

# Arboviral Infection

## Surveillance Protocol

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Arboviruses endemic to the U.S. include Eastern equine encephalitis virus (EEE), La Crosse encephalitis virus (LAC), Saint Louis encephalitis virus (SLE), West Nile virus (WNV), Western equine encephalitis virus (WEE), and the tickborne Powassan encephalitis virus (POW). Other arboviruses are associated with travel to countries where they are endemic and include chikungunya and Zika virus. This protocol was updated in the context of the 2015 Zika outbreak in the Americas. Please make certain you are working from the most current guidance. Please see other protocols for information on dengue and yellow fever.

### Provider Responsibilities

#### ***For reporting of endemic arboviral diseases (WNV, LAC, SLE, EEE):***

1. Report suspect and confirmed cases of arbovirus infection (including copies of lab results) to the local health department within one week of diagnosis. Supply requested clinical information to the local health department to assist with case ascertainment.
2. Assure appropriate testing is completed for patients with suspected arboviral disease infection. The preferred diagnostic test is testing of virus-specific IgM antibodies in serum or cerebrospinal fluid (CSF). In West Virginia, appropriate endemic arbovirus testing should include EEE, LAC, SLE, and WNV. Testing for these four diseases is available **free of charge** through the West Virginia Office of Laboratory Services (OLS). Confirmatory testing may be conducted at the Centers for Disease Control and Prevention (CDC).

#### ***For reporting of non-endemic arboviral diseases (e.g. chikungunya, Zika virus):***

1. For emerging infectious disease such as chikungunya and Zika, report suspect and confirmed cases within 24 hours; emerging infectious diseases are considered Category II reportable conditions require prompt public health prevention and control measures (e.g. home environmental assessments, contact tracing). Supply requested clinical information to the local health department to assist with case ascertainment.
2. Assure appropriate testing is completed for patients with suspected arboviral disease infection. The preferred diagnostic test is testing of virus-specific IgM antibodies in serum or cerebrospinal fluid (CSF). Some commercial laboratories perform testing for chikungunya; currently testing of Zika virus can only be done at some state laboratories and CDC. Testing of specimens for chikungunya and Zika virus can be conducted at CDC in coordination with OLS.

### Laboratory Responsibilities

1. Report positive EEE, SLE, WNV, and LAC testing results to the local health department within 1 week; report positive chikungunya and Zika virus testing results within 24 hours as they are

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currently considered Category II reportable conditions. Prompt reporting may facilitate prompt public health prevention and control activities.

2. Submit positive arboviral samples to the Office of Laboratory Services within 1 week for subsequent testing at CDC.
3. Appropriate testing for patients with suspected arboviral infection includes testing of virus-specific IgM antibodies in serum or CSF. In West Virginia, testing should routinely be conducted for WNV, EEE, SLE, and LAC. A complete arboviral panel for these diseases is available free of charge through OLS. For more information go to: <http://www.wvdhhr.org/labservices/labs/virology/arbovirus.cfm>.

### **Local Health Responsibilities**

1. Educate the public about arboviruses, especially regarding prevention measures. Late spring and early summer are optimal times to provide this education. A model press release is available under “Tools for Local Health Departments” at: <http://www.dhhr.wv.gov/oeps/disease/Zoonosis/Mosquito/Pages/Arbo.aspx>
2. Educate providers and laboratories to report cases of arbovirus infection to the local health department in the patient’s county of residence within one week of diagnosis (or within 24 hours for clusters or outbreaks of arboviral diseases and emerging arboviral diseases such as Zika virus).
3. For chikungunya and Zika virus infection within 7 days of onset:
  - a. Educate the patient about the risk of transmission to others through mosquitoes
  - b. Request that the patient stay indoors as much as possible and avoid mosquito bites for the first week of illness.
4. Conduct an appropriate case investigation.
  - c. Contact the healthcare provider that ordered the laboratory test to obtain the clinical information on the WVEDSS form.
  - d. If needed, contact the patient to obtain information regarding travel history.
  - e. Conduct a home visit and perform an environmental assessment to identify potential risk factors for exposure to mosquitoes.
  - f. Educate the patient and the patient’s family on mosquito bite prevention and other appropriate prevention messages.
  - g. Report all case data using WVEDSS.
5. Consult with the Division of Infectious Disease Epidemiology (DIDE) on emerging arboviral diseases for guidance on appropriate case management and public health actions.

