West Nile Virus
Los Angeles County

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Virus maintained bird—mosquito—bird cycle

✓ Small mammals may also play a role

Small birds serve as 1° amplifying host for WNV virus

Transmission of WNV- bite of infected mosquito
Actual transmission cycles in California:
- several *Culex* vectors
- parallel urban and rural transmission cycles
- variety of avian hosts
- no mammalian cycle
LOS ANGELES COUNTY SURVEILLANCE and EPIDEMIOLOGY
WEST NILE SURVEILLANCE IN LAC

- Mosquito pool testing - Mosquito Abatement Districts (MADs)
- Sentinel chicken testing - MADs
- Dead Bird Reporting and Testing
  - WNV-infected dead birds have been recovered from nearly all areas of LAC
- Horse testing, other animals - CDPH
- Human testing and investigation - LAC DPH
WNV INFECTIONS BY WEEK OF SYMPTOM ONSET, 2009-2014*

*Blood donors listed by date of donation. Number of cases as of October 9, 2014.
WNV BY HEALTH DISTRICT, LAC 2014

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>2014 To Date*</th>
<th>2013 Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPA 1: Antelope Valley</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>SPA 2: San Fernando</td>
<td>39</td>
<td>62</td>
</tr>
<tr>
<td>SPA 3: San Gabriel</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>SPA 4: Metro</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>SPA 5: West</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>SPA 6: South</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>SPA 7: East</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>SPA 8: South Bay</td>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>112</strong></td>
<td><strong>165</strong></td>
</tr>
</tbody>
</table>


WNV Trends in 2014

- WNV level of activity similar to 2012, 2013
- Increased cases in southeastern LAC (Orange County experiencing its largest outbreak – 172 cases)
- Continued cases in San Fernando and San Gabriel Valleys
### WNV CASE CHARACTERISTICS
#### LAC 2013*, N=165

<table>
<thead>
<tr>
<th></th>
<th>Total (N=165)</th>
<th>Asymptomatic Blood Donor (N=21)</th>
<th>WN Fever (N=40)</th>
<th>Neuroinvasive** (N=104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (M / F)</td>
<td>116/49</td>
<td>12/9</td>
<td>28/12</td>
<td>76/28</td>
</tr>
<tr>
<td>Median Age (range)</td>
<td>56 yrs (7-92 yrs)</td>
<td>48 yrs (19-78)</td>
<td>59.5 yrs (23-92)</td>
<td>56.5 yrs (7-88)</td>
</tr>
<tr>
<td>Hospitalized n (%)</td>
<td>122 (74)</td>
<td>--</td>
<td>18 (45)</td>
<td>104 (100)</td>
</tr>
<tr>
<td>Deaths n (%)</td>
<td>9 (5)</td>
<td>--</td>
<td>1 (2.5)</td>
<td>8 (7.7)</td>
</tr>
</tbody>
</table>

*Excludes cases in Long Beach and Pasadena.

**46 encephalitis, 52 meningitis, 6 acute flaccid paralysis
WNV INCIDENCE RATES BY YEAR ONSET LAC, 2004-2013

*Rates unstable due to low case count
CLINICAL PRESENTATION
Asymptomatic Infection

~80% of infections
Generation of life-long immunity (presumed)
Asymptomatic ~20%

"West Nile Fever"

<1% CNS disease

West Nile Fever

10-30% of infections
Fever, headache, rash, fatigue

~80% Asymptomatic
WNV HUMAN INFECTION
"ICEBERG" (3)

- Asymptomatic: ~80%
- "West Nile Fever": ~20%
- WNV Neuroinvasive Disease (WNND): <1% of all infections
  - Meningitis, encephalitis, poliomyelitis

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THE CLINICAL IMPACT OF HUMAN WNV INFECTION

- Most WNV infections benign and usually asymptomatic
- Febrile illness generally benign, but may be ongoing problems
  - Prolonged fatigue, subjective cognitive problems
- Severe encephalitis
  - Risk factors: older age and immunosuppression; diabetes; hypertension
  - Long lasting sequelae
- Neurologic illness: meningitis and encephalitis, poliomyelitis, parkinsonism
CLINICAL SPECTRUM OF WNV ILLNESS

WN Fever

WN Meningitis

WN Encephalitis

WN “Poliomyelitis”

Inflammatory Neuropathy
Radiculopathy / plexopathy
PREVENTION
AND
CONTROL
MOSQUITO HABITAT ELIMINATION

