

Understanding and Preventing Tick-Borne Diseases



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Understanding and Preventing Tick-Borne Diseases

- **TICK FACTS AND LIFE CYCLE**
- **TICK-BORNE DISEASES IN OUR AREA**
 - Lyme Disease
 - Anaplasmosis
 - Babesiosis
- **PRACTICAL PREVENTION STRATEGIES**
- **TICK ECOLOGY—IDEAS ABOUT WHY TICK-BORNE DISEASES HAVE SPREAD**

What are Ticks?

Ticks are ectoparasites...feeding on the blood of a large group of animals

- Mammals
- Birds
- Reptiles
- Amphibians



Unlike mosquitoes that feed quickly, ticks are designed to stay a while.

The barbed hooks on their mouthpart, called a hypostome, are the reason why ticks cannot just be brushed off.

Ticks in New England

Species	Larva	Nymph	Male	Female	Partially Fed Female	Fully Fed Female
Deer Tick <i>Ixodes scapularis</i>						
Dog Tick <i>Dermacentor variabilis</i>						
Lone Star Tick <i>Amblyomma americanum</i>						
Brown Dog Tick <i>Rhipicephalus sanguineus</i>						

Deer ticks

 Tick Encounter Resource Center ***Ixodes scapularis* (Blacklegged ticks or Deer ticks)**



Larva



Nymph



Adult Male

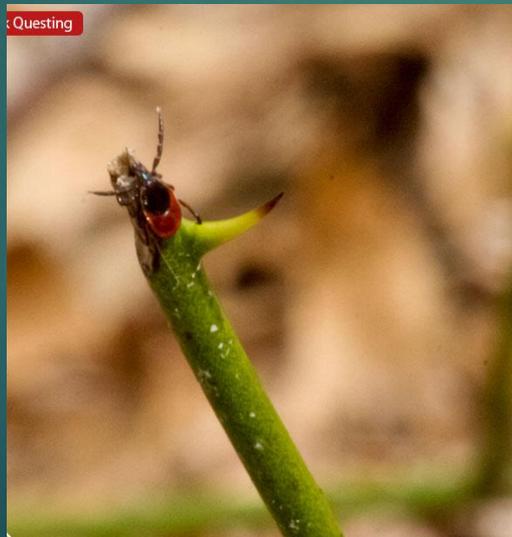


Adult Female

Tick Ambush Behavior – Questing

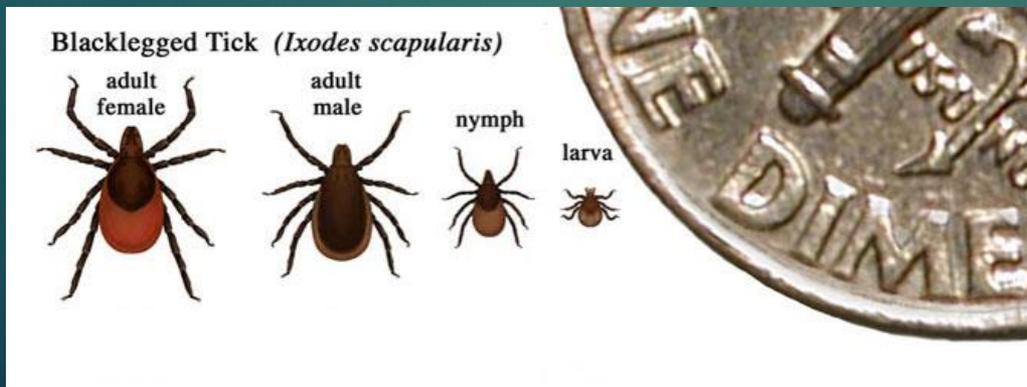
- Blacklegged ticks search for a host from the tips of low-lying vegetation and shrubs, not from trees.
- **TICKS CRAWL UP!** Ticks attach to a person or animal near ground level, then climb up.

Designed to latch onto any creature that brushes up against it

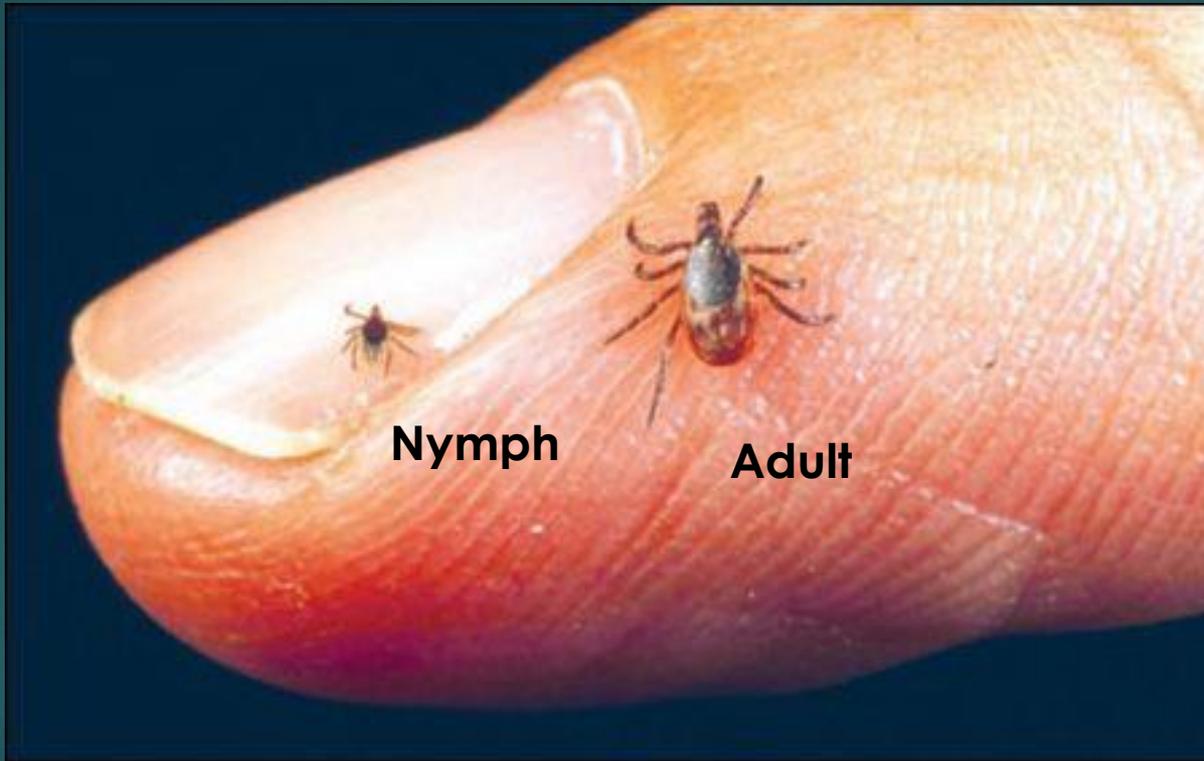


Deer Ticks SIZE WISE ? check your bagels

- ▶ Adult – Sesame Seed Sized
 - ▶ Male (Black)
 - ▶ Female (Black/Red)
- ▶ Nymph – Poppy Seed Sized

