Milwaukee harbor a 'hot spot' for bacteria resistant to antibiotics

By Don Behm of the Journal Sentinel
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Muck at the bottom of Milwaukee's harbor is a "hot spot" for the growth of fecal bacteria resistant to antibiotics, a University of Wisconsin Sea Grant Institute study found.

E. coli bacteria resistant to multiple antibiotics are more common in harbor mud than in untreated wastewater flowing to the Jones Island sewage treatment plant, according to a team of scientists from Marquette University, the Medical College of Wisconsin and the School of Freshwater Sciences at the University of Wisconsin-Milwaukee.

And the resistant bacteria are more common in the mud than in bodily fluids collected from patients at the Medical College. The research team's report, "Detection of multi-drug resistant E. coli in the urban waterways of Milwaukee, WI," was published in the online journal, Frontiers in Microbiology.

"Our biggest concern is that we are creating hot spots in the environment for antibiotic-resistant bacteria," said Krassi Hristova, assistant professor of biological sciences at Marquette University and a member of the research team.

When infectious organisms adapt to the antibiotics designed to kill them, or become resistant, then the drugs are less effective, according to the Centers for Disease Control and Prevention.

"Each year in the United States, at least 2 million people become infected with bacteria that are resistant to antibiotics and at least 23,000 people die each year as a direct result of these infections," the CDC says on a website for its national campaign to restrict use of antibiotics.

Scientists on the local team tested bacteria in muck collected at four locations: one in the outer harbor outside the Jones Island pipe for discharging treated wastewater; and three in the inner harbor, where the city's three rivers receive pollutants carrying bacteria from agricultural and urban runoff, as well as bacteria from combined sanitary and storm sewer overflows and improper sanitary connections to separate storm sewers.

Tests found that drug resistance in the bacteria was most prevalent for widely used antibiotics, including erythromycin, sulfamethoxazole, aztreonam and ampicillin.

Exposure to the lurking bacteria through swimming, wading or other activities could become another way that residential and agricultural overuse of soaps, detergents, drugs and other products containing antibacterial compounds will come back to bite the public, Hristova said.

When resistant bacteria from the environment contact skin or enter a person's body, they can transfer genes enabling antibiotic resistance to bacteria residing in mucus or in intestines, according to Hristova.

"Fewer and fewer antibiotics are still viable options for treating even common infections," she said.

The team of scientists is urging the public to halt use of antimicrobial products in their homes so that the pace of the spread of resistance among E. coli bacteria can be slowed, and the risk of harm to health reduced.

Another recommendation is to take unused medication, including antibiotics, to community collections for disposal instead of flushing the pills and tablets down the toilet. The majority of municipal police departments in Milwaukee County offer medicine collection programs.

When antibiotics are excreted in urine or flushed down drains and toilets, they do not go away, according to the researchers.

Wastewater treatment plants are not designed to remove the compounds, just as they are not built to remove all bacteria or to destroy all the genetic material that is released from bacteria.

The scientists suspect that genes for antibiotic resistance are transferred between fecal bacteria when they crowd together at the sewage treatment plant in the presence of antibiotics and personal care products in the wastewater.

The smaller number of E. coli that make it through the treatment process can live in sediment for long periods of time, increasing the likelihood for the exchange of genes for antibiotic resistance.

When routine bacteria pass genes for antibiotic resistance to more virulent bacteria, risk of illnesses increases.

Those transfer points likely explain why researchers found just 13.6% of E. coli in wastewater flowing in to the Jones Island plant was resistant to fosfomycin, a stalwart among effective antibiotics that is prescribed to treat chronic infections. But 93% of E. coli in sediment near the plant's treated wastewater discharge pipe were resistant to the antibiotic.

If genes from those resistant bacteria in the environment are transferred to illness-causing bacteria that eventually find people, then fosfomycin loses its effectiveness against the pathogens, Hristova said.

Most of the E. coli from muck in the outer harbor and the inner harbor were found to be resistant to multiple antibiotics.

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