



Tickborne Diseases in the United States: Burden, Trends, and What You Can Do to Protect Yourself

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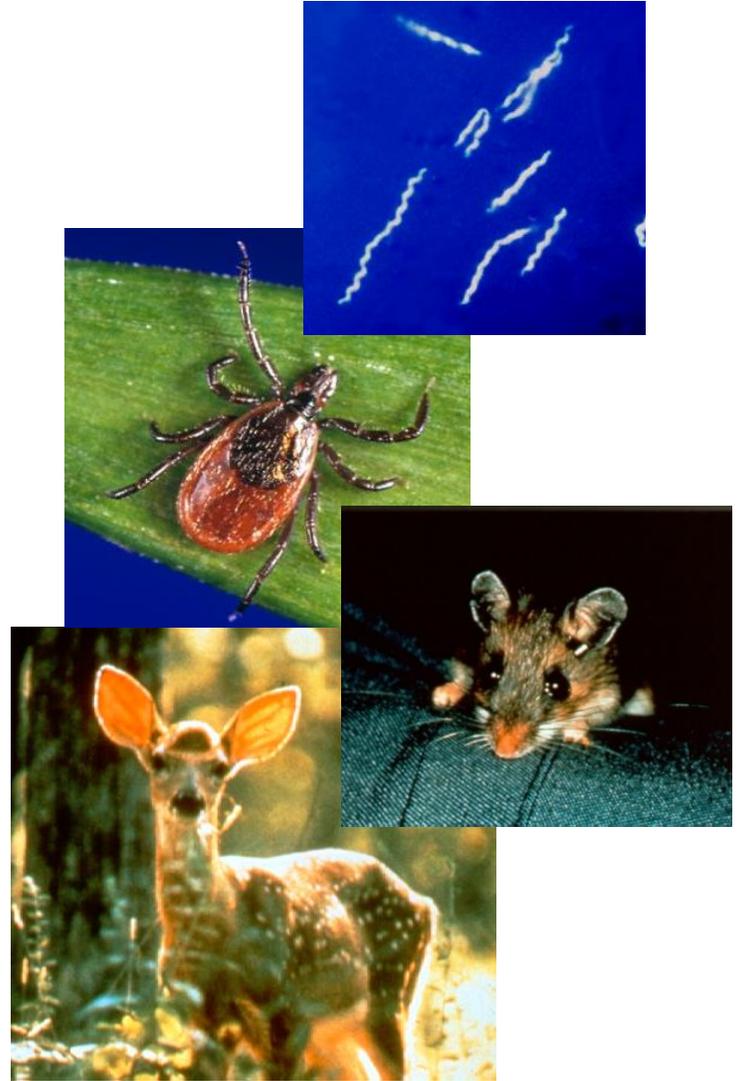
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Outline

- Key tickborne diseases: burden and distribution
- Disease trends: what's causing the increase?
- New discovery: Asian longhorned tick
- Tickborne disease prevention and control



Current state of tickborne diseases in the U.S. – increasing cases (2004-2016)

- Between 2004 and 2017, more than 550,000 cases of TBDs were reported in the US
- The number of reported cases of TBDs has more than doubled
- Tickborne diseases account for over 75% of reported vector-borne disease cases
- The reported data substantially underestimate actual disease occurrence

In 2017, a record number of cases of tickborne disease were reported to CDC

| Reported Tick-borne diseases, US | 2016 | 2017 |
|---------------------------------------|--------|--------|
| Lyme disease (confirmed and probable) | 36,429 | 42,743 |
| Anaplasmosis/Ehrlichiosis† | 5,750 | 7,718 |
| Spotted Fever Rickettsiosis§ | 4,269 | 6,248 |
| Babesiosis§§ | 1,910 | 2,368 |
| Tularemia | 230 | 239 |
| Powassan virus | 22 | 33 |
| Total | 48,610 | 59,349 |

† Anaplasmosis and ehrlichiosis were reported separately after 2008 but are combined here for the entire period

