Controlling and Responding to Mosquito-Borne Illness

State and Local Panel

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Mosquito-borne disease surveillance and response coordination, Florida

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Background

- Florida State Board of Health was created as a result of yellow fever epidemic in 1889
- Malaria and dengue also common
- The first mosquito control district was formed in 1925
- Mosquito control helped enable growth of human settlements on the Florida peninsula
- Strong history of mosquito-borne disease research at Florida universities and public health laboratories
Mosquito-borne disease in Florida

- Endemic mosquito-borne diseases
  - St. Louis encephalitis
  - Eastern equine encephalitis
  - West Nile virus disease

- Periodic transmission of non-endemic mosquito-borne diseases
  - Malaria
  - Dengue fever
  - Chikungunya fever
Florida Interagency Arbovirus Taskforce

- Department of Health
- Department of Agriculture and Consumer Services
- Department of Environmental Protection
- Fish and Wildlife Conservation Commission
- Florida Mosquito Control Association
- Florida Environmental Health Association
- Florida Association of County Health Officers
- USDA
- Universities involved in mosquito-borne disease diagnostics or research
Surveillance and Control of Selected Mosquito-Borne Diseases in Florida

- Public health surveillance guidance
- Mosquito-borne Disease Response Plan
  - Mosquito-borne disease advisory/ alert/ emergency
- Communication plan
  - Drain and Cover
  - Press releases
  - Marketing materials
Strong mosquito control infrastructure helps with coordination and standardization

- Florida Coordinating Council on Mosquito Control
  - Advisory group on mosquito control policy
- Training for partners
  - Florida Mosquito Control Association
  - Florida Medical Entomology Laboratory
- Joint exercises
IMPACT

- Routine, standardized, science-based response
  - Mosquito surveillance and control in response to animal surveillance data and suspect human case reports
  - Coordinated active case surveillance when local case clusters are suspected
  - Shared messaging to public and press
IMPACT

- “Real-time” adjustments are made with the right partners at the table
  - Conference calls to discuss risk assessment and response needs based on surveillance findings
  - Improved response to other-than nuisance mosquitoes (e.g. *Anopheles*, *Aedes aegypti*)
Centers for Disease Control and Prevention

Considerations for Enhanced Mosquito Control in NYC in Anticipation of Local Zika Transmission

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Aedes Control Will Build on a Robust West Nile Virus Control Program

- Integrated Pest Management
  - Extensive Community Outreach
  - Mosquito Surveillance and WNV testing
  - Habitat Control and Standing Water Complaint Response
  - Ground and Aerial Larval Treatment of Natural Habitat, Built Environment
  - Human Surveillance
  - Truck-Based Ultra Low Volume Adulticide Application in Populated Areas and Natural Habitat
Public Outreach, 2015

- 105 Community, Senior Center WNV Presentations
- Other Community Outreach Activities
  - Distribution of flyers in WNV and mosquito hot-spots
  - Spray notification fliers in the spray zones
  - Distribution of 2,000 – 5,000 bottles of insect repellents to at risk communities
Mosquito Surveillance

- 61 Permanent Trap Sites
- 200 Supplemental Trap Sites
- Locations Optimized for Geographic Coverage + Historical WNV Positivity
Standing Water Complaints, 2015

- ~1,700 standing water complaints via calls to 311
- ~1,500 resulting inspections
- Led to ~1,000 Applications of larvicide
Ground Larviciding in NYC, 2015

- >800 treatments at routine locations
- ~4,800 treatments based on surveillance findings
Catchbasin Larviciding in NYC, 2015

- 139,904 catch basins treated twice over 2015 mosquito season
Summary of West Nile Virus Activity, 2015

- 38 human cases
- 827 infected mosquito pools
- 31 truck-based adulticiding events
- 3 aerial larviciding events
What We Learned in Early Years of WNV Response

- Vocal public objection to aerial adulticiding, more acceptance of ground adulticiding when there is evidence of, and belief in threat of disease transmission.
- Direct local government (rather than contracted) provision of services results in improved outcomes, less conflict.
- High year-to-year variability in mosquito burden and locally transmitted disease means that surveillance and notification needs do not lessen year-to-year.
- Importance of emergency department and poison control surveillance that has verified absence of effects from pesticide use.
- Effective control requires public awareness and partnership on habitat control, direct community outreach for prevention and notification of spray events.
NYC’s Zika Response To-Date

