

# The Health Gazette

[Karl Hempel, M.D.](#)

## West Nile Virus

---

### Introduction

West Nile virus has made quite a hit in the news media recently. This is because it has spread from New York all the way to Florida in just the past several summers. The illness is spread by the bite of an infected mosquito. The mosquito becomes infected with the virus when it feeds on a bird or mammal that has the virus in its bloodstream. Less than one percent of humans that are bitten by an infected virus will actually develop symptoms of encephalitis. Encephalitis is an inflammation of the brain that occurs when the virus enters the brain tissue from the bloodstream. Encephalitis in humans caused by West Nile virus is extremely rare. Nevertheless, when it does occur it is big news all over the country. There are ways to markedly decrease the transmission of this virus to humans and I'll discuss how this is accomplished and give an overview of the symptoms and prevention of West Nile virus.

---

### History of West Nile virus

West Nile virus was first isolated in an adult female in the West Nile district of Uganda in 1937. Outbreaks of West Nile virus in humans have been infrequent with the most notable outbreaks occurring in Egypt in the 1950s and South Africa and 1974. It was recognized as a cause of encephalitis during an outbreak in Israel in 1957. It was recognized in horses in Egypt and France in the 1960s. West Nile virus is classified as a flavivirus. The flavivirus class includes St. Louis encephalitis, Japanese encephalitis and several other viruses. In 1999, there was an outbreak of West Nile virus in New York City with 62 humans developing encephalitis and 7 deaths. These were the first verified cases of West Nile virus in the United States. The West Nile virus in the United States was most genetically related to strains of West Nile virus found in the Middle East. It is unknown as to how the virus was first introduced in the United States. In 2000 there were only 17 cases with one death. As of July 2001 West Nile virus has been isolated in most eastern states as far south as Florida.

---

### Transmission of West Nile Virus

Only female mosquitoes bite mammals. They require a blood meal to produce eggs. The mosquito will typically consume its own weight in blood in a single feeding. The male mosquitoes feed on flower nectar. West Nile virus is mainly transmitted between infected birds and mosquitoes and only incidentally infects humans and other mammals. The only definite means of transmission is a mosquito bite from an infected mosquito. Ticks have not been proven to transmit West Nile virus.

Most birds that become infected do not die and they may act as a reservoir for the virus. A

notable exception is the American crow, which has a death rate approaching 100 percent when it is infected with the virus. Chickens are also particularly susceptible to developing severe illness and death.

Most mosquitoes do not have the infection. When a mosquito bites a bird or mammal that carries the West Nile virus, they may become infected. The viral concentration in the bloodstream of the infected bird or mammal will determine the ease of transmission of the virus to the mosquito. The infected mosquito carries the virus in their salivary glands and transmits the infection to other birds or mammals. Certain species of mosquitoes have a propensity to bite mammals including humans. When an infected mosquito bites a human they have a 1 in 300 chance of developing severe encephalitis. Most individuals that are bitten by an infected mosquito have no symptoms whatsoever but their blood will reveal previous infection by the West Nile virus. Some individuals will develop a flu like illness, which is not severe enough to cause them to seek medical attention. These previously infected individuals will have lifelong immunity to West Nile virus although their immunity may decrease in their senior years.

The infection can only be transmitted by the bite of a mosquito. Infections cannot be transmitted from animals to humans or from birds to mammals. It is conceivable that a mammal could become infected if it ingested an infected bird or mammal but this has not been proven and is extremely unlikely to be a significant mode of transmission. There has been one reported case of West Nile virus in a dog in southern Africa in 1982. The virus has been isolated from several dead cats in 1999 and 2000. Blood samples from dogs and cats indicate that they have a very low infection rate. Horses are quite susceptible to developing the encephalitis. There is no need to destroy animals or birds that are infected with the virus since they are incapable of transmitting the infection to humans or other mammals.