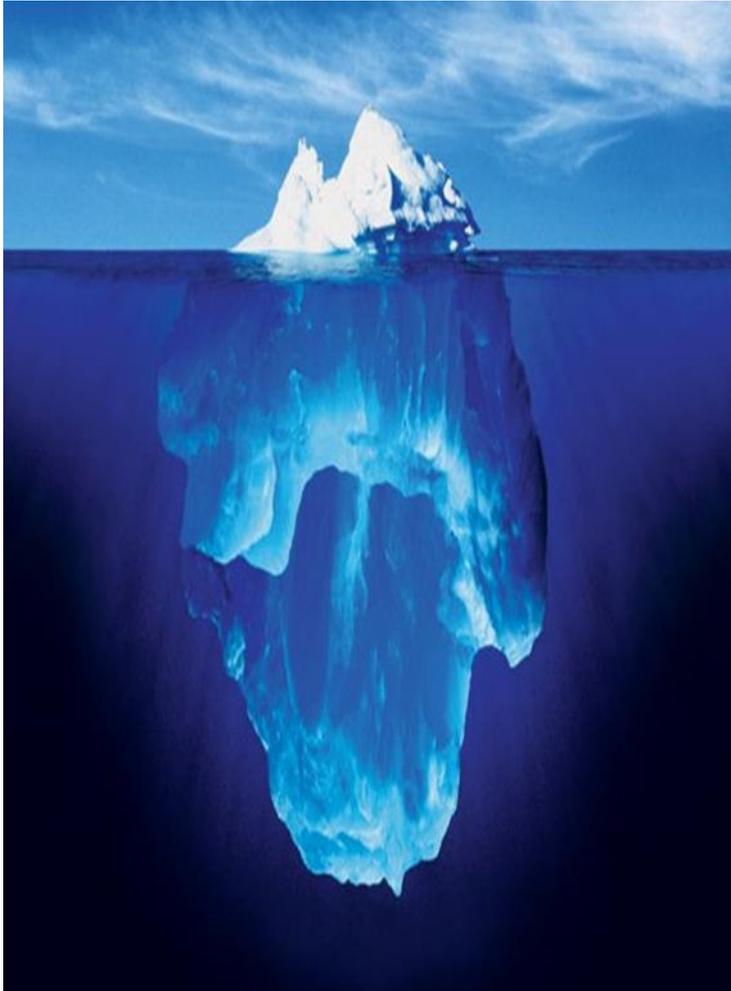
§ Includes *R. rickettsii*, *R. parkeri*, *R. species 364D*

§§ Babesiosis surveillance data are reported independently to different CDC programs. For this reason, surveillance data reported elsewhere might vary slightly from data reported in this summary

Top notifiable infectious diseases and conditions: U.S., 2017

| Disease | US Cases | NJ Cases |
|---------------------------------|---------------|--------------|
| Chlamydia trachomatis infection | 1,708,569 | 35,239 |
| Gonorrhea | 555,608 | 9,439 |
| Syphilis | 101,567 | 1,866 |
| Campylobacteriosis | 67,537 | 1,875 |
| Salmonellosis | 54,285 | 1,250 |
| Lyme disease | 42,743 | 5,092 |
| HIV diagnoses | 33,938 | 874 |
| Invasive pneumococcal disease | 19,780 | 678 |
| Pertussis | 18,975 | 465 |
| Giardiasis | 15,193 | 377 |

Estimates of Lyme disease underreporting

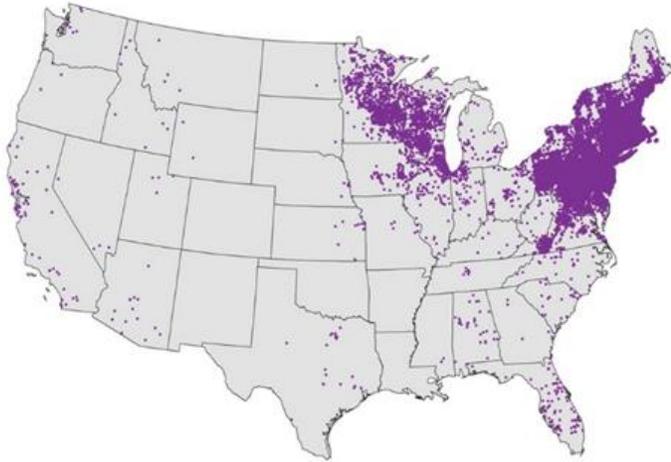


| State | Year | Under-reporting | Method |
|-------|---------|-----------------|--|
| CT | 1992 | 6-9 X | MD survey ¹ |
| MD | 1992-3 | 10-12 X | MD survey ² |
| NY | 1991-4 | 4 X | Tick bite model ³ |
| WI | 1992-8 | 3 X | Record review ⁴ |
| All | 2008,10 | 8-10 X | Lab survey, ⁵ claims data ⁶ |

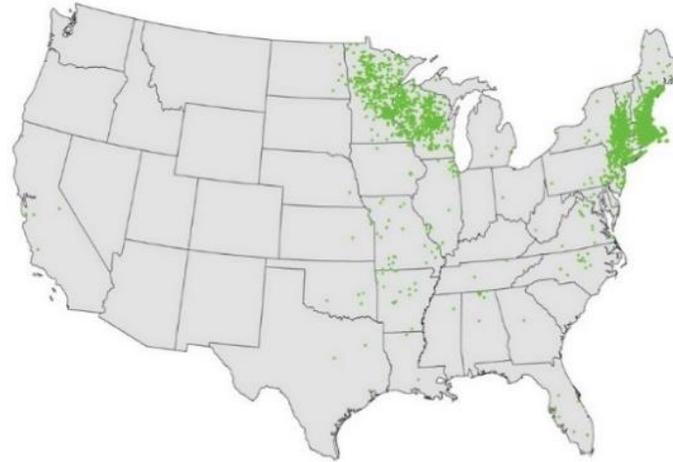
Source: 1) Meek 1996 2) Coyle 1996 3) Campbell 1998 4) Nalaway 2002
5) Hinckley 2014 6) Nelson 2015

