

# *epi*TRENDS

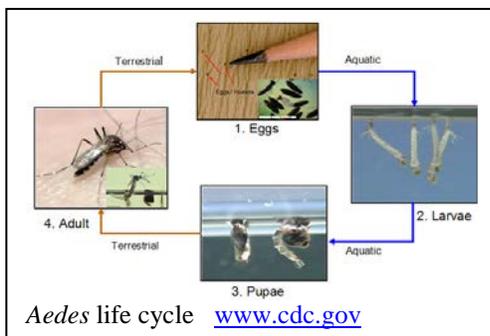
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## Mosquito-borne Disease

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Although most mosquitoes are not disease vectors, various viral and parasitic conditions carried by mosquitos have resulted in considerable morbidity and mortality throughout human history. These conditions may be reported in Washington as locally acquired or as travel related.

### Major Mosquito-borne Diseases



The typical mosquito life cycle involves four stages, with three stages occurring in a variety of water habitats, depending on the mosquito species. Mosquito eggs, which may tolerate several months of desiccation, hatch in water to form larvae, which change to pupae and eventually to terrestrial adults. The life cycle

is more rapid with higher temperatures. Male mosquitoes feed on plant fluids. Only female mosquitoes, which need a blood meal to develop eggs, are potential disease vectors. Although most commonly occurring in tropical and semitropical areas, mosquitoes are widely distributed across the planet.

Mosquitoes of the genus *Anopheles* are important vectors of the malaria parasite. There are hundreds of anopheline species located on all continents except Antarctica. Several dozen of these species carry malaria, the most commonly known species being *Anopheles gambiae*. Most anophelines either feed at night or during dusk and dawn, so bed nets can reduce or prevent exposure. About half the world population is at risk for malaria, with around 200 million infections and 625,000 associated deaths annually. Children are at increased risk for severe or fatal malaria. Malaria particularly affects tropical Africa, Southeast Asia, Southwest Pacific, forested areas of South America, and part of the Indian subcontinent. Bed nets and rapid treatment are appropriate for affected populations; travelers to these areas, including people who emigrated years before from the region, should take preventive medication.

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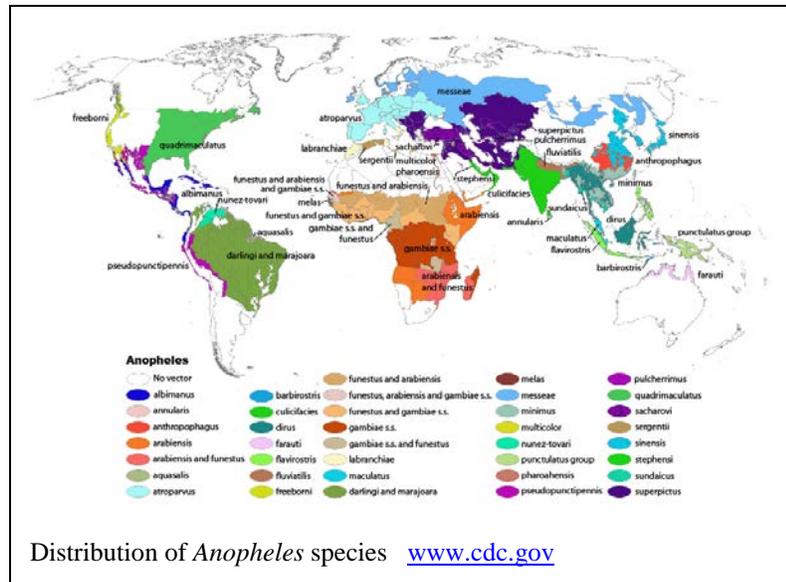
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The mosquito genus *Aedes* includes species that carry a number of significant human pathogens. *Aedes* species can transmit dengue, chikungunya, and yellow fever viruses. *Aedes aegypti* (yellow fever mosquito), the principal vector for dengue and yellow fever, bites primarily during the day but also at dawn and dusk. The species is a container breeder, laying its eggs in water-filled containers located in and around homes. *Aedes albopictus* (Asian tiger mosquito) is also a container breeder and has become widely distributed through global trade, arriving in the United States in 1985 in a shipment of used tires. This species has adapted to urban and suburban environments and is also a daytime biter in addition to at dusk and dawn. Control of both species involves eliminating breeding habitats.

