CDC Zika IMS Jurisdiction and Partner Sustainment Strategy
Wednesday, March 23, 2017

Epidemiology and Surveillance Task Force

Carolyn Gould, MD, MSCR
CAPT, USPHS
Clinical/Epidemiology Team Lead CDC Zika Response

Michael Johansson
Zika Modeling Team Lead and Biologist, Dengue Branch
OVERVIEW

- Update on the epidemiology of Zika virus
- Modeling to inform surveillance strategies to identify local transmission
- What we might expect in 2017?
- Q&As
Update on the epidemiology of Zika virus
Zika virus epidemiology

- First isolated from a monkey in Uganda in 1947
- Before 2007, only sporadic human disease cases reported from Africa and Southeast Asia
- In 2007, first outbreak reported on Yap Island, Federated States of Micronesia
- From 2013–2015, >30,000 suspected cases reported from French Polynesia and other Pacific islands

Cumulative number of countries reporting mosquito-borne Zika virus transmission since 2007 by WHO region (as of Feb 1, 2017)

Zika virus in the Americas

- In May 2015, the first locally acquired cases in the Americas were reported in Brazil
- As of March 10, 2017, local transmission reported in 49 countries and territories in the Americas
- Only countries without reported local transmission are Bermuda, Canada, and Uruguay
  - Chile (Easter Island) reported Zika virus transmission before 2015

Locally transmitted Zika virus disease cases reported by country/territory in the Americas, 2015–2017 (as of Mar 9, 2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>Cases (N=50)</th>
<th>Total (N=754,460)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>346,475</td>
<td>(46%)</td>
</tr>
<tr>
<td>Colombia</td>
<td>107,206</td>
<td>(14%)</td>
</tr>
<tr>
<td>Venezuela</td>
<td>62,200</td>
<td>(8%)</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>39,339</td>
<td>(5%)</td>
</tr>
<tr>
<td>Martinique</td>
<td>36,701</td>
<td>(5%)</td>
</tr>
<tr>
<td>Honduras</td>
<td>32,403</td>
<td>(4%)</td>
</tr>
<tr>
<td>Guadeloupe</td>
<td>31,227</td>
<td>(4%)</td>
</tr>
</tbody>
</table>

*27% of cases are lab-confirmed

Suspected and confirmed locally transmitted Zika virus disease cases reported in the Americas, 2015–2017 (as of Mar 9, 2017)

N=754,460 suspected and confirmed cases

- South America (70%)
- Caribbean (21%)
- Central America (8%)
- North America (1%)
Zika virus in the United States

- From 2007–2014, 14 Zika virus disease cases identified in US travelers
- With recent outbreaks in the Americas, cases among US travelers increased substantially
- Limited local mosquito-borne transmission identified in Florida and Texas
- Outbreaks in three US territories (Puerto Rico, US Virgin Islands, and American Samoa)

Laboratory-confirmed Zika virus disease cases reported to ArboNET by US states or territories, 2015–2017 (as of Mar 8, 2017)

<table>
<thead>
<tr>
<th>Route</th>
<th>States N=5,109</th>
<th>Territories N=38,099</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel-associated</td>
<td>4,813 (94%)</td>
<td>147 (&lt;1%)</td>
</tr>
<tr>
<td>Locally acquired</td>
<td>221 (4%)</td>
<td>37,952 (99%)</td>
</tr>
<tr>
<td>Other routes*</td>
<td>75 (1%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

*Includes sexual transmission (n=45), congenital infection (n=28), laboratory transmission (n=1), and person-to-person through an unknown route (n=1)

State or territory of residence for reported Zika virus disease cases — United States, 2015–2017 (as of Mar 8, 2017)

State of residence for reported Zika virus disease and presumptive viremic blood donor cases — US states, 2015–2017 (as of Mar 8, 2017)

<table>
<thead>
<tr>
<th>State</th>
<th>Symptomatic disease cases (N=5,109)</th>
<th>Presumptive viremic blood donors† (N=39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>1,007 (21%)</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Florida</td>
<td>1,095* (21%)</td>
<td>24 (62%)</td>
</tr>
<tr>
<td>California</td>
<td>431 (9%)</td>
<td>5 (13%)</td>
</tr>
<tr>
<td>Texas</td>
<td>317* (6%)</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>New Jersey</td>
<td>180 (4%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>175 (4%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Maryland</td>
<td>133 (3%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

† People who reported no symptoms at the time of donating blood, but whose blood tested positive when screened for the presence of Zika virus RNA by the blood collection agency. Some presumptive viremic blood donors develop symptoms after their donation or may have had symptoms in the past. These individuals may be reported as both Zika virus disease cases and presumptive viremic blood donors.

