



Department of Health
Wadsworth Center

Vector-Borne Diseases Test Catalog in a Public Health Lab

Amy B. Dean, PhD
Director Viral Encephalitis Laboratory

MARCH 24, 2025 | DIAGNOSTIC APPROACHES TO EMERGING INFECTIOUS DISEASES, ID LABCON | PASADENA CA

FUNDING DISCLOSURE/CONFLICT OF INTEREST

Arbovirus testing at the Wadsworth Center is supported, in part, by Cooperative Agreement number NU50CK000516/NU51CK000372, funded by Centers for Disease Control and Prevention.

This presentation's contents are solely the responsibility of the author and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the New York State Department of Health.

No conflicts of interest to disclose.



Department of Health
Wadsworth Center

WHAT SHOULD BE IN THE PUBLIC HEALTH TEST CATALOG?

What vector-borne diseases are endemic to the area of your service population?

What vectors are endemic to the area of your service population?

What testing is readily available to you elsewhere?

How frequently is any vector-borne disease testing requested by your service population?



LET'S GET TO KNOW EACH OTHER...

Which best describes your facility?

- A. Hospital
- B. Commercial Laboratory
- C. Public Health Laboratory
- D. Other

Poll Everywhere
Multiple Choice



Department of Health
Wadsworth Center

LET'S GET TO KNOW EACH OTHER...

How would you characterize the size of your facility/client base?

Poll Everywhere
Multiple Choice

- A. City or large regional facility
- B. Moderate sized
- C. Small general
- D. Small specialized
- E. Other



Department of Health
Wadsworth Center

LET'S GET TO KNOW EACH OTHER...

How long have you worked in a Diagnostic or Reference Laboratory?

- A. < 10 years
- B. 3-10 years
- C. 0-3 years
- D. I have a different (non-lab) role in my facility

Poll Everywhere
Multiple Choice



Department of Health
Wadsworth Center

ORGANIZATION OF VECTOR-BORNE DISEASE TESTING AT WADSWORTH CENTER

Bacteriology

Parasitology

Virology

**Diagnostic
Immunology**

**Arbovirus
Laboratory**



Department of Health
Wadsworth Center

BACTERIOLOGY - TICKBORNE BACTERIAL DISEASE

- Multiplex real-time PCR
 - *Anaplasma phagocytophilum* / *Ehrlichia chaffeensis* / *Borrelia miyamotoi*
- Multiplex real-time PCR
 - *Borrelia burgdorferi* / *Borrelia* species
- Real-time PCR
 - *Bartonella* species



Ixodes species - Learn About Parasites - Western College of Veterinary Medicine | University of Saskatchewan

PARASITOLOGY

- Real-time PCR
 - *Babesia microti*
- Multiplex real-time PCR with reflex to Sanger sequencing
 - *Trypanosoma brucei* / *Leishmania species* - reflex to identify species
- Multiplex real-time PCR
 - *Plasmodium falciparum* / *P. vivax* / *P. ovale* / *P. malariae*
- Targeted Next Generation Sequencing for drug resistance
 - *Plasmodium falciparum*
- Giemsa-stained blood smear
 - *Babesia microti* / *P. falciparum* / *P. vivax* / *P. ovale* / *P. malariae* / *Trypanosoma brucei*



VIROLOGY

Real-time reverse transcriptase PCR

Endemic viruses

- Mosquito-borne
 - West Nile virus
 - Eastern Equine Encephalitis virus
 - St. Louis Encephalitis virus
 - Cache Valley virus
 - California sero-group viruses
 - Including Jamestown Canyon
- Tick-borne
 - Powassan virus
 - Heartland virus



<https://www.cdc.gov/ticks/data-research/facts-stats/blacklegged-tick-surveillance.html>

Travel Associated viruses

- Dengue virus
- Chikungunya virus
- Zika virus
- Oropouche virus
- Yellow Fever virus



<https://www.cdc.gov/mosquitoes/about/life-cycle-of-culex-mosquitoes.html>



<https://www.cdc.gov/mosquitoes/about/life-cycle-of-aedes-mosquitoes.html>



Department of Health
Wadsworth Center

DIAGNOSTIC IMMUNOLOGY

Bacterial Serology

- Immunofluorescence Assay (IFA)
 - *Anaplasma phagocytophilum* IgG IFA
 - *Bartonella henselae* and *quintana* IgG IFA
 - *Ehrlichia chaffeensis* IgG IFA
- Enzyme-linked immunosorbent assay (ELISA)
 - *Borrelia burgdorferi* ELISA
 - VlsE1/IgG/IgM Screen with reflex
 - IgG and IgM when Screen is positive or equivocal

