

ARBOVIRAL DISEASES

PUBLIC HEALTH ISSUE

West Nile Virus and Eastern Equine Encephalitis

West Nile virus (WNV) was first discovered in East Africa in 1937. West Nile virus was reported for the first time in the United States (U.S.) in 1999 in the New York City area of Queens. From 1999 to 2015, there were a total of 43,937 cases of WNV reported in the U.S. and 1,911 deaths. Of those, 20,265 were classified as neuroinvasive (involving the brain and nervous system) with 1,783 deaths reported. West Nile virus was first detected in birds in New Hampshire in 2000, in mosquitoes in 2001, and in humans in 2003. Since then, there have been a total of 6 human cases reported in NH.

Eastern equine encephalitis (EEE) was first discovered in the U.S. in 1938 when an outbreak of EEE infections occurred in Massachusetts. Between 1964 and 2014, 308 human cases of EEE were reported nationwide. From 2004 to 2013, there were 85 cases of EEE reported in the U.S. Of those, 82 were classified as neuroinvasive, with 34 deaths reported. Eastern Equine Encephalitis was first detected in mosquitoes, humans and animals NH in 2004. Since then, there have been a total of 14 human cases reported in NH, with 4 deaths.

These viruses circulate in birds and are passed from bird to bird by certain species of mosquitoes. Occasionally, an infected mosquito will pass these viruses to humans or other animals. Less than 1% of people who become infected with WNV will develop severe illness. Additionally, and about one out of every three individuals who become infected with EEE will succumb to their illness. When a human gets ill from WNV or EEE, they may have serious symptoms that include encephalitis (inflammation of the brain) or meningitis (inflammation of the lining of the brain and spinal cord); encephalitis and meningitis can also be caused by other means, such as head injury, bacterial infections, or most commonly, other viral infections.

Powassan Virus

Powassan virus (POW) is an arbovirus similar to WNV that is transmitted by the bite of an infected tick, most often by an infected blacklegged tick. Powassan virus was first detected in Canada in 1958. From 2001 to 2014, there have been 74 reported cases of POW in the U.S., and of those, 7 deaths were reported. In 2013, NH reported its first human case of POW, and since then, there have not been any additional NH cases reported. Powassan virus has also been reported in other states in New England, including two cases in Maine in 2004 and 2013, and five cases in Massachusetts between 2013 and 2014 (the most recent available data). Symptoms of POW can appear any time from one week to one month after being bitten by an infected tick, however, not everyone who becomes infected with POW will have symptoms. Symptoms may include fever, headache, vomiting, weakness, confusion, loss of coordination,

difficulty speaking, and seizures. Symptoms may become more severe and progress to encephalitis or meningitis.

Jamestown Canyon Virus

Jamestown Canyon virus (JCV) is an arbovirus that is transmitted by the bite of an infected mosquito. It was first detected in the U.S. in 2004. The Centers for Disease Control and Prevention (CDC) reported a total of 49 human cases of JCV in the U.S. from 2011-2015. In 2013, NH reported its first human case of JCV, and since then, there have not been any additional cases reported in NH. Jamestown Canyon virus has also been reported in other New England states, including one case in Massachusetts, one in Connecticut, and one in Rhode Island. Jamestown Canyon virus is maintained in a deer-mosquito cycle, and human illness is rare. Symptoms of JCV may include headache, fever and flu-like illness. Some people who become infected may develop severe disease characterized by encephalitis or meningitis.

Zika Virus

Zika virus disease is an arbovirus that is most commonly transmitted by the bite of an infected mosquito; however, it can also be transmitted through sexual contact with an infected individual. Zika virus is related to dengue, yellow fever, and West Nile virus. First discovered in Uganda in 1947, Zika virus disease did not begin spreading to South and Central America until 2015. The outbreak in Brazil led to reports of Guillain-Barré syndrome and pregnant women giving birth to babies with microcephaly (small head size), as well as other birth defects or pregnancy loss.

There have been cases of Zika virus disease in the U.S. in people who traveled to countries or territories where the virus is being transmitted and in individuals whose sex partner traveled to a Zika-affected area. To date, there have been a total of 4,035 confirmed cases (10 of which are NH residents) of Zika virus infection amongst U.S. residents who were infected during travel to a Zika affected area. Additionally, local transmission has been identified in Florida. It is important to note that Zika virus is not present in NH mosquitoes and there is no evidence of sustained populations of the mosquitoes known to transmit Zika virus, *Aedes aegypti* and *Aedes albopictus*, in NH. The NH Division of Public Health Services (DPHS) has plans to expand mosquito surveillance to identify populations of Zika virus vectors.

Approximately 80% of people who are infected with the Zika virus do not develop symptoms. In those who do become ill, the disease is usually mild and lasts from several days to a week. The symptoms of Zika virus infection include fever, rash, joint pain, and conjunctivitis (red eyes). Severe disease requiring hospitalization is uncommon. Our understanding about Zika virus disease is still evolving and more information is learned almost daily. Please see the resources below for more information.

