

Memorandum

To: Region Safety Officers
Unit Safety Officers

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F-40

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From: Larry Crabtree, Departmental Safety Officer
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Subject: 1704 SAFETY COMMUNICATIONS
1704.2 Safety Bulletins
Safety Bulletin #06-27 West Nile Virus

Attached is a recent article regarding West Nile Virus. The month of July is a prime time for the transmission of this virus and therefore also a prime time for reviewing the prevention, recognition and treatment. Please review this attached article and use it as appropriate in your work setting.

West Nile Virology

July is a hotbed of human infection for North America's most dominant vector-borne disease. Here's what you need to know.

by Ronnie Rittenberry



Mosquitoes suck. In the process, they inject a chemical that inhibits the body's ability to stop any bleeding that might begin. This chemical is mixed with the mosquito's saliva and, depending on whom or what the mosquito visited before you, other things can be mixed in, too. At best, a sated mosquito will leave you minus a few micrograms of blood and with perhaps a temporary itch. At worst, it will leave you dead within weeks.

Despite heavy press coverage and public service announcements in recent years, death by mosquito bite probably sounds to most Americans about as random and unlikely as death by hot air balloon, but in fact millions die globally each year from malaria, yellow fever, dengue fever, West Nile virus (WNV), filariasis, and sundry encephalitis viruses, all carried and caused by mosquitoes. In the United States, outbreaks of potentially lethal eastern and western equine encephalitis, St. Louis encephalitis, and La Crosse encephalitis are annual threats, but the mosquito-borne disease you are most likely to encounter, because it is more prevalent than all the others combined, is WNV.

Found in the Western Hemisphere for the first time in the Queens area of New York City in late August 1999, WNV had caused a reported 19,655 human illnesses and 782 deaths by the end of 2005, according to the Centers for Disease Control and Prevention. Although no one is certain how the virus got here, public health authorities suspect either imported birds or infected mosquito larvae in internationally shipped cargo were responsible for the outbreak. Scientists studying that inaugural virus strain found it had a near-identical footprint to a WNV strain seen in outbreaks in Romania in 1996 and in Israel in 1998, so it is believed the epidemic-igniting virus in New York came from one of those two locations.

Vicious Cycle

WNV begins in infected birds--no one knows how--and spreads when mosquitoes bite these birds; after an interval during which the virus thoroughly infects the insects, they can then transmit the virus when they bite people or other animals. According to the National Institute of Allergy and Infectious Diseases, about 140 bird species have been found to carry the virus, and more than 40 mosquito species have been identified as WNV transmitters.

Among birds, the Corvid family in general, and crows in particular, have proven the most highly susceptible reservoirs of the infection. Sometimes the virus kills the bird, but often it just gets temporarily sick. Among mosquito species, *Culex pipiens* is the most common WNV vector. Found throughout the world, the *Culex* feeds mainly at night and likes to breed in foul, stagnant water. Like all other mosquitoes, with very rare exceptions, only the female *Culex* bites people and animals for blood. This signature, universally reviled deed is not an act of vampirism, as commonly believed, but rather solely a way for her to fuel the production of her

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***--Michael Soto,
district
superintendent of the
Florida Keys
Mosquito Control
District***

eggs. For sustenance, both male and female mosquitoes rely on plant nectar and similar sources of sugar. Male mosquitoes everywhere live only to breed and die.

Theodore G. Andreadis, Ph.D., chief medical entomologist at the Connecticut Agricultural Experiment Station in New Haven, regularly traps and tests all manner of mosquitoes at locations throughout Connecticut and has meticulously plotted WNV's progression as it has become the most dominant vector-borne disease in North America.

"This virus has spread farther and faster than anyone would have predicted," he said. "With the way we're having the recurring number of cases on an annual basis, some might not consider it an epidemic anymore, but I think if we're following the true definition of the word we'd have to still call it that, at least in certain areas of the country."