Viral Serology

- Arbovirus Screen, CSF- West Nile IgM ELISA
- Arbovirus Screen, Serum* includes:
 - IgG IFA
 - California serogroup encephalitis
 - Eastern Equine Encephalitis
 - St. Louis Encephalitis
 - Western Equine Encephalitis
 - West Nile IgM ELISA
 - IgG-IgM-IgA Polyvalent Microsphere Immunofluorescence (MIA)
 - Powassan
 - West Nile
 - Powassan IgM ELISA (if Powassan MIA result is reactive)
- Chikungunya IgG and IgM ELISA, Serum
- Flavivirus IgG-IgM-IgA MIA
 - Zika
 - Dengue
- Zika IgM Lateral Flow



ARBOVIRUS LABORATORY (BSL-3)

- Mosquito, tick, mammal, avian testing
- Arbovirus plaque-reduction neutralization test (PRNT) on human samples from Diagnostic Immunology – paired specimens preferred
 - Bourbon virus
 - Cache Valley virus
 - Dengue virus
 - Eastern equine encephalitis virus
 - Heartland virus
 - Highlands J virus
 - Jamestown Canyon virus
 - Japanese encephalitis virus
 - LaCrosse encephalitis virus
 - Mayaro virus
 - Oropouche virus
 - Potosi virus
 - Powassan virus
 - St. Louis encephalitis virus
 - West Nile virus
 - Western equine encephalitis virus
 - Yellow fever virus
 - Zika virus



WHAT ARE THE MAIN VECTOR-BORNE DISEASES IN YOU JURISDICTION?

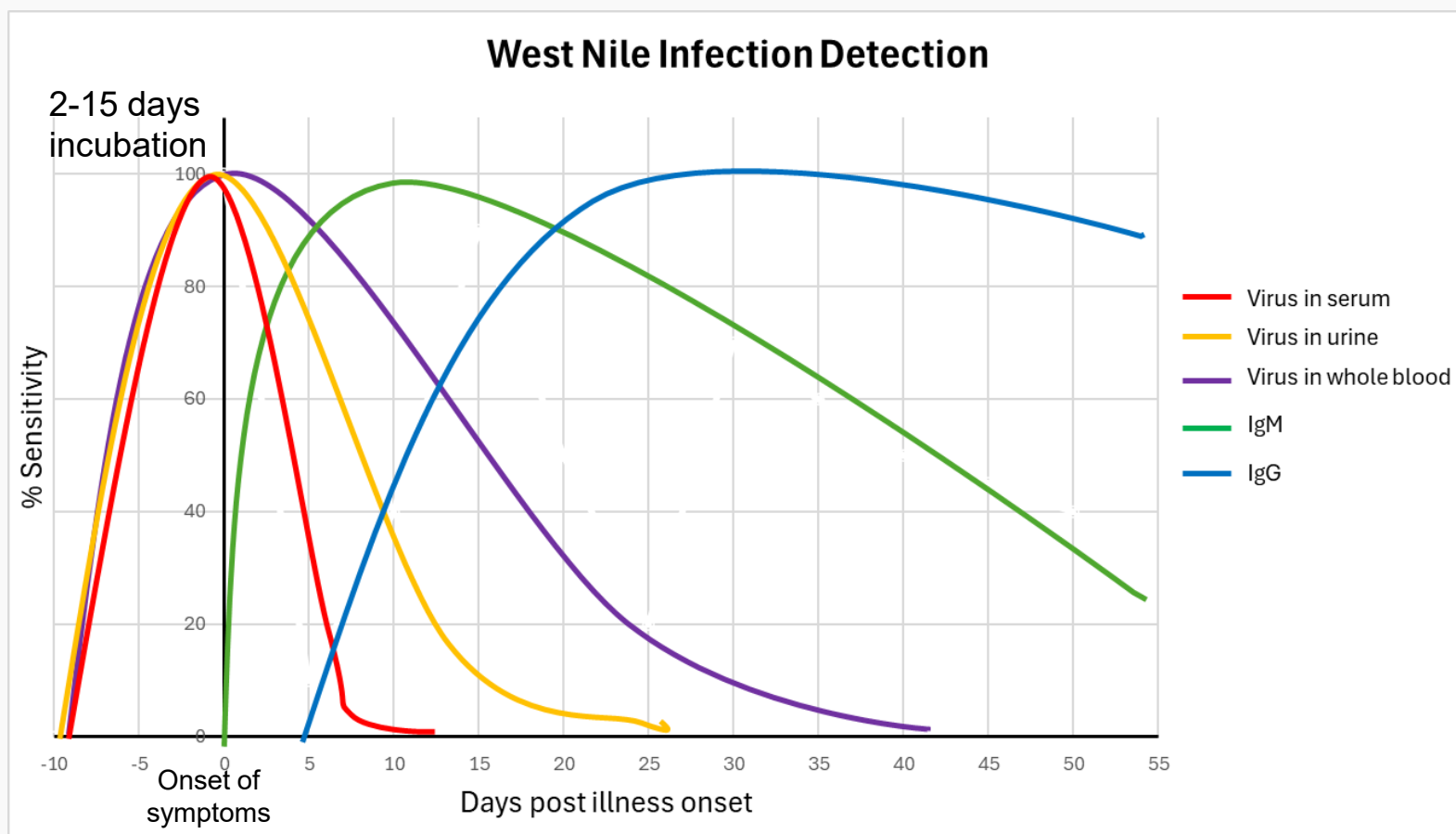
This space will be filled by the word cloud created
by participants' responses.

