Arbovirus Disease Surveillance Capacity in the United States

IOM Forum on Vector-Borne Diseases

James Hadler, MD, MPH
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Outline

• Background
  – Public health surveillance, arboviral surveillance pre-1999 and 1999-2004

• 2013 VBD Surveillance Capacity Assessment
  – Objectives
  – Methods
  – Results
    • State WNV capacity
    • State other arboviral surveillance capacity
    • Local health departments

• Conclusions
Background
Public Health Surveillance Primer 1

• Surveillance for diseases of public health importance constitutionally a state function – not federal

• Each state has own laws giving it legal authority to conduct surveillance, require disease reporting
  – CDC doesn’t have legal authority to require reporting
  – If CDC wants to conduct surveillance on an ongoing basis, has to go through states.
  – List of Nationally Notifiable Diseases developed in coordination with states through CSTE – each addition requires approval of majority of states
  – For Nationally Notifiable conditions
    • states collect information and transmit it to CDC
    • states aren’t required to conduct surveillance for it or send data to CDC.
Public Health Surveillance Primer 2

Principles of conducting surveillance at state level

- Objectives of surveillance should be clear – may be different at local, state and federal levels

- Surveillance methods should be feasible
  - Disease reporting not always the best method
  - May include surveillance for risk factors for human illness (e.g., vector prevalence & infection rates)

- Should have sufficient resources to be able to collect and analyse the data collected in a timely manner.
Federal funding is a major & increasing source of funding to support surveillance at the state and national levels

- Nearly 80% of all surveillance by state health departments is federally funded – ID and non-ID

Federal funders (mainly CDC) can require standardized surveillance methods, reporting to CDC.

but:

- Often not enough funding (federal and state) to support all recommended activities
- States don’t have to accept federal funding
Why are arboviruses of public health concern?

- Cause severe morbidity: e.g., meningoencephalitis, hemorrhagic fever, death
- Have the potential to cause large outbreaks over a short time period and overwhelm the healthcare system – e.g., WNV, SLE, dengue
- Transmitted by insect vectors, also by infected blood and organ donors
  - Results in public anxiety and undermines confidence in safety of blood/organ supply
- Potentially preventable if know whether/which arboviruses are present and level of threat
Arboviral surveillance in US pre-1999

**Purpose:** detect arboviral activity proactively, monitor threat level and prevent human cases of infection; monitor geographic distribution and trends in human infection

**Methods:**

- **Human surveillance:** cases of encephalitis due to infection with SLE, EEE, WEE or California encephalitis serogroup reportable by states to CDC
- **Vector/animal surveillance:** voluntary reporting of cases in animals, infected mosquitoes to CDC
- **No federal funding support for state/local surveillance**
  - Vector surveillance patchy, whatever states could afford and felt important
FIGURE 1. Reported enzootic activity of St. Louis encephalitis (SLE), eastern equine encephalomyelitis (EEE), or western equine encephalomyelitis (WEE) virus in mosquitoes or sentinel or wild birds, by state — United States, 1996–1997
Arboviral surveillance in US, 1999-2004

Following introduction of WNV in 1999
- Congress appropriated funding to CDC
- CDC disseminated funds to states with WNV activity through ELC cooperative agreement
- CDC provided technical guidance for WNV surveillance

By 2004
- WNV spread to all lower 48 states, ELC funding to all
- ArboNET established as an electronic national reporting system for each of four types of surveillance – all states reporting:
  - Avian mortality / sentinel bird surveillance
  - Equine surveillance
  - Mosquito surveillance
  - Human infection surveillance
ELC funding support for WNV surveillance and number of people with WNV neuroinvasive disease, 2000-2004.

* Excludes $10M in special funds
2004 CSTE Survey

Purpose
• Assess capacity of state and ELC-funded LHDs to conduct surveillance, prevention and control of WNV

Key findings
• Widespread WNV surveillance capacity (all states) developed over a short time period
  • Includes veterinary, wildlife & entomology expertise; lab testing capacity
• Capacity attributable to CDC guidance and funding
• Now have national system for WNV surveillance

Recommendation
• Expand allowable use of funding to address vector-borne and arboviral diseases more broadly
ELC funding support for WNV surveillance, 2000-2012.

* Excludes $10M in special funds
ELC funding support for WNV surveillance and number of people with WNV neuroinvasive disease, 2000-2012.

