A Survey of the Mosquito Population in North Georgia

Amy C. Grice, MPH
Objectives

• Discuss the background for the project, including a description of the host agency, public health significance, and purpose
• Discuss the methodology used for the project and study design
• Discuss the results of the study
• Discuss findings, limitations, benefit to host agency, and areas for future research
• Keep presentation within time parameters
• Questions
Host Agency

• The North Georgia Health District is a public health agency in the north central part of Georgia.

• Major programs within the agency include Health Clinic Services, Environmental Health, and Emergency Preparedness
North Georgia Health District
Dr. Zachary Taylor, M.D., M.S., Health Director

- Six counties
- Located between Atlanta, GA and Chattanooga, TN
- Two major interstates
- Mix of urban and rural areas
- Population ~450,000
- Tourism in northern counties
- Various terrain—mountains (Nat’l forest), ridge/valley, piedmont

GA DPH (2016)
Environmental Health
Raymond R. King, M.S., District EH Director

• Multiple program responsibilities in host agency (on-site sewage, food service, lead/healthy homes, rabies control, tourist accommodations, pools, body art, emergency response strike teams)

• 16 Environmental Health Specialists in host agency

• Responsible for mosquito surveillance (when active)

• No surveillance since 2004 in agency—sparse overall activity in northern part of state
Background-PH Concern

- Arboviral disease worldwide a major cause of morbidity and mortality (developing countries, southern hemisphere)

- Mosquitoes are primary arthropod vectors

- Mosquito surveillance historically limited--US and Georgia (northern Georgia in particular)

- Emergence and re-emergence of infectious disease
  - Increasing international trade and travel
  - Urbanization –roughly 80% of US population living in urban areas according to Census reports
  - Fluctuations in weather patterns (rain, drought, temperature)
  - Global spread of Zika as example
Background-PH Concern

- Zika virus local transmission a concern as travel-related cases rise in Georgia

- 2015 Census data: Hispanic/Latino population in Whitfield (33.9%), Murray (14.5%), Gilmer (11.5%), and Cherokee (10.1%) counties could be at increased risk for travel-related cases

- West Nile Virus, Eastern Equine Encephalitis, and LaCrosse Encephalitis are currently the three most commonly diagnosed (locally-acquired) mosquito-borne diseases in Georgia (Rustin & Kelly, 2016)

- *Aedes albopictus, Culex quinquefasciatis, and Culiseta melanura* identified as most common vectors of disease based on limited testing (GA DPH, 2014)
Background

- **Eastern Equine Encephalitis**
  - No symptoms, flu-like symptoms, encephalitis w/permanent brain damage likely, 33% mortality rate (CDC, 2016c)

- **LaCrosse Encephalitis**
  - No symptoms, flu-like symptoms, encephalitis w/seizures, paralysis; most severe in those <16 (CDC, 2016b)

- **West Nile Virus**
  - No symptoms, flu-like symptoms, encephalitis, meningitis (CDC, 2016c)

- **Zika Virus**
  - No symptoms, mild fever w/rash, myalgia, conjunctivitis
  **Linked to microcephaly in infants born to infected mothers and Guillain-Barre (sequelae in adults), extended person-person sexual transmission (CDC, 2016d)**
Background--Mosquitoes

- Only female mosquitoes take blood meals
- Collection of male mosquitoes in surveillance indicates large population density of species
- Mosquitoes cannot transmit all blood-borne viruses—viral replication must occur for transmission
- Species have different, habitats, feeding patterns, oviposit sites, flight ranges

CDC (2014)--Aedes albopictus
Background—Georgia

- **Georgia Mosquito Surveillance (GA DPH, 2014)**
  - **2001**: Introduction of WNV in Georgia (6 cases, 1 death)
  - **2003**: Most robust year for surveillance, 60 out of 159 counties (including some in NGHD); viral testing of birds and mosquitoes
  - **2012**: Budget cuts suspended viral testing of mosquitoes through state public health lab (117 WNV cases reported—WNV now endemic)
  - **2014**: Only 6 of 159 counties doing surveillance (southern portions and some Atlanta area)
  - **2016**: January-October: 96 cases of travel-related Zika (GA DPH, 2016)
Purpose