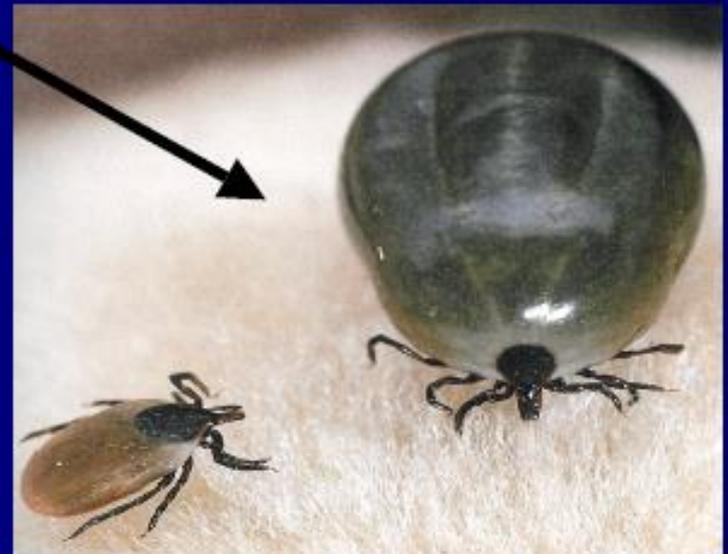
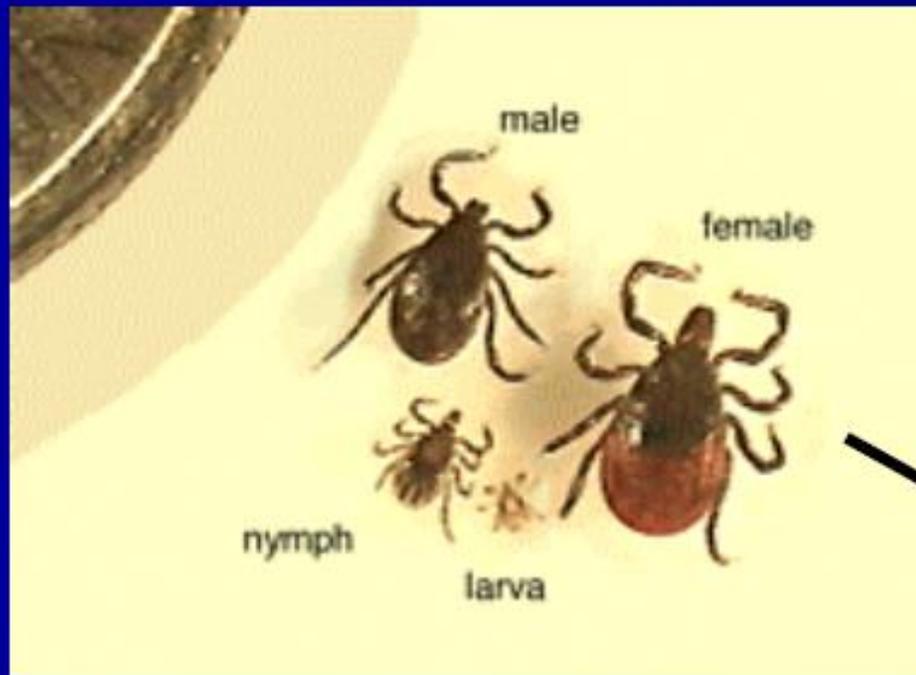


Deer Tick Size

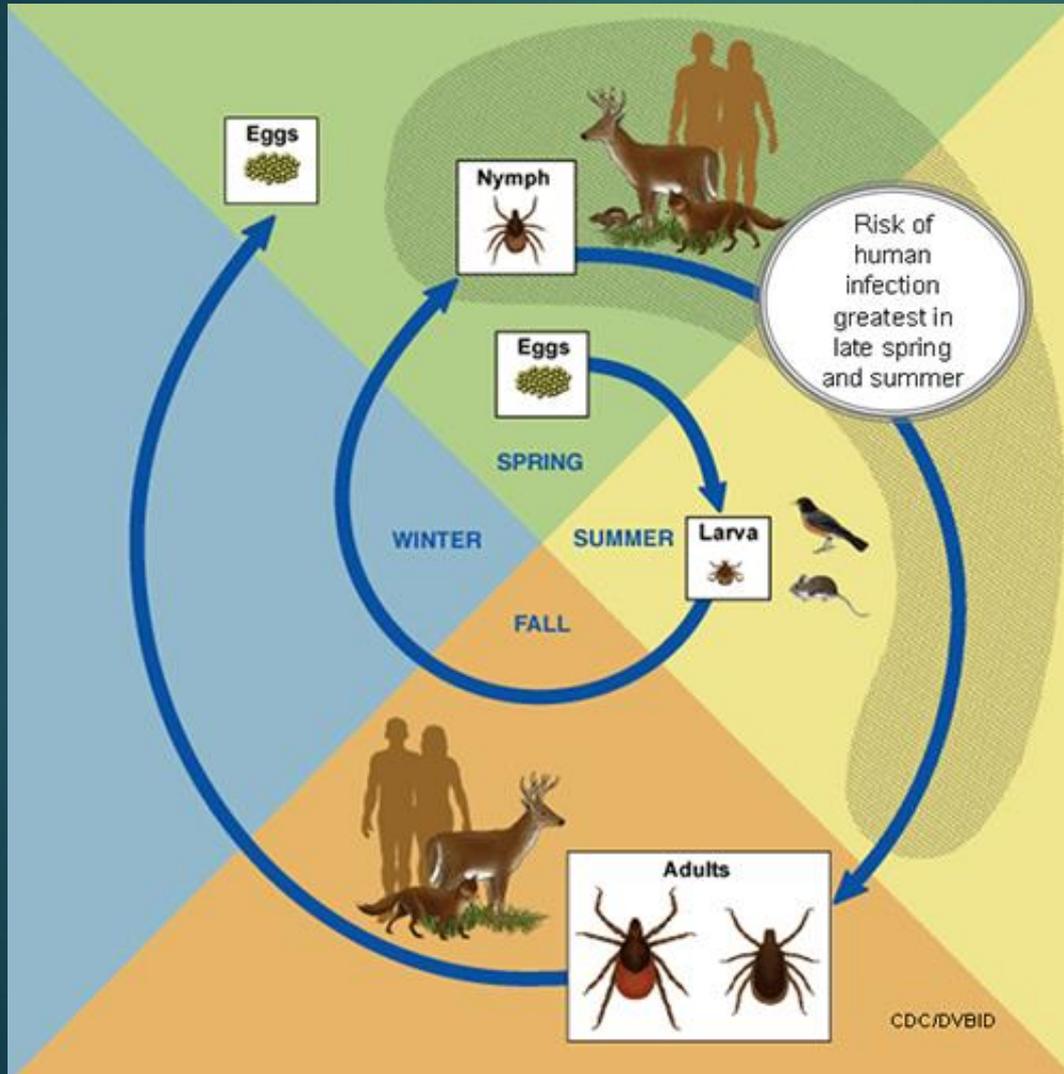


Deer Tick Life Stages

1. Four Stages – Egg, Larva, Nymph & Adult
2. Two year life cycle
3. Ticks feed only **ONCE** as a Larva, Nymph & Adult...3 meals total



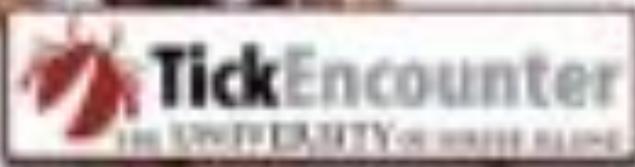
Tick Life Cycle



The Lyme Disease Cycle

1. Larval ticks feed and acquire the disease from an infected host such as a mouse or a bird.
2. Nymph ticks retain and transmit the disease back to mice and birds—and HUMANs.
3. Deer and other larger vertebrates provide the blood meal for adult female ticks to lay 2,000+ eggs

*How do
deer ticks
acquire
Lyme
disease?*



Risk of infection is year-round, but the greatest risk is in Summer

Is NOT from deer tick adults

- ▶ Most Active in Fall and Spring
- ▶ About 50% carry Lyme disease
- ▶ Bite is much more likely to be detected

