Existing and Emerging Threats of the Chikungunya and West Nile Viruses

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Dallas County Medical Reserve Corps
Chikungunya Virus
The chikungunya virus (CHIKV) is spread by an adult female Aedes mosquito biting an infected person and then biting an uninfected person.

First detected in 1954 in a patient following an outbreak in the border area between Mozambique and Tanzania.

“Chikungunya” = derived from the Makonde verb *kungunyala*, meaning to become contorted, or, more literally, "*that which bends up*"
Texas Confirms State’s First Chikungunya Case

News Release
July 7, 2014

The Texas Department of State Health Services has confirmed the state’s first human case of chikungunya, a viral disease that can cause fever and severe joint pain and is spread to people by mosquitoes.

The patient recently returned to Texas from a trip to the Caribbean where chikungunya has been causing human disease since late 2013. To date, no local spread of the virus has been reported in the continental United States, though imported cases make local spread possible because the mosquitoes that can transmit the virus are found in Texas. The Texas case is a Williamson County resident.

Chikungunya is not transmitted from direct person to person contact, but a person with the disease can be the source of the virus for mosquitoes that can then transmit the virus to others through a bite. To prevent the spread of the disease, people with chikungunya illness should be especially careful to avoid exposure to mosquitoes during the first week of illness.

Infections are rarely fatal but can cause severe joint pain, high fever, head and muscle aches, joint swelling and rash. Symptoms usually begin three to seven days after being bitten by a mosquito. There is no vaccine or treatment for the virus. Most people feel better within a week, though some people may develop longer-term joint pain.
Chikungunya virus (CHIKV)

Numerous Chikungunya virus particles

central dense core surrounded by a viral envelope

Photo credit: CDC/ Cynthia Goldsmith, James A. Comer, and Barbara Johnson
Aedes aegypti
Aedes albopictus
Chikungunya Vector Habitats

The Aedes mosquito can travel only up to ~200 meters from its habitat.

Because the vectors don’t travel far, chikungunya outbreaks occur because of infected humans traveling from an affected area to an unaffected area.

*Aedes aegypti* and *Aedes albopictus* mosquitoes usually live around homes and breed in small amounts of water in containers around the home and yard.

A distinguishing characteristic of Chikungunya: Presence of multiple cases in a single locality, such as within a home, neighborhood or village.
Transmission of Chikungunya

Infected with CHIKV

Usually bite in early morning or late afternoon

Photo: https://he.utexas.edu/hdfs/

http://www.oregonmetro.gov/sites/default/files


CDC/James Gathany (2011)
Symptoms of Chikungunya

Joint pain, swelling

~50% patients have maculopapular skin rash

Hands of 55yo man, infected 5 years before

Photo: Dr. Rajiv Desai (2010)

Photo: Simon et al., 2011

www.ambergriscaye.com
Symptoms appear 3-7 days after infection

Other symptoms may include:

- Fever
- Headache
- Vomiting
- Muscle aches
- Conjunctivitis
- Encephalitis (rarely)


This newborn girl contracted chikungunya from her mother during childbirth
So what is the risk to Texas?

http://www.lib.utexas.edu/maps/texas.html
Travel-Associated Cases…

Countries reporting local chikungunya transmission, as of March 10, 2015

Source: http://www.cdc.gov/chikungunya/geo/
Map. States reporting chikungunya virus disease cases – United States, 2015 (as of April 21, 2015)

- Locally-acquired cases reported
- Travel-associated cases reported

202015
...and Locally-Acquired Cases

Aedes aegypti

Aedes albopictus

West Nile Virus
West Nile Virus (WNV)

- Mosquito-borne arbovirus
- Originally diagnosed in a woman in the West Nile Province of Uganda in 1937, the first outbreak in the United States was in New York City in 1999 (62 human cases, 7 deaths). ³
- Symptoms occur ~4-10 days after being bitten by an infected mosquito.
- 70-80% infected individuals never show symptoms of the disease. ⁴
Most WNV transmission is by the *Culex* species

According to the CDC, WNV has been detected in 65 mosquito species.\(^5\)

*Culex quinquefasciatus* is the primary vector in the southern states, including Texas. \(^6,7\)

Around a 1 mile flight range

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CDC (2013). West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control
WNV Transmission Cycle

