

CHOC Children's Advances Population Health Using Data Science and AWS



Executive Summary

CHOC Children's, one of the nation's leading children's hospitals, collaborated with Cerner to develop a cloud-based, machine learning solution called HealtheDataLab, which was built and deployed on AWS. Using Amazon EMR for big data analytics, and Amazon S3 for object storage, HealtheDataLab helps data science teams build and run sophisticated predictive models aimed at improving patient outcomes.

Data Intelligence for Smarter Healthcare

[Children's Hospital of Orange County](#) (CHOC Children's) is using predictive analytics tools built on Amazon Web Services (AWS) to help improve care, support advanced clinical decision-making, and save lives. The organization collaborated with [Cerner](#), a [Select Technology Partner](#) in the [AWS Partner Network](#) (APN), in the creation of Cerner HealtheDataLab¹, a big data analytics ecosystem.

Using HealtheDataLab, CHOC Children's improved its "area under the curve" (AUC) for 30-day hospital readmissions from 0.79 to 0.82². AUC measures predictive model performance, with an AUC closer to one being better. Improving a model by even 0.01 can be challenging. The model is one of the most accurate in the children's population health literature and uses data from 48 hospitals and 1.4 million encounters.

"When considering when to discharge a patient, or what additional support will be required post-discharge, the clinician can look at a readmission risk score directly in the patient's medical record," says William Feaster, MD, chief health information officer at CHOC Children's. "This tool also shows the six most significant reasons for the risk determination. The clinician can focus on variables likely to make a difference in readmission rates, such as medication education."

"Initially, we executed data science using on-premises resources, which limited the speed and scale of our investigations," notes Feaster. "When Cerner approached us to collaborate on the creation of HealtheDataLab, we quickly grasped the opportunity."

These kinds of collaborations are central to Cerner's mission. "As a global health platform and technology company, we are focused on enabling healthcare organizations with intelligence that can help detect and mitigate clinical, financial, and operational risk," says Cole Erdmann, director of clinical intelligence at Cerner. "With HealtheDataLab, we aim to empower innovative organizations, such as CHOC Children's, to use more data and to discover insights efficiently."

A Playground for Insights

HealtheDataLab ingests and normalizes information from the CHOC Children's electronic health records (EHR) system, enabling its data science team to build models that help predict clinical outcomes based on medical, demographic, and other data. These models help providers make more-informed decisions for the health of their patients in near-real time.

The ability to apply cloud-scale computing power to complex healthcare challenges has improved the productivity of the CHOC Children's team and enabled it to achieve results faster. "We can now complete studies start to finish in record time using HealtheDataLab," says Louis Ehwerhemuepha, PhD, data scientist at CHOC Children's. "We will be able to publish a new study once a month this year, and we see that rate increasing in the future. That means empowering healthcare organizations around the country to improve patient care using the results of our research."

About CHOC Children's



Affiliated with the University of California, Irvine, the CHOC Children's regional pediatric healthcare network includes a state-of-the-art, 334-bed, main hospital facility in the city of Orange, California, and a hospital-within-a-hospital in Mission Viejo, California. CHOC Children's also offers many primary and specialty care clinics, more than 100 additional programs and services, a pediatric residency program, and four centers of excellence.

¹ HealtheDataLab is a registered trademark of Cerner Corporation and/or its subsidiaries.

² Leveraging Cerner HealtheDataLab for readmission data from 2004 to 2018.

Building a Smart Solution in the Cloud

CHOC Children's knew there was significant value hidden in the large amounts of data it gathered. Its instance of HealthIntent³, the Cerner source-agnostic data and insights platform, includes more than five years of inpatient and outpatient records, as well as additional sources including claims from independent practitioners, pharmacy fulfillment and laboratory data. HealthDataLab provides an elastic environment for ingesting, cataloging, and analyzing this data using a full range of open source, machine learning (ML) tools.

The solution ingests patient data from an [Amazon Simple Storage Service](#) (Amazon S3) bucket into HealthDataLab. From there, [Amazon EMR](#) enables rapid analytics at lower cost than on-premises solutions. Popular open source tools enable data scientists to build ML and deep learning models, and an Apache Spark ML pipeline enables deployment back into clinical systems.

Ehwerhemuepha says, "Using on-premises systems, this type of analysis could take days or weeks, and if there was an error, you would have to start all over again. Using HealthDataLab on AWS means we are able to get outcomes in minutes or seconds, quickly adjust, and continually improve accuracy."

Working Together for a Healthier Future

CHOC Children's expects the solution to continue delivering value over the long term. "The sky's the limit in terms of the ways we can apply this technology," says Feaster. "We are implementing an algorithm in our Emergency Department that can predict which patients will likely develop sepsis during hospitalization. Additionally, we would like to identify efficiencies in our administrative processes that could increase our financial stability in the face of risk. We also see applications related to the genomic data that will soon become a major part of all types of healthcare."

Erdmann agrees, saying, "AWS enables us to apply sophisticated algorithms, such as deep learning neural nets, giving us the ability to analyze unstructured data including text or images." Using the analytical power of the cloud, organizations like CHOC Children's can continually innovate to improve population health.

³ HealthIntent is a registered trademark of Cerner Corporation and/or its subsidiaries.

About Cerner

Cerner's health technologies connect people and information systems at thousands of contracted provider facilities worldwide. Cerner assists clinicians in making care decisions and assists organizations in managing the health of their populations. The company also offers an integrated clinical and financial system to help manage day-to-day revenue functions, as well as a wide range of services to support clinical, financial, and operational needs focused on people.

