

West Nile Virus

- Author: Jess D Salinas Jr, MD; Chief Editor: Consuelo T Lorenzo, MD [more...](#)

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Background

The West Nile virus is one of the many members of the genus *Flavivirus* that are known to cause human disease. The life cycle of the West Nile virus involves the microbe's transmission from nonhuman animals to humans by way of *Aedes*, *Culex*, or *Anopheles* mosquitoes. The West Nile virus can infect horses, birds, dogs, and other mammals.^[1, 2] However, wild birds are apparently the optimal hosts for harboring and replicating the virus.

The West Nile virus has been reported in Africa, Asia, Europe, the Middle East, and North America. In 1999, the first cases of West Nile virus disease were reported in New York City, and the infection has been spreading throughout the North American continent ever since.^[3] In 2012, a reported 5674 West Nile virus cases occurred in the United States, the result of a large outbreak of the disease.^[4] In 2013, the number of cases was 2469.^[5, 6]

The West Nile virus causes serious manifestations in approximately 1% of persons who are infected, with increased morbidity and mortality in individuals older than 50 years. In hospitalized patients in New York City, neurologic sequelae of the West Nile virus included severe muscle weakness, with approximately 10% of patients developing a complete flaccid paralysis.^[7, 8, 9] One in 150 West Nile virus infections results in **encephalitis** or **meningitis**, and the mortality rate from severe illness is 3-15%. Individuals older than 75 years are at particular risk.^[1]

As the elderly population increases and the distribution of the West Nile virus spreads nationwide, a growing number of infected individuals may require comprehensive inpatient rehabilitation to overcome the virus's disabling effects.^[10]

Patient education

For patient education information, see the [Infections Center](#) and the [Brain and Nervous System Center](#), as well as [West Nile Virus](#), [Insect Bites](#), and [Encephalitis](#).

Pathophysiology

Examining the ways in which the West Nile virus may cross the blood-brain barrier to infect the nervous system, Verma et al infected primary human brain microvascular endothelial (HBMVE) cells with NY99, a neurovirulent strain of the virus.^[11] The authors noted that the virus did not have a cytopathic effect on the HBMVE cells. Increased mRNA (messenger ribonucleic acid) and protein expression of the tight-junction protein claudin-1 and of 2 cell adhesion molecules (vascular cell adhesion molecule and E-selectin) were seen 2-3 days after cellular infection, the same time at which West Nile virus replication had peaked.

The study provided evidence that infection of HBMVE cells by the West Nile virus enables the cell-free virus to enter the central nervous system without disturbing the barrier's integrity. In addition, the authors suggested that cell adhesion molecules may help to traffic West Nile virus – infected immune cells into the central nervous system.

Epidemiology

Frequency

United States

The West Nile virus was introduced into the United States in 1999, in New York City. Since then, the disease has occurred with greater frequency in the Southern, Midwestern, and Western states. Symptoms of the infection first appear in the population in early June, with the peak incidence occurring in late August and tapering through early November.

A large outbreak of West Nile virus infection in 2012 resulted in 5674 reported cases, although the number of reported cases for 2013 dropped to 2469. In both years, 51% of the cases were neuroinvasive. In total, 39,557 cases of West Nile virus were reported to the Centers for Disease Control and Prevention (CDC) between 1999 and 2013, including 17,463 cases of neuroinvasive disease.^[4, 5, 6]

International

The West Nile virus is most commonly identified in Asia, Africa, and the Middle East and is endemic in those parts of the world. In the 1990s, outbreaks of **West Nile virus encephalitis** were reported in Algeria, the Czech Republic, France, Romania, Russia, and Israel.^[1] In the Americas, since its introduction into the United States, in 1999, the West Nile virus has spread to Canada and into South America.^[12]

Mortality/Morbidity

Reports indicate that less than 1% of persons who are infected with the West Nile virus develop severe illness; of individuals who have severe illness secondary to the infection, 3-15% die.

Severe disease particularly affects the elderly. Advanced age is by far the greatest risk factor for neurologic disease, long-term morbidity, and death, especially in persons older than 75 years. Of the 119 patients who died of West Nile virus in the United States in 2013 (out of 2469 cases), the median age was 78 years.^[5, 6]

The total number of reported deaths from the West Nile virus in the United States between 1999 and 2013 was 1668, including 1554 from neuroinvasive disease.^[13]

Race

There is no known predisposition related to a particular ethnic group.

Sex

There is no known sex predilection. Men and women are affected equally.

Age

In the United States, the elderly are particularly disposed to illness from West Nile virus infection.

Contributor Information and Disclosures

Author

Jess D Salinas Jr, MD Medical Director, Lake Mary Clinic, National Pain Institute, LLC; Associate Medical Director, Winter Park Clinic, National Pain Institute, LLC

Jess D Salinas Jr, MD is a member of the following medical societies: [American Academy of Pain Management](#), [American Academy of Pain Medicine](#), [American Academy of Physical Medicine and Rehabilitation](#), [American Medical Association](#), [American Society of Interventional Pain Physicians](#), and [Physiatric Association of Spine, Sports and Occupational Rehabilitation](#)

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Coauthor(s)

Monica L Steiner, MD Clinical Assistant Professor, Program Director, Department of Orthopedics and Rehabilitation, Loyola University Medical Center

Monica L Steiner, MD is a member of the following medical societies: [American Academy of Physical Medicine and Rehabilitation](#)

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Specialty Editor Board

Elizabeth A Moberg-Wolff, MD Medical Director, Pediatric Rehabilitation Medicine Associates

Elizabeth A Moberg-Wolff, MD is a member of the following medical societies: [American Academy for Cerebral Palsy and Developmental Medicine](#) and [American Academy of Physical Medicine and Rehabilitation](#)

Disclosure: Merz None Speaking and teaching

Francisco Talavera, PharmD, PhD Adjunct Assistant Professor, University of Nebraska Medical Center College of Pharmacy; Editor-in-Chief, Medscape Drug Reference

Disclosure: Medscape Salary Employment

Kat Kolaski, MD Assistant Professor, Departments of Orthopedic Surgery and Pediatrics, Wake Forest University School of Medicine

Kat Kolaski, MD is a member of the following medical societies: [American Academy for Cerebral Palsy and Developmental Medicine](#) and [American Academy of Physical Medicine and Rehabilitation](#)

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Kelly L Allen, MD Medical Director, Medevals

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Chief Editor

Consuelo T Lorenzo, MD Executive Health Resources

Consuelo T Lorenzo, MD is a member of the following medical societies: [American Academy of Physical Medicine and Rehabilitation](#)

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