- Increase public awareness
- Educate providers and assist them with diagnosis
- Coordinate and perform laboratory testing
- Investigate suspect cases
- Monitor pregnant women with Zika infection and their babies
- Develop *Aedes* mosquito control plans
Health Department Zika Response estimates as of March 15, 2016

**People and Money**
- Mobilized 209 Health Department employees
- Spent $2.8 million to date
- Could spend more than $20 million over next three years

**Testing and Monitoring Patients**
- Coordinated testing for 1,463 patients
- Tested 900 samples at the City’s Public Health Laboratory
- Answered more than 3,000 provider inquiries about testing

**Educating Providers and the Public**
- Handled dozens of media inquiries
- Delivered 21 community presentations
- Will launch mosquito prevention awareness campaign including subways, buses, TV and digital platforms
Factors We Consider in Developing NYC’s Local Mosquito Control Plans

- Vector Presence and Competence
  - NYC does not have *Aedes aegypti* mosquitoes, but has native widespread populations of *Aedes albopictus* and other *Aedes* mosquitoes.
  - Despite hundreds of annual cases of imported Dengue and Chikungunya cases among travelers, there has been no local transmission observed in NYC.
  - Local transmission of Zika not likely, but not out of the question.
Factors We Consider in Developing NYC’s Local Mosquito Control Plans

- Public concern about Zika is greater than for West Nile virus
- Ability to rapidly detect local transmission is limited
  - Most infections (up to 80%) are asymptomatic, suggesting that transmission to local host may occur without knowledge of the location of a viremic case in a human
  - Local transmission could occur without prior detection in mosquitoes.
  - Human testing is limited, driven by concerns about pregnancy and emergence of symptoms
  - Infectious period often passes prior to availability of test results
Factors We Consider in Developing NYC’s Local Mosquito Control Plans

- **Features of *Aedes* mosquitoes**
  - Day-biters, distinct from *Culex*, suggesting daytime population considerations rather than residential for WNV control.
  - Requires different trapping protocols
  - Breed in smaller containers, demanding different standing water control and prevention
  - Geographic distribution distinct from *Aedes*, requiring treatment in novel neighborhoods
Differing Spatial Distribution of *Aedes* and *Culex*
Zika-Driven Changes Contemplated for Mosquito Control

- **Increased outreach and complaint response to control breeding conditions**
  - Increased geographic spread of community meetings
  - Increased distribution of repellent
  - Tracking ‘nuisance’ mosquito complaints to supplement trap surveillance

- **New Surveillance Traps for Asian Tiger mosquitoes:**
  - BG Traps®, Mosquito Magnets®, Ovitrap
  - Doubling of permanent trap sites

- **New Arsenal of Pesticides:**
  - Larvicides: Methoprene (Altosid®)
  - Adulticide: DUET™ Dual-action Adulticide (Sumithrin and Prallethrin)
Zika-Driven Changes Contemplated for Mosquito Control

- **New Pesticide Application Methods:**
  - Ground larviciding using truck-mounted applicators
  - Aerial larviciding in residential areas
  - Hand-held ULV adulticide spot treatment

- **Modified Decision-Logic for Pesticide Applications**
  - Temporal and frequency priority based on mosquito density, human behavior, and built environment characteristics, less so on viral-positivity. For example:
    - Daytime population, public gathering places, areas with history of travel-acquired flavi-virus diseases, areas with higher rates of travel to Zika-affected countries, lower prevalence of air conditioner use

- **Lower threshold overall for community-level response than for WNV**
Responding to Zika: 
A Local Texas Public Health Perspective

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Harris County Public Health & Environmental Services (HCPHES)
HCPHES & Harris County

- HCPHES serves as the county health department for Harris County (TX) with over 700 public health professionals
- Third most populous county in nation with estimated population of 4.34 million
- Spread over 1,778 square miles (larger than the state of Rhode Island)
- Geographically, politically, and socio-demographically diverse and growing
- Home to world’s largest medical center
History of Harris County Mosquito Control

Celebrating 50 Years of Mosquito Control in Harris County

1964
Vote to establish the Harris County Mosquito Control District.

1979
First occurrence of Aedes grossus found in Texas and identified in Harris County.

1980
Placement of CDC light traps into storm sewer system.

1985
First discovery and identification of Asian Tiger (Aedes albopictus) mosquito in the continental United States.

1992
First mosquito control agency in the United States to establish an in-house Virology Lab.

1995
Mosquito Control becomes a division of Harris County Public Health & Environmental Services.

2001
Comprehensive response to rise in mosquito population due to tropical storm Allison.

2002
Expansion of weekly Mosquito Surveillance to ensure comprehensive mosquito surveillance for all of 268 operational areas.