Infected with WNV → Can infect a mosquito → Dead-end hosts

www.fs.usda.gov

www.gaming.ny.gov
Symptoms of West Nile Fever

- Fever
- Headache
- Nausea/vomiting
- Fatigue
- Swollen lymph glands (occasional)
- Skin rash (occasional)
- Eye pain (occasional)
Symptoms of West Nile Neuroinvasive Disease
(aka West Nile Encephalitis)

- Encephalitis (swelling of the brain)
- Meningitis (swelling of membrane around the brain/spinal cord)
- Respiratory problems
- Disorientation
- Seizures
- Paralysis
- Coma
- Death (~10%) \(^4\)

Long-term/permanent neurological effects of WNV infection:

- Decreased motor functions
- Decreased memory
Average annual incidence of West Nile virus neuroinvasive disease reported to CDC by age group, 1999-2013

Source: ArboNET, Arboviral Diseases Branch, Centers for Disease Control and Prevention
So what is the risk to Texas?
Infected birds from other states.....

West Nile Neuroinvasive Disease incidence in U.S. reported to ArboNET, by state
Average annual incidence of West Nile virus neuroinvasive disease reported to CDC by county, 1999-2013

Source: ArboNET, Arboviral Diseases Branch, Centers for Disease Control and Prevention
...and infected birds + *Culex quinquefasciatus* in Texas.
➢ No WNV activity in 2015 yet.
CHIKV

- Reservoir = Humans
- ~80% symptomatic
- Vectors:
  - Aedes aegypti, Aedes albopictus
  - ~100-200 meter flight range
  - Active: early morning, late afternoon
  - Breed in small containers

WNV

- Reservoir = Birds
- ~20-30% symptomatic (~1% WNND)
- Vectors:
  - Multiple vectors (local: Culex quinquefasciatus)
  - ± 1 mile flight range
  - Active: dawn, dusk
  - Breed in dirty water: containers, ditches, pools, etc.
# CHIKV and WNV in Texas

## 2014

<table>
<thead>
<tr>
<th>Virus</th>
<th>Mosquito Aedes</th>
<th>Asian Equine</th>
<th>Equine</th>
<th>Human Febrile Illness</th>
<th>Neuroinvasive</th>
<th>Hemorrhagic Fever</th>
<th>Total (Human)</th>
<th>Deaths</th>
<th>PVD*</th>
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<tbody>
<tr>
<td>CHIKV</td>
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<td>WNV</td>
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<td>209</td>
<td>218</td>
<td>235</td>
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<td>118</td>
<td>235</td>
<td>4</td>
<td>59</td>
<td>15</td>
<td>512</td>
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</tbody>
</table>

**Note:**
- CHIKV - Chikungunya Virus
- DENV - Dengue Virus
- EEEV - Eastern Equine Encephalitis Virus
- WNV - West Nile Virus

## Jan. 1 – May 2, 2015

<table>
<thead>
<tr>
<th>Disease</th>
<th>Positive</th>
<th>Avian</th>
<th>Equine</th>
<th>Sentinel Chicken</th>
<th>Human Febrile Illness</th>
<th>Neurologic Illness</th>
<th>Severe Dengue</th>
<th>TOTAL (Human)</th>
<th>Deaths</th>
<th>PVD*</th>
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</table>

**Note:**
- CHIKV - Chikungunya Virus
- DENV - Dengue Virus
- EEEV - Eastern Equine Encephalitis Virus
- WNV - West Nile Virus
Prevention of CHIKV and WNV Infections
Educate the Community

In Emergency Management, most important message is to encourage Prevention.

No human vaccine is available, so people must be informed about the risk factors and the measures they should take to reduce exposure.

1. Use insect repellent
2. Wear long sleeves and pants
3. Use air conditioning or window/door screens
4. Reduce mosquito breeding ground such as standing water in tires, containers, birdbaths, stagnant pools, ponds, etc.
Specific Prevention

- **WNV**
  - 4 D’s Campaign (Dress, Drain, Dusk/Dawn, DEET)

- **CHIKV**
  - Be protected outside early morning and late afternoon
  - Keep people home while sick!!
  - If bitten by mosquito, can spread virus to other family members, neighbors
Vector Control and Testing

- Develop comprehensive mosquito surveillance and control programs
- Establish an active animal health surveillance system to detect new cases in birds
  - Educate the public to report dead birds to local authorities
CHIKV & WNV Surveillance

Use specific testing equipment – need a BG-sentinal trap for Chikungunya virus vectors and a Gravid trap for West Nile virus vectors.