### **State Health Responsibilities**

1. Review completed case reports from local health departments within one week.
  2. Report all confirmed and probable cases to CDC using ArboNET upon confirmation of case status.
  3. Provide training and consultation to local health departments regarding case ascertainment and prevention for arbovirus infection.
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4. Complete enhanced passive surveillance activities each spring. This includes release of a statewide HAN to healthcare providers, a laboratory letter, a training seminar, updates to arboviral information sheets, and release of a memo to local health departments.
5. Conduct yearly mosquito surveillance activities (see mosquito surveillance protocol).
6. Provide regular data feedback to local health departments and public health partners during arboviral disease season (May-October).
7. Assure resources and equipment are available for laboratory testing and mosquito surveillance.
8. Encourage and support surveillance of dead birds and horses.
9. Coordinate with other agencies, as needed, to monitor arboviral activity and respond to urgent situations.

### **Disease Prevention Objectives**

1. Reduce disease risk through:
  - a. Public education regarding use of personal protective measures.
  - b. Public education regarding travel to areas where arboviral diseases are endemic.
  - c. Appropriate mosquito surveillance and control.
2. Use mosquito surveillance data to provide timely notification to the public and local health departments of arboviral activity in mosquitoes.

### **Disease Control Objectives**

1. Perform or increase mosquito control activities when human arboviral cases or increased arboviral mosquito activity is detected in an area.
2. Provide or increase public education when human arboviral cases or increased arboviral mosquito activity is detected in an area.

### **Disease Surveillance Objectives**

1. To identify and monitor the epidemiologic characteristics of human arbovirus infections in West Virginia.
2. To identify the geographic distribution of non-human cases of arboviral infection through testing of dead birds and suspected equine arbovirus cases.
3. To identify and characterize (by species and geographic distribution) arboviral-infected mosquitoes and evaluate their potential to transmit novel or travel-associated arboviral diseases such as dengue, chikungunya, and Zika virus.
4. To identify new or invasive mosquito species not previously identified in West Virginia that could be capable of transmitting arboviruses.
5. To provide early notification of increased arboviral disease mosquito activity through trapping and testing of mosquitoes.

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### Public Health Significance

After its introduction into New York City in 1999, West Nile virus expanded its territory across the United States, reaching California by 2002. The West Nile epidemic called attention to the weakened public health infrastructure for arbovirus surveillance in the United States. Due to this concern, federal money was allocated to improve public health infrastructure, including laboratory diagnosis and medical entomology capacity.

In late 2013, the first local transmission of chikungunya virus in the Americas was identified in the Caribbean; travelers returning to the American mainland were identified as infected with chikungunya early the following year. By the end of 2014, locally-transmitted cases of chikungunya had been identified in Florida, Puerto Rico, the U.S. Virgin Islands, and American Samoa. Chikungunya and dengue are transmitted by the same species of mosquito: *Aedes aegypti* and *Aedes albopictus*. The two diseases have similar symptoms during early illness. However, dengue can evolve to dengue hemorrhagic fever, a severe and potentially life-threatening form of the disease requiring intensive medical care. Patients with chikungunya generally recover with symptomatic treatment only.

In May 2015, the Pan-America Health Organization reported cases of Zika in Brazil; the infection has subsequently spread to South and Central America and the Caribbean, involving numerous countries and territories in that area. The infection, usually asymptomatic or self-limited in healthy adults can cause a devastating infection in utero: both miscarriage and microcephaly have been reported in infants of women who were infected during pregnancy.

While humans are dead-end hosts for arboviruses such as WNV, EEE, SLE or LAC, autochthonous transmission occurs with chikungunya, dengue and Zika viruses. Autochthonous transmission means that humans infected with the arbovirus develop sufficient levels of viremia that a mosquito can carry the disease from an infected human to a susceptible human; thus the disease can be readily introduced into a new geographic area when an infected person travels to that area. Public health officials should take steps to prevent autochthonous transmission from Zika, chikungunya or dengue cases during mosquito season.

