



# Dengue Virus Infections Investigation Guideline

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• Fact Sheet (vs. 09/2014)	
• Dengue CDC Testing Policy (vs. 1/2012)	

## Revision History:

Date	Replaced	Comments
01/2015	12/2009	Added notification section and table of contents. Updated Laboratory Analysis Section. More details added to Investigators Responsibilities and Data Management. Reformatted Standard Case Investigation section to assist with EpiTrax system data entry. Reformatted fact sheet.

# Dengue

## Disease Management and Investigative Guidelines

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### CASE DEFINITION (CDC 2015)

#### Clinical Description for Public Health Surveillance:

Dengue defined by fever as reported by the patient or healthcare provider and the presence of one or more of the following signs and symptoms:

- Nausea/vomiting
- Rash
- Aches and pains (e.g., headache, retro-orbital pain, joint pain, myalgia, arthralgia)
- [Tourniquet test](#) positive
- Leukopenia (a total white blood cell count of  $<5,000/\text{mm}^3$ ), or
- Any warning sign for severe dengue:
  - Abdominal pain or tenderness
  - Persistent vomiting
  - Extravascular fluid accumulation (e.g., pleural or pericardial effusion, ascites)
  - Mucosal bleeding at any site
  - Liver enlargement  $>2$  centimeters
  - Increasing hematocrit concurrent with rapid decrease in platelet count

#### Laboratory Criteria for Case Classification:

##### Confirmatory:

- Detection of DENV nucleic acid in serum, plasma, blood, cerebrospinal fluid (CSF), other body fluid or tissue by validated reverse transcriptase-polymerase chain reaction (PCR), or
- Detection of DENV antigens in tissue by a validated immunofluorescence or immunohistochemistry assay, or
- Detection in serum or plasma of DENV NS1 antigen by a validated immunoassay; or
- Cell culture isolation of DENV from a serum, plasma, or CSF specimen; or
- Detection of IgM anti-DENV by validated immunoassay in a serum specimen or CSF in a person living in a dengue endemic or non-endemic area of the United States without evidence of other flavivirus transmission (e.g., WNV, SLEV, or recent vaccination against a flavivirus (e.g., YFV, JEV)); or
- Detection of IgM anti-DENV in a serum specimen or CSF by validated immunoassay in a traveler returning from a dengue endemic area without ongoing transmission of another flavivirus (e.g., WNV, JEV, YFV), clinical evidence of co-infection with one of these flaviviruses, or recent vaccination against a flavivirus (e.g., YFV, JEV); or
- IgM anti-DENV seroconversion by validated immunoassay in acute (i.e., collected  $<5$  days of illness onset) and convalescent (i.e., collected  $>5$  days after illness onset) serum specimens; or
- IgG anti-DENV seroconversion or  $\geq 4$ -fold rise in titer by a validated immunoassay in serum specimens collected  $>2$  weeks apart, and confirmed by a neutralization test (e.g., plaque reduction neutralization test) with a  $>4$ -fold higher end point titer as compared to other flaviviruses tested..

**Presumptive/Probable:**

- Detection of IgM anti-DENV by validated immunoassay in a serum specimen or CSF in a person living in a dengue endemic or non-endemic area of the United States with evidence of other flavivirus transmission (e.g., WNV, SLEV), or recent vaccination against a flavivirus (e.g., YFV, JEV).
- Detection of IgM anti-DENV in a serum specimen or CSF by validated immunoassay in a traveler returning from a dengue endemic area with ongoing transmission of another flavivirus (e.g., WNV, JEV, YFV), clinical evidence of co-infection with one of these flaviviruses, or recent vaccination against a flavivirus (e.g., YFV, JEV).

**Suspected:**

- The absence of IgM anti-DENV by validated immunoassay in a serum or CSF specimen collected <5 days after illness onset and in which molecular diagnostic testing was not performed in a patient with an epidemiologic linkage.

**Epidemiologic Linkage:**

- Travel to a dengue endemic country or presence at location with ongoing outbreak within previous two weeks of onset of an acute febrile illness or dengue, or
- Association in time and place (e.g., household member, family member, classmate, or neighbor) with a confirmed or probable dengue case.

