Deer Ticks ... One bite can change your life...

Massachusetts Association of Public Health Nurses

April 14, 2016

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Deer Tick Project Coordinator - Entomologist
www.capecodextension.org
508-375-6642
Ticks have **NO** friends...

- The Dalai Lama

- "I love everything in the world...except for ticks..."
“Actually, NFL Commissioner Roger Goodell is *TIED* with ticks on my list of the unworthy...”
Incidence Rate Lyme: 2014

State Ranking

1 – Maine 88*
2 – Vermont 71
3 – Massachusetts 54
4 – Rhode Island 54
5 – Pennsylvania 51
6 – Connecticut 48
7 – New Hampshire 47

U.S. 8

* Confirmed cases Per 100,000
American Dog Tick
*Dermacentor variabilis*
Lone Star Tick
*Amblyomma americanum*
- Cuttyhunk & Naushon Islands
- Sandy Neck, West Barnstable
Lone Star Tick

- **Aggressive** biter
  - Erlichiosis
  - STARI*
    - *Falmouth*
  - Tularemia

Bite can trigger allergy to red meat consumption

Beef, Pork, Lamb and by-products...gelatin
Deer Tick, or Blacklegged Tick
New tick species discovered on Cape Cod, Massachusetts: Risk Assessment
Dierdris
carnivorous
Massachusetts Winters: Kill Ticks???
A Wisconsin Winter
The Lyme disease spirochete feasts on tick antifreeze

Glycerol (Glycerin)

Glycerol prevents ice crystal formation in cells

Lyme bacteria use glycerol as a carbon (= energy) source
An Ounce of Prevention
There are ways to protect yourself and your family. Tick checks are important, and consider repellents: DEET-based for exposed skin and Permethrin-based for clothing including footwear. Visit www.tickencounter.org/exposure to learn more.

Once Bitten, Don’t Be Shy
Prompt removal of an attached tick is highly recommended. The longer the tick is attached the higher the risk of disease transmission. Check yourself, your family, and pets often.

Lyme Isn’t the Only Concern
Lyme disease is the most prevalent vector-borne infectious disease in the U.S., but ticks carry other pathogens as well. Anaplasmosis, Babesiosis, and Relapsing Fever are also important and increasing. Visit our website www.capecodextension.org to learn more.

The Laboratory of Medical Zoology (LMZ) tests thousands of ticks from all over the country. Having your tick tested couldn’t be easier. Just follow five simple steps:

1. Place the tick in a sealable plastic bag.
2. Complete the online submission form at www.TickReport.com. Pay the $15 fee online with a credit card or enclose a check.
3. Label the bag with the order number assigned by TickReport.
4. Send the labeled tick in an envelope to:
   Laboratory of Medical Zoology
   Fernald Hall, University of Massachusetts
   270 Stockbridge Rd.
   Amherst, MA 01003
5. Results of the tick test will be sent to you in 5 business days or less.
<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Total Tested</th>
<th>Total Positive</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrelia burgdorferi</td>
<td>4,673</td>
<td>1,378</td>
<td>29.49%</td>
</tr>
<tr>
<td>Anaplasma</td>
<td>4,673</td>
<td>335</td>
<td>7.17%</td>
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<tr>
<td>Babesia microti</td>
<td>4,673</td>
<td>217</td>
<td>4.64%</td>
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<tr>
<td>Bartonella</td>
<td>44</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Borrelia miyamotii</td>
<td>4,673</td>
<td>76</td>
<td>1.63%</td>
</tr>
<tr>
<td>Borrelia mayonii</td>
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<td>0%</td>
</tr>
<tr>
<td>Pathogen</td>
<td>Date Ordered</td>
<td>Result</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
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<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Borrelia mayonii</td>
<td>4/6/2016</td>
<td>NEGATIVE</td>
<td></td>
</tr>
<tr>
<td>Borrelia burgdorferi</td>
<td>3/30/2016</td>
<td>POSITIVE</td>
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</tr>
<tr>
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<td></td>
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<td>POSITIVE</td>
<td></td>
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<td>3/30/2016</td>
<td>NEGATIVE</td>
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</tbody>
</table>