Poll Everywhere
Word Cloud



Department of Health
Wadsworth Center

COMMENTS ON APPROPRIATE TEST SELECTION



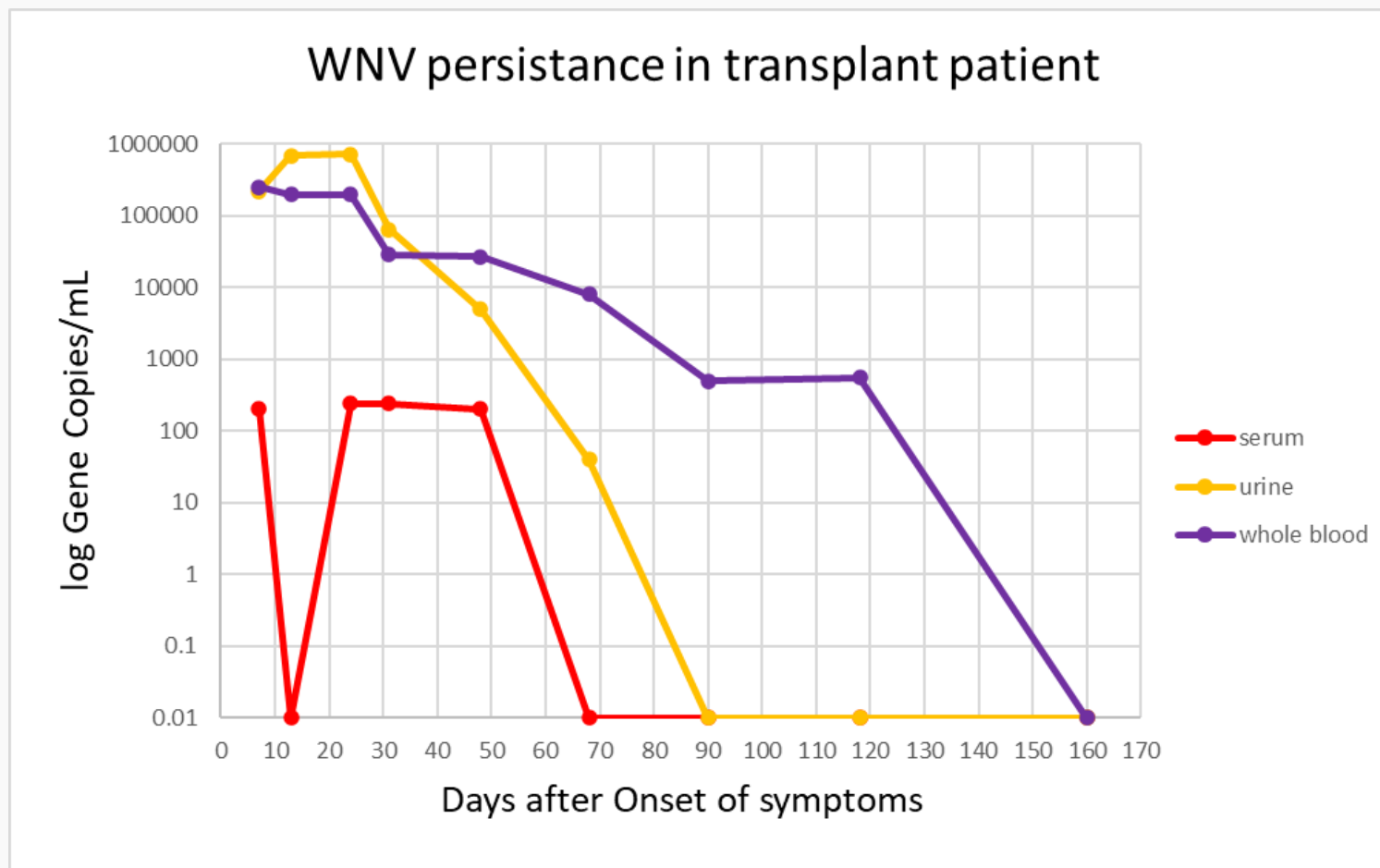
Based on Lustig Y, et al. Front Microbiol. 2018 Oct 11;9:2421.

- Timing of specimen collection should help determine test selection.
- IgM is the gold standard due to the detection window, but result is Presumptive.
- Plaque reduction neutralization test for Confirmation.
- PCR has a narrow detection window but is also Confirmatory.
- This appears to be consistent for Flaviviruses, but data is limited for other types of viruses.