2005
Establishment of a continually supported Mosquito Resistance Monitoring and Management Program.

2008
Comprehensive emergency response in the aftermath of Hurricane Ike, including aerial application of Dibrom to more than 1,000,000 acres.

2013
Incorporation of Dengue and Chikungunya Surveillance Program via BO traps.

2014
Use of VectorTests for Chikungunya virus.

2015
50 Year Celebration and broadening of other vectors to the Division’s mission.

Detection and Isolation of West Nile virus in birds and mosquitoes.

1990s
50 Years of “Fighting the Bite” Primarily Against the *Culex* Mosquito
**HCPHES Approach to Fighting Aedes**

- **Understand** *Aedes* vector predominance in Texas and Harris County
- **Recognize** need to shift from primarily *Culex*-based program to incorporation of *Aedes* mosquito as a targeted vector
- **Emphasize** importance of public education, personal protection, and source reduction as major components in fight against *Ae. aegypti* and *Ae. albopictus*
- **Assure** principles of “One Health” and health equity are applied to evolving multidisciplinary response

*Figures: Aedes albopictus and Aedes aegypti*
Role of Health Equity, One Health, & MDT

Multi-Disciplinary Team (MDT)

- An internal integrated team whose purpose is to conduct **targeted** mosquito control, epidemiological, environmental assessments of household perimeters and proximate areas to determine need for further interventions.
HCPHES Confirms First Texas Zika Case — January 11, 2016

FOR IMMEDIATE RELEASE
January 11, 2016

Travel-Related Zika Virus Infection Has Been Identified in the Harris County Area

Harris County, Texas - Harris County Public Health & Environmental Services (HCPHES) has received confirmation from the Centers for Disease Control and Prevention (CDC) that the Zika virus has been confirmed in a traveler who recently returned from Latin America. The individual developed symptoms that are often associated with the Zika virus which include fever, rash, and joint pain.

Zika virus is spread through the bite of the Aedes species mosquito. "Prevention is key to reducing the risk of Zika virus infection," said Dr. Lilia A. Tabal, MD, MPH, Executive Director of HCPHES. "Zika virus infections occur throughout the world. We encourage individuals traveling to areas where the virus has been identified to protect themselves against mosquito bites, and to contact their healthcare provider immediately if they develop Zika virus-like symptoms."

According to CDC, illness from Zika is usually mild with symptoms lasting several days to a week. Severe disease requiring hospitalization is uncommon and death rates are rare. There is no vaccine to prevent or medicine to treat Zika virus infection. The CDC recommends that all people, especially pregnant women, who are traveling to areas where Zika virus is found, should take precautions to avoid mosquito bites to reduce their risk of infection with Zika virus as well as other mosquito-borne viruses such as dengue and chikungunya.

HCPHES recommends before traveling abroad, individuals contact their healthcare provider who may recommend vaccines or important preventive medications for travel-related diseases.

To learn more about the Zika virus, please visit www.hcphes.org and www.cdc.gov.

HCPHES is the local public health agency for the Harris County, Texas jurisdictions. It provides a wide variety of public health programs and services aimed at improving the health and well-being of the Harris County community. For more information, please visit HCPhes.org/mediarelations.

Follow HCPHES on Twitter @HCPhes and like us on Facebook.