Patient Information:
Host Source: human
Gender: male
Age: 3
City: Norwell
State: MA
Zip: 02061
Attached: Yes
Site of Attachment: Head
Rash Present: No

Tick Information
Species: *Ixodes scapularis*
Sex: female
Stage: adult
Feeding State: engorged
Powassan Virus – 2004 to 2013  CDC
Powassan Massachusetts, 2013-September, 2015

- 7 cases (5 confirmed, 2 probable)
- Residents of: Barnstable, Essex, Middlesex and Norfolk counties
- Exposure occurred in Massachusetts
- Month of onset: May, June, September and October
- Encephalitis requiring hospitalization
- No fatalities
Powassan Surveillance LMZ - 2016
Phase 1 Game Plan - Protect Yourself
Protect Yourself

- Long pants - tucked into socks
- Light colors...easier to see ticks
- Tumble-dry clothes for 20 minutes
- Shoes
Deet, Picaridan, IR3535, Oil of Lemon Eucalyptus to treat *exposed skin*

“All Natural”? 
- FIFRA Section 25(c) Minimum Risk Pesticides
  - Active Ingredient *List*
  - Claims Linking Pest to Specific Diseases – **NO**
  - False or Misleading Statements – i.e. “Chemical Free”

- EPA Registration Exemption
  - Performance Data **NOT** Required

- **Note:** Some actives ID’d as known human allergens
  Negative interaction observed with sunscreens
Tick Repellent Clothing – Permethrin

Fabric only…Active thru 6 washings

Brands
- Ben’s
- Coleman
- Sawyer

Note, Permethrin is an insecticide that repels and kills ticks. Read the Label…
Pre-treated Tick Repellent Clothing

- Proprietary process to bond permethrin to fabric...
- Many brands...one supplier
- 70 Washings EPA Claim

Or, send clothing to Insect Shield for treatment
Climate change
In Hot Pursuit:
What We are Learning About Mosquito and Tick Abundance on Cape Cod

Larry Dapsis
Cape Cod Cooperative Extension

Gabrielle Sakolsky
Cape Cod Mosquito Control
Number of Mosquitoes - Trapping

Year
Range Expansion

- Host Animal Dispersal
- Degree Days above base 0 C

Leighton et al. 2012
Climate Change and Tick Abundance/Survival

- **Macroclimate**
  - Overall precipitation/drought measurements inconsistently related to tick populations

- **Microclimate**
  - RH measurements within leaf litter habitat provided a more accurate prediction of nymph stage tick abundance (Berger et al. 2014)
Questions?
Deer Tick Sampling – Cape & Islands

Graph showing the average number of nymphs per hour from 2007 to 2011.
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<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrelia burgdorferi</td>
<td>8,305</td>
<td>2,655</td>
<td>31.97%</td>
</tr>
<tr>
<td>Anaplasma</td>
<td>7,636</td>
<td>402</td>
<td>5.26%</td>
</tr>
<tr>
<td>Babesia</td>
<td>7,644</td>
<td>359</td>
<td>4.70%</td>
</tr>
<tr>
<td>Bartonella</td>
<td>76</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Borrelia miyamontoi</td>
<td>2,856</td>
<td>85</td>
<td>2.98%</td>
</tr>
<tr>
<td>Borrelia mayonii</td>
<td>97</td>
<td>0</td>
<td>0%</td>
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</tbody>
</table>

Massachusetts Deer Tick Database, 2006 - 2016
February 15, 2016

A New Culprit in Lyme Disease

*Borrelia mayonii*
Tick Ambush Behavior – Questing

...Designed to latch onto any creature that brushes up against it.
Ticks are designed to stay a while...
125 vertebrate species play in the tick-disease ecosystem...