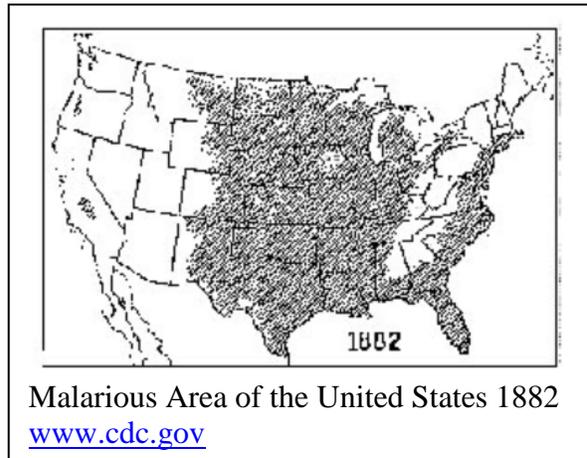
Dengue virus occurs in tropical and subtropical regions, causing hundreds of millions of cases annually. Syndromes associated with infections are dengue fever, dengue hemorrhagic fever, and dengue shock syndrome. Asia, Africa, and parts of Europe are affected by chikungunya virus, with periodic outbreaks that can involve hundreds of thousands or millions of cases. Since its recent introduction into the Caribbean Islands in late 2013, chikungunya virus has spread to cause locally acquired cases in Mexico, tropical and subtropical South America, and Florida (11 cases in 2014). There are still hundreds of thousands of yellow fever cases per year, primarily in Africa.

Arboviral encephalitides transmitted by mosquitoes include St. Louis encephalitis virus (vector *Culex*), Eastern equine encephalitis virus (*Culiseta*), Western equine encephalitis virus (*Culex*), West Nile virus (mainly *Culex*), and La Crosse virus (*Aedes*). Japanese encephalitis is carried by infected *Culex* mosquitoes in Asia and the

Western Pacific. There are a multitude of other mosquito-borne diseases including filariasis (vector *Anopheles* in Africa, *Culex* in Americas), Zika fever (*Aedes*), and Rift Valley fever (*Aedes*). Of note, human immunodeficiency virus (HIV) and Ebola are not transmitted by mosquitoes.

### Mosquito-borne Diseases in the United States

Mosquito-borne diseases have been of historical importance in the United States. Malaria was probably imported to the colonies by settlers from malaria-affected parts of Europe and by the West African slave trade. Malaria was once widespread over the continental United States, occurring along the Eastern Seaboard and Gulf Coast as well as the Midwest and Great Plains. In 1946, the Communicable Disease Center, which later became the Center for Disease Control (currently the Centers for Disease Control and Prevention), was established in Atlanta, Georgia for malaria control in southern states.



Yellow fever was also imported into the American colonies, resulting in major outbreaks in coastal areas including Galveston, New Orleans, Baltimore, Philadelphia, and Boston. In addition, the disease had a major effect on U.S. History. When the French army was heavily impacted by yellow fever while fighting in the Caribbean in 1803, Napoleon offered to sell another troublesome area, the Louisiana territory.