Mosquito Control

Habitat Elimination

Adulticiding

Larviciding

CDC

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PUBLIC INFORMATION

GOALS

- Residential Habitat Elimination
- Personal Protection
  - Avoidance
  - Clothing
  - Repellant
PERSONAL PROTECTION: MOSQUITO REPELLANTS (1)

- **DEET**: based products provide long-lasting mosquito protection, 10-35% recommend
  - ✓ Higher DEET percentage - longer lasting
- **Non-DEET**: based repellents cannot be relied on to provide prolonged mosquito-protection
- Fewer than 50 cases of serious toxic effects reported in the literature since 1960

N Engl J Med 2002;347:3-7
PERSONAL PROTECTION: MOSQUITO REPELLENTS (2)

- DEET Safety Profile
  - 1998 EPA review: "normal use of DEET does not present a health concern to the general U.S. population"
  - 40 years of use and over 8 billion human applications
  - Can use children >2 months, don’t put repellent on hands, use 30% or less
  - Follow manufacturing guidelines
  - Other products- oil of Eucalyptus based products

SOURCE REDUCTION

_eliminating larval habitats

✓ Tires, bird baths, containers, rain gutters, unused swimming pools
BIOLOGICAL CONTROL

- Utilizes predators, both natural and introduced, to eat larvae and pupae
  - Mosquito fish
    - *Gambusia affinis*, *G. holbrooki* most common
    - *Fundulus* spp., *Rivulus* spp., killifish
  - Other agents have been used but are not readily available
    - Fungus, protozoa, nematodes
    - Copepods

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ADULTICIDES

- When other control measures unsuccessful
- Least efficient
- Proper type and time of application helps efficacy
  - Ultra Low Volume foggers
    - 1 ounce per acre
  - Small droplets contact and kill adults
Emerging Threats in Mosquito-borne disease: California and the Americas

- *Aedes albopictus* and *Aedes aegypti*
  - Both in San Gabriel Valley and other areas in CA
  - Possible dengue in the future?
  - Dengue in Key West Florida

- Chicingunya virus - in the Americas
AEDES ALBOPICTUS (TIGER MOSQUITO)

- Big uptick in activity in San Gabriel Valley
- Bites during day
- Proving difficult to eradicate
- Capable of transmitting dengue virus
- *Aedes aegyptii* - discovered in Commerce - early October 2014
  - Carry Yellow Fever
  - Dengue
  - Chikungunya
CHIKUNGUNYA AND DENGUE

- Chikungunya: rare form of viral fever ("debilitating non-fatal viral illness")
  - Now in the Americas - St. Thomas and most of West Indies
  - Transmitted by Aedes aegypti

- Dengue: fever (usually benign) hemorrhagic (can be fatal)
  - Transmitted by Aedes aegypti and A. albopictus
CONCLUSIONS

- WNV has become the most common cause of arboviral neuroinvasive disease in the U.S.
- WNV is endemic in LAC and widespread
- New areas in LAC in 2013
  - South Bay and coastal areas
  - Increase activity in Antelope Valley
- Continued high number of human cases in 2014
- WNV activity has also been detected at a lower level in Tropical Americas
- Important to continue mosquito-borne disease surveillance
- Possible future risk of dengue and chikungunya infections with *Aedes albopictus* and *Aedes aegyptii* mosquitoes endemic in LAC
LAC DPH RESOURCES

ACDC Website for Los Angeles County

- [http://publichealth.lacounty.gov/acd/VectorWestNile.htm](http://publichealth.lacounty.gov/acd/VectorWestNile.htm)
- Link to weekly WNV Epidemiology Report
- Link to positive bird maps (produced by Veterinary PH)
- Link to map of recent positive mosquitoes at CalSurv site
California Department of Public Health

- [http://www.westnile.ca.gov/](http://www.westnile.ca.gov/)
  - Displays weekly counts of positive mosquitoes, birds, and sentinel chickens for all CA counties
  - Link to weekly Arbovirus Surveillance Bulletin
    - Reports specific locations of positive animals and detailed testing results
RESOURCES (1)

WEBSITES:

- Los Angeles County Acute Communicable Disease Control
  http://lapublichealth.org/acd/VectorWestNile.htm

- Los Angeles County Public Health Nursing
  http://www.lapublichealth.org/phn/

- Centers for Disease Control and Prevention (CDC)
  http://www.cdc.gov/ncidod/dvbid/westnile/index.htm

- California Department of Public Health
  www.westnile.ca.gov
Acknowledgements

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QUESTIONS AND ANSWERS
Sh h h h h h! I finished.