* Excludes $10M in special funds
Objectives of 2013 CSTE Assessment

1. Describe capacities for surveillance for WNV and other arboviruses
   a. ELC-supported state and big city/county health dep’ts
      • 2012 vs 2004
   b. LHDs with historically high WNV burden

2. Describe additional personnel needs to achieve “full surveillance capacity”

3. Examine the relationship between ELC funding support for arboviral surveillance and current surveillance capacity.
Methods 1

Workgroup
• Representatives from CSTE including state health departments; also ASTHO; NACCHO; APHL; Emory
• Input and feedback from CDC Division of VBD

Assessment questionnaire
• Started with 2004 CSTE questionnaire
• Added questions re: funding sources, response to decreases in funding, other arboviruses
• Piloted in 7 states and 4 LHDs
Methods 2

Jurisdictions to be assessed:

• All 50 states
• All 6 LHDs receiving ELC funding
  – NYC, Philadelphia, Washington DC, Chicago, Houston, Los Angeles
• 22 LHDs with >100 cumulative WNV cases since 1999 that hadn’t directly received ELC funding
• 2 LHDs with <100 cumulative WNV cases but with endemic dengue transmission
Methods 3

Dissemination
- Pdf of questionnaire emailed to state epidemiologists, local health directors
- Answers submitted via online questionnaire

Analysis
- States – 2012 vs 2004 responses
  - Stratified by whether needed additional staff, current ELC-funding level and region of country
- LHDs – ELC-supported vs not
Results

Response Rate and Staffing
Response rate

Among 56 ELC recipients
• 100% (50 states, 6 LHDs)

Among non-ELC recipients
• 63% (15 of 24 invited non-ELC LHDs)
No. persons working on WNV surveillance in 2012 vs 2004
State health departments

Number of staff

- 2004
- 2012

-41%
-16%
Arboviral surveillance personnel in 2012 by source of support
State health departments

Percentage of staff

- Non-federal
- Federal

- >=0.5 FTE
- <0.5 FTE

41% 56%
Staffing distribution by function (FTEs) State health departments, 2012

- 27% Mosquito/environmental surveillance
- 31% Laboratory staff
- 25% Other/clerical
- 17% Epidemiologists
Surveillance for WNV
Networking with animal health
State health departments, 2012 vs 2004

Percentage of states

- Medical entomologist within agency
- Medical entomologist through contract
- Wildlife biologist within agency
- Designated public health veterinarian

2004 vs 2012
Percentage of states conducting surveillance for WNV by type of surveillance, 2004 vs 2012
Percentage of states conducting surveillance for WNV by type of surveillance, 2004 vs 2012
Percentage of states conducting surveillance for WNV by type of surveillance, 2004 vs 2012
Percentage of states that pro-actively contacted specialists to encourage diagnosis & reporting of WNV, 2004 vs 2012

* Emergency departments not asked about in 2004
Changes in state-level mosquito surveillance for WNV from 2004 to 2012

- Conduct state-level surveillance
- Collect info from LHDs*
- Most LHDs conduct adult mosquito surveillance
- Most LHDs conduct larval mosquito surveillance

Percentage of states

* LHDs = Local Health Districts
Laboratory capacity for WNV testing in 2012

State labs are critical; LHDs entirely dependent on states to do testing of human specimens and largely dependent on states to do mosquito testing.

2012 General Capacity

- 92% can test human specimens for WNV
- 84% can test mosquito specimens for WNV
Has the capacity to test mosquito pools changed since 2008?

- Capacity decreased
- Decreased number of pools tested
- No longer test any pools

Percentage of states
Percentage of states reducing selected surveillance activities in past 5 years in response to reduction in ELC funding

- Eliminated or reduced dead bird surveillance
- Decreased mosquito trap sites
- Decreased number of mosquito pools tested
- Decreased number of WNV tests on people
Results

Need for Additional Staff
Additional Need
Definition of “full capacity”

- ability to complete a standard case report form on every suspected/confirmed case and report it to ArboNet
- ability to test by IgM for all relevant arboviruses on any CSF/serum specimen submitted on a suspected case of arboviral disease
- have a surveillance system that includes mosquito surveillance to routinely monitor both larval and adult arboviral activity in all parts of your jurisdiction in which there is the potential for human outbreaks of arboviral disease based on past experience.
Percentage of states needing additional staffing for WNV and other mosquito-borne virus surveillance by functional role
Current number of FTE WNV and other mosquito-borne virus surveillance staff and additional need* by functional role

* 122.6 FTEs needed, a 58% increase
Percentages of states with need for additional staff for WNV surveillance by staff role and USPHS region

Percent of states

Northeast (N=13)  SE & S Central (N=13)  Midwest (N=10)  Rocky Mountain (N=6)  West/NW (N=8)

