

# Gut check: Does a hospital stay set patients up for sepsis by disrupting the microbiome?

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Can a routine hospital stay upset the balance of microbes in our bodies so much that it sets some older people up for a life-threatening health crisis called sepsis? A new University of Michigan and VA study suggests this may be the case.

It shows that older adults are three times more likely to develop [sepsis](#)—a body-wide catastrophic response to infection—in the first three months after leaving a hospital than at any other time.

What's more, the risk of sepsis in that short post-hospital time is 30 percent higher for people whose original [hospital stay](#) involved care for any type of infection—and 70 percent higher for those who had a gut infection called *Clostridium difficile*.

In fact, one in 10 *C. diff* survivors end up with sepsis within three months of their hospital stay, according to the new study published online in the *American Journal of Respiratory and Critical Care Medicine*. It's the first analysis of its kind.

The researchers chose to look at the relationship between hospitalization and sepsis because of a growing understanding that antibiotics and other infection treatments disrupt the body's microbiome—the natural community of bacteria and other organisms that is vital for healthy body function. In turn, *C. difficile* preys upon hospital patients who have a disrupted gut microbiome.

"Our findings could mean that disruption to the microbiome in the hospital may predispose [older people](#) to get sepsis later, which is different from what we already know about the acute and chronic effects of microbiome disruption," says lead author Hallie Prescott, M.D., M.Sc., a U-M [critical care](#) physician and health care researcher. "While more work is needed to explore this further, it also opens the possibility that we might be able to prevent sepsis—by doing something as simple as helping the microbiome recover rapidly from a hospitalization."

## About the study

The researchers analyzed data from more than 43,000 hospital stays by nearly 11,000 older Americans over a 12-year period. All took part in the U-M-based Health and Retirement Survey, and allowed researchers access to their Medicare records so they could see what happened after each of their hospitalizations. The researchers also analyzed a subset of the patients to see what their odds of sepsis were during other times.

"What is really new here is that we studied dysbiosis—disruption of the microbiome—on the population level rather than on the level of the individual patient," says Robert Dickson, M.D., a co-author of the study and U-M critical care physician and microbiome researcher. "Virtually all sepsis research to date has focused on only the host or the pathogen. This paper raises the possibility that we've been ignoring a key third factor: the microbial communities living on and in our vulnerable patients."

"The implications of this paper are big," says Theodore J. Iwashyna, M.D, PhD., senior author on the study and a physician-scientist at both the University of Michigan and the Veterans Affairs Ann Arbor Center for Clinical Management Research. "We know that a major cause of microbiome disruption is antibiotic use. This study hints—it does not prove, but it hints—that profligate use of antibiotics might not just be

bad because of antibiotic resistance. Profligate use of antibiotics might also, via the microbiome, put patients at increased risk of both all kinds of other infections, and to having a particularly bad response ('sepsis') to those infections."

While researchers are still developing their understanding of what dysbiosis, or even a healthy microbiome, are, studies like this one could spur future research.

Prescott notes that such studies could include direct monitoring of the microbiomes of hospitalized patients, followed by long-term follow-up to see which develop sepsis after going home. They also hope to test diet-based interventions to encourage faster recovery of the microbiome after hospitalization. "There are nearly no strategies proven to prevent sepsis," says Prescott. "This unusual collaboration between physicians, social scientists, and microbiome researchers at Michigan offers new hope of an approach to preventing sepsis."

## **About sepsis**

Sepsis is a serious medical issue, affecting as many as 750,000 hospitalized patients in the U.S. annually, according to data from the Centers for Disease Control and Prevention. According to the Agency for Healthcare Research and Quality, sepsis is the most expensive cause of hospitalization in the United States, costing more than \$24 billion annually.

Caused by a body-wide over-reaction to any kind of infection, it can lead to damage of vital organs and now kills one in every six people diagnosed with it. More people die from sepsis than die from prostate cancer, breast cancer and AIDS combined.

Prescott launched the new analysis based on her own experience using

broad-based antibiotics to treat intensive care patients, and her curiosity about how it affected them after they went home. She credits the U-M Medical School's strong microbiome research community with assisting the research to date and planning for future studies.

**More information:** *Am J Respir Crit Care Med.* [DOI: 10.1164/rccm.201503-0483OC](https://doi.org/10.1164/rccm.201503-0483OC)

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