

Health Informatics team uses EHRs to track hospital-acquired infection

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In a first for hospital infection control, the UC San Francisco Health Informatics team has used electronic health records (EHRs) to track down a source of a common hospital-acquired infection by tracing the movements of more than 85,000 patients over a three-year period.

A bacterium known as *Clostridium difficile* (colloquially called "C. diff") is the leading cause of infections in healthcare settings, but the complex interactions and location changes that take place in hospitals often make it difficult to identify the source of these infections. UCSF is committed to reducing rates of [hospital](#) acquired *C. diff*.

In the new study, published October 23, 2017 issue of *JAMA Internal Medicine*, the UCSF Health Informatics team used time and location stamps—which are entered in EHRs whenever patients undergo procedures, such as radiological scans or operations, or are moved to different parts of the hospital—to map 435,000 patient location changes throughout the UCSF Medical Center at Parnassus between 2013 and 2016.

Ultimately, first author Sara Murray, MD, MAS, assistant professor of medicine at UCSF, and her team were able to use the data to construct a map of where all patients with *C. diff* infections had travelled in the hospital—and exactly when they had been in each place—over the course of the three-year study period. Murray and colleagues then looked to see what happened to the patients who visited the same locations within 24 hours of an infected patient, the period in which that location

was considered, for the purposes of the study, to be "potentially contaminated."

Patients who passed through a space while it was potentially contaminated were considered "exposed" to *C. diff*. The team then calculated the odds of *C. diff* [infection](#) as a result of exposure by comparing infection rates over the next two months for those considered exposed to rates for those who passed through the same spaces at a time it hadn't recently been used by a patient with *C. diff*. This controlled for the different characteristics of patients who visited these spaces, which could confound the results.

"Most studies looking at *C. diff* in hospitals typically only look at whether patients were on the same hospital floor," said Russ Cucina, MD, senior author on the study and chief health information officer at UCSF. "Some studies look at whether patients were roommates or occupied a bed recently vacated by an infected patient. But they don't think about everywhere else in the hospital patients go. If we just look at transmission in their room, we're missing potential opportunities for disease transmission."

The very broad analysis used in the new study revealed that one location—a particular CT scanner in the Emergency Department—was a significant source of exposure-related infections. Patients who entered that scanner within 24 hours after *C. diff*-positive patients were more than twice as likely to become infected with the bacterium themselves: 4 percent of the patients who were considered exposed in the scanner contracted *C. diff* within two months; the overall rate of infection for patients who passed through the scanner was 1.6 percent.

The hospital moved swiftly to standardize the cleaning practices for that scanner to match those used in other radiology suites. No other sites at the hospital raised concerns regarding *C. diff* transmission in the three

years under review.

"This shows the potential for what can happen when thoughtful data scientists leverage [electronic health records](#) to tackle a common healthcare problem," said Niraj Sehgal, MD, MPH, vice president and chief quality officer for UCSF Health and professor of medicine at UCSF, who was not involved in the study. "Their novel approach helped bolster our infection prevention strategies but also demonstrated the answers that can come from studying the vast sources of data generated through a patient's hospitalization."

Hospitals have had EHRs for a number of years, but the field of clinical informatics, which aims to discover meaningful patterns in large medical datasets, is relatively new, and researchers are only just discovering how to use these records to improve patient care. EHRs contain voluminous data—in UCSF's case, spanning some 16,000 tables—and these data can be hard to interpret.

"There are just so many places data are stored, and one of the challenges is ensuring that the data you choose truly represent what they appear to," said Murray. "The key to success with these kinds of studies is careful attention to detail and validation of the work."

The authors said the current study is just a beginning, and that UCSF's health informatics team will continue to probe EHRs for the who, what, when, where, and why of what happens to patients in the hospital.

"The electronic health record is a treasure trove of clinical data and insights, but we are just beginning to discover how to unlock its secrets," said Robert Wachter, MD, chair of the UCSF department of medicine and author of the bestselling book *The Digital Doctor: Hope, Hype and Harm at the Dawn of Medicine's Computer Age*. "This study demonstrates the potential to transform patient care when innovative

clinicians and technology experts join hands to tackle healthcare's hardest problems."

Provided by University of California, San Francisco

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