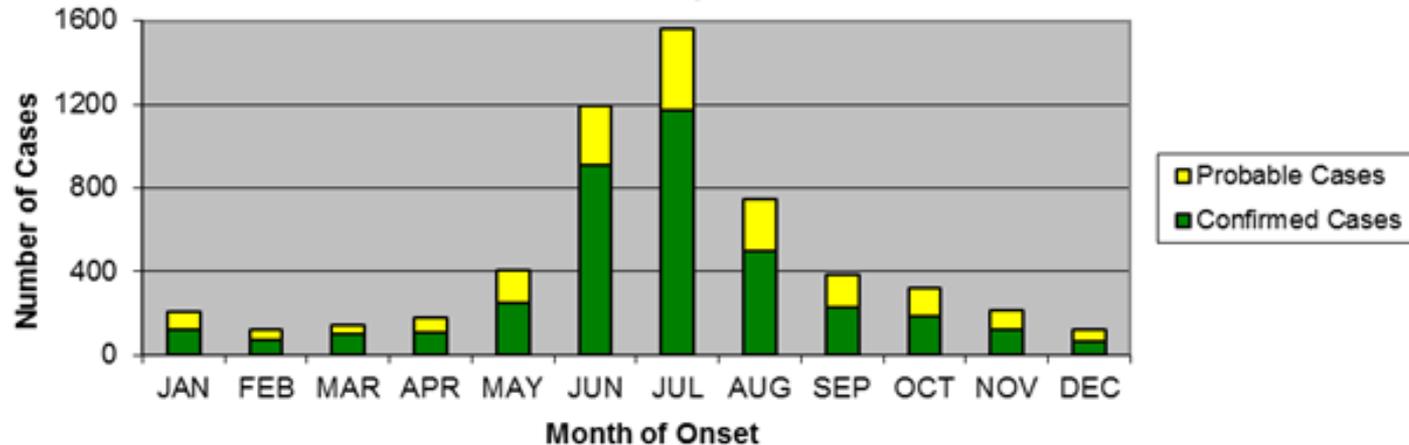


...It's from the NYMPH stage

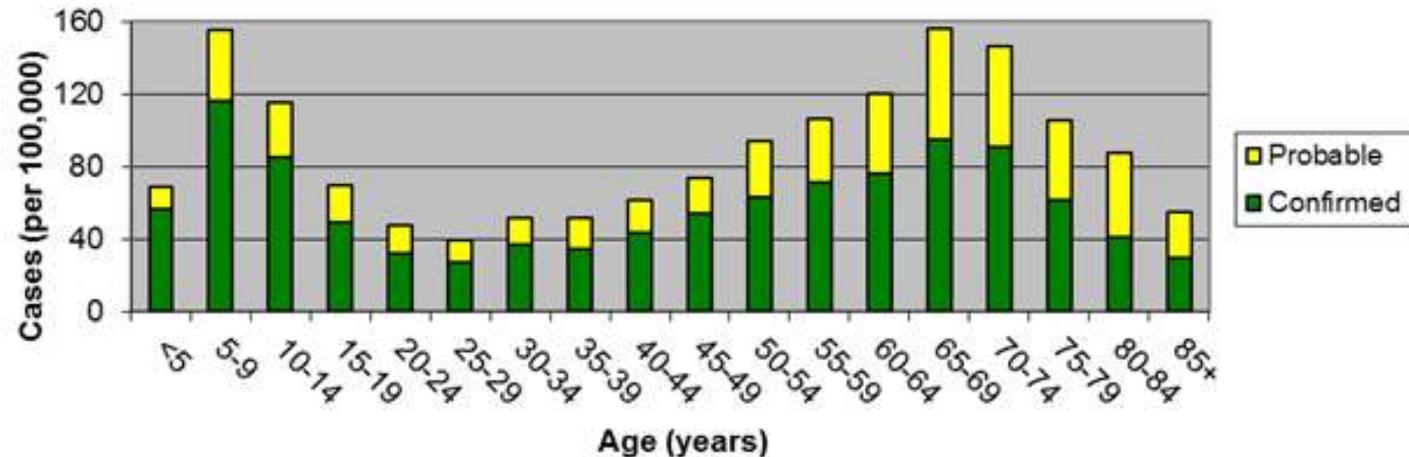
- ▶ Feeds late May into August
- ▶ About 25% carry Lyme disease
- ▶ Bite is *difficult to detect*



Number of Confirmed and Probable Lyme Disease Cases Reported in Massachusetts by Month of Onset, 2014



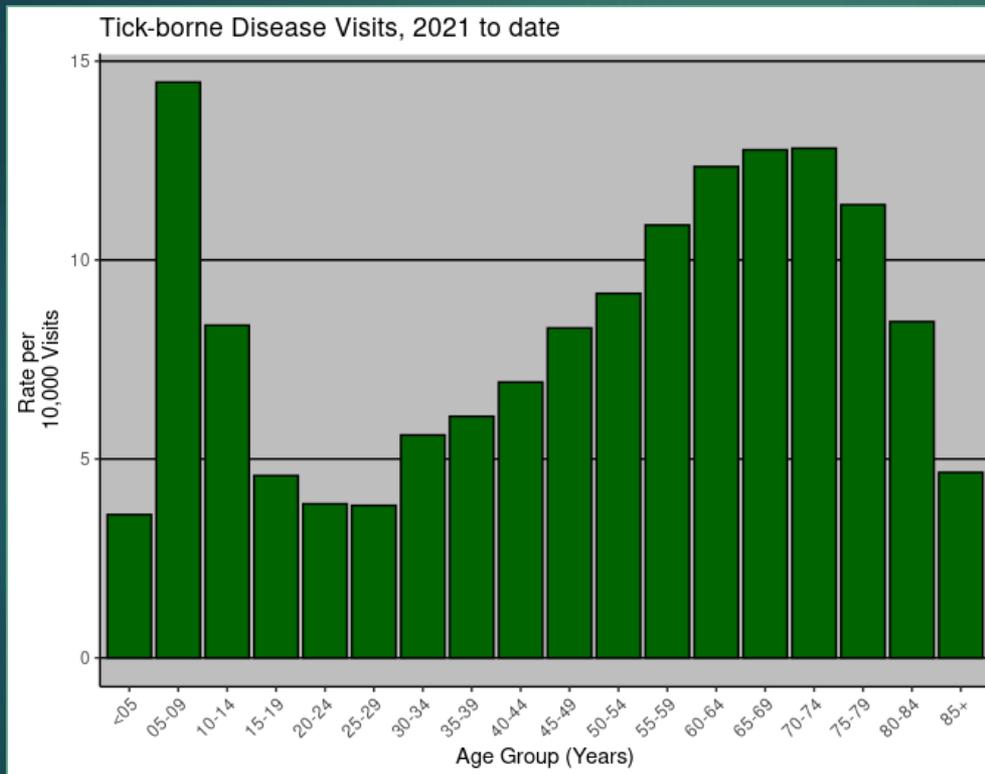
Incidence Rates of Confirmed and Probable Lyme Disease Cases in Massachusetts by Age Group, 2014



Tick Borne Diseases in Massachusetts

- ▶ Lyme Disease
- ▶ Babesiosis
- ▶ Anaplasmosis (HGA)
- ▶ Powassan Virus
- ▶ *Borrelia miyamotoi* illness
- ▶ Lone Star tick

2021 Tick-borne Disease ER Visits



- ❖ Kids → Lyme
- ❖ Older adults → Lyme, Anaplasmosis, Babesiosis
- ❖ Warmer weather, less snowy winters
- ❖ Happening with mosquito population too

LYME DISEASE

A bacterial illness, caused by *Borrelia burgdorferi*, a spirochete.