**Criteria to Distinguish a New Case from an Existing Case:**

- A person with two clinical episodes of dengue occurring at least two weeks apart and shown to be due to different infecting DENV-types confirmed by molecular diagnostic testing would be classified as two different cases.
- The same person diagnosed only by IgM anti-DENV on the second episode would have to occur >90 days apart to be classified as two different cases, due to the persistence of detectable IgM anti-DENV for ~90 days.

**Exposure:**

- During the two weeks prior to onset of fever, travel to a dengue endemic country or presence in a location experiencing an ongoing dengue outbreak, OR
- Association in time and place with a confirmed or probable dengue case.

**Endemicity:**

- In the United States: the largest burden is in the territories of Puerto Rico and the U.S. Virgin Islands.
- Other areas of the US where dengue is or has been endemic include American Samoa, the Northern Marianas, and Guam.

### **Subtype(s) of case definition:**

- Dengue-like illness: illness defined by fever as reported by the patient or healthcare provider.
- Severe dengue: dengue with any or more of the following scenarios:
  - Severe plasma leakage evidenced by hypovolemic shock and/or extravascular fluid accumulation with respiratory distress possibly with an abnormally high hematocrit value.
  - Severe bleeding from the gastrointestinal tract or vagina which requires medical intervention including fluid resuscitation or blood transfusion.
  - Severe organ involvement, including any of the following:
    - Elevated liver transaminases: aspartate aminotransferase (AST) or alanine aminotransferase (ALT)  $\geq$  1,000 per liter (U/L)
    - Impaired level of consciousness and/or diagnosis of encephalitis, encephalopathy, or meningitis
    - Heart or other organ involvement including myocarditis, cholecystitis, and pancreatitis

### **Case Classification:**

#### **Suspected**

A clinically compatible case of dengue-like illness, dengue, or severe dengue with an epidemiologic linkage, as defined above.

#### **Probable**

A clinically compatible case of dengue-like illness, dengue, or severe dengue with laboratory results indicative of probable infection, as defined above.

#### **Confirmed**

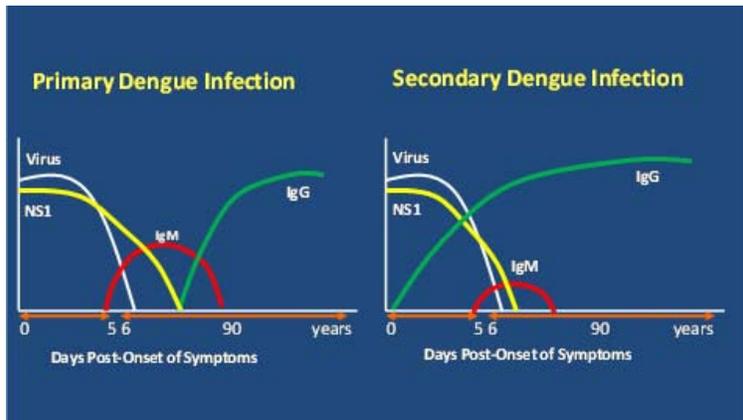
A clinically compatible case of dengue-like illness, dengue, or severe dengue with confirmatory laboratory results, as defined above.

## **LABORATORY ANALYSIS**

Laboratory diagnosis of suspected dengue specimens involves isolation of the virus, serological tests, or molecular methods. The immunological response varies between primary and secondary infections. It should also be noted that Dengue viruses have sufficient antigenic similarity to other flaviviruses, including yellow fever virus, Japanese encephalitis virus, and West Nile virus, that previous infection or vaccination may raise cross-reactive serum antibody levels and false positive results.

Among US residents, most testing for dengue is done through private clinical laboratories using IgM or IgG detection techniques. It is assumed that only a small proportion of the US population has evidence of previous flavivirus infection (or vaccination) so cross-reactive flavivirus antibodies should not be a significant limitation to dengue diagnosis among most US travelers, but the investigator should always inquire to the possibility of flavivirus infections or vaccinations.

**Figure 1: Immunological Response to Dengue Infection**



Source:  
[www.cdc.gov/Dengue/clinical\\_lab/laboratory.html](http://www.cdc.gov/Dengue/clinical_lab/laboratory.html)

The algorithms below will assist with interpretations.

**Real time PCR:** detects dengue virus in the blood (serum) within the first 5 days of symptoms. Positive result is definite proof of current infection. Negative result is “indeterminate.” Negative results should be followed by a second serum sample collected after the 5<sup>th</sup> day of illness for serological confirmation.