The infection is most likely to occur in the late summer and fall. In the southern climates the virus can be transmitted year-round. Even an area, which is considered at high risk, the percent of infected mosquitoes, is less than one percent. Since less than one percent of humans who are bitten by an infected mosquito develop encephalitis, the overall risk to humans is extremely small. Nevertheless, it is important to reduce your chances of being bitten by an infected mosquito in high-risk areas. I will discuss how to reduce your risk in a later section.

---

## Encephalitis

Encephalitis is an inflammation of the brain. Viruses cause most cases of encephalitis. Herpes virus is the most common cause of sporadic encephalitis in the United States and is responsible for about 10 percent to 20 percent of all cases of viral encephalitis. St. Louis encephalitis is the most common cause of encephalitis transmitted by a mosquito bite. The average number of yearly cases of St. Louis encephalitis in the United States is 128. West Nile virus caused 62 cases in 1999 and 12 cases in 2000 in the United States. When an infected mosquito bites a human, the West Nile virus multiplies rapidly and is transmitted to brain through the blood brain barrier. The infection causes the brain to swell resulting in bleeding within the brain and nerve damage. West Nile virus is fatal about 10% of the time when a patient gets encephalitis.

---

## Symptoms of West Nile Virus

It takes between three and 15 days after being bitten by an infected mosquito before symptoms will occur in a human. As noted above, most humans do not actually develop any symptoms from the infection. Mild symptoms develop in about 30 percent of infected individuals and consist of a slight headache, fever, and possibly a rash. They may also develop swollen lymph nodes. The rash does not itch and it is located on the back, chest and arms lasting approximately one week. More severe symptoms are severe headache, high fever, stiff neck, confusion, muscle weakness and coma or even death. There may be behavioral and personality changes as well as reduced consciousness. There may be vomiting and memory loss. Elderly patients are most susceptible to the severe infection as are individuals that are immunocompromised. Infants and children are not particularly susceptible to the severe infection.

---

## Diagnosis of West Nile Virus

A tentative diagnosis of encephalitis is made based on the clinical symptoms that a patient initially displays. The blood and spinal fluid can be analyzed for the presence of West Nile virus. New technology is available that allows rapid detection of West Nile virus. Your local health department should be contacted for instructions on how to submit a specimen properly.

---

## Treatment

There is no specific antiviral medication for West Nile virus. Patients with encephalitis should be hospitalized where intensive supportive therapy can be lifesaving. The mortality rate for West Nile virus is approximately 10 percent when encephalitis develops.

---

## Prevention

Prevention is the key to reducing the number of cases of encephalitis in humans as well as other mammals. Outbreaks in humans are usually preceded by a number of reported dead birds. It is important to survey dead birds to see if they died from West Nile virus. One model for predicting a high risk for West Nile virus outbreak is when the number of infected dead crows are greater than 1.5 per square mile. Surveys of mosquitoes are also done to identify infected mosquitoes. With routine surveys it is possible to identify areas where the risk to humans and other mammals is high. Aggressive measures to reduce the number of mosquitoes can then be instituted. Individuals can reduce the mosquito population around their homes and reduce the chance of getting bitten by doing the following things:

- Avoid spending time outdoors between dusk and dawn when mosquitoes are most active.
- When you are outdoors, wear long sleeved-shirts, long pants and socks.

- Light-colored clothing is less likely to attract mosquitoes.
- Make sure screen doors and windows are in good repair.
- Use DEET on exposed areas. Permethrin can be used on clothing. Using these two repellents together can provide protection against bites of nearly 100 percent.
- Empty standing water from discarded tires that may have accumulated on your property.
- Check for cans or other objects that may have standing water and empty them.
- Change the water in the birdbath weekly.
- Clean out roof gutters so that water does not accumulate in them.
- For standing water that cannot be emptied, consider using Mosquito Dunk larvicide. This is a bacteria that kills the mosquito larva in standing water. It comes in the form of a briquette and a single application will last one month.
- There is presently no vaccine for West Nile virus.



## A Word about Mosquito Repellents

There are numerous products on the market that claim to reduce mosquito bites. I believe it is important to know which products are safe and effective and which products are less efficacious.