ROLE OF THE HEALTH OFFICER

The health officer may be consulted by the citizens of his/her community to provide recommendations for various WNV or EEE issues. The remainder of this document will guide the health officer in providing such information, and will focus on WNV and EEE, as they are the two main arboviral diseases recognized in NH, and are of greatest concern. For issues not addressed below, you may call the Bureau of Infectious Disease Control (BIDC) @ 1-800-852-3345 x 4496 (NH only) or 603-271-4496.

The NH [Arboviral Illness Surveillance, Prevention and Response Plan](#) is a resource that provides guidance to communities on operational aspects of EEE and WNV surveillance, prevention and response. Throughout the arboviral season, BIDC determines human risk levels which are outlined in Section VI: Recommendations for a Phased Response to EEE Virus and WNV of the NH Arboviral Illness Surveillance, Prevention, and Response Plan (see link above). Currently, only positive EEE and WNV test result data are analyzed to determine human risk levels; however, there are additional factors pertaining to overall human risk that are taken into consideration, which are elaborated on in the Plan. A positive finding may or may not change the risk level of the focal area surrounding the finding. The BIDC has a [Response Plans and Funding for Mosquito Control website](#) that provides additional information.

Following an announcement by the NH Department of Health and Human Services (DHHS) of a positive EEE or WNV test result or change in the risk level, it is recommended that the health officer communicate this information to the citizens of his/her community in a timely manner. Suggestions for ways to deliver this information include but are not limited to:

- Social media (e.g. Twitter, Facebook)
- Email (e.g. list serves)
- Telephone(e.g. text message, phone call)
- Your town/city webpage
- Media (e.g. press release)

BACKGROUND

DISEASE CHARACTERISTICS:

Being bitten by an infected mosquito will not necessarily cause illness, since most people who are infected with WNV or EEE have no symptoms or experience mild illness. If illness were to occur, symptoms would appear within 3-14 days of being bitten by a WNV infected mosquito and 4-10 days after being bitten by an EEE infected mosquito. Symptoms may include mild illness such as a fever, headache, mild rash, swollen lymph glands, and body aches before fully recovering. West Nile Virus and EEE can also cause serious disease that affects brain tissue leading to neurological damage that can be fatal or result in permanent disability Symptoms of encephalitis include the rapid onset of severe headache, high fever, stiff neck, confusion, loss of

consciousness (coma), and muscle weakness. For WNV, individuals over the age of 60 and those with certain health conditions, including but not limited to immune system disorders, are at greatest risk for developing severe disease, however, people of any age can develop serious illness. For EEE, those who are under the age of 15 or over the age of 50 are at greatest risk for developing serious disease, but like WNV, severe illness can occur in people of any age.

There is no specific therapy for treating WNV or EEE. In more severe cases, intensive supportive therapy is indicated, i.e., hospitalization, intravenous (IV) fluids and nutrition, airway management, ventilatory support (ventilator) if needed, and prevention of secondary infections (pneumonia, urinary tract, etc.), along with good nursing care.

IMMUNIZATION

Currently, there are no human vaccines for the prevention of WNV or EEE. However, an equine (horse) vaccine is available for both viruses through your local veterinarian.

EXPOSURE AND TRANSMISSION OF WNV AND EEE

Mosquitoes become infected when biting a bird that carries WNV or EEE. West Nile Virus and EEE are spread to humans by the bite of an infected mosquito. West Nile virus and EEE are not spread by person-to-person contact such as touching, kissing, or caring for someone who is infected. In rare cases, WNV can be transferred through blood transfusions and in utero (from mother to unborn child). Currently, all human blood products are screened for WNV to reduce the risk from blood transfusions.

PROTECTION AGAINST WNV AND EEE

Mosquitoes are most active from June to October. As we progress through the active mosquito season, their infection rate (number of individual mosquitoes estimated containing WNV or EEE per 1,000 specimens tested) increases, peaking in late September and early October, even as mosquito populations are declining. Therefore, the risk for becoming infected with a mosquito-borne disease increases as the season progresses, even though their nuisance factor is decreasing. This is because only the older mosquitoes are remaining late in the mosquito season; these are the mosquitoes that have fed multiple times during the season, increasing the likelihood they fed on an infected bird. By taking the following precautions you can reduce the risk of becoming infected with an arboviral disease:

- If outside during evening, nighttime and dawn hours, or at any time mosquitoes are actively biting, children and adults should wear protective clothing such as long pants, long-sleeved shirts, and socks.
- If outside during evening, nighttime and dawn hours, or at any time mosquitoes are actively biting, consider the use of an effective insect repellent. Repellents containing DEET (N, N-diethyl-methyl-meta-toluamide) have been proven to be effective. Use no more than 30%

DEET for children and adults. Repellents containing Picaridin (KBR3023) or oil of lemon eucalyptus (a plant based repellent) provide protection similar to repellents with low concentrations of DEET, and have also been proven to be effective. Oil of lemon eucalyptus should not be used on children under the age of three years.