Rodents are important infective hosts – Mice are extremely “competent”, as are chipmunks

Birds play a role

Hosts that are “incompetent” are important for supporting tick numbers
Risk of infection is year round, but the greatest risk...

is NOT the tick adults
Fall thru Spring, 50% infected
Bite more likely to be detected

...it’s from the nymph stage

Late May into August, 25% infected
Bite is difficult to detect
Tick SIZE WISE?
check your bagels

Adult – Sesame Seed Sized

Nymph - Poppy Seed Sized
Number of Confirmed and Probable Lyme Disease Cases Reported in Massachusetts by Month of Onset, 2012

![Bar chart showing number of cases by month with confirmed and probable cases distinguished by color.]

- **JAN**: 50 confirmed, 70 probable
- **FEB**: 30 confirmed, 10 probable
- **MAR**: 40 confirmed, 50 probable
- **APR**: 60 confirmed, 40 probable
- **MAY**: 80 confirmed, 70 probable
- **JUN**: 100 confirmed, 90 probable
- **JUL**: 120 confirmed, 110 probable
- **AUG**: 140 confirmed, 130 probable
- **SEP**: 160 confirmed, 150 probable
- **OCT**: 180 confirmed, 170 probable
- **NOV**: 200 confirmed, 190 probable
- **DEC**: 220 confirmed, 210 probable

The chart indicates a significant rise in cases from May to July, peaking in July with a total of 240 confirmed and 220 probable cases. The chart also shows a decline in cases from August to December.
“Upon further examination the complexity of this problem continues to grow....”
Other Diseases Transmitted by Deer Ticks

- **Babesiosis**
  - Invades Red Blood Cells (malaria-like)
  - Symptoms include fever/chills, severe anemia
  - Blood Transfusion
Incidence Rates (per 100,000 population*) for Confirmed Babesiosis in Massachusetts: 2007-2011*

* Data as of 18APR2011 and are subject to change.

^ Using 2010 Census data

~ Case counts less than 5 in populations less than 50,000 are suppressed to maintain patient confidentiality.
Other Diseases Transmitted by Deer Ticks

- **Anaplasmosis (HGA)**
  - Invades White Blood Cells
  - Symptoms include fever, nausea, headache, muscle pain, abdominal pain, confusion...
Incidence Rates (per 100,000 population) for Confirmed Anaplasmosis in Massachusetts: 2007-2011

* Data as of 20APR2012 and are subject to change.
^ Using 2010 Census data
- Case counts less than 5 in populations less than 50,000 are suppressed to maintain patient confidentiality.

<table>
<thead>
<tr>
<th>Incidence Rate</th>
<th>(per 100,000 pop)</th>
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<tr>
<td></td>
<td>No Reported Cases</td>
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<tr>
<td></td>
<td>-1.0</td>
</tr>
<tr>
<td></td>
<td>-0.9 - 10.0</td>
</tr>
<tr>
<td></td>
<td>10.1 - 100.0</td>
</tr>
<tr>
<td></td>
<td>100.1 - 2000.0</td>
</tr>
</tbody>
</table>
Borrelia miyamotoi

- Known for 10 years
- First linkage to human disease in 2012 – Russia

- U.S. cases followed... Relapsing Fever
  - Misdiagnosed as Anaplasmosis

- Found in 1% of ticks collected on Cape & Islands - 2014
Phase 1 Game Plan- Protect Yourself
Phase 1 Game Plan - Protect Yourself

- Proper Tweezers
- Proper Removal
- Record Date...Save Tick

- Infection Test Available
  - Laboratory of Medical Zoology...UMass-Amherst
  - www.TickReport.com
Permethrin Facts

- 2,250 times more toxic to ticks than humans

- EPA: Reasonable certainty that permethrin-treated clothing poses no harm to infants, children or pregnant women

- Low skin absorption...metabolized quickly

- Exposure data also studied by National Academy of Sciences

- Also used for scabies and head lice control
Phase 2 Game Plan - Protect Your Yard

- Wildlife and habitat management ????

- Perimeter sprays effective
  ...NOT the entire yard
  Consider all “edges”
Phase 3 Game Plan - Protect Your Pets

- Tick check
- Products such as K9 Advantix II, Frontline
- Seresto collars
- Vaccine available for dogs
Don’t Let...one bite can change your life...