Epi  Lab  Mosquito
Key mosquito surveillance findings from LHDs

– Only 67% conduct mosquito surveillance

– All dependent on state or other lab capacity for testing of mosquito pools

– Need is greatest for mosquito surveillance staff
Surveillance for other arboviruses
Surveillance for other arboviruses

- 34 states test mosquitoes for other arboviruses
  - 24 SLE, 22 EEE, 13 California group

- 26 state labs routinely test human specimens submitted for WNV for other arboviruses
  - 24 SLE, 12 EEE, 6 WEE, 5 LaCrosse, 2 Powassan
Testing capability for other mosquito-borne viruses in state laboratories, 2012
Frequency of positive tests in humans for mosquito-borne viruses and percentage of tests positive, state laboratories, 2012

2,785 WNV+

Number of positive tests

Percentage positive

- WNV
- SLE
- LaCrosse
- Powassan
- EEE
- Colorado tick fever
- WEE
Frequency of positive tests for mosquito-borne viruses and percentage of tests positive, state laboratories, 2012

Number of positive tests

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<th>Virus</th>
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<td>WEE</td>
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Percentage positive
Dengue

• 18 states reported having identified *Aedes aegypti*.

• 5 had written plans for dengue surveillance and control
Limitations

- Not all jurisdictions answered all questions.

- Some jurisdictions may have interpreted the same question differently in 2004 and 2012, particularly questions re: number of personnel.

- Relative importance of different surveillance methods (avian mortality, equine vs mosquito) have changed over time – states have made adjustments independently of funding.

- New questions asked in 2012 not asked in 2004
Conclusions

• All 48 contiguous states retain some capacity for WNV surveillance

• State capacity has decreased substantially since 2004
  – Decreases in active human surveillance, mosquito surveillance capacity and lab capacity of most concern – have reached a tipping point in some states
  – *Ability to rapidly detect emerging & outbreak-level threats and thus initiate prevention activities is compromised*

• Decreases in ELC funding have contributed to the decreases in capacity
  – Many states have own funding support, but some entirely dependent on ELC funding
Conclusions (cont)

- Capacity to conduct surveillance for other arboviruses is patchy – in part because of limitations of lab capacity
  - *Ability to detect and monitor trends in other arboviruses and inform public is very limited.*

- A 50-60% increase in FTEs involved in arboviral surveillance is needed to enable state and local health departments to achieve full capacity.
Recommendations

• Need to assure that current capacity is maintained.
  – *Are losing the ability to detect arboviral outbreaks early enough to prevent serious morbidity*

• Ideally, CDC and all states should examine arboviral surveillance capacity and secure additional support as needed to:
  – assure mosquito surveillance occurs in all metro areas with historically high WNV burden
  – assure capacity in all states to conduct surveillance for other endemic and emerging arboviral threats (e.g., dengue, chikungunya)
Contributors

CSTE
Dhara Patel, Kimberly Miller, Rebecca Rutledge, Jessica Wurster, Jennifer Lemmings, Jeff Engel

2013 Assessment Workgroup
Carina Blackmore, Kristie Bradley, James Blumenstock, Al DeMaria, Jeff Engel, Paul Etkind, Jane Getchell, Jim Hughes, Lily Kan, Abraham Kulungara, Jennifer Lemmings, Roger Nasci, Dhara Patel, Lyle Petersen, Kelly Wroblewski

Respondents
50 states & 21 local health departments
Assessment of Capacity in 2012 for the Surveillance, Prevention and Control of West Nile Virus and Other Mosquito-borne Virus Infections in State and Large City/County Health Departments and How it Compares to 2004

Morbidity and Mortality Weekly Report

National Capacity for Surveillance, Prevention, and Control of West Nile Virus and Other Arbovirus Infections — United States, 2004 and 2012

James L. Hadler, MD¹, Dhara Patel, MPH², Kristy Bradley, DVM³, James M. Hughes, MD⁴, Carina Blackmore, DVM⁵, Paul Etkind, DrPH⁶, Lily Kan, MPH⁷, Jane Getchell, DrPH⁸, James Blumenstock, MA⁹, Jeffrey Engel, MD² (Author affiliations at end of text)

In the first 5 years after its introduction in the United States in 1999 (1), West Nile virus (WNV) spread to the 48 contiguous states, resulting in 667 reported deaths (J–3). To establish detection and response capacity, WNV surveillance

Surveillance Capacity

All 56 jurisdictions conducted surveillance for human WNV disease in 2012. Compared with 2004, they were less likely to have reporting systems in place to share surveillance data (16 of 56