The occurrence of arboviral disease outbreaks is unpredictable; thus public health officials should remain vigilant for increased activity during the summer months, which coincides with increased vector activity. SLE and EEE can occur in sometimes dramatic outbreaks at lengthy intervals with little or no apparent transmission in intervening years. With the emergence of viruses that can be transmitted by autochthonous transmission, public health officials should remain vigilant for local transmission of emerging arboviral infections during the summer months and counsel patients with suspected or confirmed infections to avoid mosquito bites to prevent transmission to others. Public health conducts various surveillance activities focused on detection and monitoring of arboviral diseases:

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1. **Dead Bird Surveillance:** The purpose of dead bird surveillance is to monitor the presence of WNV, EEE or SLE within the jurisdiction under surveillance.
2. **Mosquito Surveillance:** Mosquito surveillance is conducted to identify mosquito breeding sites and prioritize sites for abatement, and determine if disease-carrying adult mosquitoes are present. See mosquito surveillance plan.
3. **Equine Surveillance:** Horses may serve as an important indicator of WNV and EEE activity in the jurisdiction.
4. **Human Surveillance:** The purpose of human surveillance is to detect human arbovirus infection within the jurisdiction.

Regardless of the type of surveillance performed, the information collected should be used to prevent further human cases of disease. The ecology and public health aspects of arboviruses are complex. West Virginia public health officials are encouraged to take the necessary time to educate themselves about these diseases.

In West Virginia, the major locally-transmitted arbovirus of concern is LAC; however 10 cases of WNV were reported in humans during the nationwide epidemic of 2012. Birds positive for EEE were identified in 2002 in West Virginia. Twelve human cases of SLE were reported from West Virginia between 1964 and 2010, with the majority of cases occurring in 1975 during a national SLE epidemic. The last case was reported in 1997. No human cases of Powassan have been identified in West Virginia; however, the virus was isolated from the brain of a sick fox in West Virginia in 1977 and the primary tick vector, *Ixodes cookei* has been documented in multiple West Virginia counties. Two travel-associated cases of chikungunya were reported in West Virginia in 2014.

### **Clinical Description**

Arboviral diseases usually present with one of four major clinical syndromes: arboviral fever; arboviral arthritis and rash; arboviral encephalitis; or arboviral hemorrhagic fever. Many arboviruses are associated with illness in more than one category (See Table I).

Symptoms of arboviral fever include fever, headache, arthralgia, myalgia, nausea, vomiting, conjunctivitis and rash. The condition is typically self-limited and the best example of this syndrome is uncomplicated Zika virus infection.

Patient with arboviral arthritis and rash present with fever, moderate to severe arthritis lasting days to months, rash, myalgia, fatigue, headache and lymphadenopathy. This syndrome is typically self-limited and the best known example is chikungunya.

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Patients with arboviral encephalitis present with fever, seizures and mental status changes (confusion, disorientation, stupor, coma). However, nervous system involvement can be particularly variable. The patient may present with syndromes mimicking a stroke, Parkinsonism, tremors, movement disorders, neuritis, GBS, acute flaccid paralysis and/or SIADH. Aseptic meningitis can also result from arboviral infection. Because of the variability, fever plus acute onset of neurological signs during mosquito season should prompt a diagnostic work-up for arboviral illness. Severe nervous system involvement can result in life-long disability and death. The best known examples include West Nile and La Crosse encephalitis.

Arboviral hemorrhagic fevers present with a biphasic illness. The first phase of illness is similar to arboviral fever with fever, chills, headache, backache, muscle aches, nausea, vomiting and retro-orbital pain. After a brief remission, a minority of patients have sudden onset of severe symptoms: vomiting, abdominal pain, signs of hemorrhage and shock. Hospitalization and intensive care are required during the critical phase. Dengue and yellow fever are the best known examples.

Table I lists some of the most common clinical presentations for arboviral diseases.