Distribution of nationally notifiable tickborne diseases

Lyme disease



Anaplasmosis



Babesiosis



Rocky Mountain spotted fever



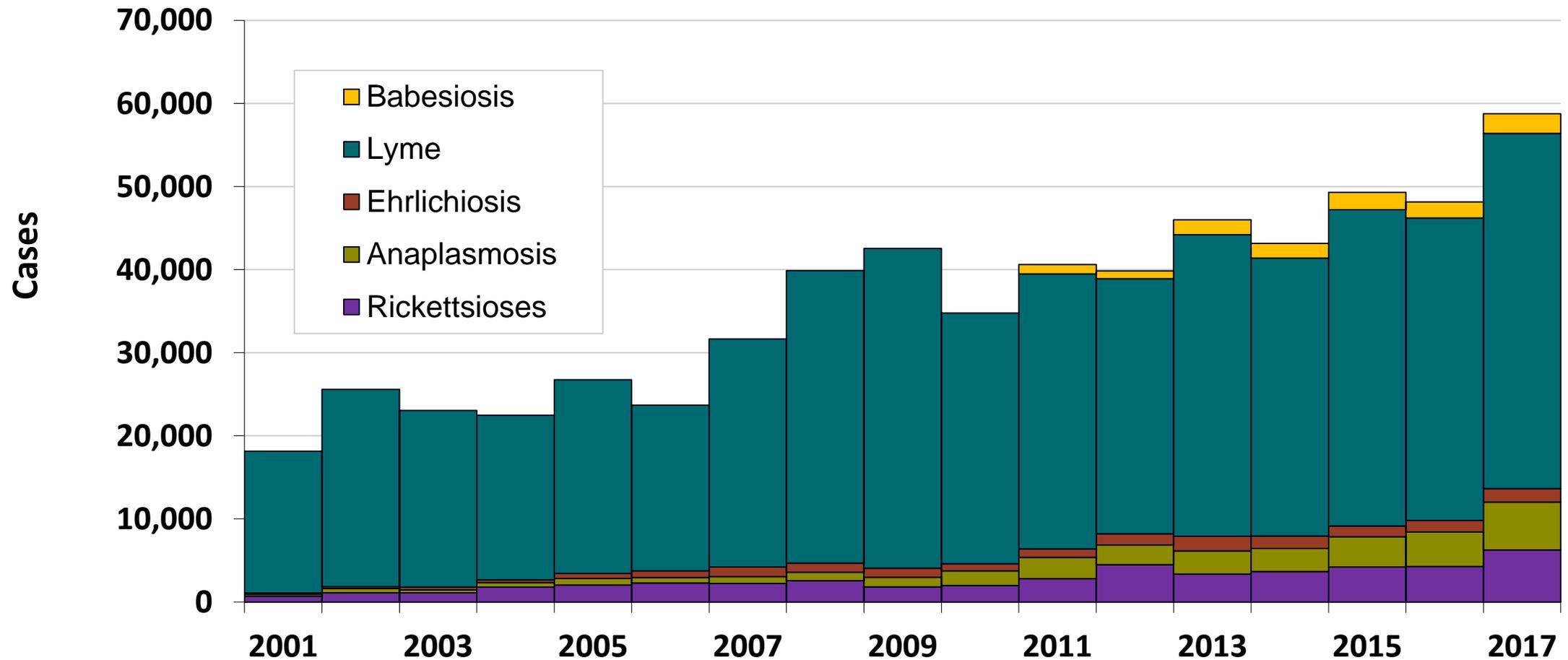
Ehrlichiosis



Tularemia

