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Physicians and data scientists are teaming up to apply 21st century tools to the opioid crisis.

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From opioid abuse to diabetes prevention, big data is making an impact

By now, the devastating impact of opioid abuse is well-documented. The Department of Health and Human Services reports that 116 American died every day in 2016, the most recent year for which comprehensive data are available, because of opioid-related drug overdoses. More than 11.5 million people misused prescription opioids, with an estimated economic impact of \$504 billion.

Conventional medical responses to the epidemic, unfortunately, have had little impact. And public policies designed to temper its wrath have proved ineffective as well. But now physicians and data scientists are teaming up to apply 21st century tools to the crisis, and the early returns show promise.

One example comes from Scott County, Indiana, about 80 miles south of Indianapolis. Like many rural areas in America, Scott County, was only too familiar with the early ravages of the opioid epidemic. But in 2015, public officials encountered an unexpected complication: an outbreak of HIV that quickly led to more than 200 confirmed cases in a population of just 4,500 residents. With diagnoses of the deadly virus accelerating, the county turned to the Centers for Disease Control and Prevention for assistance.

To expedite its analysis, the CDC utilized Hadoop-based big data software developed by Leidos called Collaborative Advanced Analytics & Data Sharing (CAADS).

"There were a lot of things that needed to be understood," said Ryan Weil, PhD, Leidos chief scientist, "including outbreak clusters, geographic factors, epidemiological patterns and drug resistance data."

The system ingested heterogeneous data from county information, internal CDC data sets as well as commercial, state and local data sources and then quickly generated visualizations for high-resolution epidemiological tracing.

Because the system required no programming proficiency, Weil said, anyone could develop queries and models without coding, reducing analysis-to-insight time from weeks to hours. The reduction in time or improvement in performance has been shown to be a factor of six.

Using CAADS, public health officials confirmed the source of the issue: A specific opioid, Opana ER, had been reformulated recently to reduce abuse and was now being ground up and injected intravenously by opioid abusers who shared needles. Once HIV was introduced into the population, it quickly spread, assisted by sexual contacts.

The CAADS system used machine learning and predictive analytics to identify patient risk and generate recommendations: Declare a public health emergency, launch a public education campaign, provide substance abuse counseling and treatment, and set up syringe exchanges. The CDC was able to apply its learnings to respond to and prevent outbreaks in other vulnerable communities. And in 2017, an FDA advisory panel recommended that Opana ER be removed from the U.S. market.

While these tools proved to be of forensic value to Scott County, they are even more powerful when used to predict and prevent disease. At University of Miami Health System (UHealth), big data tools have been integrated in the system's Epic EHR to provide physicians with predictive analytics at the point of care.

"We need a data environment that can do complex statistical analysis to help us move away from reactive medicine and toward proactive medicine, in which we get to patients before they get sick and prevent the disease from occurring," explained David M. Seo, MD, UHealth's chief information officer and associate vice president.

The first application of this integration is a diabetes prevention program. UHealth believes the tool will be a more effective mechanism for detecting medical risks, improving the quality of care and generating savings of up to \$12.5 million as pre-diabetic patients are successfully identified and participate in diabetes prevention training.

"The next 5 to 10 years of healthcare will see a burgeoning of data ingestion, availability of data analytics, and data scientists looking for patterns and correlations," said Leidos Health President Jonathan Scholl. "That's going to happen, and we're excited about that."

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