Department of Health
Wadsworth Center

EFFECT OF PATIENT'S IMMUNE STATUS



- Immunocompromised patients may have extended windows for molecular detection.

Dean, AB et al. 2019 Clinical Virology Symposium. Poster.



Department of Health
Wadsworth Center

MAINTAINING DIAGNOSTIC TESTING WHEN MINIMAL REQUESTS

PROs

- Preparedness
- Surveillance
- Special/Difficult Case Investigation, Rule-out testing

CONs

- Cost
 - Maintain reagents
 - Proficiency testing
- Need to maintain competency



REASONS FOR EXPANDED DIAGNOSTIC TESTING

Emerging Diseases

Regionally

What diseases are increasing in prevalence?

What vectors are spreading?

What infections are spreading in the vectors?

Globally

Where does your population travel?

Are there major international travel hubs in your area?



ARE THERE OTHER IMPORTANT FACTORS?

This space will be filled by the word cloud created by participants responses.

Poll Everywhere
Word Cloud



Department of Health
Wadsworth Center

ZIKA VIRUS TIMELINE – FLAVIVIRUS

2007: Outbreak in YAP State, Micronesia ~ 49 cases

2013-14: Large outbreak French Polynesia ~28,000

2014-15: Small outbreaks across the South Pacific

2015: Brazil reported first cases

May 2015: PAHO issues first alert

2016: Brazil reports many more cases and Zika-associated microcephaly in babies

January 2016: Zika spreads to 23 countries and territories in the region. More than 31 travelers have returned to the U.S. with Zika virus infections since 2015.

February 1, 2016: WHO officially declares the Zika outbreak a public health emergency of international concern.



Department of Health
Wadsworth Center

ZIKA - CRITERIA FOR SPECIMEN COLLECTION

- Pregnant women who traveled to a risk area while pregnant.
 - Risk area is defined as an area with active mosquito-borne transmission of Zika virus
- Persons who develop compatible symptoms during or within 4 weeks of travel to a risk area.
- Persons who traveled to a risk area and present with Guillain-Barré syndrome.
- Pregnant women who had unprotected sex during pregnancy, with a sex partner who traveled to a risk area.
- Infants with microcephaly or intracranial calcifications born to women with risk factors for Zika virus infection.

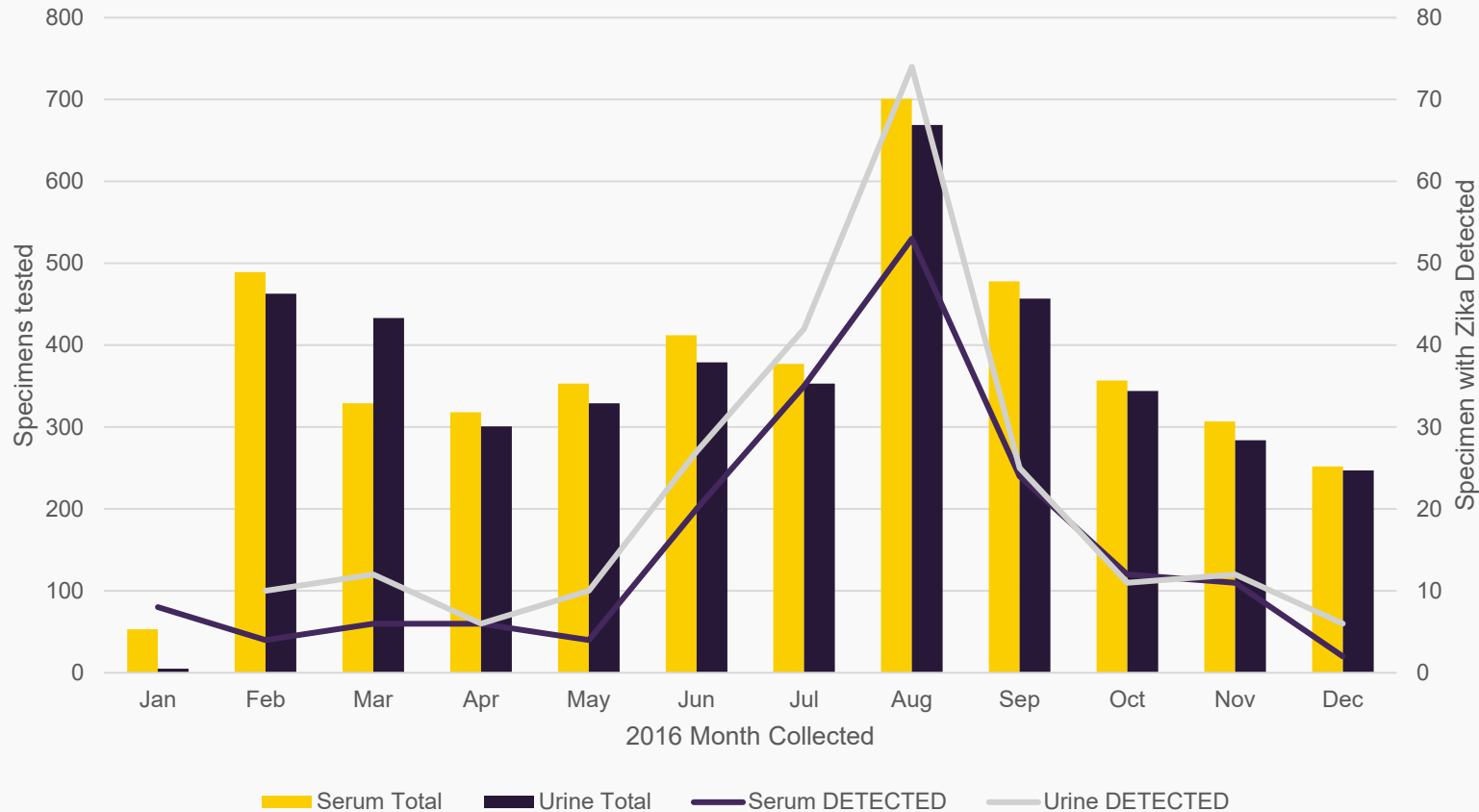
From NYS Health Advisory, March 10, 2016