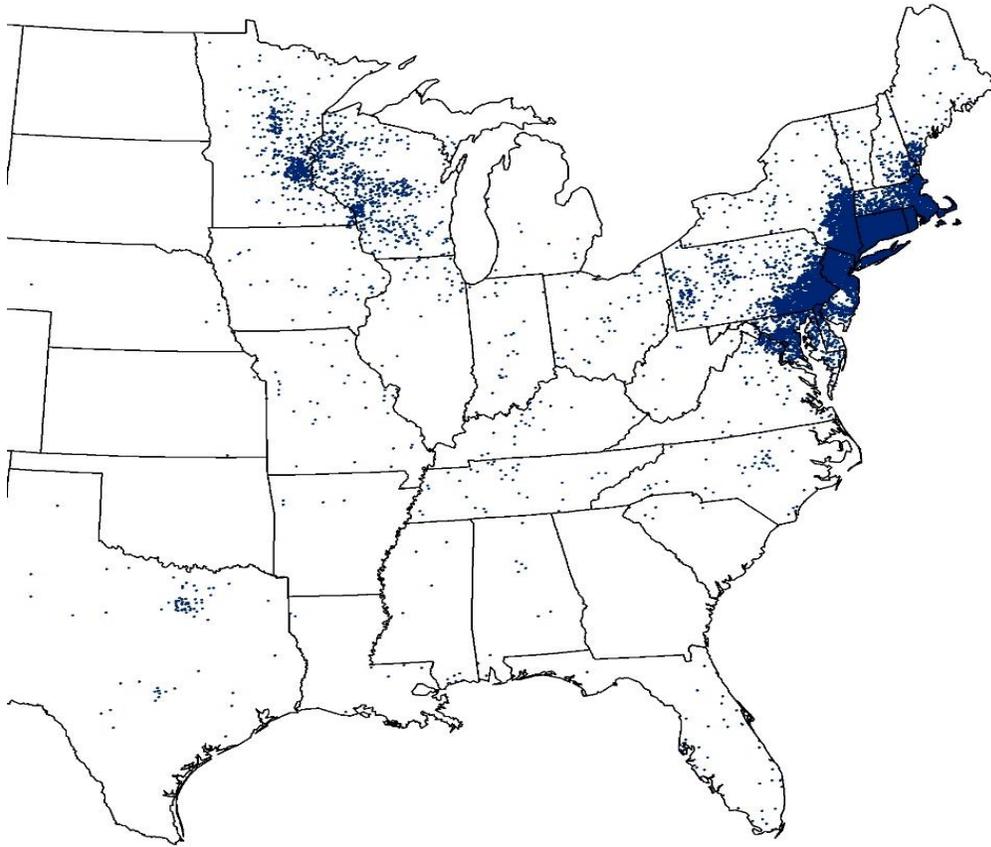


Reported cases of leading tickborne diseases by year U.S., 2001-2017

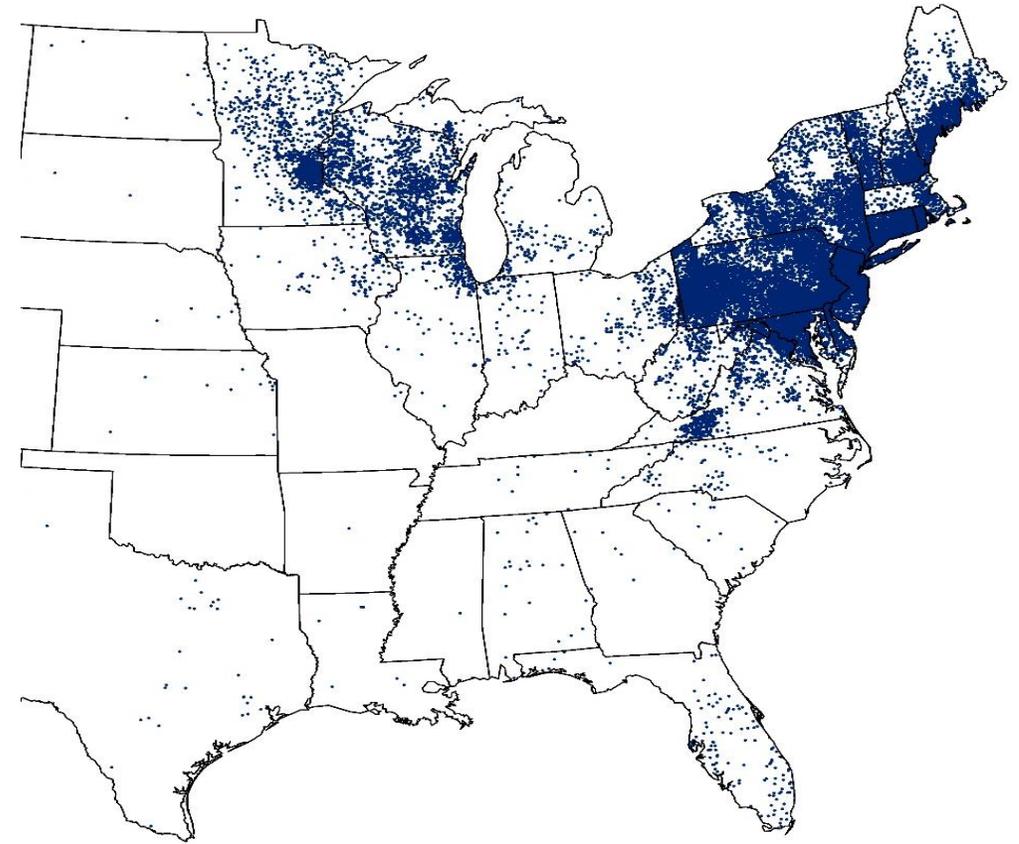


Expanding geographic range of Lyme disease cases