- The purpose of this study was to assess the distribution of mosquito species of human risk in the North Georgia Health District by
  - 1) Evaluating and analyzing historical mosquito surveillance data—historical data does not include all counties
  - 2) Conducting new mosquito surveillance to include all counties and analyzing the results of the new data.
Methods

• Descriptive Study of Mosquito Species in the Host Agency

• 2 Data Sets:
  – 1) Historical data (limited) from surveillance activities in 2003, 2004, 2011 in host agency
  – 2) New surveillance performed between June and September 2016
CDC Light Trap with CO2, Octenol, L-lactic acid

Gravid Trap
### Excel spreadsheet format used in data reporting of historical and 2016 surveillance activities

<table>
<thead>
<tr>
<th>Collection Date</th>
<th>VIAL ID</th>
<th>Address</th>
<th>City</th>
<th>Zip Code</th>
<th>Latitude (Y)</th>
<th>Longitude (X)</th>
<th>County</th>
<th>District</th>
<th>Species</th>
<th>Total per Pool</th>
<th>Trap Type</th>
<th>Blood Fed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/8/2016</td>
<td>A01</td>
<td>1130 Bluffs</td>
<td>Canton</td>
<td>30114</td>
<td>34.26801</td>
<td>-84.4715</td>
<td>Cherokee</td>
<td>NGHD 1-2</td>
<td><em>Ae. albopictus</em></td>
<td>3</td>
<td>Light</td>
<td>yes</td>
</tr>
<tr>
<td>6/8/2016</td>
<td>A01</td>
<td>1130 Bluffs</td>
<td>Canton</td>
<td>30114</td>
<td>34.26801</td>
<td>-84.4715</td>
<td>Cherokee</td>
<td>NGHD 1-2</td>
<td><em>Ae. albopictus</em></td>
<td>1</td>
<td>Light</td>
<td>yes</td>
</tr>
<tr>
<td>6/13/2016</td>
<td>A03</td>
<td>1130 Bluffs</td>
<td>Canton</td>
<td>30114</td>
<td>34.26801</td>
<td>-84.4715</td>
<td>Cherokee</td>
<td>NGHD 1-2</td>
<td><em>Ae. albopictus</em></td>
<td>6</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/13/2016</td>
<td>A03</td>
<td>1130 Bluffs</td>
<td>Canton</td>
<td>30114</td>
<td>34.26801</td>
<td>-84.4715</td>
<td>Cherokee</td>
<td>NGHD 1-2</td>
<td><em>An. punctipennis</em></td>
<td>3</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/13/2016</td>
<td>A03</td>
<td>1130 Bluffs</td>
<td>Canton</td>
<td>30114</td>
<td>34.26801</td>
<td>-84.4715</td>
<td>Cherokee</td>
<td>NGHD 1-2</td>
<td><em>An. quadriceps</em></td>
<td>2</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/13/2016</td>
<td>A03</td>
<td>1130 Bluffs</td>
<td>Canton</td>
<td>30114</td>
<td>34.26801</td>
<td>-84.4715</td>
<td>Cherokee</td>
<td>NGHD</td>
<td><em>U. sapphire</em></td>
<td>2</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/13/2016</td>
<td>A03</td>
<td>1130 Bluffs</td>
<td>Canton</td>
<td>30114</td>
<td>34.26801</td>
<td>-84.4715</td>
<td>Cherokee</td>
<td>NGHD</td>
<td><em>Wy. smithii</em></td>