Following the migratory patterns of infected birds, WNV spread rapidly westward in a wave from its northeastern starting point, reaching parts of California by 2002. By 2004, according to CDC, the virus had been found in birds and mosquitoes in every state except Alaska and Hawaii. It may be only a matter of time before it reaches Alaska, though, because recent studies have noted continent-wide changes in mosquito feeding habits and found the insects to have a new and widespread preference for the American robin, a WNV-competent avian host with a long migration pattern that, at different times of the year, takes it from Mexico to Alaska.

Since WNV's arrival in the United States, CDC's peak year for recorded incidences of the disease occurred in 2003, when it reported 9,862 cases; in 2004, reported cases dropped sharply to 2,539, followed by a slight increase last year to 2,949 total cases. Andreadis said the initially high numbers and subsequent drop-off were to be expected.

"You have to recognize that when [WNV] was introduced, it was an exotic virus coming into a new region, and nothing--not humans, birds, or other wildlife--had any prior exposure to it," Andreadis said. "When you get something as novel as this virus, you're going to see high levels of morbidity and mortality until we've got exposure to it. And so, now, after seven years in areas where the virus has been around for awhile, we're seeing fewer cases. However, it's still here, it's established, and it's not going away. It's now a permanent part of our landscape."

Mosquito Seasons

No one knows how long WNV had been a permanent part of the earth's landscape before the virus was first isolated in 1937 by a group of doctors who stumbled on it while studying yellow fever in the West Nile region of Uganda, the area that gave the newly discovered virus its name and where the disease was found to be endemic. What is known is that the virus is also endemic to other parts of Africa, as well as throughout the Middle East. In these regions, infected people are prone to experiencing only mild forms of the disease because of their long exposure to it, many in the population having been acclimated to it every mosquito season, from early childhood on.

In the United States, the mosquito season generally runs from April through October, but because it follows weather patterns and can last as long as the air stays warm and humid, there is wide latitude in its duration from state to state. Louisiana Mosquito Control Association President Roderick Wells said his state barely has an off-season.

"When you deal with mosquitoes, everything is environmental," said

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Wells, who is also assistant director of the East Baton Rouge Parish Mosquito Abatement and Rodent Control District. "Right now in Louisiana, we can almost say that our mosquito season is 12 months because our winters are fairly mild, as well. Around the country the months vary a little bit, but July is generally when you start to see a major amplification of the virus, and it escalates throughout August." *three to 15 days.*

As for what the 2006 season has in store, he said it's anybody's guess. "As usual, we just have to wait and see. We do know we're at that point where things are about to amplify."

Michael Soto, district superintendent of the Florida Keys Mosquito Control District, echoed Wells' caution, saying there is no reliable way to predict anything about mosquitoes except that their activity would begin to peak this month. "Because West Nile is still relatively new here, everybody is still sort of in a learning curve," he said. "The incident rate is going to vary every year, and it's going to vary from state to state. Down here in the Florida Keys, even the number of mosquito species that we have can vary from year to year. This past year, we found mosquito species that we've never seen before, but they're common in Cuba. Well, it just so happened that we found them right after one of our hurricanes, so we think they had to have been brought over by that."

Soto said another major variable preventing an accurate forecast for the season is that individuals react differently to mosquito bites, and the vast majority of those infected never even know it. "For every person who comes down with the virus, there are probably a thousand or more who will actually have it but not show symptoms," he said. "If you think about it, who knows for sure how many people across the United States have been infected by it? No one can really know."

Signs and Symptoms

Although his ratio might seem extreme, Soto's assertion is in line with what is known about WNV. According to CDC, up to 80 percent of infected people show no symptoms of the disease. The almost 20 percent of people infected who do show signs of it exhibit only a "mild" form, which CDC refers to as West Nile fever and says is characterized by flu-like symptoms including fever, fatigue, headache, body aches, and sometimes nausea, vomiting, skin rashes, and swollen lymph nodes, any or all of which lasts for only a few days.

The remaining less than 1 percent of those infected become severely ill, CDC says, with symptoms including high fever, disorientation, tremors, muscle weakness, and paralysis. Those in this minority are said to suffer from West Nile encephalitis, West Nile meningitis, or West Nile meningoencephalitis. These cases can be fatal.

