

Arboviral Disease

(except West Nile virus and Yellow Fever)

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To distinguish arboviral infections acquired locally from those related to travel.
2. To better understand the epidemiology of these infections in Washington State in order to target education and control measures.
3. To identify emerging arboviral infections in Washington.

B. Legal Reporting Requirements

1. Health care providers: notifiable to local health jurisdiction within 3 business days.
2. Health care facilities: notifiable to local health jurisdiction within 3 business days.
3. Laboratories: Arboviruses (eastern and western equine encephalitis, dengue, St. Louis encephalitis, La Crosse encephalitis, Japanese encephalitis, Powassan, California serogroup, Chikungunya) acute infection by IgM positivity, PCR positivity, and viral isolation, within 2 business days. Specimen submission is on request only.
4. Veterinarians: Suspected human cases notifiable within 24 hours to the local health jurisdiction; animal cases notifiable to Washington State Department of Agriculture (see: <http://apps.leg.wa.gov/WAC/default.aspx?cite=16-70>).
5. Local health jurisdictions: notifiable to Washington State Department of Health (DOH) Communicable Disease Epidemiology Section (CDES) within 7 days of case investigation completion or summary information required within 21 days.

C. Local Health Jurisdiction Investigation Responsibilities

1. Consult CDES about endemically acquired cases or for assistance with testing.
2. Facilitate transport of specimens (e.g., serum or CSF) to the Washington State Public Health Laboratories (PHL) if initial testing or confirmatory testing is needed. Please call CDES prior to submitting specimens (206-418-5500).
3. Report all *confirmed*, *probable*, and *suspect* cases to CDES (see definitions below). Complete the Arboviral Disease case report form (<http://www.doh.wa.gov/notify/forms/arbovirus.pdf>) and enter the data into the Public Health Issues Management System (PHIMS) as “Arboviral Disease.” Cases of West Nile virus disease and yellow fever are discussed in separate guidelines and should be reported separately in PHIMS as “West Nile Virus” and “Yellow Fever.”

2. THE DISEASE AND ITS EPIDEMIOLOGY

For information regarding West Nile virus and yellow fever, please see disease specific guidelines at <http://www.doh.wa.gov/notify/guidelines/pdf/wnv.pdf> and <http://www.doh.wa.gov/notify/guidelines/pdf/yellowfever.pdf>.

Background

Arboviral (arthropod-borne viral) diseases are transmitted by arthropods (e.g., mosquitoes, sandflies, ticks, or midges). 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 *Bunyavirus*.

Arboviral diseases include West Nile virus disease (discussed separately), eastern and western equine encephalitis, dengue, St. Louis encephalitis, La Crosse encephalitis, Japanese encephalitis, Powassan virus encephalitis, Chikungunya virus disease, yellow fever (discussed separately), and other less common infections. In addition, there are other arthropod-borne viruses that cause hemorrhagic fevers and other illnesses that are important as diseases with international importance (e.g., Rift Valley fever and Congo-Crimean hemorrhagic fever viruses); for reporting purposes they have been included under the condition “Rare Diseases of Public Health Significance”.

A. Etiological Agent

See Table 1 for selected arboviral agents (excludes West Nile virus and Yellow fever, which are discussed separately).

B. Description of Illness

Arboviral infections cause four main clinical syndromes: 1) acute central nervous system (CNS) illnesses, 2) acute benign fevers of short duration with or without rash, 3) hemorrhagic fevers, and 4) polyarthritis and rash with or without fevers (see Table 1).

C. Arboviral Diseases in Washington State

Each year, 0 to 14 cases of travel-associated dengue fever are reported in Washington residents. In 2004, one case of Japanese encephalitis was reported after travel to Thailand; a 2008 case was reported in a traveler who visited Cambodia and Vietnam. Chikungunya cases have been reported in travelers to Sri Lanka (2006), Indonesia (two in 2010), and East Timor (2010). In 2009, a Toscana virus case was reported in a traveler returning from Italy, and a case of St. Louis encephalitis (SLE) was reported in a person who visited Arizona.

