

Case Study

Healthcare Industry
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Harnessing the Power of Data to Battle COVID-19

How an Intel®-based SAP HANA solution turned raw, unstructured data into actionable insights about COVID-19.



As the fifth largest Catholic health system in the United States, Mercy serves communities in Arkansas, Kansas, Missouri, and Oklahoma with 44 hospitals, more than 400 clinics, and more than 44,000 employees. Mercy's total net revenue is more than \$6 billion a year, and it has ranked as one of the top five large health systems in the United States.¹

Since 2009, Mercy has worked on United States Food and Drug Administration (FDA)-funded demonstration projects, establishing unique analytics capabilities that give insights into how different medical devices affect patient outcomes.

Since 2017, Mercy has been collaborating with manufacturers, providing RWE so healthcare researchers and providers have better tools to help determine the best course of treatment for patients.

The COVID-19 pandemic is a global event few could have imagined. The dramatic spread and lack of knowledge around the illness caused countries to close their borders and isolate their populations.

COVID-19 presented unprecedented challenges for healthcare systems responding to the novel coronavirus, medical device manufacturers having to keep up with demand for supplies like ventilators, and pharmaceutical companies as they began their rush to develop a vaccine. Little was known about the virus as cases continued to rise worldwide, overwhelming some hospitals and the healthcare industry as a whole. Critical questions needed to be answered quickly to ensure healthcare worker safety, capacity planning, and the best possible patient care.

Mercy, a regional healthcare system, was able to repurpose an analytics system that combined structured and unstructured data to create a smarter view of how COVID-19 was spreading and how it affected patients. This view gave Mercy the capacity data it needed while also gaining a better understanding of how to treat COVID-19 patients. This system combines technologies from Intel, SAP, and others to provide a novel method to extract critical insights from clinical notes using natural language processing (NLP) and artificial intelligence (AI). This real-world evidence (RWE) platform is helping Mercy and some of its neighboring health systems, in addition to drug and medical device makers, address the needs of patients and healthcare providers, and it will continue to provide value after the COVID-19 pandemic recedes.

The challenge of the unknown

Mercy has a long tradition of technical innovation and leadership that has led to smarter, more informed care and lower healthcare costs. As an early adopter of electronic health records (EHR) software, Mercy implemented the Epic EHR system to standardize health records. What Mercy found, though, is that while EHR systems do well at tracking patient data and billing information, the most valuable insights into patient care and outcomes were buried within clinical notes.

This meant that the data that could be the most valuable in determining trends, geographical spread, co-infection and other risk factors, treatments, and outcomes were found in unstructured, oftentimes handwritten clinical notes. But how could Mercy extract and use that highly valuable source of data?

Finding answers in unstructured data

The solution to this problem was to digitize and index Mercy's clinical notes and combine them with structured data not only from Mercy's systems, but from governmental and other healthcare system sources. "You can't answer in-depth questions from higher-level data sources," says Curtis Dudley, VP of Enterprise Analytics and Data Services for Mercy.

“The key to creating better datasets that lead to insight is to dig deeper into the unstructured data.”

— Curtis Dudley, VP of Enterprise Analytics and Data Services, Mercy

To create a better patient dataset, the following steps were taken so Mercy would have actionable results from raw data:

- Mercy’s teams combined structured data from its EHR and other data sources with unstructured data from clinical notes.
- The researchers used NLP and AI to transform the unstructured clinical notes into structured, indexed data that the analytics software can use. The data was also anonymized such that patient information could not be matched to a specific patient.
- The resulting data was loaded into an SAP HANA database running on servers equipped with Intel Xeon Scalable processors, Intel Optane persistent memory (PMem), [Intel® Ethernet 700 Series Network Adapters](#).
- Finally, the researchers created analytics models and fed the results into custom dashboards and reports. In building the analytics system, Mercy digitized, curated, and enriched more than 700 million clinical notes. These notes gave researchers a much deeper view of how medications, medical devices, and treatments affected patient outcomes.

This analytics system was originally used to answer questions about how well cardiology patients responded to certain treatments and medical devices. But as COVID-19 began to spread, Mercy knew it had a ready-made system that could help in the fight against this new, rapidly spreading disease.

Putting COVID-19 under the analytics microscope

Kerry Bommarito, Director of Data Science at Mercy, leads a team of data scientists who built the models and datasets using Mercy’s analytics system that is based on Intel and SAP solutions. As it became clear that COVID-19 was a threat to the health of millions, Bommarito’s team shifted its focus from cardiology and began working on new models that could answer increasingly important questions in the fight against COVID-19. “We had already built a system that used NLP to extract data from clinical notes,” Bommarito says. “This initially helped us evaluate cardiology treatments and other RWEs by analyzing data that wasn’t in discrete fields. But by having the ability to automatically extract data from the clinical notes, we were able to flip quickly to analyzing data on our COVID-19 patients.”

The following are some of the questions that Mercy, its neighboring health systems, and its collaborating manufacturers had that the new models being developed by Bommarito’s team needed to address.

