Arboviruses in the news: What to know about Dengue, Eastern Equine Encephalitis, and West Nile

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LSU HEALTH SHREVEPORT
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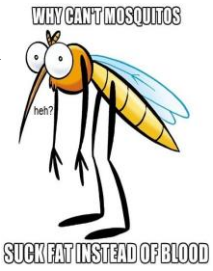
Objectives:

1. Describe the epidemiology of Dengue virus, Eastern Equine Encephalitis virus, and West Nile virus.
2. Discuss the recent outbreaks and public health response for each virus.
3. Outline routine and confirmatory laboratory testing methods for proper diagnosis and treatment.



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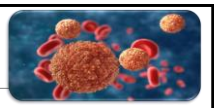
What are Arboviruses?



- Arthropod-borne RNA viruses
- Transmitted to humans through bite of infected mosquito or tick
- Many infections are asymptomatic, while others include symptoms ranging from mild febrile illness to severe neuroinvasive disease
- Anyone can be infected
- Young children and elderly most affected
- Treatment only aimed at alleviating symptoms

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Arbovirus mosquito vectors: *Aedes sp.*

- *Aedes aegypti*
- *Aedes albopictus*
- Tiger mosquito
- Feed aggressively on humans
- Peak activity at dawn and dusk
- Only fly a few blocks

Credits: © Whitepointer—iStock/Getty Images, © kitzcorner/Shutterstock.com

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Arbovirus mosquito vectors: *Culex sp.*

- *Culex pipiens*
- Common/Northern house mosquito
- Will feed on humans
- Prefers to feed on birds close to humans
- May fly up to 2 miles

Credit: https://www.cdc.gov/mosquitoes/about/life-cycle-of-culex-mosquitoes.html

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Arbovirus mosquito vectors

AEDES SP.

CULEX SP.

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Common Arboviruses in the U.S.

NOTIFIABLE TO CDC:

- **Eastern equine encephalitis**
- Jamestown Canyon
- La Crosse
- Powassan
- St. Louis encephalitis
- **West Nile**

OFTEN TRAVEL-RELATED:

- Chikungunya
- **Dengue**
- Yellow fever
- Zika

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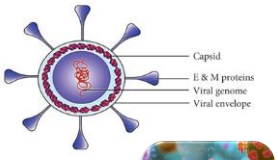
Dengue virus (DENV)



- Single stranded RNA virus
- Genus *Flaviviridae*
- Serotypes 1, 2, 3, 4
- Transmitted through bite of *Aedes* mosquitoes
- About 40 – 50% of world population at risk
- 75% of infections are asymptomatic
- 5% develop severe dengue illness
- Case-fatality rate if untreated is 10%

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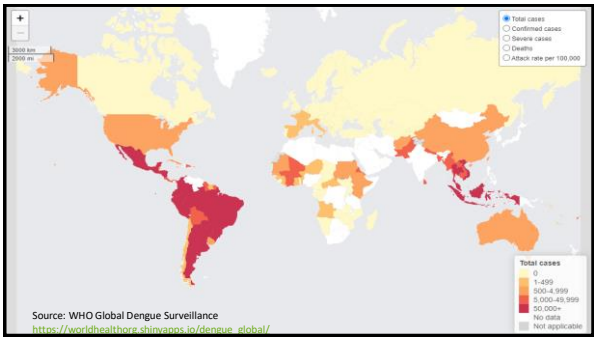

Source: WHO Global Dengue Surveillance
https://worldhealthorg.shinyapps.io/dengue_global/

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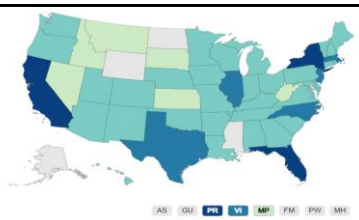
Legend
- No reported cases
- 1 to 4
- 5 to 49
- 50 to 249
- 250+



- Largest burden in U.S. = Puerto Rico and U.S. Virgin Islands
- Other U.S. areas = American Samoa, Northern Marianas, and Guam
- Travel-associated cases occur every year in all 50 states and D.C.