Other than West Nile virus, the last reported human illness due to an arboviral infection acquired in Washington State was western equine encephalitis in 1988. SLE has also occurred in Washington, primarily in the central valleys east of the Cascade Mountains. SLE infections were detected in sentinel chickens in Benton county in 2005 (Source: DOH Environmental Health-Zoonotic Disease Program).

D. Vectors and Reservoirs

Most arboviruses are maintained in enzootic cycles involving arthropods and birds or small mammals. Humans are usually “dead end hosts,” in that they do not contribute to the spread of the virus. However, some arboviral infections (e.g., dengue, yellow fever) can be indirectly spread from one person to another by a mosquito.

E. Modes of Transmission

Arboviruses are most commonly transmitted by the bites of arthropods (e.g., mosquitoes, ticks, flies, or midges). Some arboviruses have been shown to be transmitted on rare

occasions through blood transfusions, organ transplantation, consumption of unpasteurized dairy products, breast feeding, and laboratory exposures; rare transmission has also been reported transplacentally (perinatal transmission).

F. Incubation Period

Varies with agent. See Table 1.

G. Period of Communicability

Except for rare cases of transplacental transmission, organ transplantation, or blood transfusion, most arboviruses are transmitted by an arthropod vector from animal to human. Dengue and yellow fever are exceptions because mosquitoes can transmit the virus from one viremic human to an uninfected human. For dengue, human patients can infect mosquitoes during their period of high viremia, usually 3-5 days before fever onset until the fever subsides.

H. Treatment

Treatment is supportive.

Table 1: Geographic Distribution and Clinical Characteristics of Selected Arboviral Infections*

Note that separate guidelines are available for both West Nile virus and Yellow fever.

Disease (Etiologic agent)	Arthropod	Geographic distribution	Incubation period	Clinical syndrome
California serogroup viral encephalitis (La Crosse, Jamestown Canyon, Keystone, Snowshoe hare, Trivittatus, and California encephalitis viruses)	Mosquito	Widespread in the United States and Canada; most prevalent in upper Midwest; also South America, Europe, Asia	5–15 days	Encephalitis
Chikungunya fever (Chikungunya virus)	Mosquito	Africa; Asia	3–11 days	Fever, arthralgia, rash (hemorrhage rare)
Colorado tick fever (Colorado tick fever virus)	Tick	Western United States and Canada	1–14 days	Febrile illness rarely accompanied by encephalitis or myocarditis
Dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS) (dengue viruses)	Mosquito	Tropical areas worldwide: Caribbean, Central and South America, Asia, Australia, Oceania, Africa; recently reported from Florida	Commonly 4–7 days (range: 3-14 days)	Febrile illness; hemorrhagic fever and shock (particularly with second infection)
Eastern equine encephalitis (EEE virus)	Mosquito	Eastern seaboard and Gulf states of the United States; Canada; South and Central America	3–10 days	Encephalitis
Japanese encephalitis (Japanese encephalitis virus)	Mosquito	Asia; Pacific Islands; Northern Australia	5–15 days	Encephalitis, fever

Powassan encephalitis (Powassan encephalitis virus)	Tick	Canada; northeastern, north central, and western United States; Russian Federation	4–18 days	Encephalitis
St. Louis encephalitis (SLE virus)	Mosquito	Central, southern, northeastern and western United States ; Manitoba and southern Ontario ; Caribbean area; South America	4–14 days	Encephalitis, fever
Venezuelan equine encephalitis (VEE virus)	Mosquito	Central and South America; southern United States	1–4 days	Fever, encephalitis
Western equine encephalitis (WEE virus)	Mosquito	Central and western United States; Canada; Argentina, Uruguay, Brazil	2–10 days	Fever, encephalitis

*Sources:

American Academy of Pediatrics. Arboviruses. In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. *Red Book: 2006 Report of the Committee on the Infectious Diseases*. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006:212–14.

Arthropod-borne Viral Diseases. In: Heymann DL, ed. *Control of Communicable Diseases Manual*. 18th ed. Washington D.C.: American Public Health Association; 2004: 31–34.

3. CASE DEFINITION

NOTE: - **West Nile** and **yellow fever** are discussed in **separate guidelines**;
- **Dengue** is discussed in **Section 3B of this guideline**.