* Includes 215 cases in FL and 6 cases in TX acquired through presumed local mosquito-borne transmission

Mosquito-borne Zika virus transmission in Florida

- Beginning in July 2016, sporadic, locally acquired cases identified in multiple counties in South Florida
- Active transmission identified in three small areas of Miami-Dade County
  - Recommendations for pregnant women to avoid travel to those areas and pregnant residents to be tested and followed
  - Intensive public health response, including aerial adulticide and larvicide applications, helped control the outbreaks
  - No evidence of ongoing, sustained local transmission

Areas in Miami-Dade County with previous active Zika virus transmission
Mosquito-borne Zika virus transmission in Texas

- In November 2016, first case of local mosquito-borne Zika virus infection reported in Brownsville, Texas
- Area borders Mexico with frequent border crossings
- Active Zika virus transmission reported in Mexico near the US-Mexico border
- In December, CDC designated Brownsville a Zika cautionary (yellow) area
  - Recommendations for pregnant women to avoid travel to that area and pregnant residents to be tested and followed
- As of March 8, 2017, 6 cases of local mosquito-borne transmission reported from the Brownsville area

Zika cautionary area in Brownsville, Texas

Reported Zika virus disease and presumptive viremic blood donor cases — US territories, 2015–2017  
(as of Mar 8, 2017)

<table>
<thead>
<tr>
<th>Territory</th>
<th>Symptomatic disease cases (N=38,099)</th>
<th>Presumptive viremic blood donors† (N=318)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puerto Rico</td>
<td>36,967 (97%)</td>
<td>318 (100%)</td>
</tr>
<tr>
<td>US Virgin Islands</td>
<td>993 (3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>American Samoa</td>
<td>139 (&lt;1%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

† People who reported no symptoms at the time of donating blood, but whose blood tested positive when screened for the presence of Zika virus RNA by the blood collection agency. Some presumptive viremic blood donors develop symptoms after their donation or may have had symptoms in the past. These individuals may be reported as both Zika virus disease cases and presumptive viremic blood donors.

Municipality of residence for reported Zika virus disease cases — Puerto Rico, 2015–2017 (as of Jan 26, 2017)

http://www.salud.gov.pr/Estadisticas-Registros-y-Publicaciones/Pages/VigilanciadeZika.aspx
Age group for reported Zika virus disease cases — US states and territories, 2015–2017 (as of Jan 25, 2017)

Proportion of cases

- States (N=4,930)
- Territories (N=35,784)

Age group (years)

- <20
- 20-39
- 40-59
- ≥60
Month of illness onset for Zika virus disease cases — US states and territories, 2015–2017 (as of Jan 25, 2017)

Number of cases

- States (N=4,930)
- Territories (N=35,784)
Modeling to inform surveillance strategies to identify local transmission
Research Question

- In areas at risk for local Zika virus transmission that have no documented local transmission, what is the most effective way to detect transmission?

- General strategies
  - Pregnant women
    - Test all pregnant women twice during pregnancy (IgM MAC-ELISA)
  - Blood donors
    - Test all blood bank donors (NAAT)
  - Emergency department patients
    - Test symptomatic people visiting the ED with specific symptoms (rRT-PCR on serum)
Probability of detecting ZIKV transmission with different strategies

Population = 10,000

Population = 100,000

Population = 1,000,000

Weekly incidence of infection
Expected number of tests*, false positive results*, and proportion of infections detected

*Population = 100,000, numbers scale directly with population size
Number of tests and probability of detection by case definition
Probability of detection and test numbers by case definition
Model limitations