CDC adds that people of all ages may be affected but notes anyone over 50 and those who have had an organ transplant are most at risk for the severe form of the disease, as are people with chronic medical conditions such as diabetes, high blood pressure, cancer, or an otherwise impaired immune system.

Once a person is infected, the incubation period before symptoms appear, if any do, can be anywhere from three to 15 days. Currently, no cure, vaccine, or even specific treatment exists for WNV-infected humans, but research and development is rampant. In 2001, the USDA authorized use of an equine vaccine; horses are infected with WNV more often than any other domestic animal, according to the agency.

Occupational Exposure

Cases in recent years have shown that WNV can be transmitted through blood transfusions and organ transplants, and therefore every unit and pint of blood donated is now screened for the virus. CDC, the U.S. Department of Health and Human Services, and the National Institutes of Health have classified WNV as a Biosafety Level Three agent. The Biosafety rating scale has only four levels, with Level Four designating the most dangerous pathogens. WNV's Level Three signifies that it is considered a serious threat.

West Nile virus is classified as a Biosafety Level Three agent, signifying it is considered a serious threat.

Biosafety regulations are designed not only to protect laboratory workers, but also to ensure the infectious agent does not leave the lab. Containment regulations for WNV in the lab entail comprehensive training for personnel about the required safety equipment and techniques, including decontamination procedures for anything, including air, that may have touched the pathogen. Working with WNV in a lab requires protective clothing such as disposable masks, gloves, gowns, booties, and eye shields. Also required is an enclosed biological safety container that has its own ventilation system and that can be accessed for working inside only by arm-length rubber gloves. But even with these precautions, several lab workers have been infected with WNV.

For outdoor workers, the National Institute for Occupational Safety and Health has developed tips for preventing WNV exposure. Chief among the recommendations are for workers to use repellents on both skin and clothing, especially repellents containing more than 20 percent DEET, and to wear long-sleeved shirts, long pants, and socks whenever possible. Light-colored clothing is preferable, because mosquitoes are attracted to dark colors. To decrease mosquito populations on a work site, NIOSH also recommends [eliminating as many sources of standing water as possible](#).

Min-Lee Cheng, Ph.D., district manager of the West Valley Mosquito and Vector Control District in Ontario, Calif., heartily endorses the latter suggestion, saying, "It's true--as long as you have standing water, you're going to have mosquitoes. People just don't realize that a cup of water can produce hundreds of mosquitoes--sometimes even a cup of water can. We want people to know about it because until we can get mosquitoes under control, we're going to have problems."

NIOSH further recommends that outdoor workers not handle dead animals and avoid working from dusk to dawn, when mosquitoes are most active and biting. Cheng notes that while, indeed, many mosquitoes are most active at night, there are also various species that prefer the day, and some of these are aggressive enough to chase down their victims.

Looking ahead to WNV's future in America, Andreadis said, "I think what we're going to see is that we will have the risk of human infection on an annual basis, just like we have with lyme disease in ticks; it's going to be that same sort of scenario. It's something we have to be aware of now. If you're out there working and you're exposed to mosquito bites, you just can't be as cavalier about it now, knowing that this virus can potentially be serious."

Breeding Pools

Eliminate as many sources of standing water from the worksite as possible to decrease mosquito

populations:

- Change the water every four to five days in animal drinking troughs, birdbaths, and other water containers.
- Scrub the sides of water containers to dislodge eggs.
- Add an aerator to ponds and water gardens to keep the water circulating, or add fish that will eat the mosquito larvae or adults.
- Remove discarded tires or keep them dry and under cover.
- Turn over, cover, store, or remove equipment such as tarps, buckets, barrels, wheelbarrows, and containers to prevent standing water.
- Place drain holes in containers that collect water and cannot be discarded.
- Clean out rain gutters.
- Remove debris (leaves, twigs, trash) from ditches.
- Fill in ruts and other areas that collect standing water.

SOURCE: NIOSH

This article appeared in the July 2006 issue of *Occupational Health & Safety*.

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