A. Neuroinvasive and Non-Neuroinvasive Domestic Arboviral Diseases (2011)

1. Clinical Description (for Dengue, see Section 3B)

Most arboviral infections are asymptomatic. Clinical disease ranges from mild febrile illness to severe encephalitis. For the purposes of surveillance and reporting, 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 stiff neck, altered mental status, seizures, limb weakness, cerebrospinal fluid (CSF) pleocytosis, or abnormal neuroimaging. AFP may result from anterior ("polio") myelitis, peripheral neuritis, or post-infectious peripheral demyelinating neuropathy (i.e., Guillain-Barré 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 that may include headache, myalgias, arthralgias, rash, or gastrointestinal symptoms. Rarely, myocarditis, pancreatitis, hepatitis, or ocular manifestations such as chorioretinitis and iridocyclitis can occur.

2. Clinical Criteria for Diagnosis (for Dengue, see Section 3B)

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

Neuroinvasive disease

- Fever ($\geq 100.4^{\circ}\text{F}$ or 38°C) as reported by the patient or a health-care provider, **AND**
- 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.

Non-neuroinvasive disease

- Fever ($\geq 100.4^{\circ}\text{F}$ or 38°C) as reported by the patient or a health-care provider, **AND**
- Absence of neuroinvasive disease, **AND**
- Absence of a more likely clinical explanation.

3. Laboratory Criteria for Diagnosis (*for Dengue, see Section 3B*)

Confirmatory:

- 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 immunoglobulin M (IgM) antibodies in serum with confirmatory* virus-specific neutralizing antibodies in the same or a later specimen, **OR**
- Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred.

Presumptive:

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

***Arboviral serologic assays:** Assays for the detection of IgM and IgG antibodies commonly include enzyme-linked immunosorbent assay (ELISA), microsphere immunoassay (MIA), or immunofluorescence assay (IFA). These assays provide a presumptive diagnosis and should have confirmatory testing performed. Confirmatory testing involves the detection of arboviral-specific neutralizing antibodies utilizing assays such as plaque reduction neutralization test (PRNT).

4. Case Definition (*for Dengue, see Section 3B*)

Confirmed:

- Neuroinvasive: a case that meets the clinical criteria for neuroinvasive disease and one or more of the confirmatory laboratory criteria.
- Non-neuroinvasive: a case that meets the clinical criteria for non-neuroinvasive disease and one or more of the confirmatory laboratory criteria.

Probable:

- Neuroinvasive: a case that meets the clinical criteria for neuroinvasive disease and the presumptive laboratory criterion.
- Non-neuroinvasive: a case that meets the clinical criteria for non-neuroinvasive disease and the presumptive laboratory criterion.

5. Comments on Interpreting Arboviral Laboratory Results

- **Serologic cross-reactivity.** In some instances, arboviruses from the same genus produce cross-reactive antibodies. In geographic areas where two or more closely-related arboviruses occur, serologic testing for more than one virus may be needed and results compared to determine the specific causative virus. For example, such testing might be needed to distinguish antibodies resulting from infections from viruses within a genus, e.g., flaviviruses such as West Nile, St. Louis encephalitis, Powassan, Dengue, or Japanese encephalitis viruses.
- **Rise and fall of IgM antibodies.** For most arboviral infections, IgM antibodies are generally first detectable at 3 to 8 days after onset of illness and persist for 30 to 90 days, but longer persistence has been documented (e.g, up to 500 days for West Nile virus). Serum collected within 8 days of illness onset may not have detectable IgM and testing should be repeated on a convalescent-phase sample to rule out arboviral infection in those with a compatible clinical syndrome.
- **Persistence of IgM antibodies.** Arboviral IgM antibodies may still be detected in some patients months or years after their acute infection. Therefore, the presence of these virus-specific IgM antibodies may signify a past infection and be unrelated to the current acute illness. Finding virus-specific IgM antibodies in CSF or a fourfold or greater change in virus-specific antibody titers between acute- and convalescent-phase serum specimens provides additional laboratory evidence that the arbovirus was the likely cause of the patient's recent illness. Clinical and epidemiologic history also should be carefully considered.
- **Persistence of IgG and neutralizing antibodies.** Arboviral IgG and neutralizing antibodies can persist for many years following a symptomatic or asymptomatic infection. Therefore, the presence of these antibodies alone is only evidence of previous infection and clinically compatible cases with the presence of IgG, but not IgM, should be evaluated for other etiologic agents.
- **Other information to consider.** Vaccination history, detailed travel history, date of onset of symptoms, and knowledge of potentially cross-reactive arboviruses known to circulate in the geographic area of exposure should be considered when interpreting results.
- **Imported arboviral diseases.** Many exotic arboviruses (e.g., Dengue, Chikungunya, Japanese encephalitis, Tick-borne encephalitis, Venezuelan equine encephalitis, and Rift Valley fever viruses) are potential public health risks for the United States as competent vectors exist that could allow for sustained transmission upon establishment of imported arboviral pathogens. Healthcare providers and public health officials should maintain a high index of clinical suspicion for cases of potentially exotic or unusual arboviral etiology, particularly in international travelers. If a suspected case occurs, it should be reported to the local health jurisdiction, then to Communicable Disease Epidemiology Section for reporting to Centers for Disease Control and Prevention (CDC).