**MAC ELISA (IgM antibody):** Most common method used in diagnostic/commercial laboratory. Limitation is cross reactivity to flaviviruses. According to the Pan American Health Organization (PAHO) guidelines, 80% of all dengue cases have detectable IgM antibody by day five of illness, and 93-99% of cases have detectable IgM by day six to ten of illness, which may then remain detectable for over 90 days. Confirmatory when acute specimen ( $\leq 5$  days from onset) is negative and convalescent specimen (collected  $>5$  days from onset) is positive. A single positive IgM collected  $\geq 5$  days from onset is presumptive evidence. A fourfold rise in IgM titer in paired specimens collected  $>5$  days from onset is confirmatory. IgM titers may not be detectable in secondary dengue infection.

**IgG ELISA:** Used for the detection of a past dengue infection. In general, IgG ELISA lacks specificity within the flavivirus serocomplex groups. Samples with a negative IgG in the acute phase and a positive IgG in the convalescent phase of the infection are primary dengue infections. Samples with a positive IgG in the acute phase and a fourfold rise in IgG titer in the convalescent phase (with at least a 7 day interval between the two samples) is a secondary dengue infection.

**Non-structural protein 1 (NS1) ELISA:** Dengue NS1 antigen has been detected in the serum of infected patients as early as 1 day and up to 18 days after symptom onset. The NS1 ELISA based antigen assay is commercially available. The NS1 assay may also be useful for differential diagnostics between flaviviruses because of the specificity of the assay.

**Plaque Reduction Neutralization Test (PRNT):** Can often resolve cross-reactive serum antibodies in this situation when serological specific diagnostic is required. a. However, high-titered cross-reactive antibody levels produced from multiple previous flavivirus infections cannot be resolved by PRNT.

### **Testing through the CDC Dengue Branch**

CDC Dengue Branch, San Juan, Puerto Rico will provide dengue testing free of cost to submitting physicians, state and private laboratories if certain criteria are met.

- 1) A call to KDHE Bureau of Epidemiology and Public Health Informatics (BEPHI) at 877-427-7317 **before** sending any samples.
- 2) A review of the clinical diagnosis to ensure presence of an acute febrile picture with headache, retro-orbital pain, body pain, often a rash, and other variable symptoms that can include obvious or mild hemorrhagic manifestations or hemoconcentration, shock or coma.
- 3) Submission of a clear [Dengue Case Investigation Report](#) with the following\*:
  - Complete name, age, and sex of patient
  - Home address
  - Date of onset of symptoms
  - Date that sample was obtained
  - Complete name and mailing address of physician, laboratory, clinic or hospital that result should be sent to.

**\* *Samples with the above-mentioned information missing, or written with illegible handwriting or with more than a month from date of sample collection to date of arrival at CDC, will not be analyzed.***

- Specimen: Blood or serum in a red top tube. Acute and convalescent specimens do not need be sent together.
- Collection: [KHEL Multi-tube bottle with mailing box](#) and Serum Separator Tubes (SST) (red or tiger-top tube)
- Volume: 2 cc (ml.) of centrifuged serum
- Storage: On ice or in refrigerator (not in a freezer) until it is delivered to CDC Dengue Branch. Any specimens stored greater than a month prior to arrival at CDC will not be tested.
- Timing of collection for serology: Acute obtained up to 5 days after onset of symptoms; convalescent 6 or more days after onset of symptoms. (Collect only a convalescent if more than 6 days have passed since onset.)
- Test results are normally available 3 days (PCR) to 1 week (serology) after specimen receipt. During periods of a severe dengue epidemic it may be necessary to prioritize testing based on the severity of disease. **A severe case that is hospitalized should be indicated on the form to ensure that testing occurs.**
- For additional information and/or questions, call (785) 296-1620 or refer to online guidance at [www.cdc.gov/Dengue/resources/TestpolEng\\_2.pdf](http://www.cdc.gov/Dengue/resources/TestpolEng_2.pdf) or refer to the attached [CDC instructions](#).