Department of Health
Wadsworth Center

ZIKA PCR TESTING

Serum and Urine specimens from patients in NYS outside NYC tested by real-time RT-PCR for Zika Virus



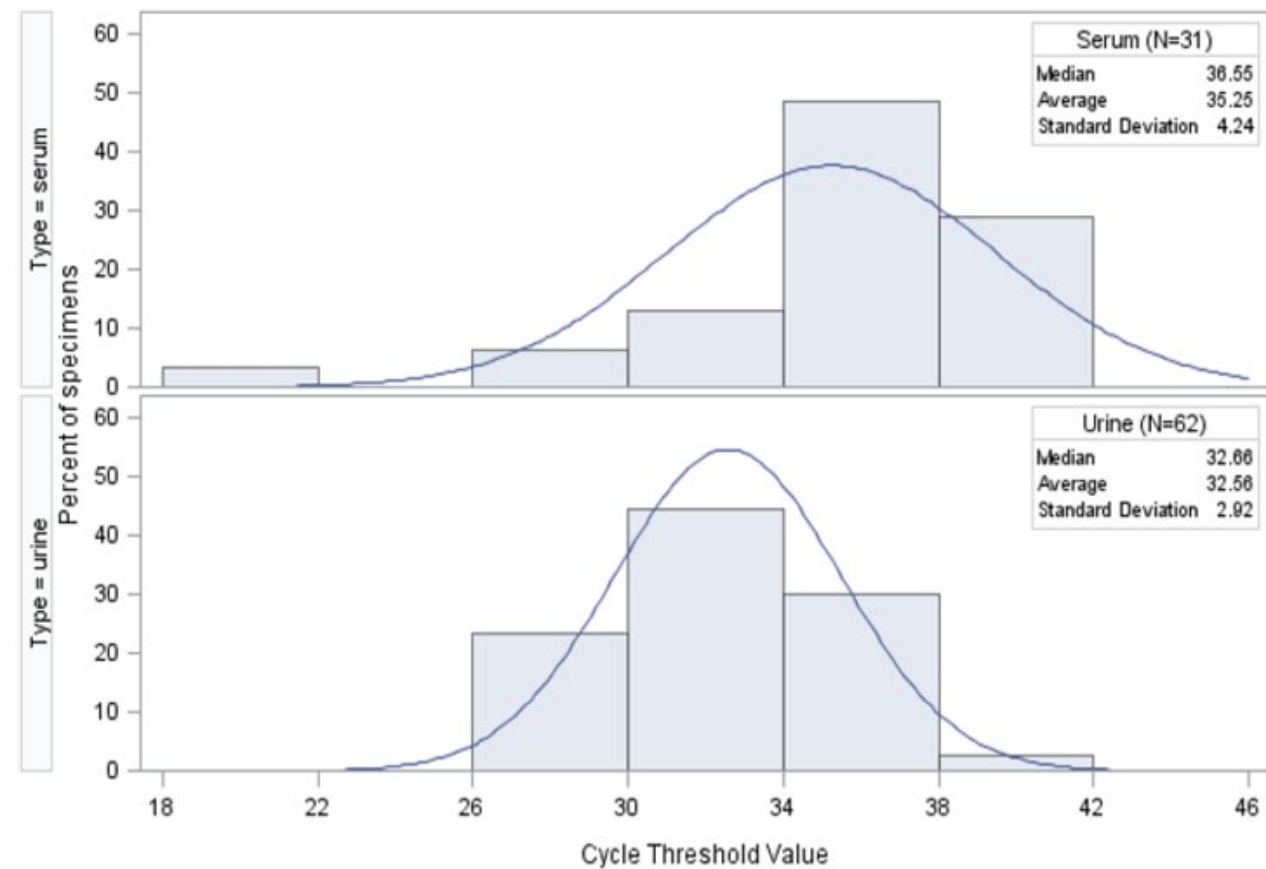
- Serum was required for PCR and serology testing
- Paired urine was also requested for PCR
- Should we multiplex test for other pathogens?



