It Takes a Village: Genomic Epidemiology of the Zika Epidemic

Developing the Partnerships, Exploring the Data and Sharing the Results

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Objectives

• Review the Bureau of Public Health Laboratories’ role in the locally-acquired Zika outbreak in Florida
• Describe the establishment of the collaboration to gather data on Zika genomic sequences
• Review the specimen and data sharing between the teams
• Discuss the observed insights in the emergence of locally-acquired Zika
Zika virus disease in the United States, 2015–2016

Source: CDC, as of 5/4/16

Courtesy of Lea Heberlein-Larson
**Time: The Zika Virus** It's a mysterious illness with devastating effects. **Is the next public health crisis in your backyard?**
## Zika Predictions

Demographic characteristics among residents of Miami-Dade County, 2010-2014

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Estimated residents (as of July 1, 2016)</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td></td>
<td>2,712,945</td>
<td>—</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>1,399,879</td>
<td>(51.6)</td>
</tr>
<tr>
<td>&lt; 5</td>
<td></td>
<td>160,063</td>
<td>(5.9)</td>
</tr>
<tr>
<td>5-17</td>
<td></td>
<td>396,089</td>
<td>(14.6)</td>
</tr>
<tr>
<td>18-64</td>
<td></td>
<td>1,733,571</td>
<td>(63.9)</td>
</tr>
<tr>
<td>&gt; 65</td>
<td></td>
<td>423,219</td>
<td>(15.6)</td>
</tr>
<tr>
<td>Age (in years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td></td>
<td>390,664</td>
<td>(14.1)</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td></td>
<td>507,320</td>
<td>(18.4)</td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
<td>1,812,247</td>
<td>(66.5)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>27,129</td>
<td>(1.0)</td>
</tr>
</tbody>
</table>

Courtesy of Isabel Griffin
Zika: locally acquired

• Zika virus (ZIKV) is a flavivirus spread primarily through the bite of an infected Aedes aegypti mosquito

• Symptoms of ZIKV include fever, arthralgia, conjunctivitis, and a maculopapular rash

• In the summer of 2016, epidemiologists in several county health departments investigated and defined cases of locally-acquired Zika virus, although no ongoing active transmission zones were identified
Zika: locally acquired

- In July 2016, the Florida Department of Health in Miami-Dade County (DOH-Miami-Dade) investigated the first outbreak of Zika virus in the continental United States.²

- Sporadic transmission occurred countywide and ongoing active Zika transmission zones were identified in the areas of Wynwood, Miami Beach, and Little River.³
Zika: locally acquired

Testing between July 26 and September 16: Mostly urine surveys (urosurveys), especially July 26 to August 19
Zika: locally acquired

Wynwood: July 29 – September 19, 2016
Miami Beach: August 19 – December 9, 2016
Zika: locally acquired

- Wynwood: July 29, 2016
- Miami Beach: August 19, 2016

Gustavo Palacios, Ph.D.
Director, Genomic Center
USAMRIID
Fort Detrick, MD

Jason T. Ladner, Ph.D.
Genomic Center
USAMRIID
Fort Detrick, MD
Establishing the Collaboration

- Discuss with supervisors
- Initiate IRB approval process
- Share information for collaboration with Florida BPHL Zika team, FL DOH Zika Epi team and Miami-Dade Zika Epi team
- Organize conference calls with partners and collaborators
Establishing the Collaboration

Florida DOH IRB Submission
August 26, 2016

Florida Department of Health

Request for Determination of Whether IRB Review is Required

For questions, concerns, to provide input, or request a consultation, call HRPP staff at 850-245-4034