## EPIDEMIOLOGY

The transport of *Aedes* mosquitoes in cargo during WWII influenced the dissemination of dengue viruses from geographically restricted locations in Africa or Southeast Asia where they originated in monkeys and were transmitted to humans 100 to 800 years ago. The Philippines and Thailand documented DHF epidemics in the 1950s. *Aedes* control programs in place until the early 1970s prevented the Caribbean and Latin America from experiencing large numbers of DHF cases until 1981. Today, dengue is endemic in at least 100 countries in Asia, the Pacific, the Americas, Africa, and the Caribbean. The World Health Organization (WHO) estimates that annually 50 to 100 million infections occur, including 500,000 DHF cases and 22,000 deaths, mostly among children. Nearly all dengue cases reported in the 48 continental states were acquired elsewhere by travelers or immigrants. Most dengue cases in U.S. citizens occur in Puerto Rico, U.S. Virgin Islands, Samoa and Guam. In Puerto Rico, and most of the Caribbean Basin, *Aedes aegypti* is abundant year-round. Dengue transmission in the Puerto Rico follows a seasonal pattern. Low transmission season begins in March and lasts until June, and high transmission begins in August until November.

## DISEASE OVERVIEW

### A. Agent:

Any one of four closely related viruses, or serotypes: dengue 1-4.; flaviviruses.

### B. Clinical Description:

Illness can range from a mild, non-specific febrile syndrome (dengue-like illness) to classic dengue fever (DF), to rare but potentially fatal forms of the disease, dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS).

Younger children and those with their first dengue infection have a milder illness than older children and adults.

Classic DF is an acute febrile illness characterized by frontal headache, retro-ocular pain, muscle, bone and joint pain and rash. Mild bleeding of nose or gums or easy bruising may be noticed.

DHF may manifest after a 2-7 day febrile phase. After the fever is gone, symptoms including persistent vomiting, severe abdominal pain, and difficulty breathing, may develop at the beginning of a critical phase where the capillaries are excessively permeable with plasma leaking into the peritoneum (ascites) and pleural cavity (pleural effusions). If not corrected, this can be followed by DSS and death.

The critical (severe) phase is marked by a low platelet count and hemorrhagic manifestations, tendency to bruise easily or other types of skin hemorrhages, bleeding nose or gums, and possibly internal bleeding. The critical phase lasts for 24-48 hours. The convalescence phase begins with a sudden arrest of plasma leak with concomitant reabsorption of plasma and fluids.

**C. Reservoirs:**

Include human/*Aedes aegypti* mosquito cycle in tropical urban centers and monkey/mosquito cycle in the forests of southeastern Asia and western Africa. (A 2001 outbreak in Hawaii was associated with the *Aedes albopictus*.)

**D. Mode(s) of Transmission:**

Bite of infected mosquitoes. No direct person-to-person spread. Because contact between *Aedes* and people is infrequent in the continental U.S., imported cases rarely result in secondary transmission. Other modes of transmission that are possible but not as common are through transfusion of infected blood or transplantation of infected organs or tissues; occupational exposure in healthcare settings (e.g., needle stick injuries) and cases of vertical transmission (i.e., transmission from a dengue infected pregnant mother to her fetus in utero or to her infant during labor and delivery).

**E. Incubation Period:**

In humans, symptoms of infection usually begin 4 - 7 days after the mosquito bite. After entering the mosquito in the blood meal, the virus requires 8-12 days incubation before it can then be transmitted to another human.

**F. Period of Communicability:**

Humans transmit virus to mosquitoes during a 3-5 day period usually shortly before through to the end of the febrile period. (Asymptomatic individuals can also transmit virus during a period of viremia.) After the 8-12 day incubation period, a mosquito is infected for life, which might be days or a few weeks.

**G. Susceptibility and Resistance:**

Infection with one serotype does not protect against the others, and sequential infections put people at greater risk for DHF and DSS.

**H. Treatment:**

Treatment of dengue fever includes relieving symptoms of pain, controlling fever, telling patients to avoid aspirin and other non-steroidal, anti-inflammatory medications and reminding patients to drink more fluids. For DHF and DSS, supportive care with monitoring of vital signs and hemodynamic status, fluid balance, and hematologic parameters and timely but measured intravascular volume replacement during the critical period is crucial. Additional information can be found on the CDC Dengue website at: [www.cdc.gov/Dengue/](http://www.cdc.gov/Dengue/).