Distribution of reported Lyme disease cases, 2001 and 2017



2001

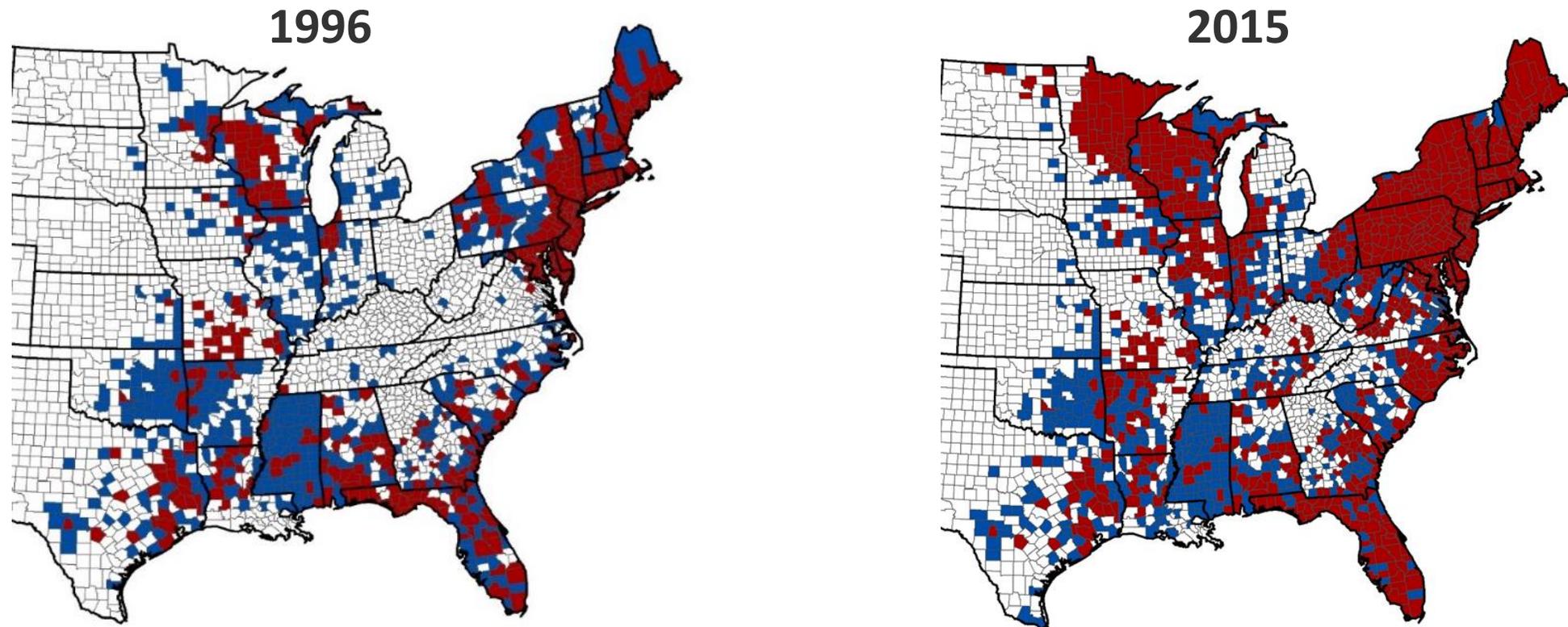


2017

Source: cdc.gov/lyme/stats/index.html

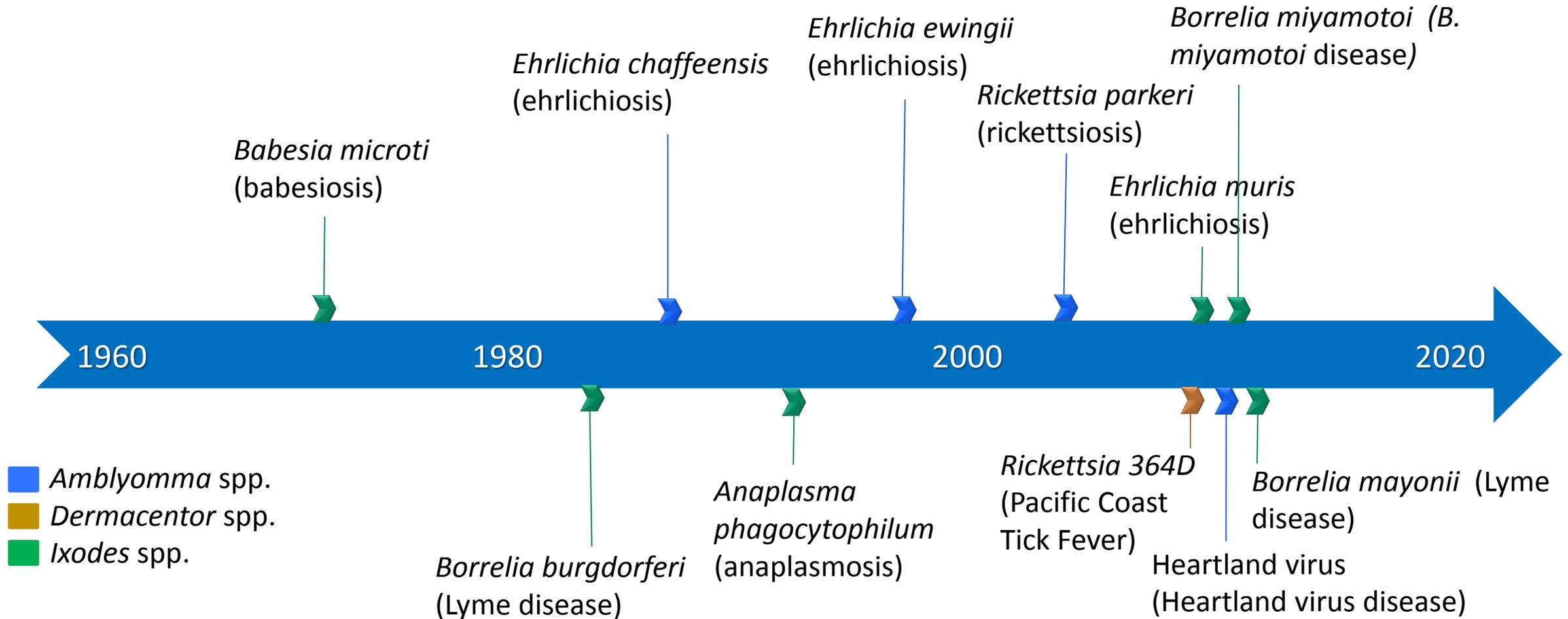
Geographic expansion of recorded *Ixodes scapularis*