B. Dengue Fever, Dengue Hemorrhagic Fever, Dengue Shock Syndrome (2010)

1. Clinical Description

- **Dengue Fever (DF)** is an acute febrile illness defined by the presence of fever and two or more of the following, retro-orbital or ocular pain, headache, rash, myalgia, arthralgia, leukopenia, or hemorrhagic manifestations (e.g., capillary fragility, petechiae; purpura/ecchymosis; epistaxis; gum bleeding; blood in vomitus, urine, or stool; or vaginal bleeding) but not meeting the case definition of dengue hemorrhagic fever. Anorexia, nausea, abdominal pain, and persistent vomiting may also occur but are not case-defining criteria for DF.
- **Dengue Hemorrhagic Fever (DHF)** is characterized by all of the following:
 - Fever lasting from 2-7 days, **AND**
 - Evidence of hemorrhagic manifestation or capillary fragility (i.e., a positive tourniquet test) , **AND**
 - Thrombocytopenia ($\leq 100,000$ cells per mm^3), **AND**
 - Evidence of plasma leakage shown by hemoconcentration (an increase in hematocrit $\leq 20\%$ above average for age or a decrease in hematocrit $\leq 20\%$ of baseline following fluid replacement therapy), OR pleural effusion, ascites or hypoproteinemia.
- **Dengue Shock Syndrome (DSS)** has all of criteria for DHF plus circulatory failure as evidenced by:
 - Rapid and weak pulse and narrow pulse pressure (< 20 mmHg), **OR**
 - Age-specific hypotension and cold, clammy skin and restlessness.

2. Laboratory Criteria for Diagnosis (*Dengue only*)

Confirmatory:

- Isolation of dengue virus or demonstration of specific arboviral antigen or genomic sequences in tissue, blood, cerebrospinal fluid (CSF), or other body fluid by polymerase chain reaction (PCR) test, immunofluorescence or immunohistochemistry, **OR**
- Seroconversion from negative dengue virus-specific serum immunoglobulin M (IgM) antibody in an acute phase specimen (collected ≤ 5 days after symptom onset) to positive dengue-specific serum IgM antibodies in a convalescent-phase specimen (collected ≥ 5 days after symptom onset), **OR**
- Four-fold or greater rise in reciprocal immunoglobulin G (IgG) antibody titer or hemagglutination inhibition titer to dengue virus antigens in paired acute and convalescent serum samples, **OR**
- Four-fold or greater difference in neutralizing antibody titers by plaque reduction neutralization test (PRNT) between dengue viruses and other flaviviruses tested in a single convalescent serum sample, **OR**
- Virus-specific IgM antibodies demonstrated in CSF.

Presumptive:

- Dengue-specific IgM antibodies present in a single serum with a P/N ratio ≥ 2 .*

***P/N ratio:** The P/N (positive to negative) ratio is the optical density (OD) of the test specimen over the OD of the control. Many commercial laboratories use a similar ratio calculation, but with different dilutions and variations on the control specimen, thus they report it differently. When a P/N ratio is not specifically reported, then use the test value and the reference range reported by the individual lab. It should be considered a positive result if the commercial laboratory reports the value within their positive reference range.