<td>3</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/17/2016</td>
<td>A04</td>
<td>243 Orchard</td>
<td>Jasper</td>
<td>30143</td>
<td>34.43542</td>
<td>-84.4781</td>
<td>Pickens</td>
<td>NGHD</td>
<td><em>Ae. albopictus</em></td>
<td>1</td>
<td>Gravid</td>
<td>yes</td>
</tr>
<tr>
<td>6/17/2016</td>
<td>A04</td>
<td>243 Orchard</td>
<td>Jasper</td>
<td>30143</td>
<td>34.43542</td>
<td>-84.4781</td>
<td>Pickens</td>
<td>NGHD</td>
<td><em>Cx. erraticus</em></td>
<td>2</td>
<td>Gravid</td>
<td>no</td>
</tr>
<tr>
<td>6/18/2016</td>
<td>A05</td>
<td>16054 Morganton</td>
<td>Jasper</td>
<td>30560</td>
<td>34.84435</td>
<td>-84.2028</td>
<td>Fannin</td>
<td>NGHD</td>
<td><em>Ae. albopictus</em></td>
<td>3</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/18/2016</td>
<td>A05</td>
<td>16054 Morganton</td>
<td>Jasper</td>
<td>30560</td>
<td>34.84435</td>
<td>-84.2028</td>
<td>Fannin</td>
<td>NGHD</td>
<td><em>An. punctipennis</em></td>
<td>1</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/19/2016</td>
<td>A06</td>
<td>243 Orchard</td>
<td>Jasper</td>
<td>30143</td>
<td>34.43542</td>
<td>-84.4781</td>
<td>Pickens</td>
<td>NGHD</td>
<td><em>Ae. vexans</em></td>
<td>4</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/19/2016</td>
<td>A06</td>
<td>243 Orchard</td>
<td>Jasper</td>
<td>30143</td>
<td>34.43542</td>
<td>-84.4781</td>
<td>Pickens</td>
<td>NGHD</td>
<td><em>An. punctipennis</em></td>
<td>6</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/21/2016</td>
<td>A07</td>
<td>180 McClure</td>
<td>Canton</td>
<td>30114</td>
<td>34.22594</td>
<td>-84.4966</td>
<td>Cherokee</td>
<td>NGHD</td>
<td><em>An. punctipennis</em></td>
<td>56</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/22/2016</td>
<td>A07</td>
<td>180 McClure</td>
<td>Canton</td>
<td>30114</td>
<td>34.22594</td>
<td>-84.4966</td>
<td>Cherokee</td>
<td>NGHD</td>
<td><em>An. punctipennis</em></td>
<td>3</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/22/2016</td>
<td>A07</td>
<td>180 McClure</td>
<td>Canton</td>
<td>30114</td>
<td>34.22594</td>
<td>-84.4966</td>
<td>Cherokee</td>
<td>NGHD</td>
<td><em>Cx. restuans</em></td>
<td>1</td>
<td>Light</td>
<td>yes</td>
</tr>
<tr>
<td>6/22/2016</td>
<td>A08</td>
<td>340 Cherokee</td>
<td>Canton</td>
<td>30114</td>
<td>34.23183</td>
<td>-84.4844</td>
<td>Cherokee</td>
<td>NGHD</td>
<td><em>An. punctipennis</em></td>
<td>5</td>
<td>Light</td>
<td>no</td>
</tr>
<tr>
<td>6/22/2016</td>
<td>A08</td>
<td>340 Cherokee</td>
<td>Canton</td>
<td>30114</td>
<td>34.23183</td>
<td>-84.4844</td>
<td>Cherokee</td>
<td>NGHD</td>
<td><em>Cx. nigripalpis</em></td>
<td>9</td>
<td>Light</td>
<td>yes</td>
</tr>
</tbody>
</table>
Methods