Project Title
Molecular epidemiology of Zika virus transmission in Florida

Abstract
Provide a summary of the project (approximately 250 words)
The first locally obtained Zika virus disease cases in the Contiguous United States were recently reported in Florida. In order to stop the spread of the virus and prevent future introductions, it is important to understand how the virus became established in the US and how it is currently spreading. High-throughput viral genomic sequencing has been shown to be a powerful tool for understanding these critical public health questions. Here, we propose to establish a collaboration between the Florida Department of Health (FLDoH) and the U. S. Army Medical Research Institute of Infectious Diseases (USAMRIID). Through this collaboration, we will generate Zika virus genome sequences using high-throughput sequencing from RNA extracted from patient samples collected by the FLDoH Bureau of Public Health Laboratories (BPHL). RNA will be extracted by BPHL staff. Sequencing and analysis will be conducted by researchers at USAMRIID’s Center for Genome Sciences. These samples will be de-identified by BPHL staff before being provided to the USAMRIID researchers. The primary objective is to determine how many independent introductions have contributed to the local transmission of Zika virus in Florida.

Purpose of the Project
Describe the purpose, specific aims, or objectives.
The purpose of this study is to determine whether the recent, vector-mediated Zika virus disease cases in Florida are linked to a single or multiple introductions of Zika virus from outside of the United States.
Establishing the Collaboration

Florida DOH IRB Approval

August 29, 2016
Zika, locally acquired: establishing the collaboration

Specimens Tested
July-December 2016

July 22, 2016
Verification panel submitted to CDC and approved 3 days later

July 29, 2016
FDCH announces area of active local ZIKV transmission in Wynwood

August 9, 2016
Governor Scott authorizes free testing for pregnant women through public health laboratories

August 19, 2016
FDCH announces area of active local ZIKV transmission in South Beach

September 12, 2016
FDCH announces area of active local ZIKV transmission in North Miami Beach

September 19, 2016
FDCH announces area of local ZIKV transmission in Wynwood

October 13, 2016
FDCH announces area of active local ZIKV transmission in Little River

December 2, 2016
FDCH announces end of local ZIKV transmission in Little River

December 9, 2016
FDCH announces end of local ZIKV transmission in South Miami Beach

Shipment Dates, 2016
September 14, October 20, & December 6

Courtesy of Stephen White
Zika: locally acquired

Wynwood: July 29 – September 19, 2016
Miami Beach: August 19 – December 9, 2016
Little River: October 13 – December 2, 2016
Specimen and Data sharing

Examples of data shared by Jason and team:
number of samples received and number sequenced, % sequence coverage, SNPs and pylogenetic information for sequenced samples, sample geographic association
Maximum-likelihood pylogenetic tree of ZIKV genome sequences. Samples from the Americas are colored based on region of sampling. ** is used to indicate sequences obtained from mosquitos. Distinct clades sampled in Florida are labeled I – IV.
“Based on the 24 partial and complete sequences we have obtained from locally-acquired ZIKV infections, we can conclude that there have been multiple introductions of ZIKV to Florida that have resulted in local transmission, and that two of these introductions appear to have established relatively extensive transmission chains.”

Jason Ladner
2016: In addition to testing urosurvey specimens (Trioplex assay), the Miami laboratory began routine testing of pregnant women in Miami-Dade county and continued supporting epidemiological investigations.
Developing the Partnerships, Exploring the Data and Sharing the Results

- Three shipments, a total of 138 de-identified samples (some duplicates, both urine and blood)
- Draft manuscript January 2017
- Manuscript submitted February 2017
- Manuscript acceptance April 2017
- Final edits May 2017
- Publication June 15, 2017
FL BPHL Miami: Darryl Pronty, Stephen White

FL DOH in Miami Dade County: Reynald Jean

Florida DOH Tallahassee: Andrea Bingham, Danielle Stanek

FL BPHL Tampa: Marshall R. Cone, Edgar W. Kopp IV, Kelly N. Hogan, Andrew C. Cannons
Developing the Partnerships, Exploring the Data and Sharing the Results

Questions?
References


3. Florida Department of Health Zika Public Health Emergency Situation Report, as of August 26, 2016 as of 7:00 am.


Thank you!

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