Birds can be monitored for the local presence of the West Nile virus, but since the Chikungunya virus is only spread between humans, we often don’t know where to test for vectors until people become sick.

In St. Croix, 2014, CDC worker is setting up a BBG-Sentinel traps (a.k.a. the BG trap or BGS trap) to collect mosquitoes for CHIKV testing.
After a Hurricane

A hurricane brings flooding, which attracts mosquitoes in two phases:

1. **Flood water mosquitoes**
   - Deposit eggs on soil prone to flooding; when flooded, eggs hatch 5-7 days after flooding, causing large swarms of mosquitoes
   - Include salt marsh mosquitoes and pastureland mosquitoes (mostly annoyance species)
   - Include *Aedes aegypti* and *Aedes albopictus*
     - Deposit eggs in backyard containers (e.g., tires, toys, birdbaths, etc.)

2. **Standing water mosquitoes**
   - Use calm pools of water after initial floods recede to oviposit their eggs
   - Include multiple disease-bearing species of mosquitoes
   - Include *Culex quinquefasciatus*
     - Breeds in septic water in ditches, storm sewers, any container that holds water

Reporting CHIKV and WNV Infections
West Nile Virus Disease is a national notifiable disease. Cases are reported to CDC by state and local health departments using standard case definitions.

Chikungunya virus will be added to the list of National Notifiable Infectious Conditions when the CDC receives Office of Management and Budget (OMB) Paperwork Reduction Act (PRA) approval to receive data for the condition.
West Nile Fever and West Nile Encephalitis/Neuroinvasive Disease cases are notifiable conditions and must be reported within a week.

Chikungunya is not yet on the notifiable conditions list

- “Arbovirus infection”
- “In addition to specified reportable conditions, any outbreak, exotic disease, or unusual group expression of disease that may be of public health concern should be reported by the most expeditious means available.”

Organizations are available to assist epidemiology groups during outbreaks

- e.g., Dallas County MRC trains members to help provide emergency telephone and in-person interviews after a disease outbreak
Who reports disease cases?

The Texas Health and Safety Code, Section 81.042

Sec. 81.042. PERSONS REQUIRED TO REPORT. (a) A report under Subsection (b), (c), or (d) shall be made to the local health authority.

(b) A dentist or veterinarian licensed to practice in this state or a physician shall report, after the first professional encounter, a patient or animal examined that has or is suspected of having a reportable disease.

(c) A local school authority shall report a child attending school who is suspected of having a reportable disease. The board by rule shall establish procedures to determine if a child should be suspected and reported and to exclude the child from school pending appropriate medical diagnosis or recovery.

(d) A person in charge of a clinical or hospital laboratory, blood bank, mobile unit, or other facility in which a laboratory examination of a specimen derived from a human body yields microscopical, cultural, serological, or other evidence of a reportable disease shall report the findings, in accordance with this section and procedures adopted by the board, in the jurisdiction in which:

(1) the physician's office is located, if the laboratory examination was requested by a physician; or

(2) the laboratory is located, if the laboratory examination was not requested by a physician.

(e) The following persons shall report to the local health authority or the department a suspected case of a reportable disease and all information known concerning the person who has or is suspected of having the disease if a report is not made as required by Subsections (a)-(d):

(1) a professional registered nurse;

(2) an administrator or director of a public or private temporary or permanent child-care facility;

(3) an administrator or director of a nursing home, personal care home, adult respite care center, or adult day-care center;

(4) an administrator of a home health agency;

(5) an administrator or health official of a public or private institution of higher education;

(6) an owner or manager of a restaurant, dairy, or other food handling or processing establishment or outlet;

(7) a superintendent, manager, or health official of a public or private camp, home, or institution;

(8) a parent, guardian, or household;

(9) a health professional;

(10) an administrator or health official of a penal or correctional institution; or

(11) emergency medical service personnel, a peace officer, or a firefighter.


Sec. 81.043. RECORDS AND REPORTS OF HEALTH AUTHORITY. (a) Each health authority shall keep a record of each case of a reportable disease that is reported to the authority.

