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Editor's Note: Please hyperlink to the [abstract](#) and [full study](#) on the AJTMH site once the embargo lifts.

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Study Finds That Cardinals May Be Shielding Atlanta Residents from West Nile Virus

Cardinals emerge as potential “super-suppressors” by drawing infected mosquitoes away from robins, long known to be West Nile “super-spreaders”

Oakbrook Terrace, Ill. (August 8, 2016)—A bird species that does a poor job spreading West Nile virus (WNV) but is particularly likely to get mosquito bites may explain why human infections with the disease are relatively uncommon in Atlanta, Georgia—despite evidence of high rates of virus circulating in the local bird population, according to a new study published online today in the *American Journal of Tropical Medicine and Hygiene*.

Researchers at Emory University, University of Georgia, Texas A&M and the Georgia Department of Transportation set out to find clues explaining why Georgia's infection rate for WNV since 2001 is quite low (about 3.3 per 100,000 people), even though evidence showed that about one-third of birds in the Atlanta area have been exposed to the disease. They noted that a similar pattern is seen throughout the American southeast, where a large amount of WNV in birds and mosquitoes has not translated into a large number of human cases. In urban areas in the northeast and midwest, the situation is frequently the opposite—infection rates in Chicago, for example, are six times higher than Atlanta's, even though less than 20 percent of Chicago birds show evidence of WNV infection.

Disease experts often refer to human cases of WNV as “spillover” infections, because they happen when disease circulating between birds and mosquitoes spills over into nearby human populations via mosquito bites. While most human infections cause few, if any symptoms, some cases can result in headaches, joint pain, and fatigue that linger for weeks. In rare instances WNV produces potentially fatal brain inflammation. Since the disease arrived in the continental United States in 1999, there have been over 780,000 human infections and 1,700 fatalities documented.

The Emory University researchers were particularly interested in the role of American robins, considered “super-spreaders” of the disease because they efficiently pass the virus along to mosquitoes that bite them. Those mosquitoes in turn can feed on humans, potentially infecting them. Over three years they collected mosquitoes and birds across Atlanta, tested them for WNV, and ran a DNA analysis of the mosquitoes' blood meals to see which birds they had bitten.

“What we found is that, for some unknown reason, around the middle of July, mosquitoes in Atlanta seem to decide that they have had their fill of robins and they switch to feeding on cardinals,” said

Rebecca Levine, PhD, the lead author of the study who conducted the research while at Emory University. “But cardinals, even though they can be infected with West Nile virus, are much less likely to have enough virus circulating in their blood to transmit the disease back to feeding mosquitoes. That is why we called them ‘supersuppressors’.”

The shift occurs just as mosquito populations are rising, which typically should mean more WNV circulating in the area and hence a greater risk of human infections, said Levine, now an epidemiologist and entomologist at the U.S. Centers for Disease Control and Prevention (CDC). She said it’s not clear what prompts the shift in feeding behavior in Atlanta but that this shift may be what is protecting Atlantans from WNV spillover.

Also, throughout the city, researchers found a high rate of exposure to WNV among mockingbirds, brown thrashers and gray catbirds. There is evidence from previous studies that gray catbirds and brown thrashers also act as suppressors slowing the transmission of WNV.

Levine said there could be many factors that determine how WNV is spread between birds and mosquitoes and how that in turn affects human risk. Changes in roosting behavior of birds are one possibility, defensive behavior is another, and there are other possibilities. For example, they found less evidence of WNV among bird populations in small patches of old growth forest. Thus, original forest cover may reduce transmission.

“So, we might find that keeping old growth forests intact, even in urban areas, can provide more than just an interesting piece of history,” she said. “Ultimately, if we can identify certain features of the local ecosystem that help prevent disease transmission, then we can consider preserving and enhancing them.”

Overall, Levine said the findings point to the complex role of many factors in the local environment interacting to determine the risk of human infections. For example, she said the study should not prompt officials in Chicago to start releasing flocks of cardinals across the city because the same species may perform different roles in different ecosystems.

“As new mosquito-borne diseases enter and spread in America, we need to better understand all aspects of pathogen transmission cycles,” said Stephen Higgs, PhD, president of the American Society of Tropical Medicine and Hygiene. “By shedding light on the reasons behind a curious discrepancy in West Nile virus human infection rates in different regions of the United States, this study has the potential to better protect Americans’ health while continuing to demonstrate the link between animal and human health.”

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