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**Table I. Common Clinical Presentations of Selected Arboviral Diseases.**

Virus	Asymptomatic Infection	Common Presentations	Case-Fatality Rate	Prevalence of Neurological Sequelae	Risk groups
Chikungunya (CHIK)	3-28%	<u>Arboviral arthritis and rash</u> : Fever, polyarthralgia headache, myalgia, conjunctivitis, nausea/vomiting, or maculopapular rash	Low	n/a	Infants born to infected mothers, elderly, persons with underlying conditions
Eastern equine encephalitis (EEEV)	Uncommon	<u>Arboviral fever</u> : chills, fever, malaise, arthralgia, myalgia; Encephalitic: headache and evidence of CNS involvement; often severe	36–70% of symptomatic cases	35% of surviving symptomatic cases	Children and the elderly
La Crosse encephalitis (LAC)	Very common	<u>Arboviral fever</u> : fever, headache, nausea, vomiting, fatigue, and lethargy Encephalitic: fever, evidence of CNS involvement, seizures	< 1% of all infections; ≈ 1% of hospitalized cases	3–12% of hospitalized cases	Children (primarily 15 years or younger)
St. Louis encephalitis (SLE)	Common	<u>Arboviral fever</u> : headache and fever. Encephalitic: fever, headache, encephalitis, spastic paralysis.	< 1% of all infections; 3– 30% among symptomatic cases	Unknown	Infants and elderly
West Nile encephalitis (WNV)	70-80%	<u>Arboviral fever</u> : headache, body aches, joint pains, vomiting, diarrhea, or rash <u>Arboviral encephalitis</u> : fever plus encephalitis or other signs of nervous system involvement	< 1% of all infections; 12– 14% among hospitalized cases	Up to 50% of hospitalized patients at one year follow up	Elderly, persons with underlying conditions
Powassan (POW)	Common	<u>Arboviral fever</u> Fever, headache, vomiting, weakness <u>Arboviral encephalitis</u>	10–15% among symptomatic cases	Up to 50% of surviving symptomatic cases	Adults
Zika virus	80%	<u>Arboviral fever</u> : Fever, rash, joint pain, or conjunctivitis, headache, muscle pain <u>arboviral encephalitis</u> : microcephaly resulting from infection <i>in utero</i>	Low	Unknown; GBS and microcephaly have been reported	Fetus <i>in utero</i>

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### **Important definitions:**

Here are some definitions of terms you may see in medical records of patients with neurological conditions due to arboviral infection.

**Acute flaccid paralysis:** sudden onset of muscle weakness with hyporeflexia (decreased muscle reflexes) due to peripheral nerve or spinal cord involvement.

**Aseptic meningitis:** Meningitis literally means inflammation of the meninges. The meninges are the membranous lining around the brain. Aseptic means that there are no bacteria found (in the spinal fluid). Symptoms of meningitis include fever, headache, photophobia, stiff neck and vomiting. Persons with aseptic meningitis have greater than 5 white blood cells in the spinal fluid and negative bacterial cultures.

**Encephalitis:** literally inflammation of the brain. These persons have fever and signs of central nervous system involvement, including: seizures, altered mental status, muscle weakness, sensory loss, or even movement disorders. On CT or MRI, focal or generalized swelling of the brain may be identified.

**Febrile headache:** is a self-limited illness characterized by fever and headache. Other signs and symptoms associated with this syndrome may include: rash, arthritis, weakness, vomiting and lymphadenopathy.

**Guillain-Barre Syndrome (GBS):** Caused by the body's immune system attacking peripheral nerves, the initial symptom of GBS may be numbness and tingling. The numbness and tingling usually begins in the feet and hands and progresses upwards. The patient also experiences symmetrical ascending weakness. At its peak, the person may be totally paralyzed and require mechanical ventilation. Because of its propensity for progression, GBS is considered a medical emergency and the patient must be closely monitored in the hospital. Rarely, the patient may experience descending paralysis. Treatment includes supportive care, physical therapy and plasmapheresis and high dose immunoglobulin therapy. Prognosis is good, but many patients have residual weakness after recovery.

**Microcephaly:** is a disorder where the baby's head is much smaller than normal. Microcephaly is associated with underdevelopment of the infant's brain and can result in developmental disorders, seizures, problems with movement, balance, sight and hearing. Severe microcephaly is associated with more of these problems and may be life-threatening.

**Myelitis:** inflammation of the spinal cord. The spinal cord contains nerve fibers that support motor and sensory function. Myelitis results in weakness or paralysis, sensory changes and impaired bowel or bladder function.

**Neuritis:** inflammation of a nerve. Peripheral nerves are those outside of the brain or spinal cord. Neuritis prevents the nerve from functioning normally, so the person with neuritis may lose sensory or motor function.