Source: CDC Dengue, current year data (2024), https://www.cdc.gov/dengue/data-research/facts-stats/current-data.html

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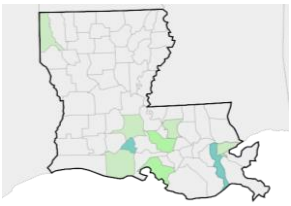
Dengue in Louisiana



- Caddo, East Baton Rouge, Iberville, Jefferson, Lafayette, Orleans, St. Landry, St. Mary, Vermillion parishes
- Total cases = 20

Source: CDC Dengue, current year data (2024)
https://www.cdc.gov/dengue/data-research/facts-stats/current-data.html

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Dengue case definition → fever and presence of 1 or more of the following:

- Nausea/vomiting
- Rash
- Aches and pains (headache, joint pain, myalgia, abdominal)
- Tourniquet test positive
- Leukopenia (total WBC count <5000/mm^3)
- Mucosal bleeding at any site
- Liver enlargement >2 cm
- Increasing hematocrit with rapid decrease in platelet count

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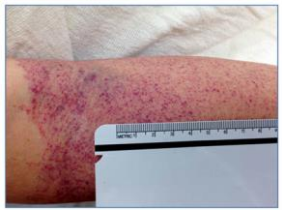
Tourniquet test

- Inflate BP cuff to midway between systolic and diastolic BP and leave for 5 mins
- Count petechiae in 5 cm diameter
- POSITIVE = 10 or more petechiae per square inch



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Phases of Dengue illness

Febrile	Critical	Convalescent
Fever 2-7 days	24 – 48 hours	Plasma leakage stops
Rash, aches/pains	Plasma leakage	Hemostasis
Hemorrhaging	↑ liver enzymes	Plt count recovers
(+) tourniquet test	Hyponatremia	Pruritic rash
	↓ WBC, plts	

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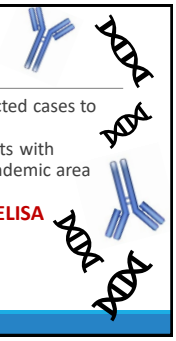
Diagnosis for Dengue



- Nationally notifiable disease – report suspected cases to state and/or local health depts
- Should be in differential diagnosis for patients with symptoms ≤ 2 weeks after returning from endemic area

≤7 days after onset → RT-PCR and IgM ELISA

≥7 after onset → IgM ELISA

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Treatment for Dengue

- No specific antiviral agents for dengue
- Supportive care and/or hospitalization
- Maintain hydration and avoid further mosquito bites
- Avoid anticoagulant meds (aspirin and NSAIDS)
- IV fluids when plasma leakage is recognized
- Avoid corticosteroids
- Avoid platelet transfusions

- Dengvaxia available for eligible children and adults

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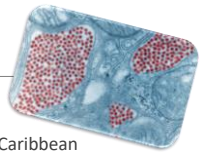
Eastern Equine Encephalitis (EEEV)



- Single stranded RNA virus
- Genus *Alphavirus*
- Group I endemic in North America and Caribbean
- Groups IIA, IIB, III caused by the closely related Madariaga virus (endemic in Central and South America)
- Humans and other animals are typically dead-end hosts
- Was transmitted through organ transplantation, involving 1 donor and 3 recipients

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Yet another type of mosquito

- *Culiseta melanura*
- Black tailed mosquito
- Freshwater hardwood swamps and bog habitats
- Responsible for spreading EEEV among birds
- Birds are “amplifying” hosts

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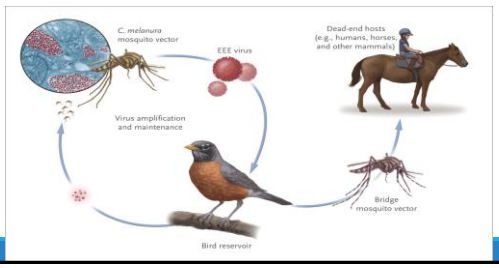
Transmission cycle of EEEV



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- Human cases highlighted = 16 neuroinvasive cases
- Wisconsin, New York, Vermont, New Hampshire, Massachusetts, Rhode Island, New Jersey, North Carolina

Source: CDC EEE, current year data (2024), https://www.cdc.gov/eastern-equine-encephalitis/data-maps/current-year-data.html

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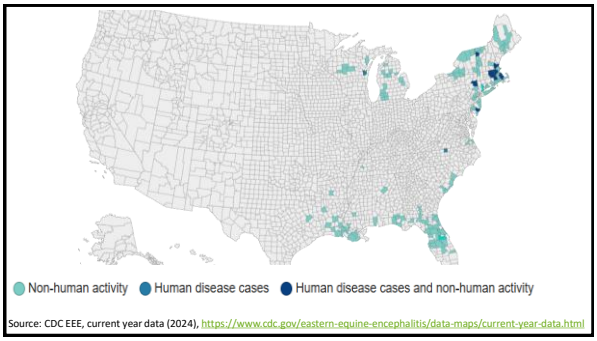

