Lyme disease under-reporting in the U.S.

- All reportable conditions are subject to under-reporting.
- Magnitude of under-reporting less for diseases that:
  - Are rare or unusual
  - Require hospitalization
  - Have a definitive diagnostic test
- Principal reasons for under-reporting of Lyme disease:
  - Busy health care providers don’t fill out the report form.
  - Health departments do not have time to follow up on missing information.
### Estimates of Lyme disease under-reporting

<table>
<thead>
<tr>
<th>State</th>
<th>Year</th>
<th>Under-reporting</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>1992</td>
<td>6-9 X</td>
<td>MD survey(^1)</td>
</tr>
<tr>
<td>MD</td>
<td>1992-3</td>
<td>10-12 X</td>
<td>MD survey(^2)</td>
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<tr>
<td>NY</td>
<td>1991-4</td>
<td>4 X</td>
<td>Tick bite model(^3)</td>
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<tr>
<td>WI</td>
<td>1992-8</td>
<td>3 X</td>
<td>Record review (^4)</td>
</tr>
</tbody>
</table>

Lyme disease testing by large commercial laboratories in the U.S.


Results:

• 3.4 million Lyme disease tests conducted annually on 2.4 million patients
• 288,000 estimated infections (Range: 244,000 – 444,000)
• Annual cost of testing alone estimated to exceed $490M per year
Incidence of clinician diagnosed Lyme disease in the U.S., 2005-2010

Emerging Infectious Diseases 2015; 21:1625-31

Results:

• >103 mil person-years of observation
• 44,445 outpatient and 985 inpatient Lyme disease diagnoses identified
• Epidemiologic patterns similar to U.S. surveillance data
• Estimated 329,000 patients treated for Lyme disease annually (range 296,000 - 376,000)
# Estimates of Lyme disease under-reporting

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<td>MD survey²</td>
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<td>Tick bite model³</td>
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<tr>
<td>WI</td>
<td>1992-8</td>
<td>3 X</td>
<td>Record review ⁴</td>
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<tr>
<td>All</td>
<td>2008,10</td>
<td>8-10 X</td>
<td>Lab survey,⁵ Claims data⁶</td>
</tr>
</tbody>
</table>

Lyme disease U.S. case distribution: 16-year trend

N = 17,209

2001

N = 36,429

2016

* One dot placed randomly within county of residence for each confirmed case

Geographic expansion of ticks – locations where *Ixodes scapularis* recorded

- Established: ≥6 or more ticks or ≥1 life stage recorded in a single year
- Reported: <6 individuals of a single life stage recorded in a single year

Positive EEE Cases in New York - 2011 through August 1st (five days prior to human onset date)

- Human case
- Mosquito pool (n=2)
- NYS Fairgrounds

Note: mosquito pool dates listed are date of lab confirmation

Toad Harbor/Big Bay Swamp
Positive EEE Cases in New York - 2011
through August 12th (human case report date)

- Human (n=1)
- Equine (n=2)
- Mosquito pool (n=11)
- NYS Fairgrounds

Note: Dates listed are date of lab confirmation
Questions?

Contact info:

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NY State Department of Health
Bureau of Communicable Disease Control
bryon.backenson@health.ny.gov
What is the Purpose of Vector Surveillance?

- Identify where vectors are breeding or abundant

- Identify the species present
  - Species is important in determining risk of transmission to humans

- Monitor vector population densities (in different life stages) by species over time

- Identify infectious agents in the vector population
Questions for Discussion:

- Why are you considering vector surveillance?
- What do you want to do, and can you actually do it?
  - Resources?
  - Personnel?
  - Equipment?
  - Skills?
  - Data Collection?
  - Data Analysis?
  - Interpretation?
  - Dissemination?
- Link to public health practice!
  - Control?
  - Education?
Mosquito Surveillance

- What, if any, species are you trying to target?
  - Techniques may vary
- Larval vs. Adult surveillance
  - Larval
    - Identify larvae? Moving water around? Or just presence/absence?
  - Adult
    - Ability to identify different species
    - Data management
    - Trap and battery maintenance
    - Trap location
- How much is enough? Too much? What is representative?
  - Balance of collections vs. results
## Most Commonly Positive Mosquito Species

**1959-2004; For Selected Arboviruses**

<table>
<thead>
<tr>
<th></th>
<th>Aedes vexans</th>
<th>Coquillettidia perturbans</th>
<th>Culex pipiens</th>
<th>Culex restuans</th>
<th>Mixed Culex pipiens/restuans</th>
<th>Culex salinarius</th>
<th>Culex sp.</th>
<th>Culiseta melanura</th>
<th>Ochlerotatus.canadensis</th>
<th>Ochlerotatus stimulans</th>
<th>Ochlerotatus communis</th>
<th>Ochlerotatus triseriatus</th>
<th>Ochlerotatus trivittatus</th>
<th>Aedes/Ochlerotatus sp.</th>
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<td><strong>43</strong></td>
<td><strong>94</strong></td>
<td><strong>296</strong></td>
</tr>
</tbody>
</table>

Different mosquito species are involved with different diseases, meaning different approaches are sometimes necessary.
CO₂-Baited CDC Miniature Light Trap

How do you trap mosquitoes?

CDC Gravid Trap
Diurnal Resting Boxes (or Shelters). These simulate areas where mosquitoes will hide during the day.
Sampling for larval (immature) mosquitoes.
Sampling for larval (immature) mosquitoes.
Sampling for larval (immature) mosquitoes.
Tick Surveillance

- What, if any, species are you trying to target?
  - Techniques may vary
- Passive vs. Active surveillance
  - Passive
    - People bring/send you specimens (Doesn’t always mean less work!)
      - Tick identification services
      - Tick spotter apps
      - Veterinary surveys
  - What level of service are you going to provide to the submitter?
  - Active
    - You go out and do collections
      - Dragging and flagging
      - Walking surveys
      - CO2 and other traps
      - Host surveys
  - How much is enough? Too much? What is representative?
    - Balance of collections vs. results
Passive Tick Surveillance: Pros and Cons

- **Pros**
  - Gain tick distribution data via crowdsourcing
  - More granular than active surveillance?
  - Identify risk groups
  - Interact with public/education opportunities

- **Cons**
  - Expensive startup
  - Ongoing costs? Mailing?
  - Time consuming, fun with packaging
  - Data interpretation can be limited
  - Potential data and specimen management issues
  - Potential medical liability issues?
  - Dealing with confidential patient data

To test or not to test?
Active Tick Surveillance: Pros and Cons

- **Pros**
  - Maximum control over surveillance
  - Can be “more scientific”
  - Provides high quality data
  - Interact with public/education opportunities

- **Cons**
  - Time and resource intensive
  - External factors can influence success
  - Typically collect then test, collect then test
  - Depending on resources, can become geographically limited—not as many data points

To test or not to test?
Active Tick Surveillance