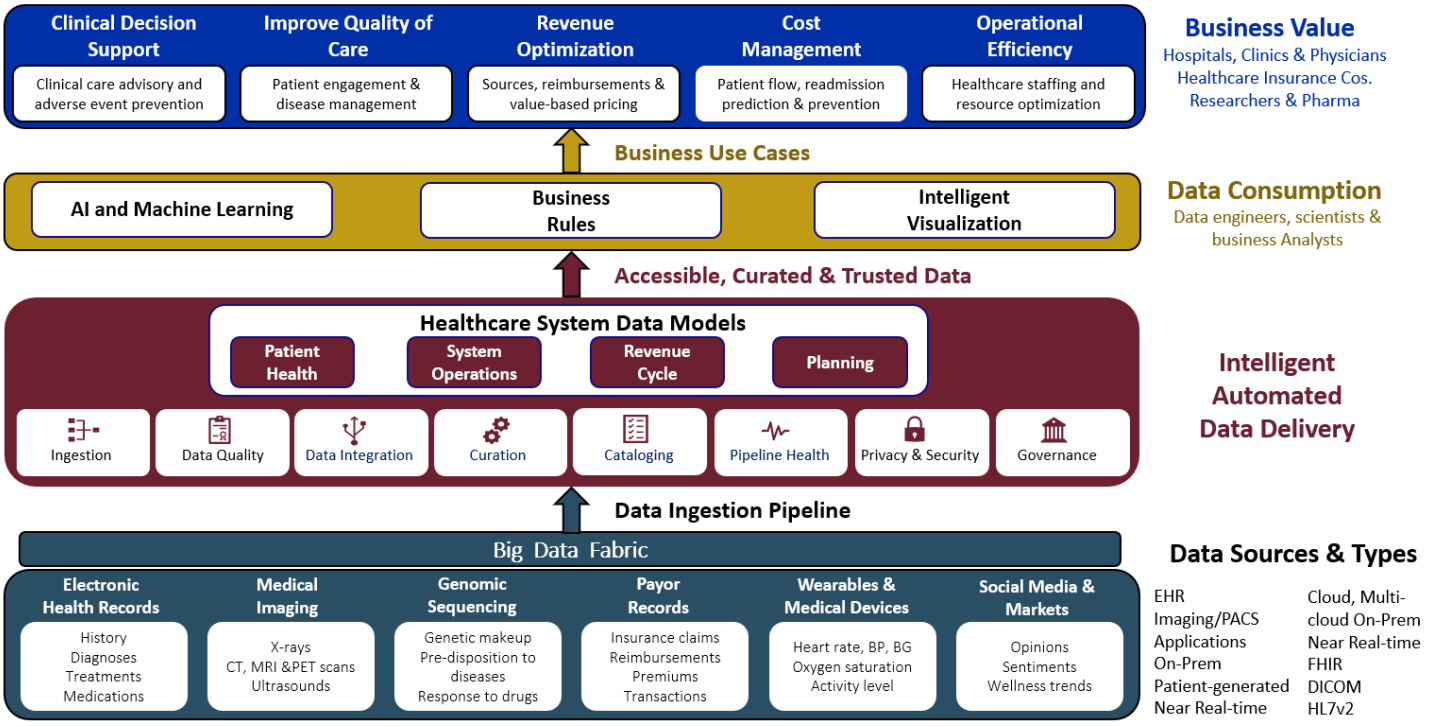
Many healthcare providers are turning to digital transformation to improve patient care. By using data to make informed decisions, workflows can become more efficient and intelligent. This shift towards data-rich environments and cloud technology also provides greater analytics capabilities. Regrettably, the information required to make well-informed decisions is scattered across various isolated data sources, creating obstacles in accessing and utilizing it effectively.

