Case Study

Healthcare Technology
Predictive Care

Hospital Uses AI to Access New Data—and Understanding

University of Alabama at Birmingham (UAB) Medicine and Medical Informatics Corp. (MIC) work to enhance near real-time decision-making and patient care

The unprecedented demands placed on healthcare providers during the COVID pandemic underscored an increasingly acute need for medical teams: faster access to more and more detailed patient information to speed decision-making. The volume of healthcare data has exploded in recent years with the introduction of an array of new technologies. This represents a growing opportunity to extract new and more complex intelligence from that data.

Today, patient care requires doctors and clinicians to consult a range of data streams sourced from a wide list of disparate devices. This data is often used in the moment, but further analysis can be time-consuming and complex.

UAB Medicine launches AI-based pilot with MIC

UAB Medicine, one of the top academic medical centers in the U.S. and a recognized leader in world-class patient care, research, and training, wanted to quickly analyze and maximize insights from the wealth of patient data they were generating. Could emerging tools such as artificial intelligence (AI) and machine learning be employed to derive more intelligence from data? Could UAB use the data to further optimize care delivery for individual patients or even predict health events?

UAB's Department of Anesthesiology and Perioperative Medicine sought to answer that question with MIC, a software company that specializes in clinical monitoring in the inpatient environment of hospitals.

The result was a first-of-its-kind pilot with UAB Medicine built on MIC's FDA-cleared Sickbay platform and Cisco and Intel® technology. Working together, the companies created a new, large-scale model for data acquisition and synchronization—and a path forward to more-personalized care.

Cardiac study takes novel approach to unlocking data value

UAB Medicine started by implementing the Intel-powered Sickbay real-time clinical surveillance-as-a-service (RTCS) platform in its operating rooms. Sickbay leverages the Cisco network architecture to enable secure, waveform-enabled medical device integration from non-networked devices such as near-infrared spectroscopy (NIRS), ventilators, anesthesia machines, extracorporeal membrane oxygenation (ECMO), electroencephalograms (EEG), and more.

This enabled the team to obtain near real-time continuous data monitoring and data collection for retrospective analysis of cardiac cases. The goal was to analyze several alterations during different types of cardiac procedures as well as during the different stages of those procedures. The results could then be correlated with the various types of available management and medications.

"UAB has been a very data-driven institution," says Dr. Dan Berkowitz, chair of the Department of Anesthesiology and Perioperative Medicine at UAB. "The Sickbay platform allows us to capture and integrate this high-resolution information from every monitoring device we have in a completely vendor-agnostic manner. That forms a profoundly useful basis for discovery and real-time monitoring."

From a broad perspective, the cardiac analysis required taking a large amount of time-series data comprised of hours of surgery samples, collected at 120 samples per second, and transforming the data into simple, illustrative and useful curves. Thus, data is transformed into useful and actionable information. What made the pilot unusual was its scope. While similar analyses have been done previously, they addressed a single patient at a time. The UAB pilot collected signals and calculated the cerebral autoregulation curves, as well as the key values from those curves, for a batch list of 55 patients, in a de-identified manner, at the rate of just four minutes per patient.

"We believe this is the first time this type of analysis has been done simultaneously on groups of multiple patients," says Dr. Ryan Melvin, principal data scientist in the Department of Anesthesiology and Perioperative Medicine at UAB.

MIC helps UAB Medicine fuse data for new insights

The Sickbay platform allowed UAB Medicine to combine and transform two or more complex signals to create a brand-new, more complete view of the patient's status. Once the new curve was built, UAB and MIC sought to use it to tackle two objectives.

The first was to identify the optimal blood pressure for each individual patient during their procedure based on real-time information, instead of relying on historical data or population averages. The new customized view offered by Sickbay consolidates the data from both cardiac and NIRS devices about the patient's condition at a moment in time. The platform then uses the data to track the optimal blood pressure for that person during the cardiac procedure. These additional insights help create a more comprehensive view of the patient, which supports the mission of optimizing care to ensure that the patient's brain is receiving the necessary blood flow at all times.

The second goal, which represents a longer-term objective, is to move beyond the curve visualization to provide doctors a single blood pressure number that is updated every few seconds. The number would specify that individual patient's recommended blood pressure level at each step of the procedure.[1]

MIC and Intel: A Shared Vision of Possibility

MIC's relationship with Intel began with the companies' joint mission to advance the idea of data collection at the edge. That collaboration fueled an ongoing partnership that today boasts many facets.

Intel® Capital

Early engagements led to Intel investing in and supporting MIC as part of its Intel Capital portfolio company program.

Intel® processors

The MIC Sickbay platform is built on a dedicated SaaS-based platform powered by Intel® Xeon® Scalable processors with hardware-enhanced security.

Intel expertise

MIC draws on Intel's deep experience and resources and its broad ecosystem of industry partners for help with issues spanning security, federated data management, infrastructure, compute, and the rapid prototyping and validation of AI. For example, Intel experts evaluated the MIC architecture to help validate that it offered a secure solution.