**Parkinson's Disease:** a neurological disorder characterized by tremor, difficulty walking, movement and coordination. Parkinsonism refers to any condition that causes a movement disorder similar to Parkinson's Disease.

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**SIADH:** syndrome of inappropriate antidiuretic hormone; results in hyponatremia (low blood sodium) due to excessive secretion of antidiuretic hormone.

### Etiologic Agent

The viruses responsible for the endemic North American arboviruses belong to three distinct families: Togaviridae, Bunyaviridae, and Flaviviridae. Zika is a flavivirus; chikungunya belongs to togavirus.

### Reservoir

Table II outlines selected medically significant arboviruses transmitted by mosquito, reservoir and mode of transmission.

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**Table II Selected Medically Important Mosquito-borne Arboviruses and Mode of Transmission.**

Virus (abbreviation)	*Mosquito	Mosquito Activity	Amplifying Hosts; i.e., Reservoir Species <sup>1</sup>	Dead-end Hosts <sup>2</sup>	Autochthonous Transmission; i.e., Humans are the Reservoir <sup>3</sup>
Chikungunya (CHIK)	<i>Aedes aegypti</i> ** <i>Aedes albopictus</i>	Day time biters; Container breeders	n/a	n/a	Yes
Dengue	<i>Aedes aegypti</i> ** <i>Aedes albopictus</i>	Day time biters; Container breeders	n/a	n/a	Yes
Eastern Equine Encephalitis (EEE)	** <i>Aedes</i> , ** <i>Coquillettidia</i> , and ** <i>Culex</i> species	Highest in and around hardwood freshwater swamps	Birds	Horses Humans	No
La Crosse Encephalitis (LAC)	** <i>Aedes triseriatus</i> ** <i>Aedes albopictus</i> , ** <i>Aedes japonicus</i>	Daytime biters; Deciduous forests; container breeders	Small rodents (chipmunks, squirrels), transovarial transmission	Humans	No
St. Louis Encephalitis (SLE)	** <i>Culex</i> species	Dusk and dawn; Container breeders Permanent or semi-permanent pools, ponds, and water containers	Birds	Humans Domestic mammals	No
Zika virus	<i>Aedes aegypti</i> ** <i>Aedes albopictus</i>	Day time biters; Container breeders	n/a	n/a	Yes

\*Mosquitoes that feed on humans or mammals. Mosquitoes that feed mostly on the amplifying host are not included.

\*\*Mosquito species found in West Virginia.

<sup>1</sup>Amplifying host: species that allows replication of the virus. The arbovirus can rise to high levels in the bloodstream of an amplifying host. A mosquito that takes a blood meal from an amplifying host picks up enough virus so that the mosquito can transmit the arbovirus the next time it bites a human. The amplifying host is the reservoir species.

<sup>2</sup>Dead-end host: species that does not allow replication of the virus to high levels. Arbovirus does NOT rise to high levels in the bloodstream of a dead-end host. A mosquito that takes a blood meal from a dead-end host CANNOT transmit the virus the next time it bites a human.

<sup>3</sup>Autochthonous transmission: transmission from human to mosquito to human. These viruses replicate in humans to such a high level such that an intermediate amplifying host is unnecessary for transmission. Humans are the ‘reservoir’ for arbovirus infections that are transmitted by autochthonous transmission.

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Powassan encephalitis is not included in Table II because it is tick-borne. Similar to some other arboviruses, POW transmission requires an intermediate amplifying host, a small to medium-sized rodent. In North America, the main transmission cycle involves *Ixodes scapularis* and white-footed mice. *Ixodes scapularis* (black-legged tick), is increasingly found in West Virginia, often bites humans and is the primary vector of Lyme disease.

### Mode of Transmission

Arboviruses are primarily spread through vectorborne transmission from the bite of an infected mosquito or infected tick (for POW only). See Table II for the primary vectors involved in human transmission.

Five additional routes of infection for West Nile include transplantation, transfusion, breastfeeding, transplacental and occupational (laboratory workers). These modes of transmission represent a very small proportion of cases. There is a theoretical concern that a person may get WNV from handling live or dead infected birds, so people should avoid bare-handed contact when handling dead animals, and use gloves or double plastic bags to place carcasses in garbage cans. ALWAYS wash your hands after handling a sick or dead animal.