## NOTIFICATION TO PUBLIC HEALTH AUTHORITIES

Dengue fever, as an arboviral disease, shall be reported within seven days. If DHF, a viral hemorrhagic fever, is identified, it shall be reported within 4 hours by phone.

1. Health care providers and hospitals: report to the local public health jurisdiction or KDHE-BEPHI (see below)
2. Local public health jurisdiction: report to KDHE-BEPHI (see below)
3. Laboratories: report to KDHE-BEPHI (see below)
4. KDHE-BEPHI will contact the local public health jurisdiction by phone within one hour of receiving any suspected dengue fever report.

**Kansas Department of Health and Environment (KDHE)  
Bureau of Epidemiology and Public Health Informatics (BEPHI)**

**Phone: 1-877-427-7317**

**Fax: 1-877-427-7318**

***(EpiTrax Users can report non-hemorrhagic Dengue cases  
with New CMR creation in EpiTrax.)***

### **Further responsibilities of state and local health departments to the CDC:**

*As a nationally notifiable condition, dengue fever cases require a STANDARD report to the Center of Disease Control and Prevention (CDC).*

- **Local public health jurisdiction** will report information requested on the disease reporting forms as soon as possible, completing the forms within 7 days of receiving a notification of a report.
- KDHE-BEPHI will file an electronic case report the next regularly scheduled electronic transmission.

(KDHE-BEPHI files electronic reports weekly with CDC.)

## INVESTIGATOR RESPONSIBILITIES

- 1) [Report](#) all confirmed, probable and suspect cases to the KDHE-BEPHI.
- 2) Contact medical provider to collect additional information and confirm diagnosis using current [case definition](#).
  - Collect all information requested in [Step 1](#)) of case investigation.
  - Establish whether symptoms of severe dengue exist.
  - Ensure that case/proxy is aware of the diagnosis.
- 3) Conduct a [case investigation](#) to identify potential source of infection.
  - Complete an interview with the [Dengue Form](#).
- 4) Conduct [contact investigation](#) to identify additional cases.
- 5) Identify whether the source of infection is major public health concern.
  - *Was there no travel to an active dengue area?*
- 6) Initiate [control and prevention](#) measures to prevent spread of disease.
  - Conduct [Case](#) or [Contact Management](#) as needed.
- 7) [Record](#) data, collected during the investigation, in the KS EpiTrax system under the data's associated [\[tab\]](#) in the case morbidity report (CMR).
- 8) As appropriate, use the notification letter(s) and the disease [fact sheet](#) to notify the case, contacts and other individuals or groups.

\* Please note the red [tab] names listed in this investigation guideline are notations on the location in EpiTrax where the collected data should be recorded.

Morbidity Event Route to Local Health Depts. Investigator:

Show | Print | Delete | Add Task | Add Attachment | Export to CSV | Create a new event from this one | Events

Disable Tabs]

Demographic | Clinical | Laboratory | Contacts | Epidemiological | Reporting | Investigation | Notes | Administrative

## STANDARD CASE INVESTIGATION AND CONTROL METHODS

### Case Investigation

1) Contact the medical provider who ordered testing of the case and obtain the following information. (This includes medical records for hospitalized patients.)

**Note:** If the physician submitted samples to CDC, a [CDC case investigation form](#) may already be completed or started – try to obtain a copy.

- Record onset date (approximate if exact date is not known) [Clinical]
- Record hospitalizations: location and duration of stay [Clinical]
- Record outcomes: survived or date of death [Clinical]
- Obtain clinical information on symptoms, including fever, headache, rash, nausea, vomiting, muscle weakness/pain, joint pains, gait/balance difficulty, stiff neck, confusion, hallucinations, disorientations, seizures, or any other symptoms [Investigation – Symptoms].
- Assess the case-patient for severe manifestations, refer to the CDC [Dengue Case Investigation Report](#), for severe illness criteria (example below)

