Sewage overflow promotes spread of West Nile virus

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Sewage that overflows into urban creeks and streams during periods of heavy rain can promote the spread of West Nile virus, a study led by Emory University finds.

The analysis of six years of data showed that people living near creeks with sewage overflows in lower-income neighborhoods of Southeast Atlanta had a seven times higher risk for West Nile virus than the rest of the city.

"The infection rate for mosquitoes, birds and humans is strongly associated with their proximity to a creek impacted by sewage," says Gonzalo Vazquez-Prokopec, the Emory disease ecologist who led the study. "And if the creek is in a low-income neighborhood, we found that the entire cycle of infection is even higher."

More affluent residents are more likely to have air-conditioning and use insect repellant and other protective measures, the researchers theorized.

The study, published in the current issue of *Environmental Health Perspectives*, was a collaboration of Emory, the Centers for Disease Control and Prevention, the Georgia Division of Public Health, the Fulton County Department of Health and Wellness, the National Institutes of Health, the Fogarty International Center and the University of Georgia.

According to the Environmental Protection Agency, about 850 billion gallons per year of untreated mixed wastewater and storm water are discharged into U.S. urban waters, mainly through combined sewer overflow (CSO) systems that are used in more than 700 cities. Under normal conditions, CSO systems channel wastewater to a treatment plant before it is discharged into a waterway. During periods of heavy rain or snowmelt, however, the wastewater flows directly into natural waterways after only minimal chlorine treatment and sieving to remove large physical contaminants.

Most of the available data on the human health impacts of sewage-affected waterways focuses on the effects of exposures to bacteria, heavy metals, hormones and other pollutants.

Previous research by Emory's Department of Environmental Studies has shown that the Culex mosquito - a vector for West Nile virus and other human pathogens - thrives in Atlanta streams contaminated with CSO discharges. The mosquitoes become more populous, breed faster and grow larger than those found in cleaner waters.

"We wanted to know if the CSOs also raised the risk of getting infected with West Nile virus," said Uriel Kitron, chair of environmental studies and a co-author of the study.

An expert in geographic information systems (GIS) technology, Vazquez-Prokopec did a spatial analysis integrating the geographic coordinates of each CSO facility and associated streams, and six years of surveillance data on mosquito abundance and West Nile virus infections in mosquitoes, humans, blue jays and crows. (These birds are considered sentinels for the disease, due to their high West Nile Virus mortality and their proximity to humans.)

During 2001-2007, Georgia reported 199 human West Nile virus infections and 17 deaths. About 25 percent of the cases resided in Fulton

County. The county forms the core of metropolitan Atlanta, and encompasses a range of socio-economic conditions, from the wealthiest neighborhoods in the state to those with the highest poverty rates in the country.

The analysis found that mosquitoes and birds near all seven of the CSO facilities and associated streams of Atlanta had significantly higher rates of West Nile virus infection than those near urban creeks not affected by CSOs. Humans residing near CSO streams also had a higher rate of infection if they lived in a low-income neighborhood with a greater proportion of tree canopy cover and homes built during the 1950s-60s. Residents of a wealthy northern Fulton County area did not experience an increase in West Nile virus cases, despite their proximity to two CSO streams.

In 2008, Atlanta completed an underground reservoir system designed to reduce the size and the number of CSOs. "In terms of mosquitoes, however, this remediation has the potential to make things worse instead of better by releasing slower flows of nutrient-rich effluent into streams," Vazquez-Prokopec notes.

Provided by Emory University

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