Sexual transmission of Zika virus has been documented. Casual person-to-person contact does not result in arbovirus transmission.

### Incubation Period

The incubation periods for arboviruses range from 2 to 18 days, depending on the virus (Table 2).

**Table 2. Incubation period for arboviral diseases reportable in West Virginia.**

Arboviral Disease	Incubation Period (days)
Chikungunya	3-7
Eastern equine encephalitis	3-10
La Crosse encephalitis (California serogroup)	5-15
Powassan encephalitis	4-18
St. Louis encephalitis	4-14
West Nile encephalitis	5-15
Western equine encephalitis	2-10
Zika virus	3-12

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## **Period of Communicability**

Studies are currently being done on sexual transmission of Zika virus. Otherwise, there is no direct person-to-person transmission for other arboviral diseases. See *Modes of Transmission*.

## **Outbreak Recognition**

An outbreak is defined as cases over and above the expected number. Individual cases of SLE, EEE, WEE or POW will be managed by the Zoonotic Disease Program in conjunction with the Outbreak Team; clustering of these diseases would be defined as an outbreak warranting prompt public health action. Cases or clustering of emerging arboviral diseases (e.g. Zika virus) or may be treated as outbreaks given that the expected number of yearly cases has not been established. Additionally, local-transmission of travel-associated arboviral diseases would be treated as an outbreak.

## **CASE DEFINITION FOR ARBOVIRAL DISEASE (NOT INCLUDING ZIKA)**

The 2015 case definition is the most current version (CSTE Position Statement Number 14-ID-04) for the subtypes listed below. See CSTE Position Statement Number 16-ID-01 for “Zika Virus Disease” and “Congenital Zika Infection.”

## **Subtypes**

California Serogroup Viruses  
Chikungunya Virus  
Eastern Equine Encephalitis Virus  
Powassan Virus  
St. Louis Encephalitis Virus  
West Nile Virus  
Western Equine Encephalitis Virus

## **Background**

Arthropod-borne viruses (arboviruses) are transmitted to humans primarily through the bites of infected mosquitoes, ticks, sand flies, or midges. Other modes of transmission for some arboviruses include blood transfusion, organ transplantation, perinatal transmission, breast feeding, and laboratory exposures.

More than 130 arboviruses are known to cause human disease. Most arboviruses of public health importance belong to one of three virus genera: *Flavivirus*, *Alphavirus*, and *Orthobunyavirus*.

## **Clinical Description**

Most arboviral infections are asymptomatic. Clinical disease ranges from mild febrile illness to severe encephalitis. For the purpose of surveillance and reporting, based on their clinical presentation,

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arboviral disease cases are often categorized into two primary groups: neuroinvasive disease and non-neuroinvasive disease.

### ***Neuroinvasive disease***

Many arboviruses cause neuroinvasive disease such as aseptic meningitis, encephalitis, or acute flaccid paralysis (AFP). These illnesses are usually characterized by the acute onset of fever with headache, myalgia, stiff neck, altered mental status, seizures, limb weakness, or cerebrospinal fluid (CSF) pleocytosis. AFP may result from anterior ("polio") myelitis, peripheral neuritis, or post-infectious peripheral demyelinating neuropathy (i.e., Guillain-Barre' syndrome). Less common neurological manifestations, such as cranial nerve palsies, also occur.

### ***Non-neuroinvasive disease***

Most arboviruses are capable of causing an acute systemic febrile illness (e.g., West Nile fever) that may include headache, myalgias, arthralgia, rash, or gastrointestinal symptoms. Some viruses also can cause more characteristic clinical manifestations, such as severe polyarthralgia or arthritis due to Chikungunya virus or other alphaviruses (e.g., Mayaro, Ross River, O'nyong-nyong).

### **Clinical Criteria**

A clinically compatible case of arboviral disease is defined as follows:

#### ***Neuroinvasive disease***

- Meningitis, encephalitis, acute flaccid paralysis, or other acute signs of central or peripheral neurologic dysfunction, as documented by a physician, AND
- Absence of a more likely clinical explanation. Other clinically compatible symptoms of arbovirus disease include: headache, myalgia, rash, arthralgia, vertigo, vomiting, paresis and/ or nuchal rigidity.