Intel philosophy

"I think just philosophically working with the Intel team has been wonderful because we're very much aligned around the same principles," said Dr. Emma Fauss, CEO of MIC. "We're both founded by engineers. We want to be curious and creatively solve the problems we face—not just for our customers, but to actually think deeply about the opportunities in front of us."

MIC Sickbay enables access to data never before available

The high-resolution signals and API offered by Sickbay formed the foundation for the pilot at UAB Medicine. The FDA-cleared, software-based platform is helping the UAB team automate the collection of patient data from the bedside and bring it to care teams wherever they are.

By fusing the once-separate data sources, Sickbay gives UAB Medicine staff access to real-time, and unlimited retrospective, full-disclosure waveform data that in many cases has never been available before. The basic ability to remotely view this data enables a more data-driven approach to everyday patient care but also provides new and novel insights around the autoregulation of blood pressure in cardiac cases. These insights can prove invaluable for patients and doctors alike, offering powerful support for a range of critical clinical and operational needs, including predicting cardiac arrests.

New model improves UAB Medicine process

"What we've built with Sickbay predicts the things we want to predict, and we can update it anytime and monitor from anywhere," says UAB's Dr. Melvin.

With scalable, vendor-neutral architecture offered by Sickbay, the medical team can submit a request to the in-house analytics department. The IT team then works collaboratively with the medical team to create a tool that does exactly what is asked for. The solution is built around UAB patients and can be changed and adapted at any time to meet evolving needs. All data can be accessed on any web-enabled device to enable virtual rounding and monitoring from almost anywhere for more efficient use of resources and improved collaboration.

"In our work with UAB, we were looking at how we actually build models to calculate and help guide clinicians to predict imminent catastrophic crashes or deteriorations," says Dr. Emma Fauss, CEO of MIC. "How do we address the problem of data acquisition and data synchronization so that it's all passively done? It was one of our goals that by using Sickbay you could take one expert physician and pair them with an undergraduate engineer and they should be able to, within a few days or weeks, build analytics and test their theories."

Pilot results show promise for patients and doctors

For the UAB Medicine pilot, it took six months to get the system up so UAB could begin working with the data. Once the positive impact on patient outcomes can be demonstrated, lessons learned during the project have the potential to deliver benefits across the continuum of care.

The benefits for patient care

UAB Medicine and MIC are now focusing on validating their findings and the algorithms used to process the data from this pilot program. The ultimate goal is to start using the Sickbay platform and what has been learned during the autoregulation project to enhance near real-time decision-making and patient care in the operating room, ICU, and beyond.

The technology pilot program also supports the possibility of adopting a more goal-directed therapy, rather than relying on conventional blood pressure measurement methods. The hospital could then take the dynamic physiological data and learn more by comparing it against different populations and different relation curves in those populations.

By using machine learning AI, Sickbay allows UAB Medicine to capture high-resolution signals in near real-time to help doctors take a step closer to precision medicine. Data related to other health and lifestyle issues could eventually be incorporated. These could include the person's sun exposure, microbiology, and gene behavior. The light and noise of their environment could be considered. It could even include a person's social media or gaming activity, making possible the ultimate in personalized treatment.

The benefits for hospital workflows

The access and synchronization of data delivers operational benefits for the hospital and its staff as well. For doctors and clinicians, Sickbay can help doctors minimize the demands that come with integrating many different data sources and checking them against their own knowledge and available literature. In this way, doctors can reclaim time and enjoy greater freedom to concentrate on what they do best—building close empathetic connections with their patients.

"The ultimate purpose of AI in healthcare is to relieve the cognitive burden on providers while improving patient outcomes," says UAB's Dr. Melvin. "If we have a project that isn't ultimately able to deliver on that objective, I just don't think it will ever gain traction. That's where you get the buy-in from the medical teams."

The predictive capabilities made possible by rich real-time patient data can also equip hospitals to better forecast future needs and operate more efficiently. Using the data, can staff identify if a patient is scheduled to leave the ICU too soon or is staying too long? Can they predict and prevent a health event or accident? How about being able to predict readmission likelihood or the number or beds that will be necessary tomorrow?

Using the Intel-based MIC-UAB model, planning decisions can be based on accessible patient data. This helps hospitals like UAB Medicine better identify and avoid unwanted patient health issues while providing better care for those who experience them. Top-line benefits include greater effectiveness for providers and a better overall experience for patients.

Learn more

Find additional information on MIC Sickbay at michealthcare.com.

Read more about UAB Medicine at uabmedicine.org.

Explore how Intel is using AI to transform healthcare at intel.com/content/www/us/en/healthcare-it/artificial-intelligence.

intel.

UAB MEDICINE
The University of Alabama at Birmingham

Medical INFORMATICS

1. This approach will require regulatory approval before it can be used in clinical settings.

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