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Division of Vector-Borne Infectious Diseases

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## Eastern Equine Encephalitis Fact Sheet **Updated!**

Eastern equine encephalitis (EEE) is a mosquito-borne viral disease. EEE virus (EEEV) occurs in the eastern half of the United States where it causes disease in humans, horses, and some bird species. Because of the high mortality rate, EEE is regarded as one of the most serious mosquito-borne diseases in the United States.

### TRANSMISSION: What is the basic EEEV transmission cycle? How do people become infected with EEEV?

- EEEV is transmitted to humans through the bite of an infected mosquito. It generally takes from 3 to 10 days to develop symptoms of EEE after being bitten by an infected mosquito.
- The main EEEV transmission cycle is between birds and mosquitoes.
- Many species of mosquitoes can become infected with EEEV. The most important mosquito species in maintaining the bird-mosquito transmission cycle is *Culiseta melanura*, which reproduces in freshwater hardwood swamps. *Culiseta melanura*, however, is not considered to be an important vector of EEEV to horses or humans because it feeds almost exclusively on birds. Transmission to horses or humans requires mosquito species capable of creating a “bridge” between infected birds and uninfected mammals such as some *Aedes*, *Coquillettia*, and *Culex* species.
- Horses are susceptible to EEE and some cases are fatal. EEEV infections in horses, however, are not a significant risk factor for human infection because horses are considered to be “dead-end” hosts for the virus (i.e., the amount of EEEV in their bloodstreams is usually insufficient to infect mosquitoes).

### ETIOLOGIC AGENT: What causes EEE?

- Eastern equine encephalitis virus is a member of the family *Togaviridae*, genus *Alphavirus*.
- Closely related to Western equine encephalitis virus and Venezuelan equine encephalitis virus

### HUMAN CLINICAL FEATURES: What type of illness can occur?

- Many persons infected with EEEV have no apparent illness. In those persons who do develop illness, symptoms range

from mild flu-like illness to EEE (inflammation of the brain), coma and death.

- The mortality rate from EEE is approximately one-third, making it one of the most deadly mosquito-borne diseases in the United States.
- There is no specific treatment for EEE; optimal medical care includes hospitalization and supportive care (for example, expert nursing care, respiratory support, prevention of secondary bacterial infections, and physical therapy, depending on the situation).
- Approximately half of those persons who survive EEE will have mild to severe permanent neurologic damage.

#### **INCIDENCE: How many and where have human EEE cases occurred?**

- Approximately 220 confirmed cases in the US 1964-2004
- Average of 5 cases/year, with a range from 0-15 cases
- States with largest number of cases are Florida, Georgia, Massachusetts, and New Jersey.
- EEEV transmission is most common in and around freshwater hardwood swamps in the Atlantic and Gulf Coast states and the Great Lakes region.
- Human cases occur relatively infrequently, largely because the primary transmission cycle takes place in and around swampy areas where human populations tend to be limited.

#### **RISK GROUPS: Who is at risk for developing EEE?**

- Residents of and visitors to endemic areas (areas with an established presence of the virus)
- People who engage in outdoor work and recreational activities in endemic areas
- Persons over age 50 and younger than age 15 seem to be at greatest risk for developing severe EEE when infected with the virus.

#### **PREVENTION: How can people avoid EEEV infection?**

- A vaccine is available to protect equines.
- People should avoid mosquito bites by employing personal and household protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active (some bridge vectors of EEEV are aggressive day-biters), and removing standing water that can provide mosquito breeding sites. For more information about preventing mosquito-borne disease see [Preventing West Nile Virus](#).

#### **LABORATORY TESTING:**

- The cornerstone of laboratory diagnosis of EEEV infection is serology, especially IgM testing of serum and cerebrospinal fluid (CSF), and neutralizing antibody testing of acute- and convalescent-phase serum.
- In fatal cases, however, PCR, histopathology with immunohistochemistry, and virus culture of autopsy tissues continue to be useful. Only a few state laboratories or other specialized laboratories, including those at CDC, are capable of doing this specialized testing.

#### **IMMUNITY:**

- EEEV infection is thought to confer life-long immunity against reinfection with EEEV. It does not confer any significant cross-immunity against other alphaviruses (e.g., Western equine encephalitis virus), and it confers no cross-immunity against flaviviruses (e.g., West Nile virus) or bunyaviruses (e.g., La Crosse virus)

#### **SURVEILLANCE: How is EEE monitored?**

- Human EEE cases are reportable by state health departments to CDC via ArboNET. Reports of infected horses, mosquitoes, and birds are also collected by ArboNET
- National human EEE case report data for [1964-2004](#) are posted on this website, by state, as is a [map](#) of reported human cases from 1964-2004.

#### **TRENDS**

- Risk of exposure to EEEV-infected mosquitoes may increase as the human population expands into natural areas where the virus circulates (e.g., near hardwood, freshwater swamps in the eastern and north-central United States).

#### **CHALLENGES**

- No human EEEV vaccine is currently licensed and it is unlikely that one will be available in the foreseeable future.
- No specific drug treatment for EEE is available.
- Control measures for EEEV are challenging and expensive. For example, laws for the protection of wetlands limit efforts to eliminate some swamps or to treat them with mosquito larvicides or aerial insecticides; in some regions, there is a lack of public support for use of insecticides to reduce populations of mosquitoes that transmit EEEV or other mosquito-borne viruses.

#### **RESEARCH PRIORITIES**

- Improve predictive capabilities
- Improve public awareness

- Develop and evaluate therapeutic drugs
- Improve diagnostic and virus detection tests

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