3. Exposure (*Dengue only*)

Criteria for epidemiologic linkage are dependent upon exposure, which is defined as:

- Travel to an dengue endemic country or presence at location with ongoing outbreak of dengue-like illness within two weeks of illness onset, OR
- Association in time and place with a confirmed or probable dengue case.

4. Case Definition (*Dengue only*)

Suspect: a clinically compatible case of DF, DHF or DSS that is epidemiologically linked to a confirmed case.

Probable: a clinically compatible case of DF, DHF, or DSS with laboratory results indicative of presumptive infection.

Confirmed: a clinically compatible case of DF, DHF, or DSS with confirmatory laboratory results.

5. Comment

An asymptomatic blood or tissue donor is defined as having dengue virus-specific viral antigen or genomic sequences demonstrated in donated blood or organs during screening and confirmatory testing in the absence of symptoms in the donor.

Dengue viruses are flaviviruses and have sufficient antigenic similarity to yellow fever virus, Japanese encephalitis virus, and West Nile virus that previous infection or vaccination may raise cross-reactive serum antibodies. In such situations, the result of ELISA testing may be unreliable and PRNT may be needed to correctly identify the infecting virus. However, high-titers of cross-reactive antibody produced from multiple previous flavivirus infections cannot be resolved by PRNT.

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

Laboratory diagnosis is primarily made by detection of viral specific antibodies in serum or CSF. See Section 3A (5) for additional information about serologic testing.

B. Tests Available at the Washington State Health Public Health Laboratories (PHL)

PHL can test for West Nile virus (WNV)-specific and St. Louis encephalitis (SLE) virus-specific IgM antibody in serum or CSF by microsphere immunoassay (MIA). In certain cases (e.g. inconclusive results), PHL will send samples to the CDC for additional testing by plaque reduction neutralization (PRNT) test. See WNV guidelines for additional information.

PHL sends specimens to the CDC for all other arboviral tests including Dengue.

Note that PHL require all clinical specimens have two patient identifiers, a name **and** a second identifier (e.g., date of birth) both on the specimen label and on the submission form. Due to laboratory accreditation standards, specimens will be rejected for testing if not properly identified. Also include specimen source and collection date.

C. Specimen Collection

Serum and/or CSF should be refrigerated and transported cold. Specimens should be submitted with a completed PHL Serology/Virology form (<http://www.doh.wa.gov/EHSPHL/PHL/Forms/SerVirHIV.pdf>).

Please call DOH Communicable Disease Epidemiology Section (206-418-5500) to request testing and obtain shipping instructions for specimens other than serum or CSF.

5. ROUTINE CASE INVESTIGATIONS

Interview the case and others who may be able to provide pertinent information.

A. Evaluate the Diagnosis

If the case tests positive for an arboviral infection at a laboratory other than Public Health Laboratories (PHL), discuss the need to perform confirmatory testing with DOH Communicable Disease Epidemiology Section (206-418-5500). As needed, facilitate transport of the specimen (e.g., serum or CSF) to PHL for further testing.

Evaluate whether the patient had a previous infection with West Nile or another arboviral disease or was vaccinated for an arboviral disease (e.g., Japanese encephalitis, tick-borne encephalitis, or yellow fever).

B. Identify Potential Sources of Infection

Obtain a detailed travel history, including specific locations and travel dates, and ask about arthropod exposures during the likely exposure period. In addition, ask about receiving blood products or about organ or tissue transplants.

C. Identify Potentially Exposed Persons

Identify others who traveled with the patient. Determine if the patient donated blood or organs, breastfed, or gave birth in the month preceding illness onset. If the patient donated blood or organs, inform the blood or tissue bank of the potential exposure. In cases of potential mother-to-infant transmission, monitor the infant for compatible signs and symptoms.

D. Environmental Evaluation

Notify local environmental health program and/or vector control of locally acquired cases. In outbreak settings, an investigation may assist in identifying and controlling factors favoring transmission.

6. CONTROLLING FURTHER SPREAD

A. Infection Control

1. Hospitalized patients should be treated with standard precautions.
2. Infected persons should be advised not to donate blood, tissues or organs.