	Yes	No	Unk		Yes	No	Unk
Fever lasting 2-7 days.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Evidence of capillary leak</b>			
Fever now(>38°C).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lowest hematocrit (%).....			
Platelets ≤100,000/mm <sup>3</sup> .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Highest hematocrit (%).....			
Platelet count: .....				Lowest serum albumin.....			
<b>Any hemorrhagic manifestation</b>				Lowest serum protein.....			
Petechiae.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lowest blood pressure (SBP/DBP)...../.....			
Purpura/Echymosis.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lowest pulse pressure (systolic - diastolic).....			
Vomit with blood.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lowest white blood cell count (WBC).....			
Blood in stool.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Symptoms</b>	Yes	No	Unk
Nasal bleeding.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Rapid, weak pulse.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bleeding gums.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pallor or cool skin.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blood in urine.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Chills.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vaginal bleeding.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Rash.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Positive urinalysis.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Headache.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(over 5 RBC/hpf or positive for blood)				Eye pain.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tourniquet test <input type="checkbox"/> Pos <input type="checkbox"/> Neg <input type="checkbox"/> Not done				Body (muscle/bone) pain.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Joint pain.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Anorexia.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<b>Warning signs</b>	Yes	No	Unk
				Persistent vomiting.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Abdominal pain/Tenderness.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Mucosal bleeding.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Lethargy, restlessness.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Liver enlargement >2cm.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Pleural or abdominal effusion.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<b>Additional symptoms</b>			
				Diarrhea.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Cough.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Conjunctivitis.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Nasal congestion.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Sore throat.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Jaundice.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Convulsion or coma.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Nausea and vomiting (occasional).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				Arthritis (Swollen joints).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Examine the laboratory testing that was reported. If needed, obtain copies of laboratory reports that are needed to confirm the case. [Laboratory]
  - Attach copies to the EpiTrax record of serology results, virus isolation, or PCR tests. [Add Attachment]
- Record information about the patient's receipt of any yellow fever vaccine and any information about previous medical history with West Nile virus or any other flavivirus [Notes]
- Collect case's demographics and contacting information (address, birth date, gender, race/ethnicity, primary language, and phone number(s)) [Demographic]

- 2) Interview the case or proxy to determine source and risk factors; focus on incubation period 2 weeks prior to illness onset. [Investigation – Exposure]
  - Travel history:
    - Travel outside of KS; list states visited; dates visited
    - Travel outside of U.S.; list country; date of departure and return to U.S.
  - *Travel to an active dengue area is a **crucial** element. With no travel to areas endemic for dengue, refer to Managing Special Situations.*
  - Note any exposure to mosquitoes, include dates and places.
  - Inquire about any laboratory exposure, blood donation or receipt, organ donation or receipt, breast fed infants or in utero transmission.
- 3) Examining the epidemiological information, record where the infection was most likely imported from. (Indigenous or out-of-county, state, or U.S.) [Epidemiologic]
- 4) Collect information from case for the Contact Investigation. (See below).
- 5) Investigate epi-links among cases (clusters, household, co-workers, etc).

### Contact Investigation

- 1) Contacts are those who have exposure. Exposure is defined as:
  - Travel to an dengue endemic country or presence at location with ongoing outbreak within previous two weeks of dengue-like illness, OR
  - Association in time and place with a confirmed or probable dengue case.
- 2) Identify other individuals who may have had contact with the source in the two weeks prior to the case becoming ill to find unreported or undiagnosed cases.
- 3) If case's travel occurred in a commercial travel group, investigate travel companions.
- 4) If a blood transfusion or organ transplant is suspected, coordinate with BEPHI.
- 5) ONLY if a risk of transmission exists, create a line listing of contacts at-risk of developing disease. [Contact]

### Isolation, Work and Daycare Restrictions

- 1) Follow blood and body fluid precautions.
- 2) **Prevent access of mosquitoes to case until fever subsides.** If mosquitoes can enter the living space, use insect screens, bed nets, and spray with insecticides.

### Case Management

- 1) Educate on how to prevent spread of dengue. **Mosquitoes that bite the patient can go on to bite and infect others.**
  - If mosquitoes can enter the patient's living space, place patient under bed net or use insect repellent until fever subsides.
  - KILL mosquitoes in the residence and empty outside containers holding water.
  - Put screens on windows and doors.
- 2) For dengue, educate caretaker to watch for warning signs as temperature declines 3 to 7 days after symptoms began and to return IMMEDIATELY to clinic or emergency department if any of the following warning signs appear:
  - Severe abdominal pain or persistent vomiting
  - Red spots or patches on the skin
  - Bleeding from nose or gums

- Vomiting blood or black, tarry stools
- Drowsiness or irritability
- Pale, cold, or clammy skin
- Difficulty breathing