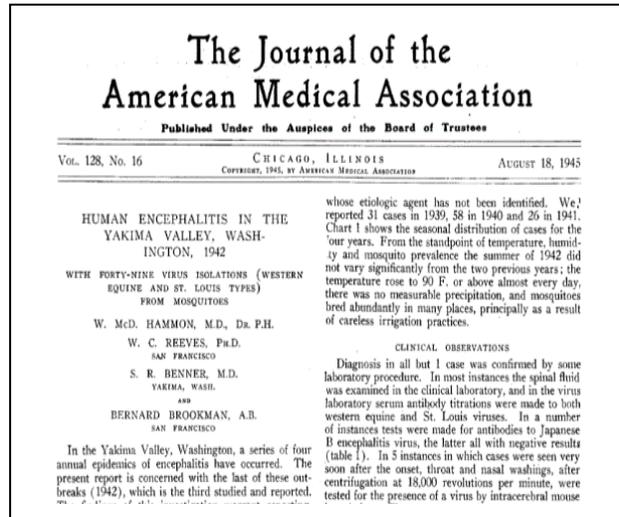
West Nile virus occurred mainly in the Middle East and Europe until cases were identified in New York City in 1999, with subsequent rapid spread across the country. Asymptomatic cases may be recognized following blood donation. Severe West Nile virus disease is rare, but may involve encephalitis or paralysis. Various other arboviral encephalitides are endemic diseases in this country including Western equine encephalitis, Eastern equine encephalitis, St. Louis encephalitis, and California serogroup viruses (California encephalitis, La Cross encephalitis, Jamestown Canyon encephalitis, and others).

States with warm and humid weather are most likely to have mosquito-borne diseases become established. During 1999-2010, Florida had locally-acquired cases of dengue in Key West, and local dengue cases also periodically occur in Texas and Hawaii. There were several local introductions of chikungunya into Florida in 2014, but none appear to have resulted in ongoing transmission or spread of the virus. The largest recent malaria outbreak in Florida was in Palm Beach County in 2003 where there were eight cases.

### Mosquito-borne Disease in Washington State

Mosquitoes in Washington with potential as disease vectors include species in the genera *Aedes*, *Anopheles*, *Culex*, and *Culiseta*. The first year of Washington's record keeping for arthropod-borne encephalitis listed 33 cases in 1939 and 91 the following year. The last major cluster was

15 cases in 1946. During these years Yakima had several outbreaks of encephalitis which were attributed to Western equine encephalitis and St. Louis encephalitis viruses. Other than West Nile virus infections, the last reported human arboviral infection acquired in Washington was in 1988. Mosquito control districts established in response still carry out mosquito control activities in many counties. West Nile virus first caused endemic cases in Washington in 2006, with additional cases in several subsequent years. In 2009, 38 cases of West Nile virus disease were recorded, the largest number on record for the state. Washington State Department of Health's Zoonotic Disease Program works closely with partners throughout the state to monitor the presence of pathogens in mosquito populations.



For Washington residents, travel-related cases are more common than endemic exposures for arboviral diseases. Imported malaria and dengue cases are reported in residents every year. With the introduction of chikungunya to the Caribbean, the reported number of cases has increased greatly; no cases were reported during 2011-2013, but 11 chikungunya cases were reported in 2014. There are periodic reports of travel-related cases of Japanese encephalitis.

Globally, mosquito-borne diseases result in considerable costs in terms of morbidity, mortality, disability, healthcare costs, and lost productivity. With the presence of vector mosquitoes in this country, the introduction and spread of mosquito-borne infections remains a threat. Prompt diagnosis and reporting of cases can assist in controlling these conditions.

## Resources

Washington State Department of Health:

<http://www.doh.wa.gov/Portals/1/Documents/Pubs/333-187.pdf>

CDC mosquito-borne diseases: [http://www.cdc.gov/ncidod/diseases/list\\_mosquitoborne.htm](http://www.cdc.gov/ncidod/diseases/list_mosquitoborne.htm)

CDC malaria elimination: [http://www.cdc.gov/malaria/about/history/elimination\\_us.html](http://www.cdc.gov/malaria/about/history/elimination_us.html)

USGS mosquito-borne disease maps: <http://diseasemaps.usgs.gov/index.html>

Florida mosquito-borne diseases: [http://www.floridahealth.gov/diseases-and-conditions/mosquito-borne-diseases/index.html#heading\\_2](http://www.floridahealth.gov/diseases-and-conditions/mosquito-borne-diseases/index.html#heading_2)