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— Kerry Bommarito, Director of Data Science, Mercy

Questions for healthcare providers:

- **How fast was the virus spreading?**

Mercy’s team needed to determine how fast the SARS-CoV-2 virus was spreading. This information would help them understand how COVID-19 would impact their facilities—especially their intensive care units (ICUs) and emergency rooms (ERs)—and help predict where resources would be needed the most. Mercy coordinated data gathering and integration with other regional healthcare systems to expand the dataset.

- **How quickly would the virus peak, and what effect would peaks and surges have on Mercy’s resources?**

Using the combined data from Mercy and its neighboring health systems, Bommarito and her team were able to accurately predict how quickly the virus was spreading and when it would peak. The data also helped predict surges and where those surges would occur. These predictions helped determine whether existing facilities would be able to handle the surges, or whether additional temporary facilities would need to be deployed, helping prevent unnecessary strains on Mercy’s resources.

Having the right inventory on hand at the right locations would be key to saving lives. The analytics system also helped predict what inventory levels of critical equipment—such as ventilators for patients and personal protective equipment (PPE) for healthcare providers—would be required, and within what time frame. Mercy is now using these predictive models to determine how many resources are needed, and where those resources are needed the most.

Additional questions that pertain to healthcare providers, drug and device manufacturers, and regulatory agencies:

- **Which populations were most at risk?**

During the early spread of COVID-19, healthcare systems had to make educated guesses as to which populations were affected the most. As more data became available, Mercy was able to focus in on which populations were being hit the hardest. For example, data often doesn’t pinpoint where patients are coming from. Mercy was able to make use of the clinical-notes data to determine that a large number of patients were coming from nursing homes, and that these patients were often sicker than patients from younger age groups.

- **Which symptoms were most aligned with COVID-19?**

Mercy’s team was able to quickly build models that compared the Centers for Disease Control and Prevention’s (CDC’s) list of symptoms against symptoms they were seeing in Mercy’s facilities. “We started with the CDC’s

list of known COVID-19 symptoms, such as fever, shortness of breath, cough, and loss of smell and taste," Bommarito says. "We were able to compare patients who tested either positive or negative for COVID-19 with recent flu and pneumonia patients to see how the symptoms aligned with the CDC's published symptoms. With the limited number of testing kits available during the first weeks of the pandemic, we wanted to ensure that we were targeting the right patients for testing."

- **What treatments contributed to better patient outcomes?**

As the number of COVID-19 patients increased, Mercy's team analyzed which treatments were most effective in treating the disease. This analysis helped Mercy understand treatment outcomes for patients across all age groups, as well as the risk factors contributing to more severe cases of COVID-19 and whether risk factors were shifting.

Using these capabilities, Mercy is working with a global device manufacturer, providing insights that help identify risk factors for COVID-19 patients and information to better predict which patients will need certain treatment like respiratory support through ventilators and other oxygen support, how long they'll require treatment, and the variables that help predict progression and mortality.

- **How will we know if vaccines are safe and effective?**

Because COVID-19 vaccines are in clinical trials that have limited sample sizes, Mercy's analytics system is able to meet the anticipated need of pharmaceutical companies and the FDA to have near real-time, real-world evidence to validate safety, effectiveness, and variables that impact outcomes once the vaccines are in use in clinical settings.

Better analysis leads to a better response

The combination of solutions in Mercy's RWE platform, including Intel and SAP, made it possible for the Mercy team to rapidly build models that quickly analyzed enormous amounts of unstructured and structured data. This analysis helped the team answer critical questions faster and more accurately than ever before, which is leading to better COVID-19 response coordination throughout the region and smarter patient care.

The analytics also provided better inter-departmental communication and coordination within Mercy. For example, risk management and supply-chain teams had the data they needed to understand how to protect Mercy's frontline healthcare providers while maintaining inventory levels of critical medications and equipment.

Additionally, Mercy and its collaborating manufacturers can better evaluate and understand what treatments and devices are working, and the risk factors that can potentially impact patient outcomes, which can be mutually beneficial as providers and manufacturers work together to improve COVID-19-related care for patients.

Making use of data to drive better results

Intel Xeon Scalable processors and Intel Optane PMem are built to help healthcare organizations increase agility so that leaders gain insights faster, and helps set up health systems like Mercy for future success and innovation. The scalability, flexibility, and performance of Mercy's analytics system gave Bommarito and her team the ability to quickly pivot to providing data-driven answers to critical COVID-19 questions.

The solution will continue to provide Mercy's healthcare providers and researchers with valuable insights that can help improve patient outcomes. "We'd like to see providers, manufacturers, and regulatory bodies collaborating on a common set of data that will help us provide better care," says Dudley. "What has been valuable for COVID-19 can be valuable in other patient-care areas."

To learn more about building a high-performance analytics platform, visit intel.com/sap.

To learn more about how Mercy's RWE Insights solution is driving smarter care through manufacturer collaborations, visit mercytechnology.net/solutions/real-world-evidence.



¹ Mercy. "Mercy Named Top Five Health Care System in the U.S." April 2019. [mercy.net/newsroom/2019-04-22/mercy-named-top-five-large-health-care-system-in-the-u-s-/-](https://mercy.net/newsroom/2019-04-22/mercy-named-top-five-large-health-care-system-in-the-u-s-/).

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