• Identification of species and classification as risk or non-risk to humans (Risk species: species associated with human arboviral disease transmission in region)

• Simpson and Shannon Indices (ecological science) used to assess species richness and biodiversity

• Risk and non-risk groups analyzed separately (historical and 2016 data also analyzed separately)

• Shapiro-Wilk (p < .05) tests of normality used for statistical significance
Results

- Shannon and Simpson diversity measures indicated moderate diversity/species evenness among risk and non-risk groups in both data sets (not measures of significance, no extreme values)

Mosquito Collection from NGHD

CDC (2014)
Results

• Shapiro-Wilk (p < .05)
  – Results not significant (p > .05) for *distribution of species* between risk and non-risk groups in both historical and 2016 data. Normal distribution of species
  – Results significant (p < .05) for *distribution of mosquitoes* within risk and non-risk species in both historical and 2016 data. Distribution of mosquitoes within species is skewed
## Results

### Table 1. Summary of Statistical Measures Used to Assess Mosquito Populations of the North Georgia Health District

<table>
<thead>
<tr>
<th>Statistical Measures</th>
<th>Historical Data</th>
<th>2016 Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Species</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Total Mosquitoes</td>
<td>1170</td>
<td>39</td>
</tr>
<tr>
<td>Shannon Index$_1$</td>
<td>.887</td>
<td>.974</td>
</tr>
<tr>
<td>Shannon’s Equitability$_2$</td>
<td>.495</td>
<td>.605</td>
</tr>
<tr>
<td>Simpson Index$_3$</td>
<td>.530</td>
<td>.476</td>
</tr>
<tr>
<td>Shapiro-Wilk$_4$ Species Comparison</td>
<td>.987, $df = 5$,</td>
<td>.982, $df = 6$,</td>
</tr>
<tr>
<td>Shapiro-Wilk$_4$ Mosquito Comparison</td>
<td>.757, $df = 5$,</td>
<td>.787, $df = 6$,</td>
</tr>
<tr>
<td>Within Risk and Non-Risk Groups</td>
<td>$p = .035$</td>
<td>$p = .045$</td>
</tr>
</tbody>
</table>

Notes: 1) **Shannon Index**: 0 = no diversity; 5 = infinite diversity 2) **Shannon’s Equitability**: 0 = no diversity; 1 = maximum evenness/diversity; 3) **Simpson Index**: 0 = infinite diversity ; 1 = no diversity 4) **Shapiro-Wilk**: Significant at $p < .05$ level and rejection of null hypothesis
Discussion

• 31 species identified between historical and 2016 collections
• No significant difference in numbers of species identified as human risk vs non-risk
• Dominant mosquito species within groups
Results

Chart 1: Historical Mosquito Species ($n = 11$) Distribution -- North Georgia Health District

- **Non-Risk Species:**
  - Total % within non-risk group
  - Psorophora ferox, 64.10%
  - Culiseta inornata, 2.60%
  - Anopheles punctipennis, 25.60%

- **Risk Species:**
  - Total % within risk group
  - Culex quinquefasciatus, 69.90%
  - Aedes albopictus, 17.80%
  - Aedes vexans, 9.80%

Genus and Species:
- Psorophora ferox
- Psorophora ciliata
- Culiseta inornata
- Anopheles walkeri
- Anopheles punctipennis
- Ochlerotatus triseriatus
- Ochlerotatus thibaulti
- Culex salinarius
- Culex quinquefasciatus
- Aedes vexans
- Aedes albopictus

Total Sampled Population

0.00% 10.00% 20.00% 30.00% 40.00% 50.00% 60.00% 70.00% 80.00%
Results

Chart 2: 2016 Mosquito Species \((n = 25)\) Distribution - North Georgia Health District