Source: CDC EEE, current year data (2024), https://www.cdc.gov/eastern-equine-encephalitis/data-maps/current-year-data.html

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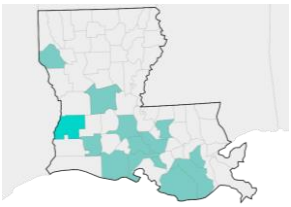
EEEV in Louisiana



- Beauregard, DeSoto, East Baton Rouge, Iberia, Iberville, Jefferson Davis, Lafourche, Rapides, St. Charles, St. Landry, St. martin, Terrebonne, Vermillion parishes

Source: CDC EEE, current year data (2024), https://www.cdc.gov/eastern-equine-encephalitis/data-maps/current-year-data.html

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EEEV infection and illness statistics

- Average of 11 human cases per year in U.S.
- Only 4 – 5% of infections result in encephalitis
- ↑ risk = occupational and recreational activities in endemic areas
- ↑ risk of severe disease = persons > 50 y.o. and < 15 y.o.
- 30% case fatality rate in those who develop severe disease
- Of those who recover, >50% retain neurological sequelae requiring life-long care
- Infection assumed to provide life-long immunity from re-infection

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Signs and symptoms of EEE

- Incubation period = 4 – 10 days
- Systemic febrile illness
- Progress to neurologic illness
  - Encephalitis
  - Meningismus/meningitis
  - Confusion
  - Focal deficits
  - Seizure
  - Coma

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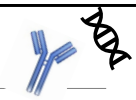
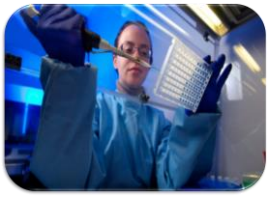
Diagnosis for EEE



- Nationally notifiable disease
- Detection of EEEV-specific IgM in serum or CSF
- Confirmation by state PUBH lab or CDC
- RT-PCR may be better for immunocompromised



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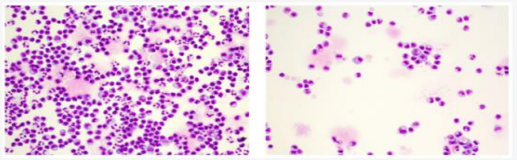
Cerebrospinal fluid (CSF) assessment

- Initial neutrophil-predominant pleocytosis
- Later lymphocyte-predominant pleocytosis
- Increased protein, normal glucose



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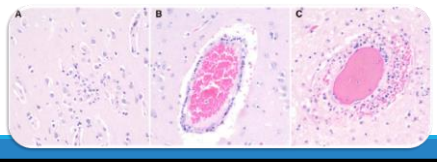
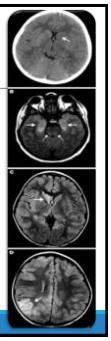
Neuropathological findings in EEE

- Brain lesions consistent with encephalitis
- Neuronal destruction
- Vasculitis





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Treatment for EEE

- No specific treatment
- Supportive care and/or hospitalization
- Maintain hydration and avoid further mosquito bites
- Pain control for headaches
- Antiemetics for nausea/vomiting
- Close monitoring for elevated intracranial pressure
- Close monitoring for inability to protect airway

- No vaccines for human use

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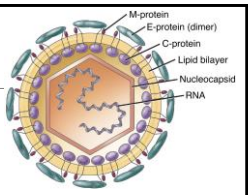
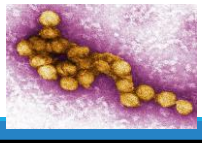
West Nile Virus (WNV)



- Single stranded RNA virus
- Genus *Flaviviridae*
- Leading cause of mosquito-borne disease in U.S.
- 1 in 5 people develop fever
- 1 in 150 people develop severe, potentially fatal disease
- Humans are dead-end hosts



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WNV transmission cycle

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Which birds are most susceptible to WNV?

- MOST SUSCEPTIBLE: birds in corvid family
  - Crows, blue jays, ravens

- Other types that may be infected:
  - Passerines: sparrows, grackles, finches
  - Raptors: owls, hawks, eagles, falcons
  - Psittacines: parrots, parakeets, conures
  - Galliformes: ruffed grouse, sage-grouse

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West Nile and dead birds

- Reporting and testing of dead birds is one way to check for the presence of WNV in the environment
- Avoid bare-handed contact when handling any dead animal
- Contact state health dept or state wildlife agency

LA Dept of Health
Arboviral Program Coordinator
(504) 568-8342
Sean.Simonson@la.gov

LA Dept of Wildlife and Fisheries
1-800-256-2749
(225) 765-2800
www.wlf.louisiana.gov