We have developed a Data Analytics Framework for the healthcare industry to tackle this obstacle. This framework utilizes data from on-premises or cloud applications where it already exists. Our framework has been established on a dependable and thoroughly curated data pipeline, which is used for data science, machine learning, and advanced analytics applications. It is a platform that can be utilized to implement intelligent interactive dashboards, which aid healthcare organizations in providing high-quality care and improving operational efficiency. The framework includes the following components:

- A secure, trusted Healthcare data pipeline
- Patient and Healthcare data models
- Healthcare provider intelligent dashboards

Advanced Analytics Framework for Healthcare

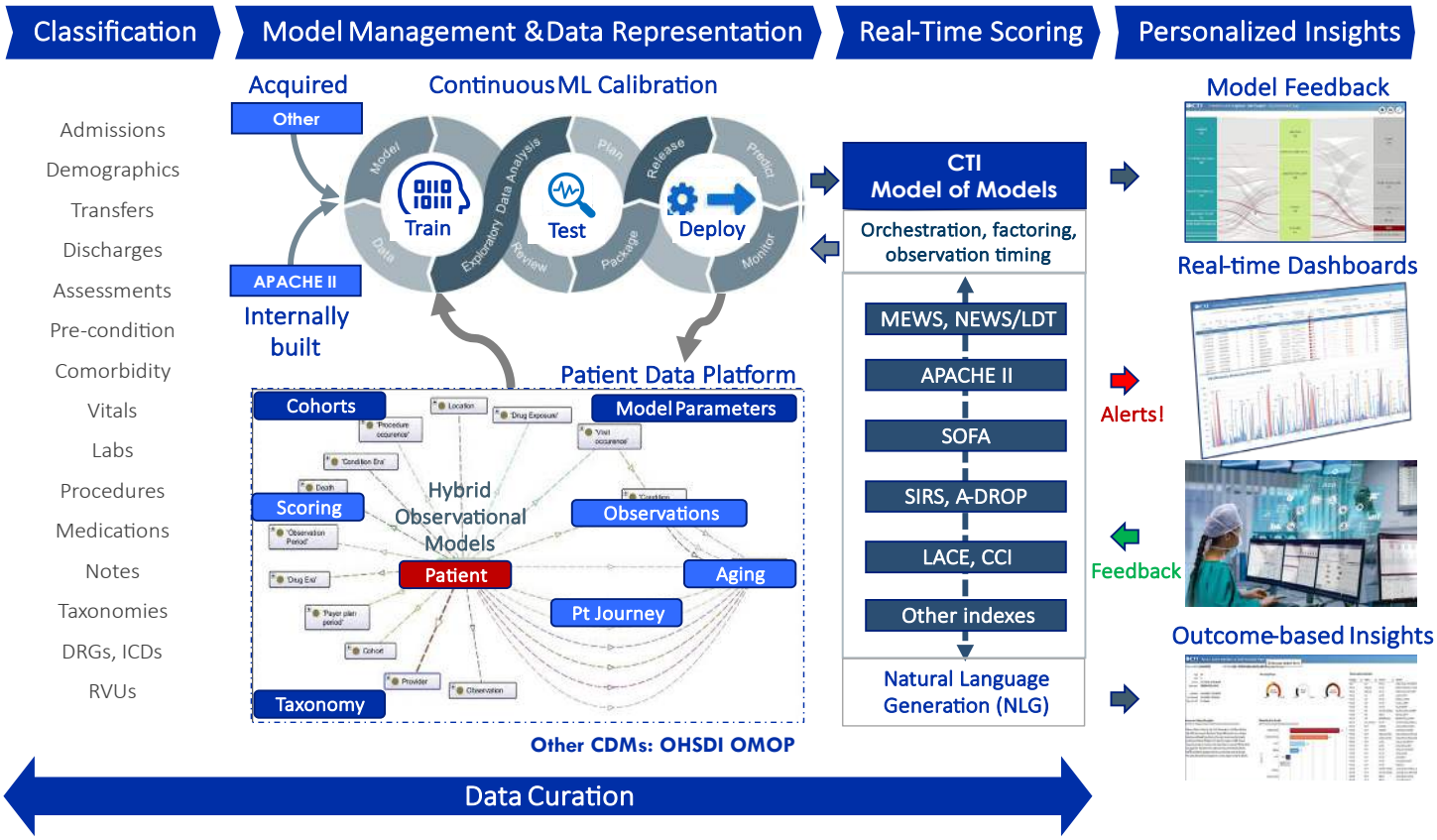
Our approach involves utilizing proven tools and expertise to enable healthcare organizations with analytics capabilities, resulting in tangible benefits for established use cases. Using AI can reshape the industry with the ability to improve patient experiences, enhance efficiency, foster better health outcomes, and spur innovation and growth.