(b) Except as provided by Subsection (c), a health authority shall report reportable diseases to the department's central office at least as frequently as the interval set by
The Texas Health and Safety Code, Section 81.042

Sec. 81.042. PERSONS REQUIRED TO REPORT.
• A dentist or veterinarian
• A local school authority
• A person in charge of a clinical or hospital laboratory, blood bank, mobile unit

The following persons shall report to the local health authority or the department a suspected case of a reportable disease and all information known concerning the person who has or is suspected of having the disease if a report is not made as required by [above persons]:

• Professional registered nurse
• Administrator or director of a public or private child-care facility
• Administrator or director of a nursing home, adult day-care center, etc.
• Administrator of a home health agency
• Administrator or health official of a public or private institution of higher education
• Owner or manager of a restaurant, dairy, or other food handling establishment
• Superintendent, manager, or health official of a camp, home, or institution
• Parent, guardian, or householder
• Health professional
• Administrator or health official of a penal or correctional institution
• Emergency medical service personnel, a peace officer, or a firefighter
Click on a county name for contact information.

https://www.dshs.state.tx.us/idcu/investigation/conditions/contacts/
# Arboviral Case Investigation

**Patient Information**

- **Last Name:**
- **First Name:**
- **Date of Birth:** __/__/____
- **Sex:** □ Male □ Female □ Unknown
- **Street Address:**
- **City, State, Zip:**
- **Patient Phone:**
- **County of Residence:**
- **Race:** □ Asian □ American Indian/Alaskan Native □ Black or African American □ Native Hawaiian/Pacific Islander □ White □ Unknown □ Other: ______
- **Ethnicity:** □ Hispanic □ Not Hispanic □ Unknown

**Clinical Information**

- **Physician:**
- **Address:**
- **City, State, Zip:**
- **Phone:**
- **Fax:**
- **Was the patient hospitalized for this illness?** □ Yes □ No □ Unknown
  - If yes, provide name of hospital: ______
  - Dates of hospitalization: Admission __/__/____ Discharge __/__/____
- **Date of Illness Onset:** __/__/____
- **Is the patient deceased?** □ Yes □ No □ Unknown
  - If yes, provide date of death: ______ (submit documentation if due to arbovirus)

**Clinical Evidence**

<table>
<thead>
<tr>
<th>Non-neurological Evidence</th>
<th>Neurological Evidence (indicated in medical record)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>□ Yes □ No □ Unknown □ Altered taste □ Yes □ No □ Unknown</td>
</tr>
<tr>
<td>Chills</td>
<td>□ Yes □ No □ Unknown □ Abnormal reflexes □ Yes □ No □ Unknown</td>
</tr>
<tr>
<td>Headache</td>
<td>□ Yes □ No □ Unknown □ Nerve palsy □ Yes □ No □ Unknown</td>
</tr>
<tr>
<td>Anorexia</td>
<td>□ Yes □ No □ Unknown □ Ataxia □ Yes □ No □ Unknown</td>
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<tr>
<td>Severe malaise</td>
<td>□ Yes □ No □ Unknown □ Acute flaccid paralysis □ Yes □ No □ Unknown</td>
</tr>
<tr>
<td>Nausea/Vomiting</td>
<td>□ Yes □ No □ Unknown □ Confusion □ Yes □ No □ Unknown</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>□ Yes □ No □ Unknown □ Seizures □ Yes □ No □ Unknown</td>
</tr>
<tr>
<td>Stiff neck</td>
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<td>□ Yes □ No □ Unknown □ CSF pleocytosis □ Yes □ No □ Unknown</td>
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<tr>
<td>Myalgia</td>
<td>□ Yes □ No □ Unknown □ Myelitis □ Yes □ No □ Unknown</td>
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<td>Joint/Bone Pain</td>
<td>□ Yes □ No □ Unknown □ Demyelinating neuropathy □ Yes □ No □ Unknown</td>
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<tr>
<td>Rash</td>
<td>□ Yes □ No □ Unknown □ Neuritis □ Yes □ No □ Unknown</td>
</tr>
<tr>
<td>Vertigo</td>
<td>□ Yes □ No □ Unknown □ Other Neurological Illness □ Yes □ No □ Unknown</td>
</tr>
</tbody>
</table>

**Does the patient have an underlying chronic illness?** □ Yes □ No □ Unknown

**Is the patient immunosuppressed?** □ Yes □ No □ Unknown

**Is there a more likely clinical explanation for the patient’s symptoms?** □ Yes □ No □ Unknown

**Clinical Syndrome:** □ Uncomplicated Fever □ Encephalitis □ Meningitis □ Other Neurological Illness

DHSS Form EP15-1877

Revised January 2015
References


2. Simon et al. (2011) Chikungunya viral infection. *Current Infectious Disease Reports*.


KEEP CALM AND TAKE CARE OF CHIKUNGUNYA