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Worldwide distribution of WNV

- Prevalent throughout Africa, Europe, Middle East, West Asia, Australia, and the Americas

- 1937: First isolated in Uganda
- 1957: Epidemic in Israel
- 1953: Identified in crows in Nile delta region
- 1997: Causes death in birds in Israel
- 1999: imported into New York
- 2002-2003: worst U.S. outbreak with 9,862 cases

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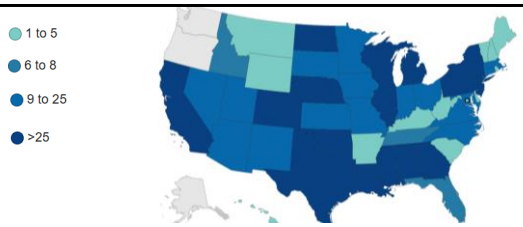

- Total human cases = 1,195
- Neuroinvasive disease cases = 851
- Cases reported in 48 states as of October 29, 2024

Source: CDC WNV, current year data (2024), https://www.cdc.gov/west-nile-virus/data-maps/current-year-data.html

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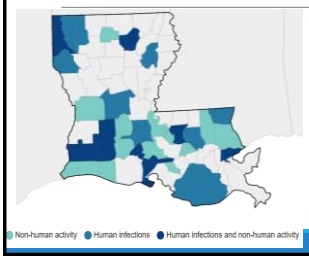
WNV in Louisiana

Source: CDC WNV, current year data (2024), https://www.cdc.gov/west-nile-virus/data-maps/current-year-data.html



- Acadia, Allen, Ascension, Bossier, Caddo, Calcasieu, Cameron, DeSoto, East Baton Rouge, Evangeline, Franklin, Iberia, Jefferson Davis, Lafayette, Lafourche, Lincoln, Livingston, Orleans, Ouachita, Point Coupee, Rapides, St. Landry, St. Martin, St. Tammany, Tangipahoa, Terrebonne, Vernon, Washington, Webster, West Baton Rouge

- Total cases = 34

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Symptoms of West Nile viral infection

- 70 – 80% of infections are subclinical or asymptomatic
- Symptomatic people experience acute febrile illness:
  - Fever and headache
  - Myalgia or arthralgia
  - Gastrointestinal symptoms
  - Transient maculopapular rash
- Most recover completely
- Fatigue and weakness may last for weeks – months

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Neuroinvasive West Nile viral infection

- Fatal for 1 out of 10 people who develop serious illness
- Encephalitis or meningitis
  - High fever and headache
  - Neck stiffness
  - Stupor or disoriented
  - Tremors or convulsions
  - Muscle weakness
  - Vision loss
  - Numbness and paralysis

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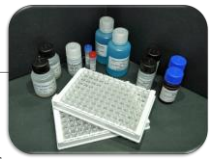
Diagnosis for West Nile



- Nationally notifiable disease
- Detection of WNV-specific IgM antibodies
  - Serum or CSF
  - Detectable 3 – 8 days after onset of illness
  - Persist for 30 – 90 days
- Some cases require confirmation at state PUBH lab
- RT-PCR useful for immunocompromised
  - Serum, CSF, or tissue

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Treatment for West Nile

- No specific treatment
- Supportive care and/or hospitalization
- Maintain hydration and avoid further mosquito bites
- Pain control for headaches
- Antiemetics for nausea/vomiting
- Close monitoring for elevated intracranial pressure
- Close monitoring for inability to protect airway
- Various drugs have been empirically used
- No vaccines for human use

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Prevention of mosquito-borne illness

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Arboviruses and the blood supply

- Cannot get infected by donating blood
- All donated blood screened for WNV since 2003
- Any blood product found to be infected is removed from supply

Anti-HIV
Anti-Hepatitis C
Anti-HTLV
Anti-Hepatitis B core antigen
Hepatitis B surface antigen
Hepatitis B DNA
Hepatitis C RNA
HIV1 RNA
West Nile RNA
Ab/Ag to syphilis
Ab to *Trypanosoma cruzi*
Ab to cytomegalovirus
Babesia DNA

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ArboNET
National Arbovirus Surveillance System

https://www.cdc.gov/mosquitoes/php/arbonet/index.html

- National arboviral surveillance system
- Managed by CDC and state health departments
- Maintains data on arboviral infections in humans, presumptive viremic blood donors, veterinary disease cases, mosquitoes, dead birds, and sentinel animals

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THANK YOU FOR LISTENING!

"It's nice outside. I think I'll sit on the patio."

213 MOSQUITOES liked your post

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