Patient and Healthcare Data Models

Healthcare providers can make better decisions and provide more effective care by analyzing patterns and trends in patient data. Our healthcare data modeling process organizes patient data to make it easier to analyze, interpret, and use it effectively.

To ensure success with the machine learning model, it's vital to involve healthcare professionals and data experts in its development and implementation. We collaborate with our clients to create a clear structure for healthcare data that accurately represents and comprehends the information.



Accurate and meaningful analysis, reporting, and decision-making in healthcare rely on effective data modeling. This process ensures consistency, quality, organization, and structure, as well as integration of the data. The components are:

- Healthcare Data Model - a data schema that logically represents the data elements and their relationships.
- Data Dictionary - the data elements, their definitions, data types, and permissible values. The data dictionary helps maintain consistency and clarity across different data sources and systems.
- Entity-Relationship Diagrams (ERDs) - the healthcare system's entities (such as patients, providers, and medications) and their relationships.
- Data Standardization – a representation of healthcare data using standards like HL7, SNOMED CT, LOINC, and ICD-10 to help improve data consistency ensure interoperability and consistent data exchange.

Dynamic Healthcare Provider Dashboards

Hospitals can improve patient care and operational efficiency by using predictive analytics. This involves using techniques like machine learning, statistical modeling, and predictive modeling to anticipate patient admissions, manage beds, allocate resources, and improve patient flow. Regression models, time series analysis, and machine learning algorithms such as random forests, gradient boosting, and recurrent neural networks are all commonly used in healthcare data analytics.

Resource Management

Utilize the predictions from the models to optimize resource allocation and manage patient census efficiently.

Admissions Forecasting: Build models to predict future patient admissions. This helps estimate the number of patients arriving within a given time frame, allowing hospitals to anticipate resource needs.

Length of Stay Prediction: Develop models to estimate the length of stay for admitted patients. This helps with discharge planning, allowing hospitals to optimize patient flow.

Bed Management: Based on admission forecasts and length of stay predictions, allocate beds appropriately, ensuring availability for incoming patients and facilitating timely discharges.

Staffing Optimization: Use predictive analytics to align staffing levels with anticipated patient demand, preventing overstaffing or understaffing situations.

Discharge Planning: Identity patients that are likely to have shorter lengths of stay or are ready for discharge, enabling proactive discharge planning and facilitating the timely release of beds.

Patient Census Dashboard

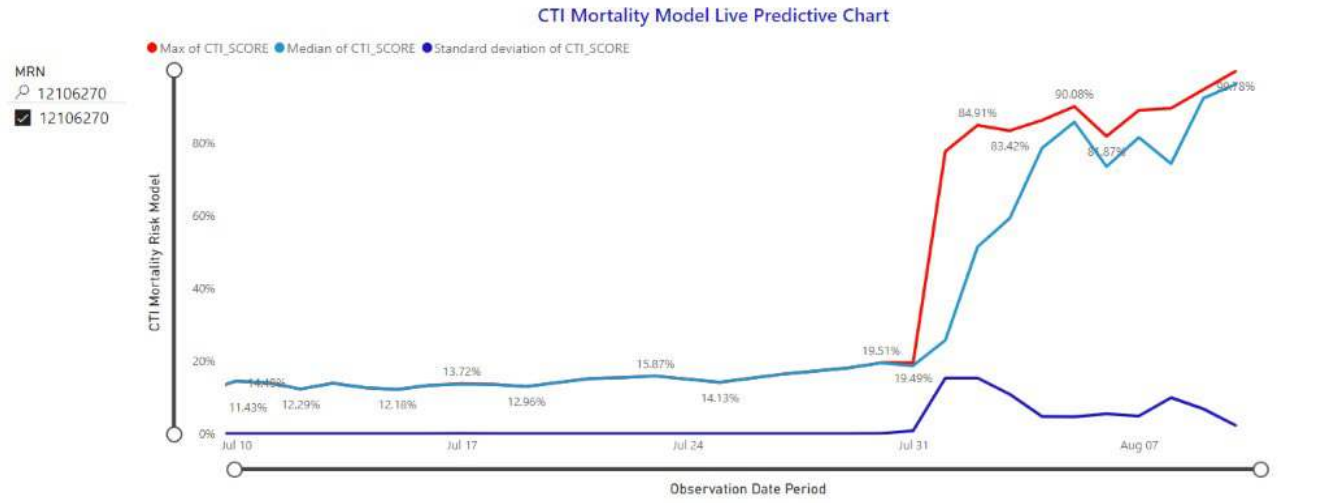
Patient Risk Surveillance

Our patient surveillance model uses proven decision-support tools and techniques to monitor and track patient health data. Predictive analytics helps identify abnormal patterns, deviations from normal ranges, and potential health risks to suggest proactive intervention.