### Contact Management

- 1) If a contact listing was created because of the high possibility of disease, follow-up with the listed contacts to determine if illness occurred [\[Contact\]](#).
  - Collect information on each contact's health status, noting any symptoms
  - Inform contact of possible exposure to facilitate proper diagnosis and therapy.
  - [Educate](#) the contacts as needed.
- 2) A symptomatic contact is considered a suspect case requiring investigation and [reporting](#) to KDHE-BEPHI [\[Contact\]](#)
  - *On the [\[Contact\]](#) Tab of the CMR, click 'Show' beside the symptomatic contact on the listing. When [View Contact Event](#) opens in show mode, select 'Promote to CMR'*
  - Investigate symptomatic contacts with dengue-like illness as suspect cases, collect [acute and convalescent specimens](#) and coordinate testing at CDC Dengue laboratory through BEPHI.
  - Symptomatic contacts/suspect cases should be instructed to:
    - Rest, drink plenty of fluids, and consult a physician.
    - If they feel worse (e.g., develop vomiting and severe abdominal pain) 24 hours after the fever declines, they should immediately seek an immediate medical evaluation with their physician or hospital.
    - Take extra precautions to prevent mosquitoes from biting any person ill with dengue and biting others in the household. Use screens/ mosquito bed nets; eliminate mosquitoes found indoors; and wear repellent.

### Environmental Measures

Mosquito control is important in preventing virus transmission. The *A. aegypti* mosquito, while rare in the U.S., has been found in: Alabama, Arkansas, Delaware, Florida, Georgia, Illinois, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Missouri, New Mexico, New York, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and Washington, D.C..

The Association of State and Territorial Health Officials [Vector-Borne and Zoonotic Disease Resources](#) may be of assistance for planning.

### Education

- 1) Instruct travelers to endemic areas on the risks and to minimize contact with mosquitoes through the use of nets and repellents.
- 2) Additional education and resources for patient education are found at: [www.cdc.gov/dengue/educationTraining/index.html](http://www.cdc.gov/dengue/educationTraining/index.html), especially:
  - Basic – Fact Sheet: for patients after a diagnosis of suspected dengue
  - Homecare for Dengue Patients
- 3) Information for travelers to dengue endemic areas can be found at the CDC Traveler's Health website. ([wwwn.cdc.gov/travel/](http://wwwn.cdc.gov/travel/))

## MANAGING SPECIAL SITUATIONS

### A. No Recent Travel to Endemic Areas:

*One or more cases for which a known risk factor (i.e., recent travel) cannot be identified should be considered a potential outbreak and adequate resources applied to the investigation. A locally acquired case of dengue fever would be an unusual occurrence in the continental United States.*

- Report and investigate a single diagnosed or suspected case of non-indigenous dengue fever with no travel history immediately.
- Contact the on-call epidemiologist (local) and KDHE (1-877-427-7317).
- It may be necessary to:
  - Inquire about potential medical exposures: blood transfusions and organ transplantations.
  - Obtain assistance to search the case's work and places visited for any mosquitoes possible of transmitting dengue fever.
  - Investigate febrile illness reports or unexplained deaths in the area.

### B. Intentional Contamination

*If a natural etiology cannot be established by a prompt, vigorous investigation; the situation is considered a bioterrorist act until proven otherwise.*

If suspected:

- Notify local law enforcement and state public health officials.
- Implement "[Chain of Custody](#)" procedures for all samples collected, as they will be considered evidence in a criminal investigation.
- Work to define population at risk. Public health authorities will play the lead role in this effort, but must consult with law enforcement, emergency response and other professionals in the process. The definition may have to be re-evaluated and redefined at various steps in the investigation and response.
- Once the mechanism and scope of delivery has been defined, the identification of the symptomatic and asymptomatic exposed individuals can be completed and recommendations for the treatment made.
- Establish and maintain a detailed line listing of all cases and contacts with accurate identifying and locating information.

Safety Considerations:

- By the time the first cases are identified the risk of exposure is dependent on the number of infected mosquitoes remaining at the exposure site. Appropriate protective clothing and repellents should be used.

