

# The surprising origin of a deadly hospital infection

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Hospital staff spend a significant amount of time working to protect patients from acquiring infections while they are being cared for in the hospital. They employ various methods from hand hygiene to isolation rooms to rigorous environmental sanitation. Despite these efforts, hospital-onset infections still occur—the most common of which is caused by the bacterium *Clostridioides difficile*, or *C. diff*, the culprit of

almost half a million infections in the U.S. each year.

Surprising findings from a study in *Nature Medicine* suggest that the burden of *C. diff* infection may be less a matter of hospital transmission and more a result of characteristics associated with the [patients](#) themselves.

The study team, led by Evan Snitkin, Ph.D. and Vincent Young, M.D., Ph.D., both members of the Departments of Microbiology & Immunology and Internal Medicine/Infectious Diseases at University of Michigan Medical School and Mary Hayden, M.D. of Rush University Medical Center, leveraged ongoing epidemiological studies focused on hospital-acquired infections that enabled them to analyze daily fecal samples from every patient within the [intensive care unit](#) at Rush University Medical Center over a nine-month period.

Arianna Miles-Jay, a postdoctoral fellow in Dr. Snitkin's lab, analyzed the over 1,100 patients in the study, and found that a little over 9% were colonized with *C. diff*. Using whole genome sequencing at U-M of 425 *C. difficile* strains isolated from nearly 4,000 fecal specimens, she compared the strains to each other to analyze spread.

"By systematically culturing every patient, we thought we could understand how transmission was happening. The surprise was that, based on the genomics, there was very little transmission."

Essentially, there was very little evidence that the strains of *C. diff* from one patient to the next were the same, which would imply in-hospital acquisition. In fact, there were only six genomically supported transmissions over the study period. Instead, people who were already colonized were at greater risk of transitioning to infection.

"Something happened to these patients that we still don't understand to

trigger the transition from *C. diff* hanging out in the gut to the organism causing diarrhea and the other complications resulting from infection," said Snitkin.

Hayden notes this doesn't mean hospital infection prevention measures are not needed. In fact, the measures in place in the Rush ICU at the time of the study—high rates of compliance with hand hygiene among [health care personnel](#), routine environmental disinfection with an agent active against *C. diff*, and single patient rooms—were likely responsible for the low transmission rate. The current study highlights, though that more steps are needed to identify patients who are colonized and try to prevent infection in them.

Where did the *C. diff* come from? "They are sort of all around us," said Young. "*C. diff* creates spores, which are quite resistant to environmental stresses including exposure to oxygen and dehydration...for example, they are impervious to alcohol-based hand sanitizer."

However, only about 5% of the population outside of a health care setting has *C. diff* in their gut—where it typically causes no issues.

"We need to figure out ways to prevent patients from developing an infection when we give them tube feedings, antibiotics, [proton pump inhibitors](#)—all things which predispose people to getting an actual infection with *C. diff* that causes damage to the intestines or worse," said Young.

The team next hopes to build on work investigating the use of A.I. models to predict patients at risk of *C. diff* [infection](#) to identify patients who are likely to be colonized and who could benefit from more focused intervention.

Said Snitkin, "A lot of resources are put into gaining further improvements in preventing the spread of infections, when there is increasing support to redirect some of these resources to optimize the use of antibiotics and identify other triggers that lead patients harboring C diff and other health care pathogens to develop serious infections."

**More information:** Longitudinal genomic surveillance of carriage and transmission of *Clostridioides difficile* in an intensive care unit, *Nature Medicine* (2023). [DOI: 10.1038/s41591-023-02549-4](https://doi.org/10.1038/s41591-023-02549-4)

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