Lyme is the second most prevalent infectious disease in MA (only Hepatitis C is higher)

Discovered in 1975 in Lyme CT, but has existed for much longer



LYME DISEASE: THE GROWING HEALTH PROBLEM

US CASES OF LYME

2002

*240,000



2017

*420,000



1 TICK, MANY DISEASES

Babesiosis
Anaplasmosis

Borreliosis
Powassan Virus



Blacklegged tick

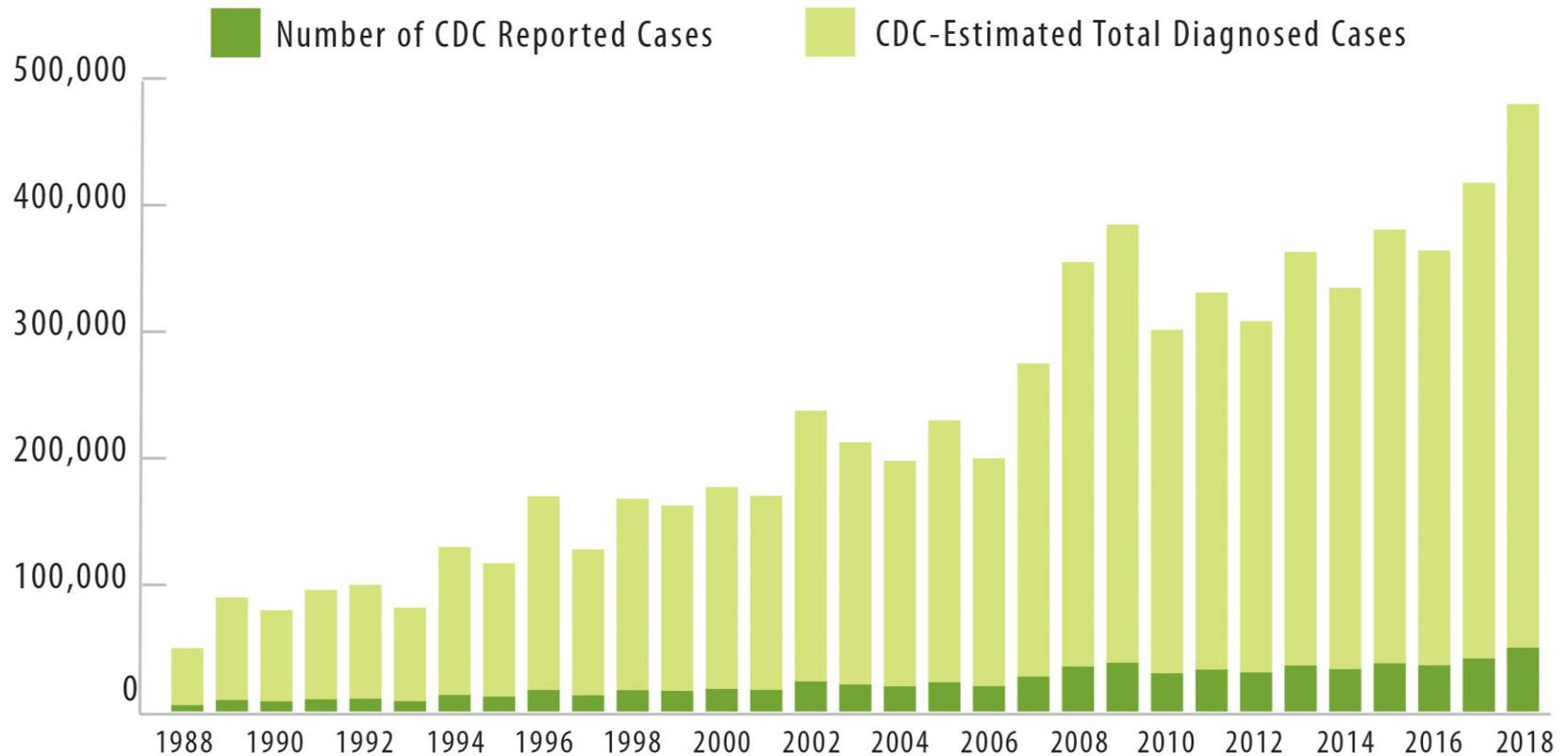
*estimated



LYME DISEASE IS SPREADING TO NEW REGIONS
EST. COST: \$712M-1.3B/YR

Credit: Cary Institute of Ecosystem Studies

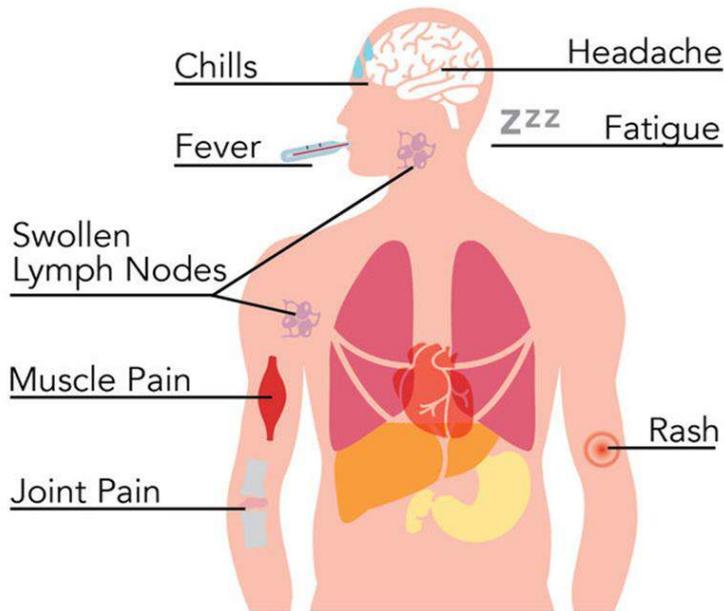
Annual Cases of Lyme Disease in the US



Lyme disease

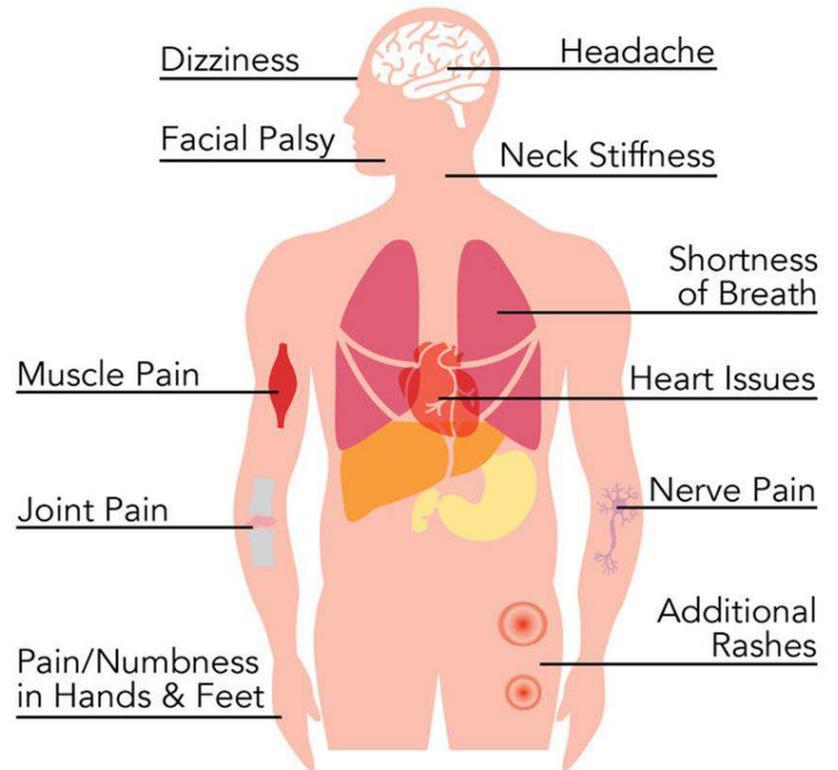
Early Lyme Disease Symptoms

3-30 Days After Infected Black Legged Tick Bite



Chronic Lyme Disease Symptoms

Days to Months After Infected Black Legged Tick Bite



Lyme Disease— Early Signs and Symptoms

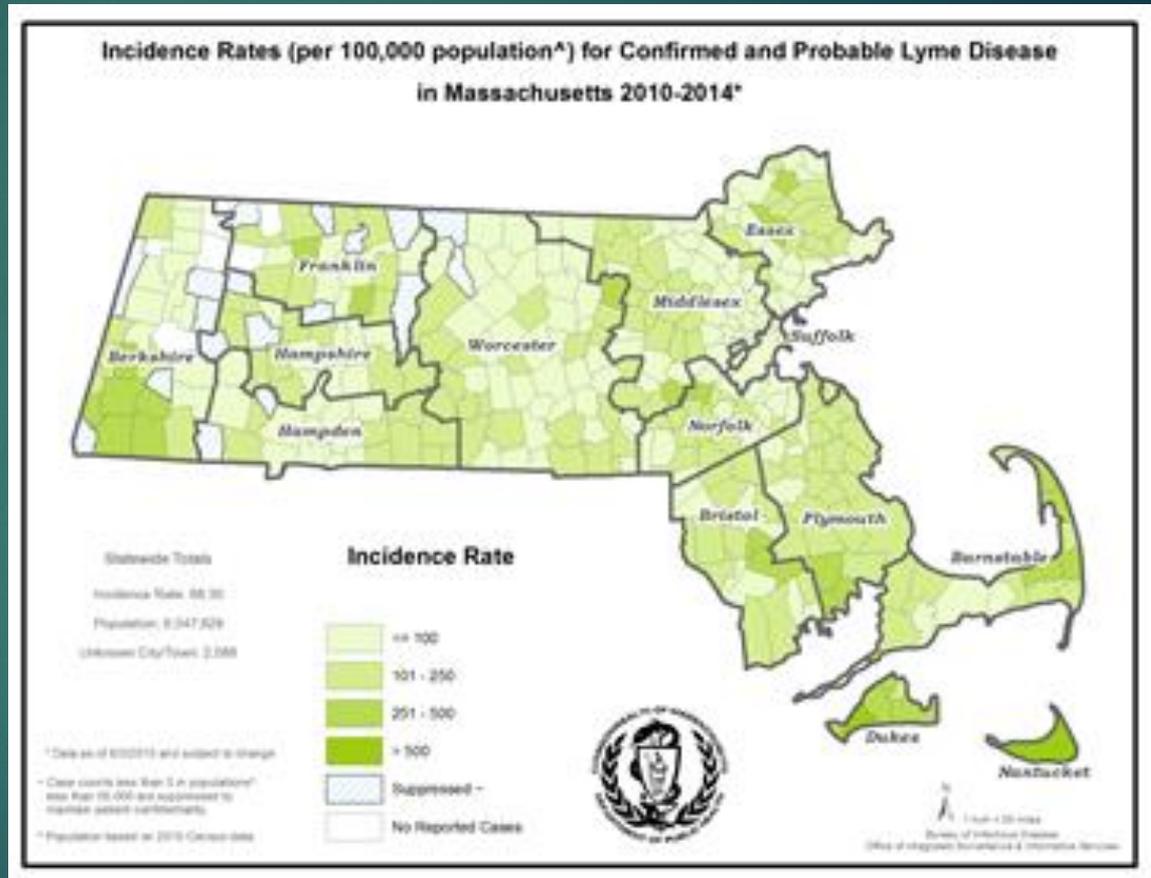
Lyme Disease-- Early Signs and Symptoms

- Erythema migrans “Bull’s eye” rash:
 - Occurs in approximately 70 to 80 percent of infected persons
 - Begins at the site of a tick bite after a delay of 3 to 30 days (average is about 7 days)
 - Expands gradually over a period of days reaching up to 12 inches or more (30 cm) across