- Always use repellents according to manufacturer's directions.
- Do not apply repellent directly on children. An adult should apply it to his or her own hands and then put it on the child's skin.
- The length of time a repellent is effective varies with ingredient and concentration. Avoid prolonged or excessive use of repellents. Use sparingly to cover exposed skin and clothing.
- Wash all treated skin and clothing after returning indoors.
- Store repellent out of reach of children.
- Vitamin B, ultrasonic devices, incense and bug zappers have not been shown to be effective in preventing mosquito bites.

More information on mosquito repellents is available in a technical article for physicians at the American College of Physicians website ([Mark S. Fradin, MD. Mosquitoes and mosquito repellents: A clinician's guide.](#) Annals of Internal Medicine, June 1 1998. 128:931-940), the NH DHHS [Eastern Equine Encephalitis and West Nile Virus](#) webpage, and Centers for Disease Control and Prevention [Insect Repellent Use and Safety](#) webpage. Additionally, the University of New Hampshire Cooperative Extension has developed an [insect repellent guide](#) that is specific for NH. The Environmental Protection Agency (EPA) has also developed a web-based [insect repellent tool](#) that is available to help with the selection of an appropriate repellent based on the desired purpose, length of time and insect to be repelled.

HOUSEHOLD PRECAUTIONS FOR THE PREVENTION OF MOSQUITO BREEDING:

Mosquitoes lay their eggs in standing water. Weeds, tall grass, and bushes provide an outdoor home for the adult mosquitoes. Mosquitoes can enter homes through unscreened windows or doors, or broken screens. Here are some steps that you can take:

- Make sure that doors and windows have tight-fitting screens. Repair or replace all screens in your home that have tears or holes.
- Remove all discarded tires from your property. The used tire has become the most important domestic mosquito-breeding habitat in this country.
- Eliminate standing water by disposing of tin cans, plastic containers, ceramic pots, or similar water-holding containers. Do not overlook containers that have become overgrown by aquatic vegetation. Use landscaping as needed. Mosquitoes can develop in any puddle that lasts more than 4 days.
- Drill holes in the bottom of recycling containers that are left outdoors. Containers with drainage holes that are located on the sides collect enough water for mosquitoes to breed in.

- Make sure roof gutters drain properly or are covered. Clean clogged gutters in the spring and fall, or more frequently if they clog often.
- Tightly screen "rain barrels" to ensure mosquitoes cannot deposit eggs in or on water.
- Clean and chlorinate swimming pools and outdoor hot tubs. If not in use, keep empty and covered and drain water from pool covers.
- Aerate ornamental pools or stock them with fish. Water gardens are fashionable but become major mosquito producers if they are allowed to stagnate.
- Turn over wheelbarrows when not in use and change water in birdbaths at least twice weekly. Both provide breeding habitat for domestic mosquitoes.
- Remind or help neighbors to eliminate breeding sites on their properties.

Please Note: Although certain pesticide products are available for sale in the market place for home use to control mosquito larvae, one must obtain a special permit from the Department of Agriculture, Division of Pesticide Control to be able to apply pesticides to any surface waters in the State of New Hampshire. Questions regarding how to apply for such special permits may best be directed to the New Hampshire Department of Agriculture, Division of Pesticide Control at 603-271-3550. Additionally, there are several contractors licensed in NH for pesticide application. The Division of Pesticide Control maintains lists of licensed contractors and applicators. A list of licensed pesticide applicators that submit mosquito specimens to the NH Public Health Laboratories for testing and their contact information can be found here: <http://www.dhhs.nh.gov/dphs/cdcs/arboviral/municipal.htm>.

ADDITIONAL INFORMATION

1. New Hampshire Arboviral Illness, Surveillance, Prevention and Response Plan:
<http://www.dhhs.nh.gov/dphs/cdcs/arboviral/documents/arboviralresponse.pdf>
2. Mosquitoes and mosquito repellents: A clinician's guide:
<http://annals.org/article.aspx?articleid=711460>
3. NH DHHS Eastern Equine Encephalitis and West Nile Virus webpage:
<http://www.dhhs.nh.gov/dphs/cdcs/arboviral/index.htm>
4. CDC Insect Repellent Use and Safety:
<http://www.cdc.gov/westnile/faq/repellent.html>
5. Insect Repellents: Dr. Alan Eaton, UNH Cooperative Extension:
http://extension.unh.edu/resources/files/Resource000963_Rep1073.pdf
6. Search for a Repellent that is Right for You - EPA Insect Repellent Tool:
<http://cfpub.epa.gov/oppref/insect/>
7. NH DHHS Zika Virus webpage:
<http://www.dhhs.nh.gov/dphs/cdcs/zika/index.htm>
8. CDC Zika Virus webpage:
<http://www.cdc.gov/zika/index.html>

FOR MORE INFORMATION

NH Bureau of Infectious Disease
1-800-852-3345 ext. 4496 (NH only), or 603-271-4496

NH Public Health Laboratories
1-800-852-3345 ext. 4461, or 271-4461

NH State Veterinarian
603-271-2404

NH Fish and Game Department
1-800-852-3411, or 271-3361 (nights/weekends)