3. Infected lactating women should discuss breast-feeding with their medical care provider.
4. Patients being treated for acute dengue fever in the United States should be sequestered from mosquitoes while viremic to avoid urban transmission. Given that *Ae. aegypti*, the principle mosquito vectors, are not endemic to Washington State, the risk of the case infecting mosquitoes which could subsequently infect other humans is very low. However, endemic dengue infections were recently identified in Florida.

B. Case Management

No case follow-up needed.

C. Contact Management

None, since arboviral infections are not transmitted from person-to-person.

D. Management of Other Exposed Persons

Instruct others persons potentially exposed to the same source to seek medical attention if symptoms of arboviral disease develop.

E. Environmental Measures

Environmental measures to reduce local arboviral transmission may include the elimination of mosquito breeding habitats and the use of chemical (i.e., pesticides) and biological controls. Consult with local environmental health or vector/mosquito control programs to determine appropriate intervention measures.

7. MANAGING SPECIAL SITUATIONS

Not applicable

8. ROUTINE PREVENTION

A. Immunization Recommendations

Japanese Encephalitis Vaccine

Persons planning to travel or reside in areas where Japanese encephalitis is endemic or epidemic should consult with a travel medicine health provider regarding the need for Japanese encephalitis vaccine.

To learn more about vaccine indications, contraindications and side effects, see the CDC website (<http://www.cdc.gov/ncidod/dvbid/jencephalitis/qa.htm>) and the recommendations from the ACIP (Centers for Disease Control and Prevention).

Inactivated Japanese Encephalitis Virus Vaccine Recommendations of the Advisory Committee on Immunization Practices [ACIP], MMWR. Jan. 8, 1993;42:11. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/00020599.htm>).

B. Prevention Recommendations

To prevent arboviral diseases, persons should avoid arthropod bites by:

- Wearing a long sleeve shirt, long pants, and a hat when going into mosquito- or tick-infested areas, such as wetlands or woods. Tuck pant legs into socks or boots and shirts into pants to keep ticks on the outside of clothing where they can be more easily spotted and removed.

- Using mosquito repellent when necessary. The most effective mosquito repellents contain the EPA approved active ingredients DEET (N, N-diethyl-m-toluamide), Picaridin, oil of lemon eucalyptus, or IR3535. Read and follow instructions on the label. Permethrin is another long-lasting repellent that is intended for application to clothing and gear, but not directly to skin. In general, the more active ingredient (higher concentration) a repellent contains, the longer time it protects against mosquito bites. Do not over use repellents. Take special care when using repellent on children.
- When traveling, using mosquito bed nets when exposure to mosquitoes may occur at night.
- Additional information regarding the use of repellents can be found on the CDC website at: http://www.cdc.gov/ncidod/dybid/westnile/qa/insect_repellent.htm and <http://www.cdc.gov/ncidod/dybid/westnile/RepellentUpdates.htm>.

Persons traveling to arboviral endemic areas should consult with a travel clinic health care provider regarding additional measures which should be taken in specific areas.

ACKNOWLEDGEMENTS

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UPDATES

July 2008: In Section 2C, the number of dengue fever cases reported each year was changed from 0–8 to 0–10. In Section 8B, IR3535 was added as a safe and effective mosquito repellent.

March 2010: In Section 1B, requirements for the veterinarian were clarified to distinguish animal and human case reporting. In Section 1C, reporting of suspect cases was included (to reflect new 2010 CSTE dengue case definition). Section 3A was revised to include a clinical illness description and to differentiate the laboratory criteria for diagnosis from the case definitions. In Section 3B, the dengue case definition was updated. Sections 4B and 4C, the laboratory testing available at PHL was updated. In Section 5, case investigation guidelines were amended.

January 2011: The Legal Reporting Requirements section has been revised to reflect the 2011 Notifiable Conditions Rule revision. In section 2, modes of transmission were updated (E) and the CAL serogroup was updated in Table 1. Section 3A was completely replaced to reflect the 2011 CSTE case definition for Arboviral disease (non-Dengue). In Section 3B, the laboratory criteria were updated to clarify the requirements for P/N ratio. Section 4B was modified to reflect current test availability at PHL as of November 2010.