 - May feel warm to the touch but is rarely itchy or painful
 - Sometimes clears as it enlarges, resulting in a target or “bull’s-eye” appearance
 - May appear on any area of the body

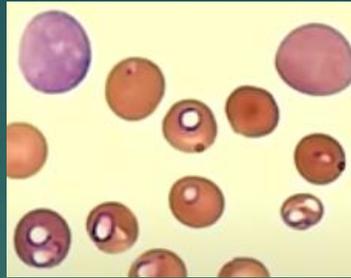


Lyme disease in MA

- Widespread across MA and all of New England
- Highest in eastern MA, especially on Cape and Islands
- Only 66% of confirmed cases had a reported “bulls-eye” rash.



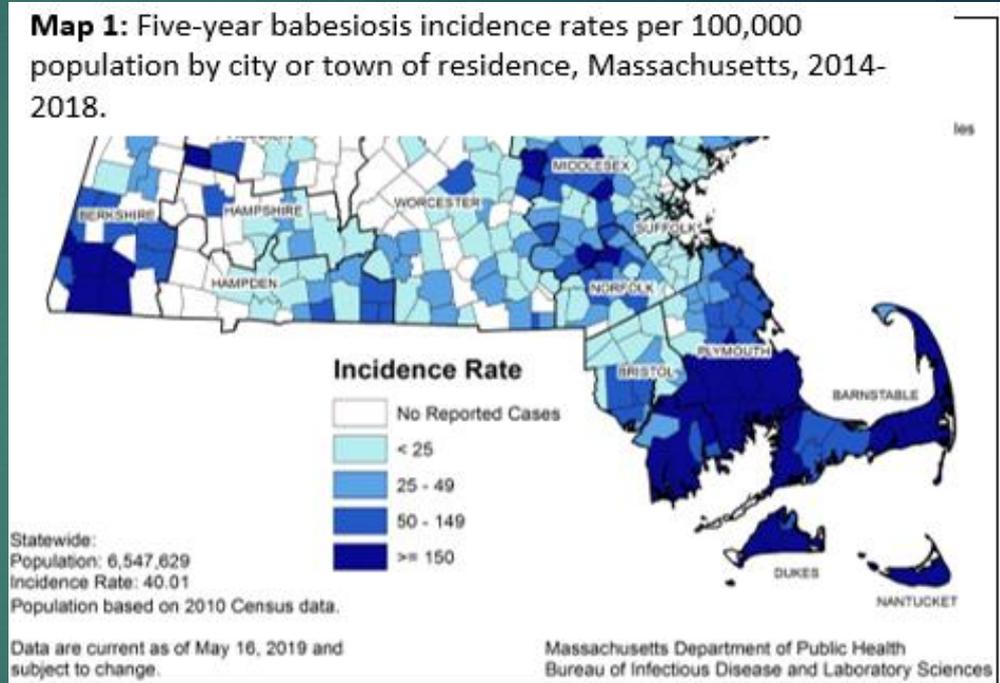
Babesiosis



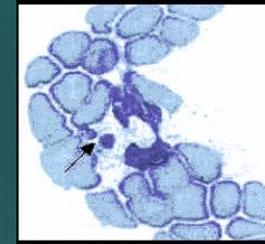
- ▶ Protozoan pathogen that invades red blood cells (malaria-like)
- ▶ Nonspecific flu-like symptoms, such as fatigue (79%), fever (64%), malaise (62%), muscle aches and pain (58%) and chills (53%).
- ▶ Can be life threatening for those with:
 - Weak immune system
 - Liver or kidney disease
 - Elderly
- ▶ Approx. 35% of cases require hospitalization.
- ▶ 62% of all patients identified with babesiosis > 60 years

Babesiosis in MA

- ▶ Widespread across eastern MA. esp. Cape and Islands
- ▶ Also high in Middlesex County
- ▶ Majority of cases occurred in June, July and August, with only 19% of cases reporting awareness of a recent tick bite.



