

USF study: Sewage spills breed 'superbugs' that could undermine last-resort antibiotic

Jim Waymer, FLORIDA TODAY 1:22 a.m. EDT July 27, 2016



(Photo: Jim Waymer)

Spill sent 1M gallons of sewage toward Banana River

Continual sewage spills could contribute to a powerful, last-resort antibiotic becoming powerless against some staph and other potentially fatal infections, a new study suggests.

The study by researchers from the University of South Florida found a strain of bacteria, called *Enterococcus faecium*, in water and soil near a 2014 sewage spill in St. Petersburg that tested resistant to vancomycin, a last-resort antibiotic against severe and multidrug-resistant infections.

The drug is typically used to treat post-surgery infections. Bacteria resistant to the drug have been found in raw sewage tested from hospitals but is rarely found in the wild. So USF's findings portend another ecological threat to waters periodically doused with sewage, such as the Indian River Lagoon, where some dolphins and other wildlife already harbor antibiotic resistant bacteria.

"I think we are worried that we're seeing evidence of this spread outside of hospitals," said Suzanne Young, a PhD student at USF who worked on the study. "I think if we're seeing it in Tampa, we're going to see it everywhere else."

Even more concerning to the researchers: the vancomycin-resistant enterococcus (VRE) was found to harbor what are called *vanA* genes, which can spread vancomycin resistance to other kinds of bacteria.

The Centers for Disease Control and Prevention (CDC) estimates that roughly 20,000 VRE infections occur in hospitalized patients annually, 1,300 which are fatal.

USF's study, recently published in *Applied and Environmental Microbiology*, examined a 2014 sewage spill in St. Petersburg ditch that flows to Boca Ciega Bay, northwest of and linked to Tampa Bay. The researchers sampled water and soil for seven weeks following a broken sewer pipe that spilled 500,000 gallons of raw sewage.

"Most VRE are confined to hospitals, but detecting them in waters of the Tampa Bay community is quite concerning," study co-author Valerie Harwood, PhD, a professor in the department of integrative biology at USF, said in a news release. "People need to be aware of what may be entering the water after heavy rains, accidental spills, or after intentional sewage releases."

The researchers found that high levels of VRE and *vanA* genes lasted in the environment for about two weeks after the spill, then diminished steadily.

The researchers didn't find any *vanA* genes in the water or soil after two weeks. That led them to conclude the contaminants resulted from the sewage spill and weren't there before the spill.

Vancomycin-resistant bacteria have been found in the environment before, but bacteria harboring *vanA* genes have rarely been found outside of hospitals, where most VRE infections happen.

The sewage spill in the study was not near a hospital, the researchers noted, and sewage from the closest hospital flows away from the site where the sewer-line break happened.

Future sewage spills at beaches and recreational areas could spread vancomycin resistance beyond hospitals and pose a public health threat, they said.

Vancomycin has been around for more than six decades but was quickly passed over for other more effective and less toxic antibiotics. Its use reemerged in the 1980s. Vancomycin is now the main drug used against methicillin-resistant *Staphylococcus aureus* (MRSA). But increased use of vancomycin has wrought resistance.

For the past decade, about 40 scientists have examined and released more than 240 bottlenose dolphins, most of them from the Indian River Lagoon. During the federally funded study, they have found antibiotic-resistant bacteria, a high incidence of tumors, heart problems, cancers, stomach ulcers, skin lesions, genital herpes and other ailments previously thought rare in dolphins. As many as half the dolphins studied in the lagoon suffer from some form of chronic infectious disease, suggesting compromised immune systems.

"We found a very high prevalence of antibiotic-resistant bacteria in these dolphins," said Greg Bossart, chief veterinary officer at the Georgia Aquarium and a lead researcher on the lagoon dolphin studies.

Dolphins captured near Merritt Island, especially, seem in poor health. And the researchers point to water tainted by partially treated sewage and runoff as the possible cause.

In 2014, researchers at Georgia Aquarium and Harbor Branch found that one in every three bottlenose dolphin tested in the Indian River Lagoon has antibodies to a bacteria that can make them more vulnerable to other deadly infections.

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The finding came as researchers struggle to figure out what has caused a rash of unexplained dolphin deaths in the lagoon that have since tapered off.

Researchers found 43 of 126 dolphins tested had antibodies indicating exposure to the Chlamydiaceae bacteria, which can make them more vulnerable to other deadly infections.

The USF researchers suggest more monitoring of vancomycin-resistant bacteria and its associated resistance genes outside of hospital settings, to gain better understanding of the risk to the public.

"The concern for me is when these raw sewage inputs happen, and when they happen in recreational areas," Young said.