Massachusetts Arbovirus Surveillance and Response Plan

Catherine M. Brown, DVM, MSc, MPH
State Public Health Veterinarian
MA Department of Public Health
November 29, 2012

Outbreak of Encephalitis in Man Due to the Eastern Virus of Equine Encephalomyelitis

ROY F. FEEMSTER, M.D., Dr.P.H., F.A.P.H.A.
Director of the Division of Communicable Diseases of the Massachusetts Department of Public Health, Boston, Mass.

About the middle of August, 1938, cases of encephalomyelitis in horses were recognized in Massachusetts and it was soon ascertained that an epidemic was developing. All five of these cases occurred within 15 miles of each other, the nearest being 20 miles southeast of Boston. An interesting coincidence was that they
1831 Epidemic of brain disease in horses in Massachusetts
1931 Differentiated from other equine encephalitides
1933 Virus isolated
1933-36 Birds implicated as reservoir of virus
1938 Outbreak of “brain disease” in horses in Massachusetts (~ 300 cases)
1938-39 Outbreak of human EEE in Massachusetts (35 cases)
1947 Louisiana and Texas outbreaks
1955-56 Second Massachusetts outbreak (16 cases), aerial spraying, DDT
1957 Taunton Field Station of the USPHS
1969 Taunton Field Station closed, State Laboratory continues surveillance
1973 Equine vaccine
1973-75 Outbreak (7 cases), aerial spraying, malathion
1982-84 Outbreak (10 cases)
1990 Outbreak (3 cases), aerial spraying, malathion
Human EEE Cases by County of Residence, 1938-2011

Overall Progression During Mosquito Season

First EEE infected mosquito
First EEE infected mammal-biting mosquito
First EEE infected horse or other animal
First EEE infected person

July 12-Aug 20
July 25-Sept 16
July 20-Sept 25
July 31-Sept 1
*Notes: First arrow indicates aerial adulticide application, July 20-22. Second arrow indicates aerial adulticide application, August 13.*
**EEE Infection Rate in Mosquitoes**

2012 vs 2011 *Cs melanura* Minimum Infection Rate (MIR) at MDPH Long-term Traps

Notes: First arrow indicates aerial adulticide application, July 20-22. Second arrow indicates aerial adulticide application, August 13.

---

**Arbovirus Surveillance and Response Plan**

VECTOR CONTROL PLAN TO PREVENT

VECTOR CONTROL PLAN TO PREVENT

EASTERN (EQUINE) ENCEPHALITIS

A Joint Program of the
Executive Offices of Health and Human Services
and Environmental Affairs

COMMONWEALTH OF MASSACHUSETTS
RISK CATEGORIES

1. LOW - A LOW LEVEL OF EEE RISK may exist if all of the following conditions are met:

   Current Season
   1. EEE virus isolates in Cx. melanura Cx
   2. Population of Cx. melanura below long-term mean

   Previous Season
   1. No human or horse cases
   2. Cx. melanura below long-term mean
   3. EEE virus isolates Cx

2. MODERATE - A MODERATE LEVEL OF EEE RISK may exist if any of the following conditions exist:

   Current Season
   1. EEE virus isolates from Cx. melanura Cx
   2. Cx. melanura populations approaching long-term mean
   3. Clinically presumptive horse cases

   Previous Season
   1. 1 human case or horse case
   2. Cx. melanura population above the long-term mean
   3. EEE virus isolates from Cx. melanura Cx

3. HIGH - A HIGH LEVEL OF EEE RISK may exist if any of the following conditions exist:

   Current Season
   1. Confirmation of 1 human case
   2. Multiple horse cases
   3. EEE virus isolates in bridge vector species

   Previous Season
   1. 2 or more confirmed human or horse cases

4. PUBLIC HEALTH EMERGENCY - DPH will forward a recommendation to the Governor’s Office to declare a PUBLIC HEALTH EMERGENCY in the event that any of the following conditions exist:

   Current Season
   1. 2 human cases are confirmed
   2. Surveillance data indicating that multiple human cases of EEE will occur without intervention
West Nile Virus Disease Reported in the U.S.
(as of 9/11/2012*)

**EEE RISK LEVELS AND RESPONSE ACTIONS**

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Response</th>
<th>Public Education</th>
<th>Vector Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Routine surveillance</td>
<td>Information sent to health care providers,</td>
<td>Routine IPM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>health officers, camps, campgrounds and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>libraries</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Increased surveillance</td>
<td>Intensified public education campaign</td>
<td>Targeted ground larviding and/or</td>
</tr>
<tr>
<td></td>
<td>of bridge vector</td>
<td>including press advisories on EEE risk</td>
<td>adulticiding of bridge vectors</td>
</tr>
<tr>
<td></td>
<td>populations; targeted</td>
<td>and prevention</td>
<td></td>
</tr>
<tr>
<td></td>
<td>supplemental trapping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>Intensified public education campaign</td>
<td>Targeted aerial larviding and/or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>including radio and television</td>
<td>adulticiding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>announcements</td>
<td></td>
</tr>
<tr>
<td>Public Health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td>Declaration of a Public</td>
<td>Intensified public education campaign</td>
<td>Wide area adulticiding</td>
</tr>
<tr>
<td></td>
<td>Health Emergency</td>
<td>utilizing all media outlets</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Data as of 9/11/2012*
Massachusetts Department of Public Health

2012
Massachusetts Arbovirus Surveillance and Response Plan

Table 1. Guidelines for Phased Response to WNV Surveillance Data

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Probability of locally acquired human disease</th>
<th>Definition of Risk Category for a Focal Area¹</th>
<th>Recommended Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parents</td>
<td>All of the following conditions must be met:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Risk Year: No prior year WNV activity detected in the local area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>And Current Year: No current surveillance findings indicating WNV activity in mosquitoes in the focal area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>And No animal or human cases.</td>
<td></td>
</tr>
</tbody>
</table>

¹. MDPH staff provides educational materials and clinical specimen submission protocols to targeted groups involved in arbovirus surveillance, including, but not limited to, local boards of health, physicians, veterinarians, animal control officers, and state health agencies.

2. Educational efforts directed to the general public on personal prevention steps and vector reduction, particularly to those populations at higher risk for severe disease (e.g., the elderly).

3. MDPH provides recertification information on WNV/BSE disease, and disposal of dead birds via MDPH WNV information line: 1-888-MAINE-WNV.

4. Assess mosquito populations, monitor larval and adult mosquito density.

5. Passive collection and testing of mosquitoes.

6. Initiate source reduction: use larvicides at specific sites identified by entomology survey. In making a decision to use larvicides consider the abundance of Culex larvae, intensity of prior virus activity and weather.

7. Locally determined standard, adult mosquito control activities are implemented. No specific supplemental control efforts are recommended.

8. Passive human and home surveillance.

9. Emphasis for schools to comply with MA requirements for flying outdoor IPM plans.
Phased Response

- Risk Assessment
  - Five stages: remote to critical
  - Based on history and current data
  - Provides evolving set of recommendations for agencies and locals
Prevention Tools

- Larvaciding to kill young mosquitoes
- Awareness
- Repellents
- Clothing
- Avoiding peak mosquito activity time
- Ground spraying to kill infected adult mosquitoes
- Aerial spraying to kill infected adults

Increasing Risk

Frequency of use

The Commonwealth of Massachusetts

2011 OPERATIONAL RESPONSE PLAN TO REDUCE THE RISK OF MOSQUITO-BORNE DISEASE IN MASSACHUSETTS

July 1, 2011

This document is open to continual review and evaluation and can be modified, if and when appropriate

MDAR
Division of Crop and Pest Services

State Reclamation and Mosquito Control Board
Massachusetts Department of Agricultural Resources
251 Causeway Street, Suite 500
Boston, MA 02114-2151
http://www.mass.gov/agr/mosquito/index.htm
Number of EEE Human Cases By Year, 1938-2011

Intervals (in years) between years with any human EEE cases. Position of circle on x-axis is the midpoint between years with cases.
Experts in the fields of
- mosquito control
- toxicology,
- ecology,
- climate change,
- public health
- infectious disease were invited to participate.