- Dennis DT, Nekomoto TS, Victor JC, et al. J Med Entomol. 1998 Sep;35(5):629-38.
- Eisen RJ, Eisen L, Beard CB. J Med Entomol. 2016 Mar;53(2):349-86.



- **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

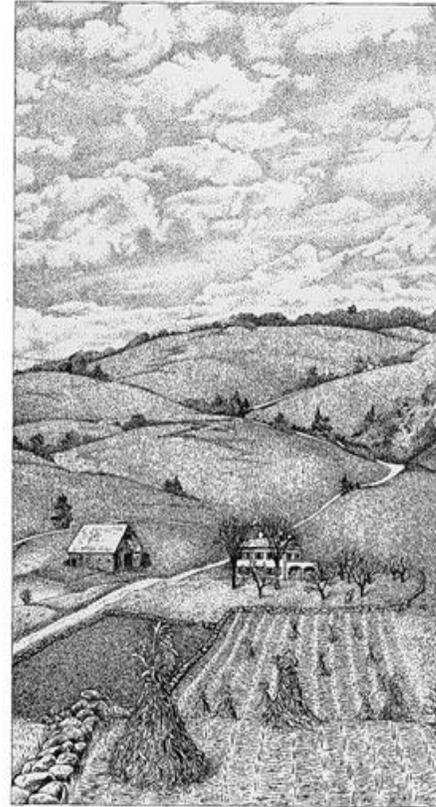
Discovery of tickborne pathogens as causes of human disease by year, 1960–2018



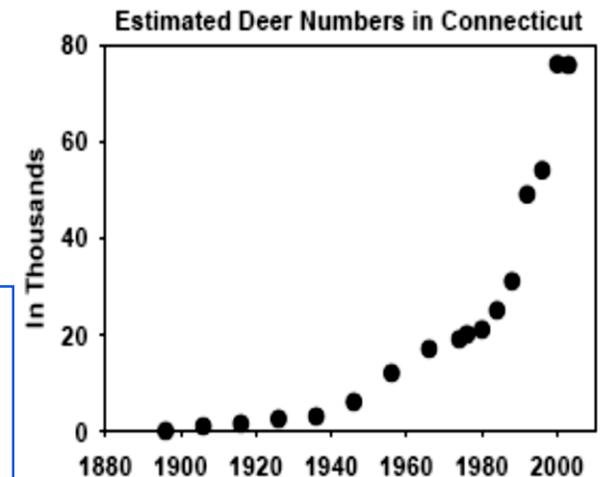
- Year represents when tickborne pathogen was recognized as cause of human disease.
- Adapted from: Paddock CD, Lane RS, Staples JE, Labruna MB. 2016. In: Mack A, Editor. Global health impacts of vector-borne diseases: workshop summary. National Academies Press. p. 221-257.

What's causing increases in tickborne disease?

- Reforestation
- Increasing deer populations
- Expansion of suburbia into wooded areas
- Increasing habitat around homes for rodents that spread bacteria
- More ticks
- More people at risk for exposure



Source:
Bald hills: New England before the trees
returned. From *Thoreau's Country*.
American Scientist Online
<http://www.americanscientist.org>



Source: K. Stafford, CT Agricultural Experiment Station

Asian longhorned tick

Discovery of *Haemaphysalis longicornis* (Ixodida: Ixodidae) Parasitizing a Sheep in New Jersey, United States

Tadhg Rainey,¹ James L. Occi,² Richard G. Robbins,³ and Andrea Egizi^{2,4,5}

- August 1, 2017 on a sheep in in Hunterdon County, New Jersey
- No travel history and no other animals on property
- Large numbers of ticks both on the sheep and in the paddock
- Identified preliminarily as *H. longicornis* based on DNA analysis at Rutgers University
- Identity confirmed by USDA National Veterinary Services Laboratories, Ames, IA