We combine multiple clinically validated patient assessment tools to create a comprehensive accurate view of acuity using data from sources including EHRs, administrative systems, other healthcare providers, social determinants of health.

Clinical Surveillance Dashboard

MRN	Encounter ID	Gender	Age	Admit To	Admission Date	CTI Score	APACHE Score	LDT NEWS Aged Score	Comorbidity	Readm. Risk	Risk Stratification	Past ER Visits	
12106270	29333624	F	65	OBSERVATION ADMIT	7/10/2135	99.78%	17	14.00	0	Medium	Catastrophic (High)	1	
18711331	29023380	M	64	URGENT	7/14/2178	99.68%	6	1.00	0	High	Catastrophic (High)	1	Other Respiratory & Ch
16467092	26269762	F	69	OBSERVATION ADMIT	7/12/2137	99.42%	6	7.00	1	Low	Catastrophic (High)	0	Nonextensive Procedur
18078692	26545545	F	66	URGENT	7/12/2184	97.18%	18	6.00	0	High	Catastrophic (High)	1	Infectious & Parasitic D
12175964	28055342	M	59	OBSERVATION ADMIT	7/4/2126	96.80%	10	2.00	0	High	Catastrophic (High)	0	Tracheostomy W Long



The surveillance model can identify potential risks and alert healthcare providers to act promptly. Additionally, it offers timely decision-support capabilities by providing insights, recommendations, and treatment guidelines based on latest available assessment data.

Risk Assessment

By combining multiple models and techniques, a healthcare patient surveillance model of models aims to provide a comprehensive and holistic view of patient health, enhance patient safety, and improve healthcare outcomes. It enables healthcare providers to proactively identify and address potential concerns, reducing hospital readmissions, adverse events, and unnecessary healthcare costs. This solution framework consists of:

Descriptive Analytics: Calculate basic statistics and generate summary reports to understand the characteristics of the patient population and mortality rates.

Predictive Analytics: Build predictive models using machine learning algorithms to predict the risk of mortality based on the selected features.

Survival Analysis: Analyze time-to-event data, such as the duration until a patient's death; survival analysis methods like Kaplan-Meier curves or Cox proportional hazards models can be used.

Risk Stratification: Segment the patient population into risk categories based on the developed models or statistical analyses. This helps in identifying high-risk groups that require additional attention or interventions.

Combining multiple commonly accepted assessment models, we leverage their strengths to improve the overall surveillance capabilities.

The healthcare industry produces and relies upon massive amounts of data from diverse sources. That creates a rich environment for applying AI and ML. The need for these technologies is there, given the inefficiencies in the healthcare system. Our goal is to enhance the accuracy of patient monitoring, early detection of deteriorating health conditions, identification of at-risk populations, and more precise prediction of outcomes.

Summary

The combination of technology and healthcare advancements has opened doors for exciting opportunities and a surge of innovation. Leaders in the healthcare industry must explore ways to utilize advanced predictive and prescriptive models to enhance care and manage expenses.

The dynamic nature of the healthcare industry's technological advancements, medical breakthroughs, regulatory changes, and shifting patient demographics, underscores the need for providers to keep pace with these changes by leveraging analytics and insights at the speed of change. AI/ML solutions that can be implemented on a large scale are necessary to effectively balance unpredictable demand and supply in a resource-intensive sector like healthcare.

Getting the Most Out of Your Investment

By collaborating with our team of data and analytics experts and leveraging our advanced data and analytics framework, you can implement meaningful changes and achieve measurable enhancements throughout your organization.

Our healthcare solutions provide an accurate view of all relevant healthcare data. Furthermore, we will work closely with you to develop and share accountability for mutual goals. Then, after deployment, we follow through to ensure we've met our shared objectives and that you are satisfied with the solutions we've delivered for your organization.

Contact us to explore our real-world case studies to learn more about how we've helped our healthcare clients grow and create business value.