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Arboviral Infection

Surveillance and Investigation Protocol

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I. ABOUT THE DISEASE

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.

A. Clinical Presentation

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.

Patients 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. The best known example is chikungunya.

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, Guillain-Barre syndrome (GBS), acute flaccid paralysis and/or syndrome of inappropriate antidiuretic hormone (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.

Arboviral hemorrhagic fevers present with a biphasic illness. The first phase of illness is like arboviral fever with fever, chills, headache, backache, muscle aches, nausea, vomiting and retro-orbital pain. After a brief remission, a minority of patients will 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)	85% symptomatic	Arboviral arthritis and rash: Fever, polyarthralgia headache, myalgia, conjunctivitis, nausea/vomiting, or maculopapular rash	0.35% of cases	n/a	Infants born to infected mothers, elderly, people with underlying conditions
Eastern equine encephalitis (EEE)	4-5% symptomatic	Arboviral fever: chills, fever, malaise, arthralgia, myalgia; Encephalitic: headache and evidence of CNS involvement; often severe	30% of cases	>50% of neuroinvasive cases	Children and the elderly
La Crosse encephalitis (LAC)	<1% symptomatic	Arboviral fever: fever, headache, nausea, vomiting, fatigue, and lethargy Encephalitic: fever, evidence of CNS involvement, seizures	< 1% of all infections; ≈ 1% of hospitalized cases	6-15% of cases	Children (primarily 15 years or younger)
St. Louis encephalitis (SLE)	<1% symptomatic	Arboviral fever: headache and fever. Encephalitic: fever, headache, encephalitis, spastic paralysis.	5-20% of cases	5-10% of cases	Elderly
West Nile encephalitis (WNV)	20% symptomatic	Arboviral fever: headache, body aches, joint pains, vomiting, diarrhea, or rash Arboviral encephalitis: fever plus encephalitis or other signs of nervous system involvement	1-9% of cases	30-60% of cases	Elderly, people with underlying conditions
Powassan (POW)	65% symptomatic	Arboviral fever: fever, headache, vomiting, weakness Arboviral encephalitis: fever plus encephalitis or other signs of nervous system involvement	10-15% of cases	50% of neuroinvasive cases	Adults

Important definitions:

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

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- **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:** Inflammation of the brain. These people have fever and signs of central nervous system involvement, including seizures, altered mental status, muscle weakness, sensory loss, or even movement disorders. On a computed tomography (CT) or magnet resonance image (MRI), focal or generalized swelling of the brain may be identified.
- **Febrile headache:** 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.
- **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 like Parkinson's Disease.
- **SIADH:** Syndrome of inappropriate antidiuretic hormone; results in hyponatremia (low blood sodium) due to excessive secretion of antidiuretic hormone.

B. Etiologic Agent

The viruses responsible for the endemic mosquito-borne arboviruses (EEE, JTC, LAC, SLE, WNV) belong to three distinct families: Togaviridae, Peribunyaviridae, and Flaviviridae. Zika virus belongs to the Flaviviridae; chikungunya virus belongs to the Togaviridae, and Oropouche virus belongs to the Peribunyaviridae. The viruses responsible for endemic tickborne disease belong to the Flaviviridae (Powassan virus), Phenuiviridae (Heartland virus) (HEA), and Orthomyxoviridae (Bourbon virus) (BOU).

C. Reservoir

Table 2 outlines selected medically significant arboviruses transmitted by mosquitoes, reservoir and mode of transmission.

Table 2. Selected Medically Important Mosquito-borne Arboviruses and Mode of Transmission.

Virus (abbreviation)	*Mosquito Vector	Mosquito Activity	Amplifying Hosts, i.e., Reservoir Species[1]	Dead-end Hosts[2]	Human to Human Transmission
Chikungunya (CHIK)	*Aedes aegypti* **Aedes albopictus*	Day time biters; Container breeders	n/a	n/a	Yes
Dengue	*Aedes aegypti* **Aedes albopictus*	Day time biters; Container breeders	n/a	n/a	Yes
Eastern Equine Encephalitis (EEE)	*Culiseta melanura,* ***Aedes*, ***Coquillettidia*, and ***Culex* species	Highest in and around hardwood freshwater swamps	Birds	Horses Humans	No
La Crosse Encephalitis (LAC)	***Aedes triseriatus* ***Aedes albopictus,* ***Aedes japonicus*	Daytime biters; Deciduous forests; container breeders	Small rodents (chipmunks, squirrels), transovarial transmission	Humans	No