Environmental decontamination:

- The viruses do not persist in the environment for long periods of time. No environmental decontamination necessary.
- A release in areas populated with appropriate arthropod vectors could initiate both an epizootic and epidemic trends.
- Integrated pest management at the presumed infected site, including insecticide fogging, may be a reasonable approach.

## DATA MANAGEMENT AND REPORTING TO THE KDHE

- A.** Accept the case assigned to the LHD and record the date the LHD investigation was started on the [[Administrative](#)] tab.
- B.** Organize and collect data, using appropriate data collection tools including:
- EpiTrax [Dengue Form](#) (A paper-based form that allows the collection of all required information without being logged into EpiTrax.)
  - Alternatively, investigators can collect and enter all required information directly into EpiTrax [[Investigation](#)], [[Clinical](#)], [[Demographics](#)], [[Epidemiological](#)] tabs.
  - For Severe Dengue cases, the CDC [Dengue Case Investigation Report](#) will assist with the collection of additional information.
  - During outbreak investigations, refer to guidance from a KDHE epidemiologist for appropriate collection tools.
- C.** Report data collected during the course of the investigation via EpiTrax.
- Verify that all data requested on the [Dengue Form](#) has been recorded on an appropriate EpiTrax [[tab](#)], or that actions are completed for a case lost to follow-up as outlined below.
  - Some data that cannot be reported on an EpiTrax [[tab](#)] may need to be recorded in [[Notes](#)] or scanned and attached to the record.
  - Paper report forms do not need to be sent to KDHE after the information is recorded and/or attached in EpiTrax. The forms should be handled as directed by local administrative practices.
- D.** If a case is lost to follow-up, after the appropriate attempts to contact the case have been made:
- Indicate 'lost to follow-up' on the [[Investigation](#)] tab with the number of attempts to contact the case recorded.
  - Record at least the information that was collected from the initial reporter.
  - Record a reason for 'lost to follow-up' in [[Notes](#)].
- E.** Once the investigation is completed, the LHD investigator will record the date the investigation was completed on the [[Administrative](#)] tab and click the "Complete" button. This will trigger an alert to the LHD Administrator so they can review the case before sending to the state.
- The LHD Administrator will then "Approve" or "Reject" the CMR.
  - Once a case is "Approved" by the LHD Administrator, BEPHI staff will review and close the case after ensuring it is complete and that the case is assigned to the correct event, based on the reported symptoms reported.  
(Review the [EpiTrax User Guide, Case Routing](#) for further guidance.)

## ADDITIONAL INFORMATION / REFERENCES

- A. Treatment / Differential Diagnosis:** American Academy of Pediatrics. Red Book: Report of the Committee on Infectious Disease, 29th Edition. Illinois, Academy of Pediatrics, 2014.
- B. Epidemiology, Investigation and Control:** Heymann. D., ed., Control of Communicable Diseases Manual, 19th Edition. Washington, DC, American Public Health Association, 2010.
- C. Case Definitions:** CDC Division of Public Health Surveillance and Informatics, Available at: [wwwn.cdc.gov/nndss/](http://wwwn.cdc.gov/nndss/)
- D. Kansas Regulations/Statutes Related to Infectious Disease:** [www.kdheks.gov/epi/regulations.htm](http://www.kdheks.gov/epi/regulations.htm)
- E. Chain of Custody:** KDHE Chain of Custody Standard Operating Guide, [www.kdheks.gov/cphp/operating\\_guides.htm](http://www.kdheks.gov/cphp/operating_guides.htm)
- F. ASTO Mosquito Control Resources:** [www.astho.org/Programs/Environmental-Health/Natural-Environment/Vector-Borne-and-Zoonotic-Diseases/Vector-Borne-and-Zoonotic-Disease-Resources/Main/](http://www.astho.org/Programs/Environmental-Health/Natural-Environment/Vector-Borne-and-Zoonotic-Diseases/Vector-Borne-and-Zoonotic-Disease-Resources/Main/)
- G. Additional Information (CDC):** [www.cdc.gov/health/default.htm](http://www.cdc.gov/health/default.htm)
- **CDC Dengue Fever Site:** [www.cdc.gov/Dengue/](http://www.cdc.gov/Dengue/)

## ATTACHMENTS

To view attachments in the electronic version:

1. Go to <View>; <Navigation Pane>; <Attachments> – OR – Click on the “Paper Clip”  icon at the left.
2. Double click on the document to open.