Department of Health
Wadsworth Center

Dean A. 2017. Zika County Learning Conference (NYS)

ZIKA: CHOICE OF SPECIMENS



Data from first 80 real-time RT-PCR Zika positive cases in New York State

- 19 serum positive (10 no urine)
- 11 serum and urine positive
- 50 urine positive (3 no serum)

Viral load higher in urine than serum (lower Cts)

Serum needed for serology

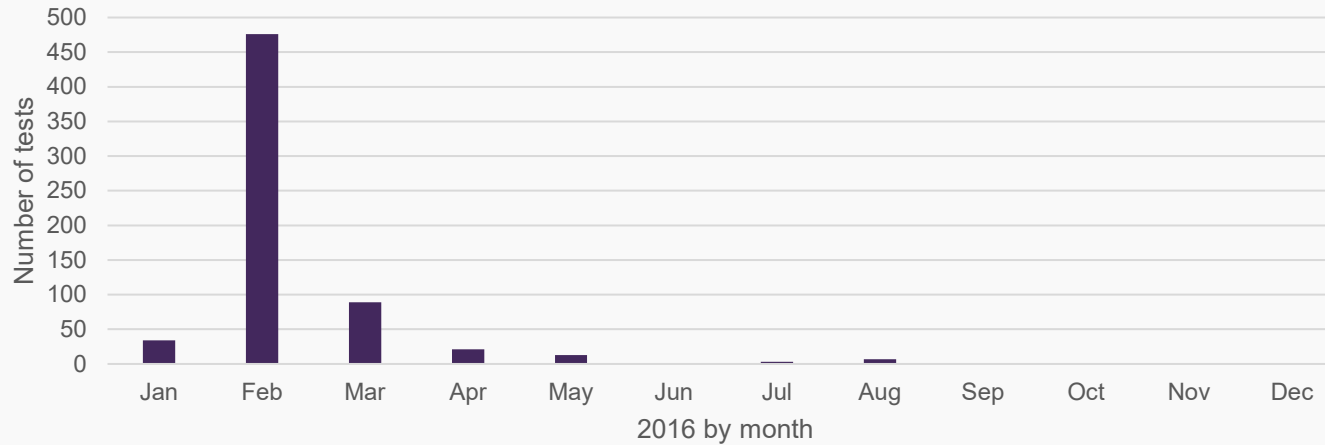
St George K, et al. 2017. *J Clin Microbiol* 55:535-544.