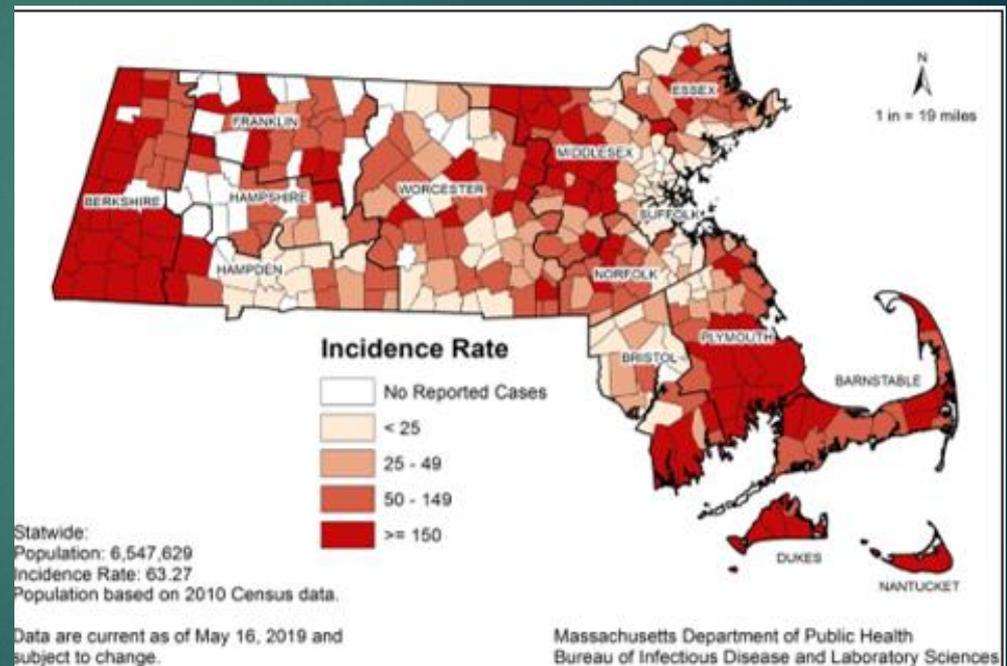
Human Granulocytic Anaplasmosis (HGA)



- ▶ Rickettsial type pathogen that invades white blood cells
- ▶ Non-specific symptoms include fever (99%), malaise (73%), and muscle aches and pain (72%).
- ▶ HGA can be a severe disease. Approximately 25% of patients with HGA are hospitalized.
- ▶ People aged 60 years and over continue to be at greatest risk for clinical disease (51% of patients identified with HGA were 60 or over)

Human Granulocytic Anaplasmosis (HGA)

- ▶ Widespread across MA.
- ▶ Significant risk in Middlesex County
- ▶ Majority of cases occurred in May, June, and July, with only 40% of cases reporting awareness of a recent tick bite.



Take Home messages

- ▶ If you have any of these symptoms in summer, even if you don't know you've been bitten by a tick—seek medical attention
- ▶ Co-infections with multiple pathogens are possible

Deer Tick Habitat

- ◉ Deer ticks require HUMIDITY; they will die from low humidity and dehydration
- ◉ Live in leaf litter and other shady leafy areas
- ◉ These wooded, brushy areas provide food and cover for white-footed mice, chipmunks, deer and other mammals.
- ◉ Exposure to ticks may be greatest in the woods (especially along trails) and the fringe area between the woods and border.



Deer Tick Habitat

Our neighborhoods and houses have encroached into deer mouse and tick habitat and altered that habitat.

Our shrubs and gardens provide food for deer
Our birdfeeders provide food for mice and chipmunks

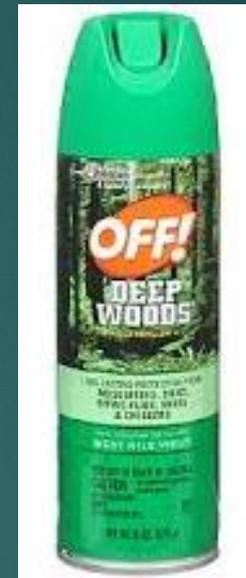


Practical strategies to prevent tick-borne diseases

- ▶ Insect repellents for skin
- ▶ Permethrin-treated clothing
- ▶ Daily tick checks
- ▶ Landscaping/backyard interventions
- ▶ Awareness of disease symptoms and prompt medical attention

Insect Repellents

- ▶ Repellents can play an integral part
- ▶ Use DEET based products
- ▶ DEET comes in 2 strengths:
 - ▶ 7 % effective for mosquitos only
 - ▶ **>20% effective for ticks**
- ▶ Botanical/organic repellents–
(oil of lemon eucalyptus, picaridin)
effectiveness varies



Insect Repellents

- ▶ BUT, BE AWARE--Repellents containing DEET are not sufficient to protect against tick bites.
- ▶ DEET only repels ticks to areas where they could bite and even that little protection does not last long.
- ▶ The best protection you can achieve is by wearing Permethrin-treated clothing and DEET repellent on your skin.

#1 Best Prevention Strategy

Tick Repellent Clothing

- ▶ Clothing treated with permethrin provides long lasting tick bite protection.
- ▶ Permethrin kills ticks on contact
- ▶ Odorless, invisible
- ▶ Lasts through approx. 70 washings



3X protection
from ticks latching onto hands or arms and crawling under t-shirt

5X protection
from ticks latching onto legs and crawling under shorts

74X protection
from ticks latching onto shoes and crawling up leg

Permethrin Facts—is it safe?

- ⦿ Permethrin is more than 2500 times more toxic to ticks than humans.
- ⦿ EPA: Reasonable certainty that permethrin-treated clothing poses no harm to infants or children
- ⦿ If put directly on skin, absorption is <1%
- ⦿ A 140-pound person would have no adverse health effects if exposed to 32 grams of permethrin per day. There is less than 1 gram of permethrin in one container of clothing treatment spray.
- ⦿ Source: www.tickcounter.org at University of Rhode Island

Can you find the tick?



Tick Encounter

THE UNIVERSITY OF ST. THOMAS

<https://www.youtube.com/watch?v=1BFtKjVau30>

Sources of Tick Repellent Clothing

Did you know you can turn your own favorite clothes into tick repellent clothes?



Professionally treated with an invisible, odorless, EPA registered, tick repellent (permethrin) that remains effective through 70 washes! Service performed by Insect Shield. Click image above for more information.

Insect Shield - Casual Wear

<http://www.insectshield.com/work/Casual-Wear-C18.aspx>

L.L.Bean - Insect-repellent apparel

<http://www.llbean.com>

REI - Outdoor clothing products available on-line

<http://www.rei.com>

Gamehide - "ElimiTick" tick repellent clothing

<http://www.gamehide.com/>

Sawyer - Treat your own

<http://www.sawyer.com/bugs.html>

Tick Block - Treat your own

<http://www.tickblock.com/>

Columbia - Insect Blocker clothing

<http://www.columbia.com/Insect-Blocker>

Go to www.insectshield.com to order. Costs about \$10 per item and protection lasts all season, approx. 70 washings.

