MOSQUITO-BORNE DISEASES OF ARIZONA

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MOSQUITO-BORNE DISEASES OF ARIZONA

*Culex spp.* mosquitoes
- Locally endemic diseases
  - West Nile virus
  - St. Louis encephalitis

*Aedes spp.* mosquitoes
- Diseases imported only, but could become endemic
  - Chikungunya
  - Dengue
CULEX SPP.

WEST NILE VIRUS

&

ST. LOUIS ENCEPHALITIS
**CULEX MOSQUITOES:**
**EGGS AND LARVAE**

Eggs laid in aquatic habitats, larvae prefer ground collections of water that is polluted with organic debris.

- Associated with urbanization
  - Areas with poor drainage and sanitation
- Ex. Pools, puddles, ditches, rice fields, etc.
CULEX MOSQUITOES: ADULTS

Found throughout AZ

- *Culex tarsalis*
- *Culex quinquefasciatus*

Typically dusk/dawn biters

Will shelter either indoors or outdoors

Will feed on a variety of species

- Ex. Birds, horses, humans, etc.
  - Makes them good for zoonotic disease transmission
WEST NILE VIRUS

Most common arboviral disease of Arizona

Only 10-20% of infections lead to disease

- Initially nonspecific
  - Fever, headache, nausea, vomiting, fatigue, etc.
- In severe cases, can become neuroinvasive
  - 1-2% of those may be fatal

West Nile Virus Transmission Cycle

In nature, West Nile virus cycles between mosquitoes (especially Culex species) and birds. Some infected birds can develop high levels of the virus in their bloodstream and mosquitoes can become infected by biting these infected birds. After about a week, infected mosquitoes can pass the virus to more birds when they bite.

Mosquitoes with West Nile virus also bite and infect people, horses and other mammals. However, humans, horses and other mammals are ‘dead end’ hosts. This means that they do not develop high levels of virus in their bloodstream, and cannot pass the virus on to other biting mosquitoes.
WNV CLINICAL “ICEBERG”

- Older persons
  - Co-morbid conditions
- Younger persons
- WNND: <1% cases
- WNF: ~20% cases
- Asymptomatic Infection: ~80% cases
INCIDENCE RATE OF WNV IN ARIZONA

Cases and Rates per year for West Nile virus

Year

2008 2009 2010 2011 2012 2013

113 21 166 69 135 62

Number of cases

Rates (per 100,000)
Spatial Distribution of WNV Cases by Incidence Rate

2008

2009

2010

2011

2012

2013

Rates

- 0-0.2
- 0.2-0.9
- 0.9-1.4
- 1.4-2.8
- 2.8-22.6
WNV Case Rates by Race & Ethnicity

Rates by race/ethnicity per year for West Nile virus

Year

2008 2009 2010 2011 2012 2013

Rates

% Unknown

ASIAN/PACIFIC ISLAND
Black, non-hispanic
Hispanic or Latino
Native American
White, non-Hispanic
WNV SURVEILLANCE

Surveillance of human WNV cases
Mosquito pool surveillance
Surveillance of WNV in other animals
  • Typically birds or horses
ST. LOUIS ENCEPHALITIS

Only one case in Arizona in the past five years, in 2014

We know that the mosquitoes are infected

Less than 1% of infections are apparent

- Will be either non-neuroinvasive or neuroinvasive
- 5-15% of cases are fatal
AEDES AEGYPTI

DENGUE & CHIKUNGUNYA
**Aedes Aegypti Mosquitoes: Eggs & Larvae**

Eggs are black and laid singly just above the water line, they can withstand desiccation for over a year.

Larvae prefer artificial water-holding containers

- Ex. Tires, buckets, etc.
- Usually found in or around human homes
AEDES MOSQUITOES: ADULTS

Aedes aegypti found dispersed throughout Arizona

Daytime biting adults

Prefer to bite humans in and around their homes

Known sightings are just the tip of the iceberg

- Using Culex spp. surveillance data
CHIKUNGUNYA VIRUS

An RNA virus spread by mosquitoes

- *Aedes* spp.
- Mosquito-human-mosquito-human cycle

First appeared in western hemisphere in December, 2013

- Since then has caused a huge outbreak in the Caribbean and Latin America

Naïve population + *Aedes* vectors = large outbreak potential

Probable locally acquired case in Sonora, Mexico → moving northward

• Current outbreak:
  - As of 1/22/15
    - 1,133,561 cases
    - 172 deaths
CHIKUNGYUNYA: What is local transmission?

A person with no recent history of travel to an area with the virus who gets bitten by a mosquito infected with chikungunya virus where they live, work or play.

A mosquito bites a person who is sick with chikungunya and picks up the virus from the infected person's blood.