St. Louis Encephalitis (SLE)	**_Culex_ species	Dusk and dawn; Container breeders Permanent or semi-permanent pools, ponds, and water containers	Birds	Humans Domestic mammals	No
West Nile Virus (WNV)	**_Culex_ species	Dusk and dawn; Container breeders Permanent or semi-Permanent pools, Ponds, and water containers	Birds	Humans Horses	No

*Mosquitoes that feed on humans or mammals. Mosquitoes that feed mostly on the amplifying host are not included.
**Mosquito species found in West Virginia.
[1]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.
[2]Dead-end host: Species that do 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.

Ticks are also competent vectors for arboviruses. Like other arboviruses, POW transmission requires both an arthropod vector, the blacklegged tick (*Ixodes scapularis*) or the groundhog tick (*Ixodes cookei*), and an intermediate amplifying host, a small to medium-sized mammal (squirrels, mice, groundhogs, opossums, skunks, raccoons). The blacklegged tick, *Ixodes scapularis,* is increasingly found in West Virginia, often bites humans, and is the primary vector of Lyme disease (*Borrelia burgdorferi*). The lone star tick (*Amblyomma americanum*) and the Asian longhorned tick (*Haemaphysalis longicornis*) are competent tick vectors for Heartland virus and Bourbon virus.

D. Incubation Period

The incubation periods for arboviruses range from 1 to 35 days, depending on the virus.

Table 3. Incubation period for arboviral diseases reportable in West Virginia.

Arboviral Disease	Incubation Period (days)
Chikungunya	1-12
Eastern equine encephalitis	4–10

La Crosse virus disease (California serogroup)	5–15
Oropouche	3-10
Powassan virus disease	7-35
St. Louis encephalitis	4–14
West Nile virus disease	2-14
Western equine encephalitis	5–10

E. Mode of Transmission

Arboviruses are primarily spread through vectorborne transmission from the bite of an infected mosquito or infected tick (for POW, HEA, and BOU). See 'Reservoir' for the primary arthropod vectors involved in human transmission.

Five additional routes of infection for West Nile include transplantation, transfusion, breastfeeding, transplacental, and occupational (laboratory workers). Additional routes of chikungunya virus transmission include transplantation, transfusion, transplacental, and occupational (laboratory worker). Oropouche virus can be transmitted through transfusion and across the placenta. 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 handing a sick or dead animal.

F. Period of Communicability

There is usually no direct person-to-person transmission of arboviral diseases. Zika virus is one of the few arboviral diseases capable of being transmitted sexually from person-to-person. Zika virus can be passed through sex from a person infected with Zika virus to their partners through vaginal, anal, and oral sex and the sharing of sex toys. Although Oropouche virus has been detected in the semen of an Oropouche patient, there have been no recorded instances of sexual transmission of Oropouche virus. Otherwise, there is no direct person-to-person transmission for other arboviral diseases. See *Mode of Transmission*.

II. DISEASE CONTROL AND PREVENTION

A. Disease Control Objectives

1. Perform or increase mosquito control activities when human arboviral cases or increased arboviral infection in mosquitoes are detected in an area.

2. Provide or increase public education when human arboviral cases or increased arboviral infection in mosquitoes are detected in an area.

B. Disease Prevention Objectives

1. Reduce disease risk through:
   a. Public education regarding the 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 human, mosquito, and tick surveillance data to provide timely notification to the public and local health departments of arboviral activity.
3. Use gloves when handling sick or dead animals for arboviral testing.
4. Wash hands after handling sick or dead animals for arboviral testing.

C. Disease Prevention and Control Intervention

1. Perform or increase mosquito control activities when human arboviral cases or increased arboviral infection in mosquitoes are detected in an area.
2. Provide or increase public education when human arboviral cases or increased arboviral infection in mosquitoes or ticks are detected in an area.

D. Treatment

Vaccines are available for some non-endemic arboviral diseases. The yellow fever vaccine has been in use since the 1930's and is recommended for international travelers travelling to yellow-fever endemic areas or laboratory personnel. Japanese encephalitis vaccine is also recommended for international travelers. Dengue vaccine is approved for individuals under 45 years of age (under 16 in the United States) with a history of dengue exposure. A vaccine providing immunity against chikungunya has been approved for adults at increased risk for chikungunya exposure. Tickborne encephalitis virus vaccine is also available for international travelers.