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Advance Access Publication Date: 19 February 2018

Short Communication

OXFORD



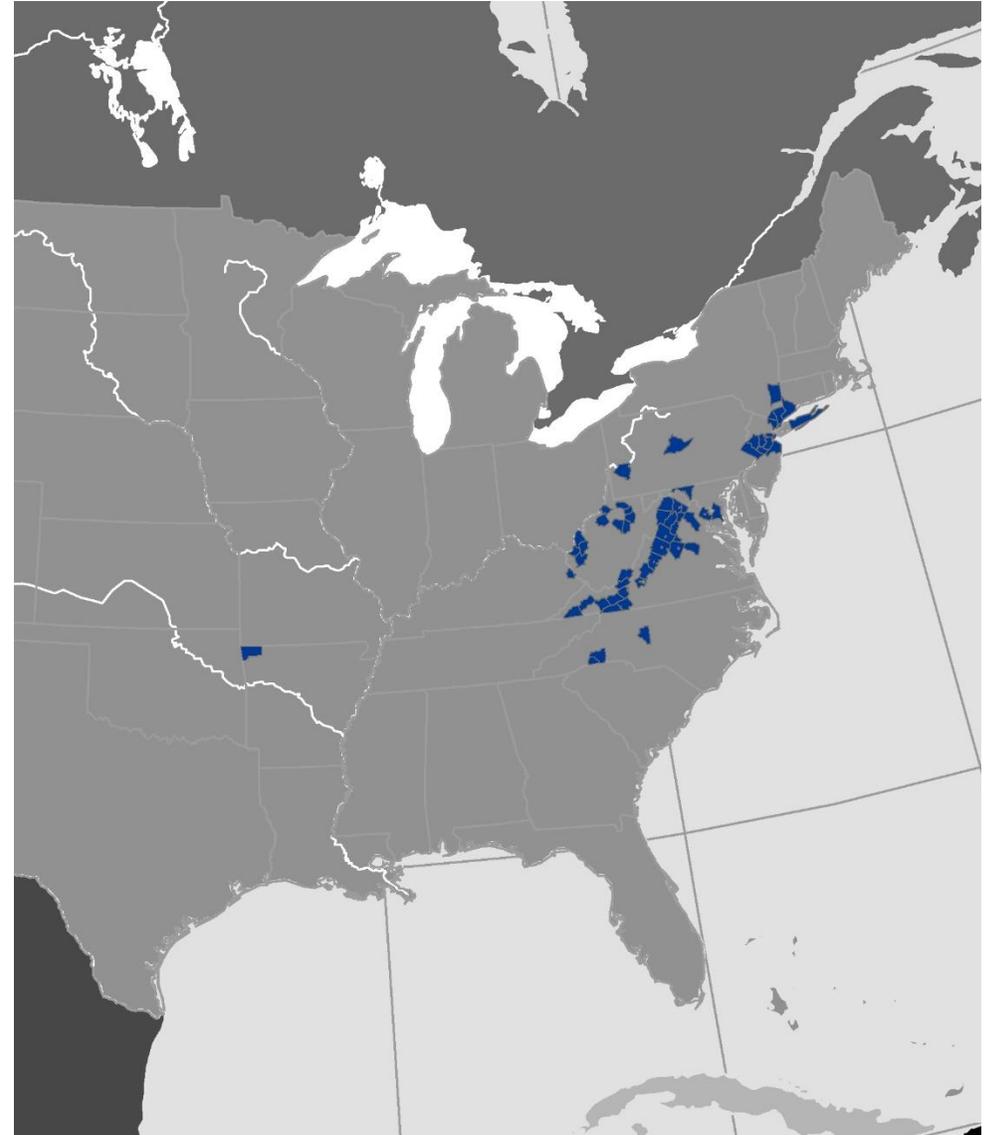
General biology, origin, and distribution

- Also referred to as the cattle tick or the bush or scrub tick
- Adapted to multiple hosts, including large and small mammals, and birds
- Populations in U.S. reproduce without males
- Native to eastern China, Japan, the Russian Far East, and the Korean peninsula
- Introduced and now established in Australia, New Zealand, New Caledonia, Fiji, and some island nations in the South Pacific



Current distribution in the United States

- As of May 9, 2019, reported from ten U.S. states (Arkansas, Connecticut, Kentucky, Maryland, New Jersey, New York, North Carolina, Pennsylvania, Virginia, and West Virginia)
- Documented in 51 counties or county equivalents
- Known distribution is expanding as surveillance efforts increase



Haemaphysalis longicornis pathogens of chief concern for possible transmission to people in the United States