Infected mosquitoes can then spread the virus to other people through bites.

For more information: www.cdc.gov/chikungunya
Most common symptoms: severe joint pain, fever, rash, nausea, vomiting, diarrhea

- Joint pain so severe can’t leave bed
- 80-90% of all infections lead to disease

Mortality typically very low, <1%

BUT morbidity may be very high

- Chronic infection can cause months or years of rheumatic symptoms, fatigue, and depression
DENGUE
BACKGROUND

RNA virus transmitted by Aedes mosquito vectors

Found globally throughout tropics and subtropics

Serotypes I, II, III, IV

- No cross-immunity
- Second infection (with different strain) much worse than the first.
  - Antibody dependent enhancement
DENGUE, THE OUTBREAK

Dengue outbreak in Sonora, Mexico

93 imported cases into AZ between Sept. 2014 and Feb. 2015
DENGUE OUTBREAK
EPI CURVE
DENGUE OUTBREAK
CASES BY COUNTY

Arizona County of Residence

<table>
<thead>
<tr>
<th>County of Residence</th>
<th>Number of persons</th>
</tr>
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<tbody>
<tr>
<td>Graham</td>
<td>1</td>
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<tr>
<td>Maricopa</td>
<td>15</td>
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<tr>
<td>Pima</td>
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<tr>
<td>Pinal</td>
<td>1</td>
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<tr>
<td>Santa Cruz</td>
<td>2</td>
</tr>
<tr>
<td>Yuma</td>
<td>68</td>
</tr>
</tbody>
</table>
MULTIPLE CLINICAL MANIFESTATIONS

Dengue-like illness

- Fever and travel to dengue-endemic area

Dengue

- Fever and at least one of the following:
  - Nausea/vomiting, rash, aches/pains, tourniquet test positive, leukopenia, abdominal pain/tenderness, extravascular fluid accumulation, mucosal bleeding, liver enlargement, increasing hematocrit with platelet count decrease

Severe dengue

- Dengue with any of the following:
  - Severe plasma leakage, severe bleeding, severe organ involvement
VECTOR CONTROL

Public education
• Source reduction
• Personal and property protection

Conduct Surveillance
• Evidence based control efforts

Source Reduction
• Eliminate egg laying sites

Larviciding
• Apply larvicides to larval habitats

Adulticiding/Fogging
• Prioritize fogging based on surveillance
SOURCE REDUCTION

Eliminating larval habitats

• Tires, bird baths, containers, rain gutters, unused swimming pools
• Education component is very important
• Most useful for *Aedes spp.*
PERSONAL PROTECTION

Reduce time outdoors

Long pants and sleeves

Use mosquito repellent

• Apply according to instructions
• Reapply according to instructions
• Apply after sunscreen
HOME PROTECTION

Keep window screens intact, or use AC
Source reduction, source reduction, source reduction
Treat non-removable standing water with insecticide
Remove water collecting debris from the yard
TARGET BY SPECIES

**CULEX SPP.**

Focus on larvicides, adulticides, etc. in the high risk areas
- At community level
- Standing ground water areas
- Agricultural areas
- Education for personal protection
- Etc.

**AEDES SPP.**

Education for homeowners
- Household level
- Aedes aegypti live in and around human homes, so focus on education
- Source reduction near homes
- Home protection
- Personal protection
Protect yourself from West Nile Virus

• Use insect repellents that contain **DEET**.

• **Drain** any standing water.

• **Dress** in long, loose, light-colored clothing.

• Use repellent & protective clothing from **Dusk** to **Dawn**.
ADHS’S ROLES

Classify, track, and analyze human disease cases
Database management and analysis of vector data
Provide support to county and tribal partners, when requested
Disease and vector surveillance reporting to federal partners
Educational campaigns and assessments for the public, clinicians, and local partners

1/23/2015
Arizona Department of Health Services
PREVENTION EDUCATION CAMPAIGN

ADHS WNV website: www.westnileaz.com

ADHS staff available for presentations

Brochures in English & Spanish

WNV poster – backyard prevention
QUESTIONS?

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Vectorborne and Zoonotic Disease Program
Office of Infectious Disease Services, ADHS
SOURCES/ADDITIONAL RESOURCES

Center for Disease Control and Prevention SLE webpage:
  • http://www.cdc.gov/sle

Center for Disease Control and Prevention Chikungunya webpage:
  • http://www.cdc.gov/chikungunya/

Center for Disease Control and Prevention Dengue webpage:
  • http://www.cdc.gov/Dengue/

Center for Disease Control and Prevention (CDC) WNV webpage:
  • http://www.cdc.gov/ncidod/dvbid/westnile/surv&control_archive.htm

Arizona Dept. of Health Services WNV page:
  • http://azdhs.gov/phs/oids/westnile/