

Pittsburgh Hospital Taps AI to Prevent Spread of Infections

About 3% of U.S. patients get infections linked to hospital care



Dr. Lee Harrison, left, a professor at the University of Pittsburgh School of Medicine, led the team of Pitt and Carnegie Mellon University researchers who developed the AI system.

PHOTO: NATHAN LANGER, UPMC

By [John McCormick](#)

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A Pittsburgh hospital is using artificial intelligence to help map the spread of infections through the facility, an effort aimed at better preventing hospital-based outbreaks.

Even before Covid-19, infections were a huge problem for hospitals. About one in 31 U.S. patients contracts at least one infection linked to hospital care, according to the Centers for Disease Control and Prevention.

The University of Pittsburgh Medical Center said last week that it was deploying the machine-learning system at its flagship hospital, UPMC Presbyterian, after two years of testing at the facility.

The system was developed by a team from two Pittsburgh universities, the University of Pittsburgh School of Medicine and Carnegie Mellon University School of Computer Science. Pittsburgh, once synonymous with steel production, is now associated with research in health care, robotics and artificial intelligence.

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Known as Enhanced Detection System for Healthcare-Associated Transmission, or EDS-HAT, the system relies on a combination of bacterial DNA sequencing and electronic health records.

Genomic sequencing determines if an infection has spread from one person to another or if two or

more patients caught an infection from the same source. The process identifies mutations that occur when an infection moves from patient to patient. If there are very few changes in the bacterial samples of two patients, it is a sign that one of those patients passed the infection to the other or that they both were in contact with the same source of contamination.

When DNA sequencing identifies patients with the same infection, machine learning analyzes patient electronic health records to map its spread. Machine learning is a form of artificial intelligence that can teach itself to find patterns in troves of information, such as health records.

Patients' records track the rooms in which they stayed, the procedures they had, the equipment used to treat them, and the health workers who came in contact with them.

The hope is that the system will show exposure patterns and help medical staff take steps to stop the spread of an infection, including enhanced measures to disinfect rooms and sterilize equipment.

"It's the data mining, machine learning that helps us figure out what the transmission route is," said Lee Harrison, who led the team that created the system. "What we have found is that it uncovers transmission routes that we never would have identified," said Dr. Harrison, an infectious-disease specialist who is a professor at the University of Pittsburgh's medical school and its Graduate School of Public Health.

Dr. Harrison's team tested EDS-HAT at UPMC Presbyterian over a two-year period. The team estimates that during that time about 60 transmissions of infectious diseases could have been prevented.

At UPMC Presbyterian, the team this month began the process of genome sequencing on current-patient samples. Dr. Harrison said that the hospital will start pulling and analyzing health records when it finds signs of common infections, adding that UPMC is exploring use of the system at its other hospitals.

The UPMC tool is a different approach to the problem, said Ashraf Shehata, national sector leader for healthcare and life sciences at advisory-services firm KPMG LLP.

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“This is novel,” he said. “I do believe it’s first of its kind to combine the

personalized-medicine view as well as the AI view...to turn it into real-time data.”

Most outbreaks typically are spotted when a hospital worker notices that several patients in a unit have come down with the same infection. At that point, employees might manually comb through the patients’ hospital records in an attempt to contain the spread.

EDS-HAT automates that process.

Unlike some more sophisticated forms of AI, such as neural networks that use layers of neurons and mimic the way the human brain works, the machine learning the team used relies on probabilistic inference to find likely correlations between hospital activities, said Artur Dubrawski, a professor at Carnegie Mellon University School of Computer Science who is part of the team behind the system. That makes it easier to understand the system’s decision making, he said.

“The key is that the results can be interpreted, validated, and internalized by the clinicians,” he said, which is important when clinicians need to explain care decisions to patients.

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