Treatment for arboviral disease infection is limited to supportive care.

III. DISEASE INVESTIGATION

A. Case Definition and Case Classification

Clinical Description

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

disease cases are often categorized into two primary groups based on their clinical presentation: 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
- 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.

B. Reporting Timeframe to Public Health

West Virginia Code 64CSR7 requires healthcare providers and laboratories to report arboviral disease within one week of notification.

C. Outbreak Recognition

An outbreak is defined as the number of cases are over and above the expected number. A cluster of diseases would be defined as an outbreak warranting prompt public health action. Additionally, local-transmission of travel-associated arboviral diseases is considered an outbreak.

D. Healthcare Provider Responsibilities

For reporting of endemic arboviral diseases (WNV, LAC, JTC, SLE, EEE, POW, HEA, BOU):

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 for virus-specific IgM antibodies in serum or cerebrospinal fluid (CSF). In West Virginia, appropriate endemic arbovirus testing should include EEE, JTC, LAC, SLE, WNV, POW, HEA, and BOU. Confirmatory testing may be conducted at the Centers for Disease Control and Prevention (CDC). Since there are no commercial laboratory tests available for BOU or HEA, testing of serum samples can be conducted at CDC or partner state health laboratory following consultation with the Zoonotic Disease Program and OLS.

For reporting of non-endemic arboviral diseases (e.g. chikungunya, Oropouche):

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 infection. The preferred diagnostic test is testing for virus-specific IgM antibodies in serum or cerebrospinal fluid (CSF). Some commercial laboratories perform testing for chikungunya. Testing of specimens for chikungunya and Oropouche can be conducted at CDC in coordination with OLS.

E. Laboratory Responsibilities

1. Report arboviral disease testing results to the local health department within one week. Prompt reporting may facilitate prompt public health prevention and control activities.
2. 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 EEE, JTC, LAC, SLE, WNV, POW, HEA, and BOU.

F. 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: https://oeps.wv.gov/arboviral/Pages/mbd.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. For clusters or outbreaks of arboviral diseases and emerging arboviral diseases, report immediately.
3. For non-endemic mosquito-borne arboviral disease infection:
   a. Educate the patient about the risk of transmission to others.
   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.
   a. Contact the healthcare provider that ordered the laboratory test to obtain the clinical information on the WVEDSS form.
   b. If needed, contact the patient to obtain information regarding travel history.
   c. Conduct a home visit and perform an environmental assessment to identify potential risk factors for exposure to mosquitoes to prevent additional arboviral disease cases. Information on environmental assessments near arboviral patient's residence is available at: (https://oeps.wv.gov/arboviral/documents/mosquito/lhd/Mosquito-Surveillance-Plan_Appendix1.pdf).

d. Educate the patient and the patient's family on mosquito bite prevention and other appropriate prevention messages. Additional information on mosquito bite prevention and mosquito management around the household is available at: (https://oeps.wv.gov/arboviral/Documents/mosquito/community/mbd_fact_sheet.pdf)
e. Report all case data using WVEDSS.

5. Contact the Office of Epidemiology and Prevention Services (OEPS) or Epidemiologist On-Call at (304) 558-5358 ext. 2 for guidance and management of emerging arboviral diseases.

G. State Health Responsibilities

1. Review completed 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.
4. Complete enhanced passive surveillance activities each spring. This includes release of a statewide health advisory/alert notification (HAN) to healthcare providers, a laboratory letter, a training seminar, updates to arboviral information letter, and release of a memo to local health departments.
5. Conduct mosquito surveillance activities (see mosquito surveillance protocol (https://oeps.wv.gov/arboviral/documents/mosquito/lhd/Mosquito-Surveillance-Plan.pdf) and tick surveillance activities.
6. Assure resources and equipment are available for laboratory testing and mosquito surveillance.
7. Encourage and coordinate EEE/WNV/SLE testing of dead birds with the West Virginia Division of Natural Resources and EEE/WNV testing of horses with the West Virginia Department of Agriculture.
8. Coordinate with other agencies, as needed, to monitor arboviral activity and respond to urgent situations.