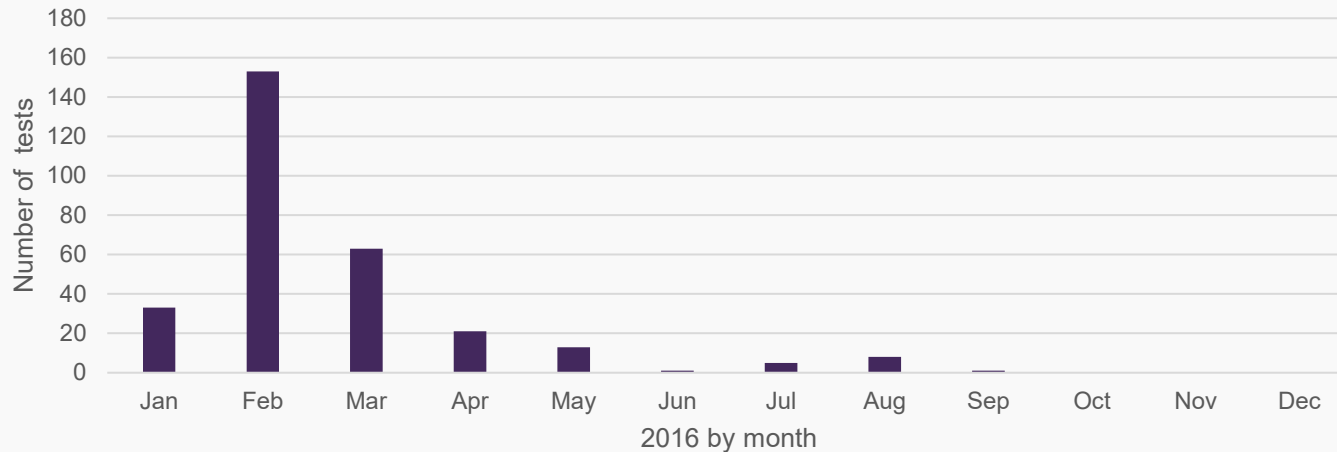
Department of Health
Wadsworth Center

MULTIPLEX TESTING

Chikungunya virus tests



Dengue virus tests



Additional testing on serum specimens received for Zika testing

Chikungunya virus – 644 serums

- no positives

Dengue virus – 298 serums

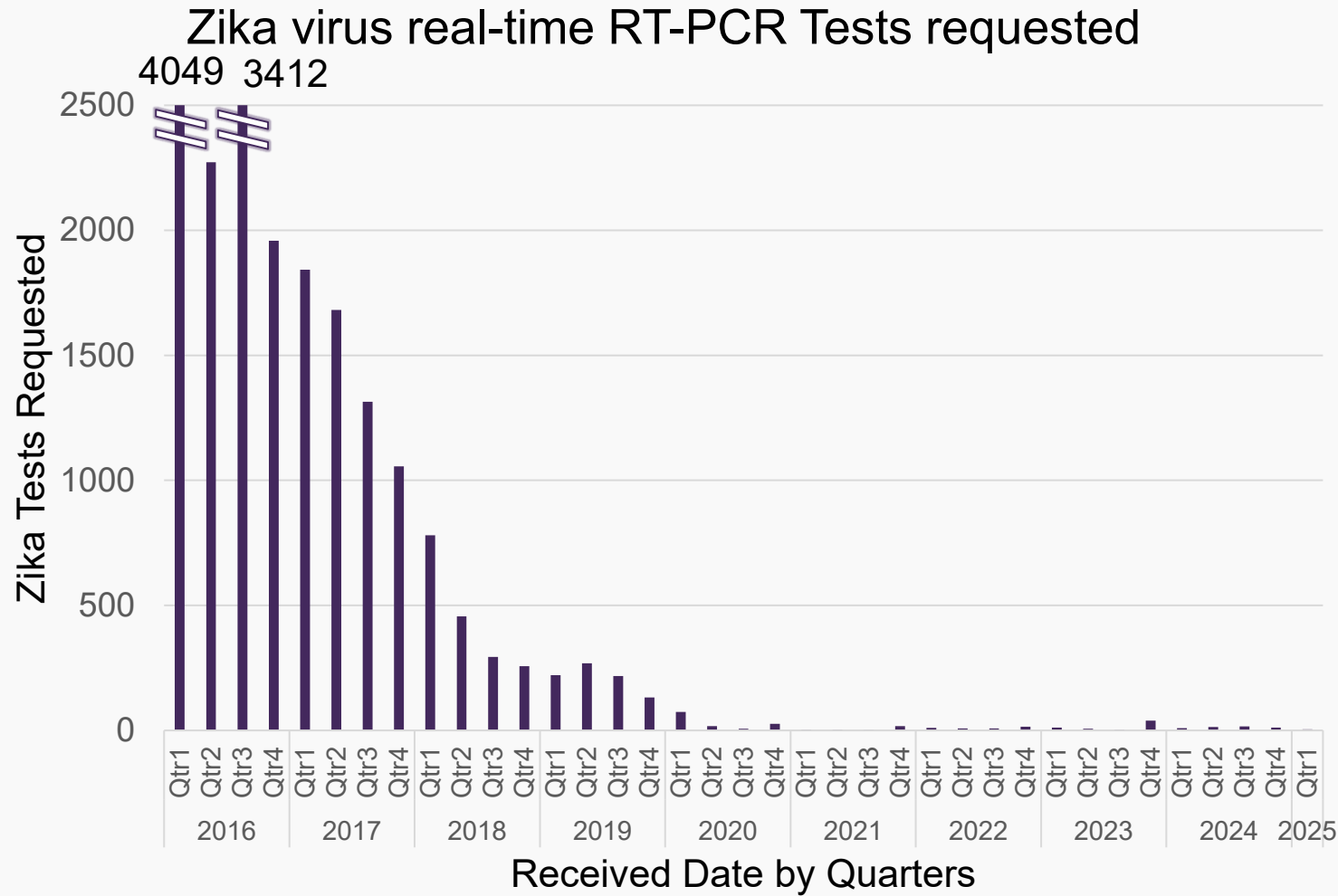
- Dengue-1
 - 3 positives: Feb(2), Mar(1)
- Dengue-2
 - 2 positives: Feb(2)
- Dengue-3
 - no positives
- Dengue-4
 - no positives



Department of Health
Wadsworth Center

Dean A. Virology Laboratory Data

IS ZIKA DISAPPEARING?



- 2020-2024
- Average ~40 requests per year for Zika testing



Department of Health
Wadsworth Center

Dean A. Virology Laboratory Data

SHOULD ZIKA TESTING STILL BE OFFERED?