First case of tropical Zika virus linked to serious birth defect found in Texas
HCPHES Planned Zika Response Levels

- **Level 4** — *Normal Conditions*: Travel-related Zika cases but no locally acquired cases in Harris County
- **Level 3** — *Increased Readiness*: One case of locally acquired Zika in Harris County
- **Level 2** — *High Readiness*: A few or cluster of cases of locally acquired Zika within Harris County
- **Level 1** — *Maximum Readiness*: Widespread cases of locally acquired Zika throughout Harris County
HCPHES Vector Surveillance and Control

- Utilize mosquito surveillance using (limited) historical data on *Ae. aegypti* combined with (expanded) surveillance including incorporation of predictive modeling within the 268 MC operational areas.
- Generate GIS maps indicating key metrics such as mosquito population density levels of *Ae. aegypti*, Zika confirmed mosquito samples, local cases of human infections, and sources of breeding, etc.
- Conduct necessary staff training for inspectors, larvicide applicators, and other MC support personnel related to Zika and *Aedes*.
- Acquire Zika-related testing materials and laboratory equipment for MC virology laboratory.
- Work with partners and community members on key issues around reducing mosquito habitats.
Types of Mosquito Traps Used in Harris County, TX

- Biogents (BG) Sentinel Trap (*Aedes*)
- Gravid Trap (*Culex* & *Aedes*)
- CDC Storm Sewer Trap (*Culex*)
HCPHES Communications, Education and Engagement

- Conduct disease prevention education, personal protection, and source reduction campaigns
- Utilize media and other community partners to provide credible information
- Distribute insect repellent and other prevention modalities to local communities when possible and where appropriate
- Create messaging in languages most appropriate for affected communities, working with area consulates, etc.
- Conduct door to door education and outreach in targeted communities
- Engage federal, state, and local stakeholders to coordinate efforts
HCPHES Planned Zika Response Focus Areas

- Epidemiology Surveillance & Testing
- Healthcare Provider/Clinician Outreach
- Environmental Public Health
- Veterinary Public Health
- Legal Review and Authority
- Emergency Preparedness and Response
Select Zika Response Challenges

- The situation related to Zika is one that continues to evolve

- “We cannot spray our way out of this situation”

- Additive Arbovirus Response: *Culex*-based activities *plus* *Aedes*-based activities

- Addressing key logistical issues to ensure operational efficiencies

- Funding and resource needs
The role of Public Health just makes “Common Sense”
Zika Vector Control Strategies
The Puerto Rico Experience

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Puerto Rico Department of Health
Zika Prevention Kits (ZPKs)

- **Distribution**
  - WIC clinics
  - Obstetricians
  - Drugstores with pregnancy kit purchase

- **Components**
  - Insect repellent: DEET 25%
  - Condoms
  - Bed nets
  - Educational materials
  - Other components
Temporary Screening Kits

- Viability
  - Wall and window/door styles, frames and surfaces
  - Financing
- Acceptability
- Coordination of services
- Pilot screening interventions
Insecticide Use

- Vector surveillance
  - Insecticide resistance patterns
- Delivery methods
  - ULV
  - Indoor/outdoor residual spraying
  - Aerial spraying
  - Larviciding
- Acceptability
- Federal and state regulations/permits
- Rollout logistics
  - Outsourcing versus state vector control programs
  - Engaging high risk populations and outreach community groups
  - Coordination of services
Behavioral and Messaging Studies

- **Zika Prevention Kit (ZPK)**
  - Evaluation ZPK among pregnant women in Puerto Rico

- **Interventions**
  - Vector control strategies and personal protective behaviors
    - Acceptability

- **Messages**
  - Messaging
  - Spokespersons
Communications

- Arbovirus weekly report
- Vector Control Interventions
- Zika prevention messaging
- Media
Surveillance Systems & Epidemiology

- Passive arboviral diseases surveillance system (PADSS)
- Zika Active Pregnancy Surveillance System (ZAPSS)
- Birth Defects: Congenital microcephaly
- Guillain-Barre syndrome passive surveillance system (GBSPSS)
- Zika infections associated to blood transfusion
Laboratory Capacity

- CDC’s developed *Trioplex* RT-PCR testing
  - DENV, CHIKV, ZIKV

- IgM testing
  - ZIKV, DENV*

* Dengue endemic areas high rates of cross reactivity
Unintended Pregnancy Prevention

- Increase range of contraceptives options
  - Long acting reversibly contraceptives (LARCs)
  - Behavioral Risk Factor Surveillance System (BRFSS)

- Messaging
  - Women and men of reproductive age
  - Health care provider training

“We do not know how to prevent possible adverse birth outcomes related to Zika, but we do know how to prevent unintended pregnancies.” - Dr. Thomas Frieden
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.