Simplified Game Plan Summary

- Tick Checks and Use of Permethrin-Treated Clothing
- Perimeter Yard Spray
- Pet Protection
Mice become vaccinated against Lyme bacteria

Tick infection rate reduced by 76% after five-years...
Damminix Tubes – Eco-Health, Inc.
Several initial university studies looked promising
- Fewer ticks on mice

Follow-up studies, NY & CT
- Replicated, multi-year
- No significant effect on nymph tick populations
  ...not all tick-carrying animals take cotton

Company website – testimonial driven, no baseline data in company trial
You wouldn’t like me when I’m angry...

Because I always back up my rage with facts and documented sources.

-The Credible Hulk
TCS – Tick Box Technology Corporation
- Mice, chipmunks, meadow voles

CDC
- 500 Households 2012 – 2015
- Final Report Pending
CAUTION!

DEER TICK HABITAT

APPROXIMATE ACTUAL SIZES

Nymph Female Male

Deer ticks can carry the pathogens that cause Lyme Disease, Babesiosis, and Anaplasmosis. Nymphs are active May-August. Adults are active September-May.

PREVENTION TIPS

- Stay on the trail.
- Wear shoes, not sandals.
- Repellents recommended:
  - DEET on exposed skin
  - Permethrin on clothing and footwear
- After outdoor activities, check yourself, your children, and your pets for ticks. Place clothes in the dryer for 20 minutes.

DON'T LET ONE BITE CHANGE YOUR LIFE

TICK-BORNE DISEASES ARE PREVENTABLE

CAPE COD COOPERATIVE EXTENSION
www.capecodextension.org

Funding support provided by CAPE COD HEALTHCARE
Protect Yourself

- Tick Checks...Choose Proper tool for removing an attached tick

A  NO

B  NO

C  NO

D  NO

E

YES...pointy tweezers
2014 – Falmouth *Babesia* infected ticks
Lyme Disease Transmission is Not Immediate

24 Hour “Rule”...for Lyme
Nymph Stage Tick Infection

### Punkhorn Conservation

<table>
<thead>
<tr>
<th>Year</th>
<th>Bor</th>
<th>Bab</th>
<th>Ana</th>
</tr>
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<tbody>
<tr>
<td>2013</td>
<td>28</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>20</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>2011</td>
<td>22</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>47</td>
<td>13</td>
<td>8</td>
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### Bells Neck Conservation

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<th>Year</th>
<th>Bor</th>
<th>Bab</th>
<th>Ana</th>
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<td>12</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>32</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>2011</td>
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<tr>
<td>2010</td>
<td>27</td>
<td>0</td>
<td>5</td>
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## Nymph Stage Tick Infection

### Almanack Pond

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<th>Year</th>
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<th>Bab</th>
<th>Ana</th>
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<tbody>
<tr>
<td>2012</td>
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<td>12</td>
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<tr>
<td>2011</td>
<td>17</td>
<td>40</td>
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<tr>
<td>2010</td>
<td>29</td>
<td>5</td>
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### Loring Foundation

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<th>Year</th>
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<tr>
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<tr>
<td>2010</td>
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<td>0</td>
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Nymph Stage Tick Infection

Jehu Pond Conservation

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<th>Ana</th>
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<tbody>
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<td>2013</td>
<td>21</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>19</td>
<td>4</td>
<td>8</td>
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<tr>
<td>2010</td>
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Average Co-infection all sites/years: 8%
# Nymph Stage Tick Infection

## Burgess Conservation

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<th>Year</th>
<th>Bor</th>
<th>Bab</th>
<th>Ana</th>
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<tbody>
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<tr>
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</tr>
<tr>
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<td>18</td>
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<tr>
<td>2010</td>
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</table>
Can Deer Exclusion Fencing reduce tick populations on a homeowners property???

Fact or Myth
Effect of Deer Exclusion Fencing on Tick Numbers

Perkins, 2008
“Hard Data” for patients to review with medical providers

Develop baseline data for Relapsing Fever

Evaluate potential to reduce medication scripts

Should tick testing be a CC Healthcare benefit…