Panelists were chosen specifically because they were not already involved in the Massachusetts arbovirus surveillance and mosquito control processes, and could be expected to provide fresh perspectives.
Question 1

- Is there evidence that the historical EEE cycle in Massachusetts has changed; i.e. has there been an increase in the frequency of human cases?

![Graph showing number of human EEE cases from 1940 to 2000.]

Question 2

If there has been a change, is it attributable to anything specific, such as climate change?

- Land use changes
- Changes in predominant bird species
- Changes in average temperatures and precipitation events related to climate change.
- Changes in mosquito abundance, types of mosquitoes or movement behavior.
Question 3
Are there other factors indicating human risk?
- Horses and other animals may be less useful
- Calculating new measure that combines a measure of how many mosquitoes are out there with how many of them are infected

Historical indicators which continue to be evaluated
- above average rainfall in the prior fall and spring,
- mild winters with insulating snow cover,
- EEE activity in the previous year,
- any EEE virus isolations from mosquitoes prior to July 1,
- isolation of EEE virus from a mammal-biting species of mosquito,
- infection of an animal or person prior to late August, and
- higher than average summer temperatures
Question 4
Is there the possibility of an early season intervention?
- Few effective products currently available for swamps
- Timing conflicts with night-time weather
- Newer products possible in the future

Question 5
What factors should trigger an aerial spray?
- Not possible to prevent every single case of EEE
- Aerial applications are one tool that can be employed to reduce, but not eliminate, risk
- Personal prevention should form the basis of all risk reduction efforts; Aerial spraying poses a risk of conveying a false sense of security
Question 5 continued

- Threshold for consideration of aerial spraying should be lowered

- Consider options for focal area aerial spraying as an alternative to full regional spraying; explore potential local assets/airplane-based equipment to support more rapid and focused spray actions

Human Health Effects of Sumethrin and Piperonyl butoxide (PBO)

- When applied in a manner consistent with its’ labeling, the panel agreed the data suggest that aerial application should not result in negative health effects for the general public.

- DPH recommends precautions be taken to avoid any opportunity for exposure.

- During 2006 and 2010 aerial applications, individuals who reported health impacts to DPH after aerial applications were among those who did not take precautions (e.g., were outside during actual application and/or left windows open during application).
Studies indicate that there are effects on non-target insects associated with these ingredients. The panel agreed that widespread adulticiding for disease risk mitigation should be limited to public health emergencies.

**Abundance Infection Factor**

*2012 vs 2011 Cs melanura Abundance Infection Factor (A/P) at MDPH Long-term Traps*

Notes: First arrow indicates aerial adulticide application, July 20-22. Second arrow indicates aerial adulticide application, August 13.
Massachusetts 1970-2012
Human EEE and EEEV Mosquito Isolates

Aerial Spray for EEE, 2012
First spray – 21 communities
Persistent risk – Hockomock Swamp
Second spray – 6 communities
Figure 5. Eastern equine encephalitis virus (EEEV) activity reported to ArboNET, by state, United States, 2012 (as of September 11, 2012)
Massachusetts 2000-2012
Human WNV and WNV Mosquito Isolates

Figure 1. West Nile virus (WNV) activity reported to ArboNET, by state, United States, 2012 (as of September 11, 2012)
Areas for Improvement

- Combined risk map
- Risk levels and response recommendations for WNV
- Localizing WNV risk
- Predicting EEE risk outside of southeast MA

Successes

- Evidence of increased EEE risk in SE Mass detected promptly
- Rapid response time
- Improved coordination with LHDs over cancellation of evening events
Thank you!