<table>
<thead>
<tr>
<th>Genus and Species</th>
<th>Non-Risk Species: Total % within non-risk group</th>
<th>Risk Species: Total % within risk group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranotaenia sapphirinia</td>
<td>9.90%</td>
<td>Anopholes punctipennis, 36.40%</td>
</tr>
<tr>
<td>Psorophora ferox</td>
<td>4.10%</td>
<td>Anopholes crucians, 32.40%</td>
</tr>
<tr>
<td>Psorophora cyanescens</td>
<td>2.50%</td>
<td>Culex erraticus, 7.42%</td>
</tr>
<tr>
<td>Orthopodomyia signifera</td>
<td>0.40%</td>
<td>Culex restuans, 1.38%</td>
</tr>
<tr>
<td>Orthopodomyia signifera</td>
<td>0.40%</td>
<td>Culex quinquefasciatis, 6.57%</td>
</tr>
<tr>
<td>Orthopodomyia signifera</td>
<td>0.40%</td>
<td>Culex pipiens, 3.92%</td>
</tr>
<tr>
<td>Culex pilosus</td>
<td>0.10%</td>
<td>Culex nigripalpus, 1.38%</td>
</tr>
<tr>
<td>Culex pilosus</td>
<td>0.10%</td>
<td>Culex peccator, 1.27%</td>
</tr>
<tr>
<td>Culex quinquefasciatis</td>
<td>6.57%</td>
<td>Culiseta melanura, 0.95%</td>
</tr>
<tr>
<td>Culex quinquefasciatis</td>
<td>6.57%</td>
<td>Coquillettidia perturbans, 2.76%</td>
</tr>
<tr>
<td>Anopholes barberi</td>
<td>0.10%</td>
<td>Aeodes strictucus, 3.20%</td>
</tr>
<tr>
<td>Aeodes strictucus</td>
<td>3.20%</td>
<td>Aeodes vexans, 17.18%</td>
</tr>
<tr>
<td>Culex erraticus</td>
<td>7.42%</td>
<td>Aeodes triceriatus, 0.11%</td>
</tr>
<tr>
<td>Culex restuans</td>
<td>1.38%</td>
<td>Aeodes japonicus, 1.27%</td>
</tr>
<tr>
<td>Culex quinquefasciatis</td>
<td>6.57%</td>
<td>Aeodes cinereus, 0.42%</td>
</tr>
<tr>
<td>Culex pipiens</td>
<td>3.92%</td>
<td>Aeodes vexans, 17.18%</td>
</tr>
<tr>
<td>Culex nigripalpus</td>
<td>1.38%</td>
<td>Aeodes triceriatus, 0.11%</td>
</tr>
<tr>
<td>Culex peccator</td>
<td>1.27%</td>
<td>Aeodes japonicus, 1.27%</td>
</tr>
<tr>
<td>Culiseta melanura</td>
<td>0.95%</td>
<td>Aeodes cinereus, 0.42%</td>
</tr>
<tr>
<td>Coquillettidia perturbans</td>
<td>2.76%</td>
<td>Aeodes vexans, 17.18%</td>
</tr>
<tr>
<td>Aeodes vexans</td>
<td>17.18%</td>
<td>Aeodes triceriatus, 0.11%</td>
</tr>
<tr>
<td>Aeodes triceriatus</td>
<td>0.11%</td>
<td>Aeodes japonicus, 1.27%</td>
</tr>
<tr>
<td>Aeodes japonicus</td>
<td>1.27%</td>
<td>Aeodes cinereus, 0.42%</td>
</tr>
<tr>
<td>Aeodes cinereus</td>
<td>0.42%</td>
<td>Aeodes vexans, 17.18%</td>
</tr>
<tr>
<td>Aeodes albopticus</td>
<td>54.70%</td>
<td>Aeodes albopticus, 54.70%</td>
</tr>
</tbody>
</table>
Discussion—Historical Data
Major Findings

• *Culex quinquefasciatis*, *aka* southern house mosquito, most prevalent species in historical totals accounting for 67.7% of total
  – Historical surveillance performed in response to West Nile virus cases rather than for general studies
  – *Cx. quinquefasciatis* thought to be primary WNV vector, viral testing of mosquitoes
  – Locations may have been sampled repeatedly where mosquito was found

• *Aedes albopictus* accounted for 17.2% of historical totals
Discussion-2016 Data Major Findings

- *Aedes albopictus* most prevalent species in 2016 total collection (30.3%) and of risk group (54.7%)
  - Indicates a rise in prevalence from historical *Ae. albopictus* totals (17.2%)
  - Comparable to 2014 state totals (40.6%)

- *Culex quinquefasciatus* (3.6%) of 2016 collection and (6.8%) of 2016 risk group
  - Much lower than historical total (67.7%)
  - Lower than 2014 state reported (29.1%)
  - 2016 drought conditions could be a factor
Discussion—*Aedes albopictus*

- *Aedes albopictus* ("Asian Tiger") mosquito is a concern of the host agency for potential local Zika virus transmission as travel-related cases continue.
- Thought to be a competent vector of Zika virus, second to *Aedes aegypti* for US transmission.
- *Aedes aegypti* not found during surveillance activities in host agency (*Ae. albopictus* is superior competitor).
Discussion-Limitations

• Site selection not random which may have biased results (property access, travel, urban areas)
• Differences in historical and 2016 data made comparisons difficult (purpose of collection, mosquito ID, missing info)
• Only 2 trap types used; octenol & lactic acid used
• Drought conditions in 2016
Benefits to Host Agency

• Improved baseline knowledge of mosquito species in area helps direct limited funding (habitats, behavior, insecticide use)
• Included all district counties in the surveillance
• Surveillance logistics improved (dry ice, specimen preservation, trap placement)
• Data also shared with Georgia DPH
• Contribution to state-wide Zika preparedness efforts
• State/Federal Grant (CDC 485) awarded to district in August 2016 for public education (billboards, flyers, etc...), surveillance equipment
June-Sept 2016 Collection
Sites ($n=53$) --- 78 sites total w/hist.
Billboard—Hwy 411