Tick/Insect Repellent Clothing – Do-it-Yourself Treatment



**Permethrin products
available retail and on-
line**

**Fabric only...not exposed
skin. Active through 6
washings.**



**Sold under a variety of
brand names.**

**– *Permanone, Repel,
Sawyers & Duranon***



**Note, Permethrin is an insecticide
that repels and kills ticks. Read the
Label...**

To apply, spray Permethrin directly onto clothing and gear with a slow sweeping motion, keeping the bottle about 6 to 8 inches away, and treating each side of the garment for about 30 seconds.



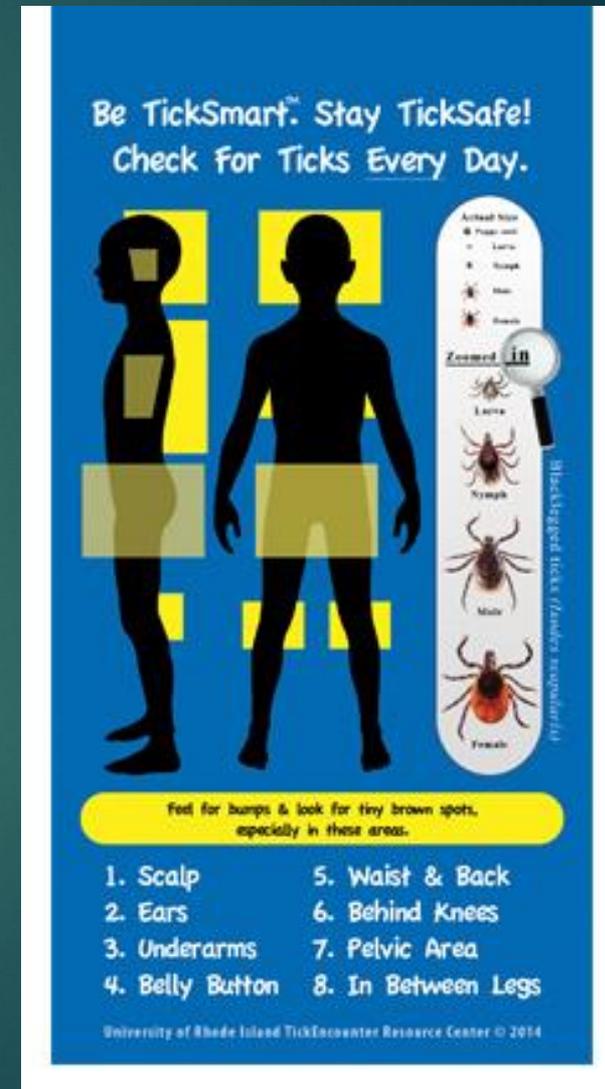
If you don't want to use tick-repellent clothing-----

- ▶ Have a set of clothes you use for yard work or trail walking
- ▶ Most ticks are VERY sensitive to dryness. After working in the yard strip clothing off and throw it in a **hot dryer for 15 min.** after wearing
- ▶ **DRY CLOTHES FIRST - THEN WASH.** Washing clothes does not always kill ticks



Daily Tick Checks

- ▶ Anytime after you have been in tick habitat you should thoroughly check your entire body and remove attached ticks immediately.
- ▶ Ticks need to be attached >24 hrs. to transmit disease.
- ▶ The simplest way to protect yourself is to remove a tick before it has a chance to transmit disease-causing pathogens.
- ▶ Ticks can attach anywhere, in particular, they will find spots like: the back of your knee, around waistbands, under armpits or any other constricted place.
- ▶ Once attached, ticks DO NOT wash off in the shower



Deer Tick Habitat Prevention Strategies



- ▶ Landscaping controls—Reduce Tick Habitat
- ▶ Perimeter Sprays and Granules
- ▶ Mouse Targeted Devices--Tick tubes

Reduce Tick Habitat in Your Yard

Deer ticks are usually only found in shady, leaf-covered areas

Deer ticks are not out in the middle of your lawn, they live where yards border wooded areas, ornamental plantings and gardens, or anywhere it is shaded and there are leaves with high humidity.



Reduce Tick Habitat in Your Yard

- By raking leaves, trimming shrubs and low branches you can make certain areas where ticks cannot survive.
- Pay special attention to frequented border areas, woodpiles, stonewalls and sheds.
- Create borders of wood chips or gravel to serve as a barrier and a reminder between tick-safe and tick-risky zones.



Make Your Backyard Mouse Unfriendly

- ▶ Keep stonewalls clear of leaves, use 3 ft wood chip border
- ▶ Move woodpiles away from daily activity.
- ▶ Consider eliminating birdfeeders, which attract and provide high quality food for rodents. Or choose birdfeeder designs that have less spillage



Perimeter Sprays



An insecticide application applied mainly to the yard perimeter, shady perennial beds , or along trails and paths in woods

- Limited amount of pesticide being applied, targeting the areas where people most frequently come into contact with deer ticks.
- An effective way to reduce deer ticks in your yard

Perimeter Sprays



- The chemicals used are much less toxic than in the past, and are used in very low concentrations.
- Bifenthrin and permethrin are most commonly used
- These do not leach through soil and are degraded by soil microorganisms within the top 4 cm of the soil surface.
- Highly recommend hiring a professional applicator

Perimeter sprays



Helpful hint #1: In most situations, TREATMENT IS NOT NEEDED ON OPEN OR SUNNY LAWNS

Ask your professional where they will be applying the product. In most cases, the entire yard does not need to be treated.

Helpful hint #2: Two applications usually work best, and should be done in mid-May and again in mid-June. It may be helpful to add one fall application -- timed after the emergence of adult-stage ticks -- typically in mid-October.

Perimeter sprays—other considerations

- ▶ Permethrin is toxic to aquatic organisms, so do not apply near wetlands or streams
- ▶ Any application within 100 ft of wetland requires approval from Conservation Commission.

Mouse -Targeted Devices

Tick Control Tubes



- Tick Tubes are stuffed with cotton nesting material impregnated with permethrin.
- Mice will steal the treated nesting material and place it in their nests, where contact with the treated cotton kills ticks on the mice.

