Science News

from research organizations

BH comment: Below a good summary of complex data stats as in the Lax original paper available at:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5706123/

Year-long survey tracks the microbiome of a newly opened hospital

6,523 samples from surfaces, air, water and 252 patients reveal constant flow of microbes in a hospital

Date: May 24, 2017

Source: University of Chicago Medical Center

Summary: A 12-month study mapping bacterial diversity within a hospital -- with a focus on the flow of microbes between patients, staff and surfaces -- should help hospitals worldwide better understand how to encourage beneficial microbial interactions and decrease potentially harmful contact.

FULL STORY

A 12-month study mapping bacterial diversity within a hospital -- with a focus on the flow of microbes between patients, staff and surfaces -- should help hospitals worldwide better understand how to encourage beneficial microbial interactions and decrease potentially harmful contact.

"The Hospital Microbiome Project is the single biggest microbiome analysis of a hospital performed, and one of the largest microbiome studies ever," said study author Jack Gilbert, PhD, director of the Microbiome Center and professor of surgery at the University of Chicago and group leader in Microbial Ecology at Argonne National Laboratory.

"We've created a detailed map, highly relevant to clinical practice, of microbial exchange and interaction in a large hospital environment," he said. "This describes the ecology of a building, a thriving microbial ecosystem that regularly interacts with patients in a seemingly benign way -- at least most people don't appear to be negatively affected. It gives us a framework, something we can build on, showing how microorganisms enter and colonize a hospital environment."

The study, **"Bacterial colonization and succession in a newly opened hospital,"** began two months before the University of Chicago Medicine opened its new hospital, the Center for Care and Discovery, on Feb. 23, 2013, and continued for 10 months afterward. The researchers collected more than 10,000 samples. They were able to detect microbial DNA in 6,523. These came from 10 patient care rooms and two adjoining nursing stations, one caring for surgical patients and the other, on a different floor, for cancer patients.

The investigators swabbed each patient's hand, nostril and armpit, as well as the surfaces patients may have touched, such as bedrails or faucet handles. They collected additional room samples from multiple surfaces, including the floor and the air filter. Each room was cleaned daily, with a more extensive cleaning after each patient's discharge.

The researchers also gathered samples from each unit's nursing staff, swabbing their hands, gloves, shoes, nursing station countertops, pagers, shirts, chairs, computers, land lines and cell phones.

The most obvious change came when the hospital opened, which followed extensive cleaning efforts. Bacterial organisms such as *Acinetobacter* and *Pseudomonas*, abundant during construction and pre-opening preparations, were quickly replaced by human skin-associated microbes such as *Corynebacterium*, *Staphylococcus* and *Streptococcus*, brought in by patients.

"Before it opened, the hospital had a relatively low diversity of bacteria," Gilbert said. "But as soon as it was populated with patients, doctors and nurses, the bacteria from their skin took over."

A second, and ongoing, set of changes followed each patient's hospital admission. On a patient's first day in the hospital, microbes tended to move from surfaces in the patient's room -- bedrails, countertops, faucet handles -- to the patient. But by the next and every subsequent day, the preponderance of microbes moved in the other direction, from the patient to the room, steadily adding to the microbial diversity of the surfaces in the room.

"By the second day of their stay," Gilbert said, "the route of microbial transmission was reversed. Within 24 hours, the patient's microbiome takes over the hospital space."

There were two unanticipated findings. First, when the heat and humidity increased during the summer, staff members shared more bacteria with each other. Second, when they measured the impact of treatments -- such as antibiotics prior to or during admission, chemotherapy during admission, surgery, or admission to the hospital though the emergency department -- the impact was minimal.

"We consistently found that antibiotics given intravenously or by mouth had almost no impact on the skin microbiome," Gilbert said. "But when a patient received a topical antibiotic, then, as expected, it wiped out the skin microbes."

Samples from the rooms of 92 patients who had longer hospital stays, measured in months, revealed a trend. Some potentially harmful bacteria, such as *Staphylococcus aureus* and *Staphylococcus epidermidis*, faced with continual selective pressure, managed to acquire genes that could boost antibiotic resistance and promote host infection.

"This requires further study," Gilbert said, "but if it proves to be true then these genetic changes could affect the bacteria's ability to invade tissue or to escape standard treatments."

Story Source:

Materials provided by **University of Chicago Medical Center**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Simon Lax, Naseer Sangwan, Daniel Smith, Peter Larsen, Kim M. Handley, Miles Richardson, Kristina Guyton, Monika Krezalek, Benjamin D. Shogan, Jennifer Defazio, Irma Flemming, Baddr Shakhsheer, Stephen Weber, Emily Landon, Sylvia Garcia-Houchins, Jeffrey Siegel, John Alverdy, Rob Knight, Brent Stephens, Jack A. Gilbert. **Bacterial colonization and succession in a newly opened hospital**. *Science Translational Medicine*, 2017; 9 (391): eaah6500 DOI: 10.1126/scitranslmed.aah6500

BH comment

Note when IV Abs used contrary to often what is believed, LESS antibiotic resistance is selected for/induced.

This is because most Abs are excreted renally, so IV Abs generally do not have contact with where the bulk of our microbial microbiome is – the bowel (think ESBL, CPE *E coli*).

But oral Abs do have contact with the trillions of bowel microbiota before being absorbed – so induce/select for much more AB resistance.