Prevent Zika:
Tip 'n Toss
All Standing Water

Find out what it takes to stop Zika. Visit dph.georgia.gov/zika
Educational Flyers—English and Spanish

**ZIKA PARA MUJERES EMBARAZADAS QUE NO VIVEN EN UN ÁREA CON ZIKA**

Los CDC comprenden que las mujeres embarazadas pueden estar preocupadas y tener dudas en cuanto a la infección por el virus del Zika durante el embarazo. Obtenga más información sobre las pruebas de detección del virus del Zika en mujeres embarazadas y qué puede suceder si padece esta enfermedad durante el embarazo.

**Cómo se propaga el zika.**

Una mujer embarazada que no vive en un área afectada por el zika puede infectarse con el virus a través de la picadura de un mosquito mientras esté de visita en un área en que la enfermedad se propaga a través de los mosquitos. También puede contraer el zika si tiene relaciones sexuales con una pareja infectada. Para obtener más información sobre la transmisión del zika, visite [www.cdc.gov/zika/transmission](http://www.cdc.gov/zika/transmission).

**Lo que los CDC saben acerca del virus del ZIKA y el embarazo.**

- El virus del ZIKA puede transmitirse de la madre al feto durante el embarazo o en el momento próximo al nacimiento.
- El virus del ZIKA puede causar defectos de nacimiento y se ha asociado a otros problemas en bebés.

**Lo que los CDC aún desconocen acerca del virus del ZIKA y el embarazo, y están investigando de forma inmediata para revelarlo.**

- Desconocemos si una mujer se infecta durante el embarazo.
- Si una mujer se infecta, ¿qué probabilidades hay de que el virus la afecte o afecte al embarazo?
- ¿Qué probabilidades hay de que el virus pase al feto?
- ¿Qué probabilidades hay de que el feto, si se infecta, tenga defectos de nacimiento?
- ¿En qué momento del embarazo la infección puede dañar al feto?

[CDC’s Response to Zika](#)

**How can a pregnant woman find out if she has ZIKA?**

- If a pregnant woman gets infected with ZIKA, the virus will be in her blood and urine for up to two weeks. If she gets sick with a fever, joint pain, rash, or red eyes, doctors or other healthcare providers can test small amounts of her blood and urine and test them for ZIKA virus.
- If she never feels sick, or if more than two weeks have gone by since possible exposure to ZIKA (through travel or sexual contact with an infected partner), doctors can order a different test to look for evidence of ZIKA infection.

**What do the test results mean?**

**What happens if samples from a pregnant woman test positive?**

If a woman has a positive test result for ZIKA during pregnancy, it signals to her doctor or other healthcare provider to watch her pregnancy more closely, meaning the provider might do more ultrasounds or other tests to check the growth and development of her fetus and check for any signs of ZIKA virus infection. CDC recommends steps for doctors or other healthcare providers to help care for pregnant women.

**What happens if a pregnant woman’s test results are inconclusive (not positive or negative)?**

Sometimes, if the tests aren’t clearly positive or negative, the results are considered inconclusive. If the test results are inconclusive, her doctor may follow the CDC recommendations for a positive test result, meaning he or she might do more ultrasounds or other tests to monitor your pregnancy.

**What happens if a pregnant woman tests negative?**

If she tests negative, her doctor may check the growth and development of the fetus during an ultrasound and check for any signs of ZIKA virus infection. If there are no signs of ZIKA virus infection, routine prenatal care is recommended. If her doctor sees signs of ZIKA virus infection during an ultrasound, the doctor may do additional tests.

Educational Flyers – English & Spanish

Mosquito Bite Prevention (United States)

Not all mosquitoes are the same. Different mosquitoes spread different viruses and bite at different times of the day.

Type of Mosquito | Viruses spread | Biting habits
---|---|---
*Aedes aegypti; Aedes albopictus* | Chikungunya, Dengue, Zika | Primary daytime, but can also bite at night
*Color species* | West Nile | Evening to morning

Protect yourself and your family from mosquito bites

Use Insect Repellent

Use an Environmental Protection Agency (EPA)-registered insect repellent with one of the following active ingredients. When used as directed, EPA-registered insect repellents are proven safe and effective, even for pregnant and breastfeeding women.