**DEET**-This product was developed by the military in 1946. It was approved for general public use in 1957. It is quite effective against mosquitoes, biting flies, chiggers, fleas, and ticks. It is the most widely used mosquito repellent worldwide. It is used by approximately 38 percent of the U.S. population. It is available in concentrations of 5 percent to 100 percent. Studies have shown that there is really no reason to go above 35 percent. It is available as solutions, lotions, creams, gels, aerosols, pump sprays, and towelettes. Lower concentrations work very well but they do not last as long on the skin. The American Academy of Pediatrics recommends that the DEET concentration for children's use be no higher than 10 percent. DEET can also be applied to clothing, sleeping bags or other objects that are used outside. DEET containing insect repellents can diminish the effects of sunscreen by dilution. There are products that contain both insect repellent and sunscreen together. DEET has been used by millions of people worldwide over the past four years and has a very high safety profile. There have been several cases of toxicity reported in children and rarely in adults. Many of these persons had a history of long-term, excessive, or inappropriate use of DEET. Nevertheless, care should be taken when using DEET products in children. It is important to avoid getting DEET in the eyes.

**Skin-So-Soft**-Although Skin-So-Soft is a mild mosquito repellent, it only provides 40 minutes of protection from bites. This is 10 times less than that of 12.5% DEET.

**Plant-Derived Repellents**-Several plant products have been reported to have repellent

activity. These include citronella, cedar, verbena, pennyroyal, geranium, lavender, pine, cajeput, cinnamon, rosemary, basil, thyme, allspice, garlic, and peppermint. These products also have a short duration of action and would have to be applied frequently to provide protection. Citronella candles decreased bites by 42 percent in people sitting next to them. Ordinary candles reduce bites by 23 percent. Candles probably reduce bites by attracting the mosquitoes away from the individual.

**Bite Blocker**-This is a plant based repellent that combines soybean oil, geranium oil and coconut oil. Canadian studies showed that this product gave 97 percent protection against mosquitoes even 3.5 hours after application. In the same study, a 6.65% DEET spray reduced bites by 86 percent. Skin-So-Soft only afforded a 40 percent protection level in the same study.

**Permethrin**-This product can be applied to clothes and works as a contact insecticide causing nervous system toxicity that leads to the death of the insect. Permethrin has low toxicity in mammals but shouldn't be applied to the skin.

**Electrical bug zappers**-They do not work against mosquitoes and they mainly kill beneficial insects.

**Ultrasonic devices**-These devices have absolutely no value whatsoever in reducing mosquito bites.

Oral antihistamines are helpful for the swelling and redness of mosquito bites.

---

## References

1. Frandin, M. S. Mosquitoes and Mosquito Repellents: A Clinician's Guide. *Annals of Internal Medicine*, 1 June 1998. Pg 931-940.
2. CDC. Update: West Nile Virus Activity---Northeastern United States, September 15, 2000/49 (36); 820-2.
3. Peterson L.R. and Roehrig J.T. West Nile Virus: A Reemerging Global Pathogen. Available at URL: <http://www.cdc.gov/ncidod/eid/vol7no4/petersen.htm>.
4. What's going on with the West Nile Virus? Available at URL: <http://www.cfe.cornell.edu/erap/WNV/index.html>.
5. CDC. West Nile Virus. Questions and Answers. Available at URL: <http://www.cdc.gov/ncidod/dvbid/westnile/q&a.htm>.
6. Encephalitis: Viral. Available at Mdconsult URL: <http://home.mdconsult.com/das/patient/body/50892140/41/5923.html>.
7. West Nile Virus Update. Available at URL: <http://www.ci.bristol.ct.us/BBHealth/westnile.htm>.

---

The information provided above is offered as a community service about health-care issues and is not a substitute for individual consultation. Advice on individual problems should be obtained from your personal physician. This information is based on research by the author and represents his interpretation of the literature.

---

[\*Return to the Home Page\*](#)