#### ***Non-neuroinvasive disease***

- Fever (chills) as reported by the patient or a health-care provider, AND
- Absence of neuroinvasive disease, AND
- Absence of a more likely clinical explanation. Other clinically compatible symptoms of arbovirus disease include: headache, myalgia, rash, arthralgia, vertigo, vomiting, paresis and/ or nuchal rigidity.

### **Laboratory Criteria for Diagnosis**

Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, OR

- Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, OR
- Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, OR

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- Virus-specific IgM antibodies in CSF or serum.

### CASE CLASSIFICATION

#### **Probable**

##### *Neuroinvasive disease*

A case that meets the above clinical criteria for neuroinvasive disease and the following laboratory criteria:

- Virus-specific IgM antibodies in CSF or serum but with no other testing.

##### *Non-neuroinvasive disease*

A case that meets the above clinical criteria for non-neuroinvasive disease and the laboratory criteria for a probable case:

- Virus-specific IgM antibodies in serum but with no other testing.

#### **Confirmed**

##### *Neuroinvasive disease*

A case that meets the above clinical criteria for neuroinvasive disease and one or more of the following laboratory criteria for a confirmed case:

- Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, OR
- Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, OR
- Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, OR
- Virus-specific IgM antibodies in CSF, with or without a reported pleocytosis, and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred.

##### *Non-neuroinvasive disease*

A case that meets the above clinical criteria for non-neuroinvasive disease and one or more of the following laboratory criteria for a confirmed case:

- Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, or other body fluid, excluding CSF, OR
- Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, OR
- Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen.

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### Division of Infectious Disease Epidemiology

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# Arboviral Infection

## Surveillance Protocol

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### CASE DEFINITION FOR ZIKA VIRUS DISEASE AND CONGENITAL ZIKA INFECTION

The 2016 Position Statement is the most current version (CSTE Position State 16-ID-01).

#### Case Classification Narrative Describing How to Classify Cases with Zika Infection

##### *Clinical Criteria*

##### Mosquito-borne or sexually transmitted case

A person with one or more of the following:

- acute onset of fever (measured or reported)
- maculopapular rash
- arthralgia
- conjunctivitis
- complication of pregnancy
  - fetal loss in a mother with compatible illness and/or epidemiologic risk factors; or
  - in utero findings of microcephaly and/or intracranial calcifications with maternal risk factors
- Guillain-Barré syndrome not known to be associated with another diagnosed etiology.

##### Congenital case

- live birth with microcephaly or intracranial calcifications or central nervous system abnormalities

##### *Laboratory Criteria*

1. detection of ZIKV or ZIKV specific nucleic acids in specimens of serum, CSF, urine, saliva, amniotic fluid, placenta, umbilical cord, or fetal tissue, OR
2. detection of ZIKV antigen by immunohistochemical staining of maternal or fetal tissue; OR
3. detection of ZIKV specific IgM antibody in serum, CSF, or amniotic fluid; AND ZIKV neutralizing antibody titers  $\geq 4$ -fold higher than neutralizing antibody titers against dengue virus or other flaviviruses endemic to region of exposure.

##### *Epidemiologic Linkage*

- Travel to a country or region with known ZIKV transmission, OR
- Sexual contact with a laboratory confirmed case of ZIKV infection, OR
- Receipt of blood or blood products within 30 days of symptom onset; OR
- Organ transplant recipient within 30 days of symptom onset; OR
- Association in time and place with a confirmed or probable case.
- For congenital syndrome, a pregnancy with maternal epidemiologic linkage.

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# Arboviral Infection

## Surveillance Protocol

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### CASE CLASSIFICATION

#### **ZIKA VIRUS DISEASE**

##### **Clinical Criteria**

A person with one or more of the following:

- acute onset of fever (measured or reported)
- maculopapular rash
- arthralgia
- conjunctivitis
- complication of pregnancy
  - fetal loss in a mother with compatible illness and/or epidemiologic risk factors; or
  - in utero findings of microcephaly and/or intracranial calcifications with maternal risk factors
- Guillain-Barré syndrome not known to be associated with another diagnosed etiology.