H. Occupational Health

It is important to prevent exposure to arboviral diseases when conducting environmental assessments and arthropod surveillance. Individuals should cover their skin as much as possible. Wear long-sleeved shirts, long pants, socks, and a hat. Shirt should be tucked into pants and pants should be tucked into socks. In addition to covering exposed skin, repellants with DEET (at least 20%) oil of lemon eucalyptus, IR3535, or picaridin (≥20%)

should also be used. If repellant is not worn during arthropod surveillance, permethrin-treated shirts should be considered.

Bloodborne transmission of chikungunya virus and Oropouche virus is possible due to the high viremia in amplifying human hosts. Laboratory and healthcare workers have been infected with chikungunya virus after handling infected blood samples. Laboratory workers have been accidentally infected with Oropouche virus through aerosolization or ingestion of samples in the laboratory.

IV. DISEASE SURVEILLANCE

A. Public Health Significance

Arboviral diseases endemic to the continental United States and transmitted by mosquitoes include eastern equine encephalitis (EEE), Jamestown Canyon virus disease (JTC), La Crosse virus disease (LAC), Saint Louis encephalitis (SLE), West Nile virus disease (WNV), and western equine encephalitis (WEE). Arboviral diseases endemic to the continental United States and transmitted by ticks, such as Powassan virus disease (POW), Heartland virus disease (HEA), and Bourbon virus disease (BOU), have not been reported in humans in West Virginia. Chikungunya virus disease (CHIK) and Oropouche (ORO) are arboviral diseases not endemic to the continental United States.

In West Virginia, the major endemic 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 2024, with most cases occurring in the 1975 national SLE epidemic. Although JTC has never been detected in West Virginia, JTC cases have recently been recorded in neighboring Ohio, Pennsylvania, Tennessee, and North Carolina. Tickborne arboviral disease cases have not been detected in West Virginia. No human cases of Powassan virus disease have been identified in West Virginia; however, the virus was isolated from the brain of a sick fox in West Virginia in 1977 and competent tick vectors including the blacklegged tick (*Ixodes scapularis*) and the groundhog tick (*Ixodes cookei*) have been documented in multiple West Virginia counties. Although HEA has not been detected in West Virginia, human HEA cases have been identified in surrounding states (including Kentucky, North Carolina, Tennessee, and Virginia) and the competent tick vectors, including the lone star tick (*Amblyomma americanum*) and the Asian longhorned tick (*Haemaphysalis longicornis*) are established in many West Virginia counties. Like HEA, there have been no human cases of BOU but serological survey detected previous BOU

infection in white-tailed deer in neighboring North Carolina and the competent tick vector, the lone star tick (*Amblyomma americanum*) is established in West Virginia. Three travel-associated cases of chikungunya have been reported in West Virginia since 2014.

While humans are dead-end hosts for mosquito-borne arboviruses such as WNV, EEE, SLE or LAC, humans are amplifying hosts for chikungunya, dengue, and Oropouche viruses. Humans infected with chikungunya and dengue virus develop sufficient levels of viremia to infect a susceptible mosquito and the infected mosquito can then transmit the arbovirus to a susceptible human. Thus, chikungunya and dengue can be readily introduced into a new geographic area when an infected person arrives. Like chikungunya and dengue, people infected with Oropouche virus develop high enough viremic loads to infect biting midges. Public health officials should take steps to prevent horizontal transmission of chikungunya, dengue or Oropouche from an infected human to arthropod vectors from late spring to early fall.

The occurrence of arboviral disease outbreaks can be unpredictable; thus, public health officials should remain vigilant for increased arboviral activity during the summer months, which coincides with increased vector activity. Public health conducts various surveillance activities focused on detection and monitoring of arboviral diseases.

B. Disease Surveillance Objectives

1. To identify and monitor the epidemiological 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 arboviral cases.
3. To identify and characterize (by species and geographic distribution) arthropods that transmit novel or travel-associated arboviral diseases such as dengue and chikungunya.
4. To identify new or invasive arthropod species not previously identified in West Virginia that could be capable of transmitting arboviruses.
5. To provide early notification of increased arboviral infection in mosquitoes through trapping and viral testing of mosquitoes.

C. Surveillance Indicators

1. Proportion of cases with complete clinical, laboratory, and epidemiological information including clinical symptoms, testing, and risk factor information (i.e. travel history, outdoor activities.)

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