- A. Few requests are received - discontinue
- B. Not cost effective to maintain
- C. Still receive sufficient requests to continue
- D. Shares symptoms with other arboviruses, needed for rule-out testing
- E. We maintain testing for as long as possible

Poll Everywhere
Multiple Choice
Allow more than
One response



Department of Health
Wadsworth Center

DENGUE, CHIKUNGUNYA, ZIKA & OROPOUCHE SHARE SYMPTOMS

- Abrupt onset fever, headache, joint pain (arthralgia), muscle pain (myalgia), chills, nausea, vomiting, and maculopapular rash.
- Central nervous system infection (4%) is one of the more severe manifestations of an infection including aseptic meningitis and meningoencephalitis.
- Zika and Oropouche both have been reported to adversely affect pregnancy outcomes causing miscarriages, stillbirths, and infants with birth defects such as microcephaly.
 - Vertical transmission has also been documented with placental and fetal somatic organ infections.



ORPOUCHE VIRUS - ORTHOBUNYAVIRUS

1955: Discovered in Vega de Oropouche, Trinidad and Tobago

Transmitted by biting midges (*Culicoides paraensis*) and possibly mosquitos (*Culex quinquefasciatus*, *Coquillettidia venezuelensis* and *Aedes serratus*)

Dec 2023 – Oct 2024: became more widespread with > 10,000 cases in South America and the Caribbean

Dec 2024: reported in additional new countries, vertical transmission reported, 2 deaths

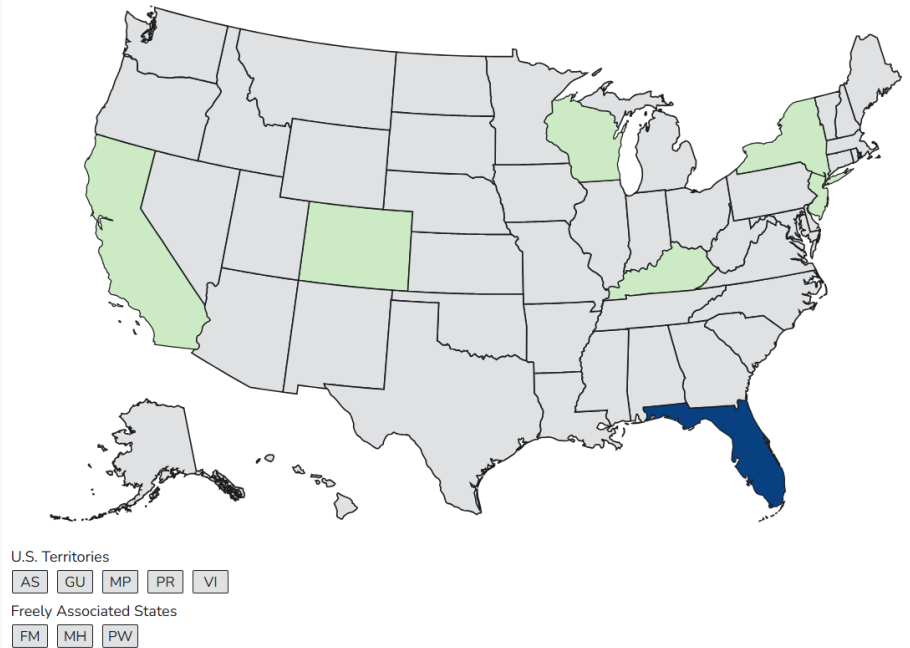


ORPOUCHE VIRUS

- Monitoring cases in South America & Caribbean
- Outbreak in Cuba
- Travel-associated cases in Florida

Oropouche virus in United States 2024-2025 from ArboNET as of Mar. 11, 2025

- 103 cases in Florida
- 1 case each in California, Colorado, Wisconsin, Kentucky, New Jersey and New York



<https://www.cdc.gov/oropouche/data-maps/current-year-data.html>



Department of Health
Wadsworth Center

ORPOUCHE VIRUS INFECTION

Should your lab establish testing for Oropouche virus?

- Frequency of travel to Caribbean (Cuba), South America, Florida?
- What are the demographics of your clientele/patients/population?
- Is there a major international travel hub in your jurisdiction?
- Do you have a plan for alternative reference labs for testing?
- What was the historical picture for Zika virus in your jurisdiction?



WHAT OTHER FACTORS CONTRIBUTE TO TEST MENU DECISIONS?

- A. Treatment availability
- B. Request frequency
- C. Ease of validation/implementation
- D. Cost to maintain
- E. Staff levels and expertise
- F. External test availability
- G. Other

Poll Everywhere
Multiple Choice
Allow multiple
responses



ACKNOWLEDGEMENTS

Wadsworth Center

Virology Laboratory

Kirsten St. George

Rene Hull

Bacteriology Laboratory

Kimberlee A. Musser

Danielle Wroblewski

Kara Mitchell

Parasitology Laboratory

Susan Madison-Antenucci

Kim Mergen

Diagnostic Immunology

William Lee

Karen Kulas

Kelly Howard

Arbovirus Laboratory

Alexander Ciota

Alan Dupuis



Department of Health
Wadsworth Center



Department of Health Wadsworth Center