##### **Probable case**

Meets clinical criteria AND

- resides in or has recently traveled to an area with ongoing ZIKV transmission, OR
- has direct epidemiologic linkage to a person with laboratory evidence of recent ZIKV infection (e.g. sexual contact, in utero or perinatal transmission, blood transfusion, organ transplantation), OR
- association in time and place with a confirmed or probable case

AND meets the following laboratory criteria:

- positive ZIKV-specific IgM antibodies in serum or CSF; and
- negative dengue virus-specific IgM antibodies; AND
  - No neutralizing antibody testing performed; or
  - Less than four-fold difference in neutralizing antibody titers between ZIKV and dengue or other flaviviruses endemic to the region where exposure occurred.

##### **Confirmed case**

Meets clinical criteria AND

Has laboratory evidence of recent ZIKV infection by:

- Detection of ZIKV by culture, viral antigen or viral RNA in serum, CSF, tissue, or other specimen (e.g. amniotic fluid, urine, semen, saliva); OR

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# Arboviral Infection

## Surveillance Protocol

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- ZIKV IgM antibodies in serum or CSF **with** ZIKV neutralizing antibody titers 4-fold or greater than neutralizing antibody titers against dengue or other flaviviruses endemic to the region where exposure occurred.

### ***ZIKA VIRUS CONGENITAL INFECTION***

#### **Clinical Criteria**

An infant with microcephaly or intracranial calcifications or other central nervous system abnormalities.

#### **Probable Case**

An infant meets the clinical criteria AND:

- Mother lived in or traveled to a country or area with ongoing ZIKV transmission during the pregnancy; OR
- Mother has laboratory evidence of ZIKV or unspecified flavivirus infection during pregnancy;

AND the infant meets the following laboratory criteria:

- ZIKV IgM antibodies detected in serum or CSF; and
- Tests negative for dengue or other endemic flavivirus-specific IgM antibodies; AND
  - No neutralizing antibody testing performed; or
  - Less than four-fold difference in neutralizing antibody titers between ZIKV and dengue or other flaviviruses endemic to the region where exposure occurred.

#### **Confirmed Case**

An infant meets the clinical criteria AND meets one of the following laboratory criteria:

- ZIKV detection by culture, antigen test, or polymerase chain reaction (PCR) in serum, CSF, amniotic fluid, urine, placenta, umbilical cord, or fetal tissue; OR
- ZIKV IgM antibodies present in serum or CSF with ZIKV neutralizing antibody titers 4-fold or greater than neutralizing antibodies against dengue or other flaviviruses endemic to the region where exposure occurred.

#### **Preventive Interventions**

There is currently no vaccine against human arboviruses. Repellants such as DEET, oil of lemon eucalyptus, IR3535 and picaridin have demonstrated efficacy against mosquitoes.

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# Arboviral Infection

## Surveillance Protocol

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Share these prevention messages with the public:

- Empty standing water in old tires, cemetery urns, buckets, plastic covers, toys, or any other container where mosquitoes may breed.
- Empty and change the water in bird baths, fountains, wading pools, rain barrels, and potted plant trays at least once a week if not more often.
- Drain or fill temporary pools with dirt.
- Keep swimming pools treated and circulating.
- Keep rain gutters unclogged.
- Use mosquito repellents according to the label directions. Apply sparingly to children before they play out of doors, and rinse children off with soap and water when they come back in. Do not apply repellent to the face and hands of young children because they may rub it in their eyes. Follow label directions and precautions closely.
- Wear long sleeves and long pants if you venture into areas with high mosquito populations.
- Make sure window and door screens are bug tight.
- Check travel advisories when traveling out of the United States to determine if mosquito-borne disease transmission is ongoing in the country of upcoming travel.

### Treatment

Supportive; no specific treatment exists for arboviral infections.

### Surveillance Indicators

1. Proportion of cases with complete clinical, laboratory, and epidemiologic information including clinical symptoms, testing, and risk factor information (e.g. travel history, outdoor activities).
2. Proportion of cases with a home visit completed for environmental evaluation, including GIS coordinates of location and patient and family education.
3. Percentage of human arboviral infection cases with positive labs with specimens forwarded by OLS to CDC for additional laboratory confirmation (e.g. PRNT).

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