**Active ingredient**

- DEET
- Picaridin, also known as KBR 3023, Bayrepel, and Icaridin
- Oil of lemon eucalyptus (OLE) or para-methane-diol (PMD)
- IR3535

**Some brand name examples**

- OFF! Cutter, Sawyer, Ultrathon
- Cutter Advanced, Skin So Soft Bug Guard Plus, Autan (outside the United States)
- Repel
- Skin So Soft Bug Guard Plus Expedition, SkinSmart

Insect repellent brand names are provided by your information only. The Centers for Disease Control and Prevention and the U.S. Department of Health and Human Services cannot recommend or endorse any name brand products.

Si tiene un bebé o niño

- Siempre sigue las instrucciones en la etiqueta del producto al aplicar repelente de insectos a los niños.
- No utilice repelente de insectos en bebés menores de dos meses.
- Visite a su hijo con ropa que le cubra los brazos y las piernas, oo...
- Cubra la cama, el cochecito y la manta con un mosquitero.
- No aplique repelente de insectos en las manos, los ojos, la boca, o la piel intinta o cortada de un niño.
- Almacene el repelente de insectos en un lugar seguro.
- No use productos que contengan aceite de eucalipto (OLE) o para-methane-diol (PMD) en niños menores de 3 años.

Trate la ropa y el equipo

- Trate con permanganato los artículos como botas, pantalones, calcetines y tiendas de campaña o compre ropa y equipo ya tratados con permanganato.
- La ropa tratada con permanganato proteja durante varias lavadas. Lea la información del producto para saber cuánto tiempo durará la protección.
- Si usted va a aplicar el tratamiento, siga las instrucciones del producto.
- No use productos con permanganato directamente sobre la piel.

Mantenga su hogar libre de mosquitos

- Use una malla o tela metálica en las puertas y ventanas. Repare los huecos que tenga la malla o tela metálica para mantener los mosquitos afuera.
- Use el aire acondicionado si está disponible.
- Evite que los mosquitos pegan huevos en agua acumulada.
- Una vez a la semana, vacíe unos cuantos recipientes que acumulan agua, tales como canastas, balde, fresas, manzanas, jarrones, piscinas, baños para pájaros, botes o contenedores de basura. Revise dentro y fuera de su hogar.

www.cdc.gov/features/StopMosquitoes
Future Research/Suggestions

• Compare species diversity of settings (urban vs rural), terrain (mountain vs valley) and trap types (light vs gravid)

• Establish standardized surveillance protocol (random selection, frequency, uniform reporting)

• Examine vector species that are risks to other mammals (i.e. horses, dogs)
Acknowledgements

• Preceptor
  – Mr. Raymond, R. King

• North Georgia Health District and Counties
  – Cherokee, Gilmer, Fannin, Murray, Pickens, Whitfield
  – Mr. Don Bristol

• Georgia Department of Public Health
  – Dr. Rosmarie Kelly

• UWF MPH program
  – Dr. Melanie Sutton
  – Dr. Peter Memiah
  – Ms. Leauna Stone
  – Dr. Enid Sisskin
  – Dr. Denice Curtis
  – Dr. Justice Mbizo
Questions??

Illustration by Ray King
References


ESTIMATED range of *Aedes albopictus* and *Aedes aegypti* in the United States, 2016*

*Aedes aegypti* mosquitoes are more likely to spread viruses like Zika, dengue, chikungunya and other viruses than other types of mosquitoes such as *Aedes albopictus* mosquitoes.

These maps DO NOT show
- Exact locations or numbers of mosquitoes living in an area
- Risk or likelihood that these mosquitoes will spread viruses

These maps show
- CDC’s best estimate of the potential range of *Aedes aegypti* and *Aedes albopictus* in the United States
- Areas where mosquitoes are or have been previously found

*Maps have been updated from a variety of sources. These maps represent CDC’s best estimate of the potential range of *Aedes aegypti* and *Aedes albopictus* in the United States. Maps are not meant to represent risk for spread of disease.*