- There are many variables, each one with substantial uncertainty and variability.
- The analysis was limited to three surveillance strategies, though many are possible.
- Syndromic surveillance was limited to ED visits. (We were only able to obtain detailed symptom data for ED patients.)
- The costs of implementing any of these systems should also be considered but was not analyzed here.
Conclusions

- The probability of detection for a given surveillance strategy depends on the incidence of infection and the population size.
- The expected proportion of infections detected by any system is low.
- Assay specificity is important, as testing will largely occur on non-ZIKV infected individuals, requiring follow-up on all positive results.
- Testing ED patients with Zika symptoms is likely more effective than testing pregnant women or blood donors. (increased probability of detection and fewer false positive results)
- For surveillance among ED patients, case definitions should capture symptoms that are common in ZIKV infections and uncommon in ED patients (increased probability of detection and fewer false positive results).
What might we expect in 2017?
Zika dynamics in 2017

- Three tiers of risk
  1. Epidemics in tropical areas
  2. Infected travelers
  3. Local transmission in the continental US and Hawaii

- Evidence from Zika, chikungunya, and dengue
Puerto Rico and other tropical areas

- Estimated 20-30% of Puerto Ricans infected in 2016
- Local transmission is likely to continue
- Another large epidemic is not likely
- Large-scale geographical spread is likely to be more restricted
Travel-associated cases

- After the initial chikungunya outbreaks, incidence among travelers declines.
- Travel-associated cases of chikungunya and Zika show seasonality.
Autochthonous cases

- Although arbovirus introduction continues to happen, local transmission is limited.
- More awareness and increased surveillance activities likely increase case numbers.
Conclusions

- In Puerto Rico and other dengue-endemic areas, herd immunity will likely reduce transmission of Zika virus in the near-future but not eliminate it.
- For US travelers, risk will continue but will likely decrease and show some seasonality (similar to chikungunya).
- In US states, limited local transmission may occur with sporadic cases or clusters.
- Improved surveillance and testing practices in the United States may lead to relatively higher case numbers compared to what we have seen with dengue and chikungunya.
Questions/Discussion
<table>
<thead>
<tr>
<th>Task Force</th>
<th>Date/Time/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory Task Force</td>
<td>Wed 3/22/2017 / 2pm–3pm / Rm 5116</td>
</tr>
<tr>
<td>Eddie Ades, Robert Lanciotti, Christy Ottendorfer</td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Joint Information Center/Communications</td>
<td>Wed 3/15/2017 / 2pm–3pm / Domestics</td>
</tr>
<tr>
<td>Cathy Young, John O’Connor</td>
<td>Wed 3/15/2017 / 5pm–6pm / Islands</td>
</tr>
<tr>
<td></td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Epidemiology Task Force</td>
<td>Wed 3/23/2017 / 2pm–3pm / Rm 5116</td>
</tr>
<tr>
<td>Stacey Martin, Carolyn Gould</td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Vector Issues Team</td>
<td>Tues 3/28/2017 / 2pm–3pm / Rm 5116</td>
</tr>
<tr>
<td>Janet McAllister, Audrey Lenhart</td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Policy and Partnerships</td>
<td>Wed 3/29/2017 / 1:30pm–2:30pm / Rm 5116</td>
</tr>
<tr>
<td>Sue Visser, Melody Stevens</td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Pregnancy and Birth Defects Task Force (including surveillance)</td>
<td>Wed 3/29/2017 / 3pm–4pm / Rm 5116</td>
</tr>
<tr>
<td>Peggy Honein, Dana Meaney-Delman, Suzanne Gilboa</td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Blood Safety Task Force</td>
<td>Thurs 3/30/2017 / 2pm–3pm / Rm 5116</td>
</tr>
<tr>
<td>Sustainment Strategy Discussions</td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Koo Chung, Matt Kuhnert, Craig Hooper</td>
<td></td>
</tr>
<tr>
<td>Medical Investigations Team</td>
<td>Thurs 3/30/2017 / 3:30pm–4:30pm / Rm 5116</td>
</tr>
<tr>
<td>Sustainment Strategy Discussions</td>
<td>Bridge Line: 1(888)972-6716/ Passcode: 6721430</td>
</tr>
<tr>
<td>Maleeka Glover</td>
<td></td>
</tr>
</tbody>
</table>
Thank You!

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.