Mouse -Targeted Devices

Tick Control Tubes



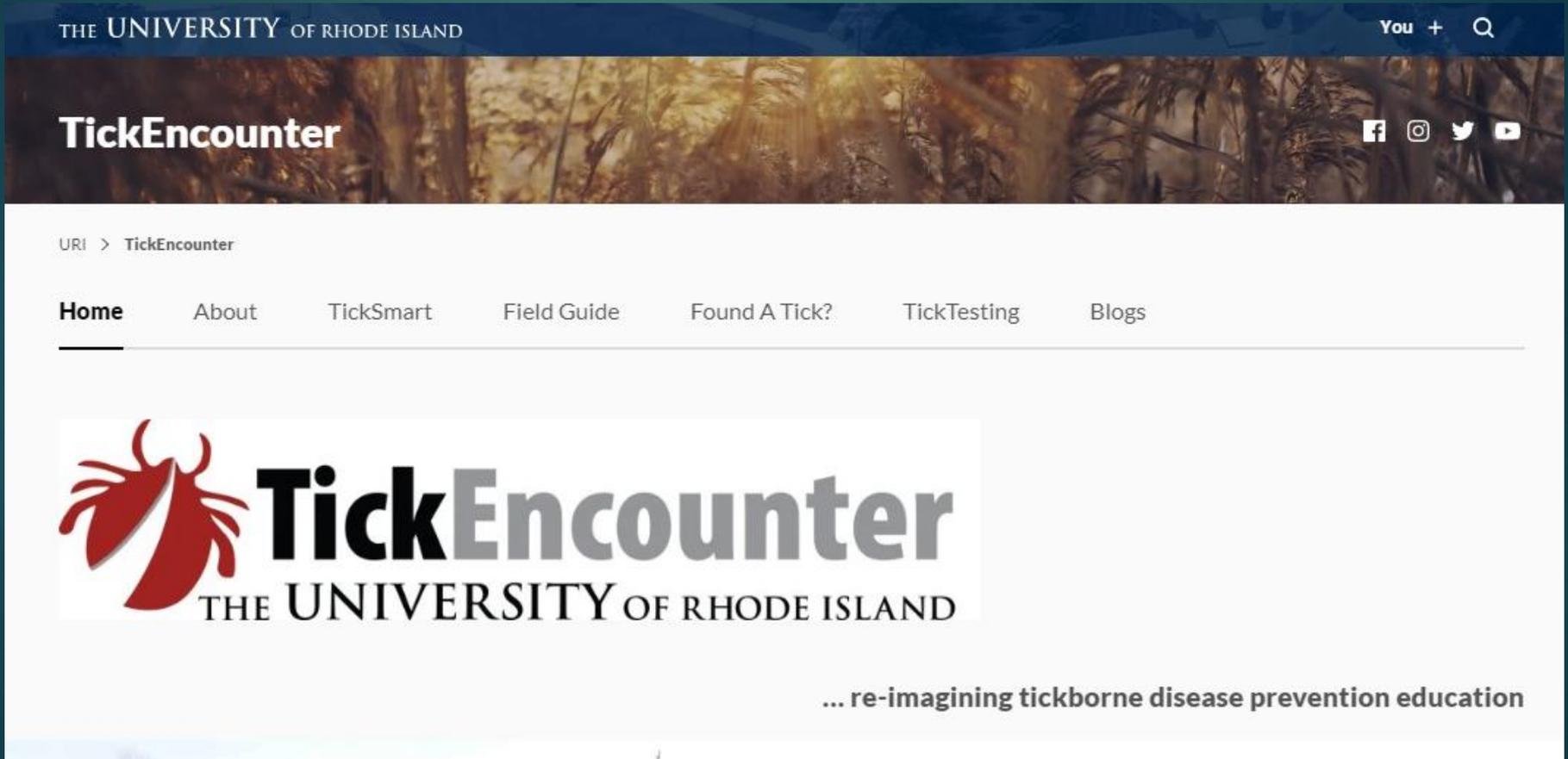
- Recommend applying Tick Tubes in late July/August when larvae are active, and again before next-year's nymphs emerge in May.
- A typical 1 acre yard will require applying about 24 tubes at each application.
- Tick Tubes are extremely eco-friendly; cardboard Tick Tubes completely biodegrade, and the permethrin is tightly bound to the cotton fibers. There is minimal risk for environmental contamination, and a toddler would need to consume more than a pound of treated cotton before there would be any chance for toxicity.

Tick Testing

- ▶ Ticks can be tested to see if they are carrying the pathogens that cause a number of diseases
 - ▶ But remember, that although the tick carries a pathogen, the pathogen may not have been transmitted to you. during the tick bite.
- ▶ Available through a number of labs
- ▶ Least expensive is Laboratory of Medical Zoology at UMass: \$50 www.tickreport.com

More Resources— Best sources of information

www.tickencounter.org



The screenshot shows the homepage of the TickEncounter website. At the top, there is a dark blue header with the text "THE UNIVERSITY OF RHODE ISLAND" on the left and "You + [search icon]" on the right. Below this is a banner image of a forest with the word "TickEncounter" in white text on the left and social media icons for Facebook, Instagram, Twitter, and YouTube on the right. A white navigation bar contains the following links: "Home" (underlined), "About", "TickSmart", "Field Guide", "Found A Tick?", "TickTesting", and "Blogs". Below the navigation bar is a large white box containing the TickEncounter logo, which features a red tick icon to the left of the text "TickEncounter" in a large, bold, grey font, with "THE UNIVERSITY OF RHODE ISLAND" in a smaller, black font underneath. At the bottom right of the white box, the tagline "... re-imagining tickborne disease prevention education" is displayed in a black font.

Barnstable County TICKOLOGY – In depth videos on various topics

https://www.youtube.com/playlist?list=PLnyke5qp-yax0gwypEmge_-hFAI1lwAEd

YouTube Search

Tickology Project - 2018

Barnstable County
10 videos 5,332 views Last updated on Sep 20, 2018

Play all Shuffle

- 1** **Tickology: Tick Identification and Ecology**
Barnstable County • 43K views • 4 years ago
9:04
- 2** **Tickology: Tick Borne Diseases**
Barnstable County • 1.8K views • 4 years ago
12:21
- 3** **Tickology: Lone Star Tick - The New Tick in Town**
Barnstable County • 4.9K views • 4 years ago
7:59
- 4** **Tickology: Permethrin Treated Clothing**
Barnstable County • 12K views • 4 years ago
13:23
- 5** **Tickology: Skin Repellents**
Barnstable County • 21K views • 4 years ago
10:00



Why have these diseases emerged and spread so rapidly in the past 30 years?

Is there anything we can do about it?

Cary Institute of Ecosystem Studies

<https://www.caryinstitute.org/our-expertise/disease-ecology/lyme-tick-borne-disease>

Studying how the environment shapes tick-borne disease risk, with the goal of informing management that makes the outdoors safer .

- ▶ Ecology of tick borne diseases
- ▶ Climate change and tick borne disease risk

Cary Institute of Ecosystem Studies

Ecology of tick borne diseases

Rodents play an outsized role in amplifying tick-borne disease risk.

- When blacklegged ticks feed on white-footed mice and chipmunks, they are much more likely to survive and become infected with the pathogens that cause Lyme disease, anaplasmosis, and babesiosis.
- “It’s not uncommon to see mice with fifty feeding ticks attached. They can carry huge tick burdens without having their fitness compromised. This is bad news for us, because these rodents are also very efficient at harboring and transferring pathogens to feeding ticks.” – Rick Ostfeld, Cary Institute

Cary Institute of Ecosystem Studies

► Ecology of tick borne diseases

Disease amplifiers: Loss of biodiversity and fragmentation of forest habitat due to suburbanization.

Forest Fragmentation:

- Forest fragments have a higher percentage of infected ticks compared to intact forests.
- This is because forest patches have lower animal diversity, fewer predators, and an abundance of white-footed mice.

Cary Institute of Ecosystem Studies

Ecology of tick borne disease

Loss of biodiversity

- ▶ When the landscape is home to a diversity of mammals, tick-borne disease risk decreases.
- ▶ Non-mouse mammals are less likely to infect ticks with disease-causing pathogens,
- ▶ Predators like foxes and bobcats keep mouse populations in check.
- ▶ Some animals are very efficient at killing ticks. Opossums kill more than 90% of the ticks that try to feed on them.

Cary Institute of Ecosystem Studies

Effect of climate change

- ▶ Deer ticks are active and seeking blood meals anytime the temperature is above freezing.
- ▶ Climate change is extending the feeding season for ticks, and allowing them to expand their range northward, into previously unsuitable regions.
- ▶ As climate change brings warmer spring temperatures and milder autumns to the northeastern US, blacklegged ticks are emerging earlier and feeding longer.
- ▶ The number of US counties reporting deer ticks has more than doubled over the past twenty years.

Discussion?