Bacteria

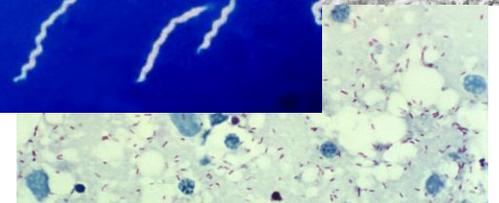
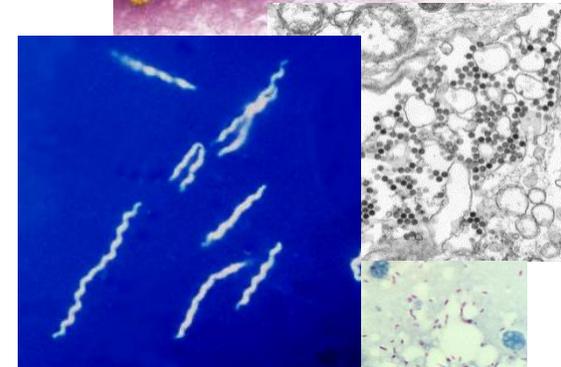
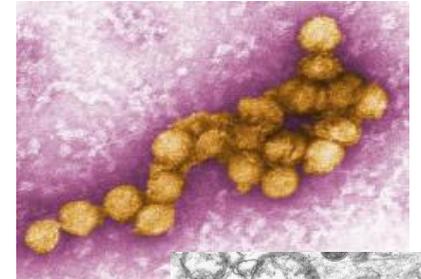
- *Anaplasma phagocytophilum*
- *Borrelia burgdorferi*
- *Ehrlichia chaffeensis*
- *Ehrlichia ewingii*
- *Rickettsia rickettsii*

Viruses

- Bourbon virus
- Heartland virus
- Powassan virus

Protozoa

- *Babesia microti*



Protection against tickborne diseases

No vaccines are currently available in the U.S., but a Lyme disease vaccine trial is underway in Europe.



VALNEVA SE

Campus Bio-Ouest | 6, Rue Alain Bombard
44800 Saint-Herblain, France

Valneva Reports Positive Initial Booster Data and Final Phase 1 Data for its Lyme Disease Vaccine Candidate

Saint-Herblain (France), January 31, 2019 – Valneva SE (“Valneva”), a biotech company developing and commercializing vaccines for infectious diseases with major unmet needs, today announced positive initial booster data and final Phase 1 data for its leading, unique Lyme disease vaccine candidate VLA15.

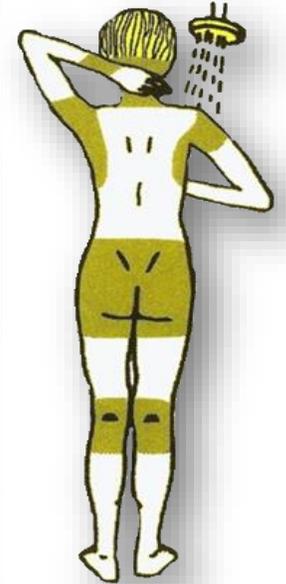
<https://www.valneva.com/en/rd/vla15>

Preventing tickborne diseases requires:

- Reducing exposure to ticks
 - On people, pets, and property
- Quickly removing any ticks on people or their clothing
- Early and accurate diagnosis and treatment

CDC Lyme disease prevention tool kit:

<https://www.cdc.gov/lyme/toolkit/index.html>



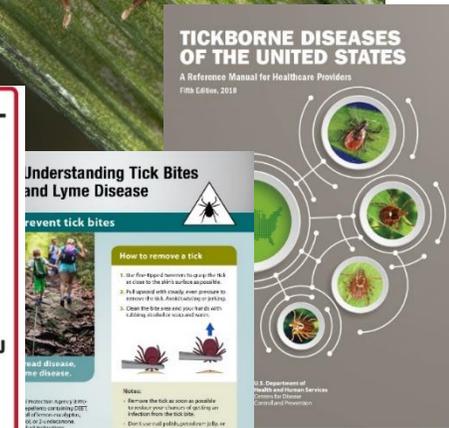
H. longicornis prevention and control

- To date *H. longicornis* not found infected with any pathogens in the U.S.
- *H. longicornis* in the U.S. appear to be sensitive to the pesticides used against other ticks in the U.S.
- Methods used for personal protection against other ticks in the U.S. appear to be effective against *H. longicornis* (preliminary data for permethrin-treated clothing)
- Efforts are underway to confirm these initial findings



CDC activities to prevent tickborne diseases

- Conducting research to improve diagnostics, surveillance, and prevention and control
- Funding state-based vector-borne disease activities through the Epidemiology and Laboratory Capacity cooperative agreement
- Established 5 regional VBD Centers of Excellence
- Established a national surveillance systems for reporting and mapping tick and pathogen distribution
- Led efforts involving 6 federal departments to develop a national strategy for vector-borne disease prevention and control in the U.S.



CDC tools and resources – ticks

Tick home page: <https://www.cdc.gov/ticks/index.html>

Tick identification page:

<https://www.cdc.gov/ticks/tickbornediseases/tickID.html>

Reference manual for healthcare providers:

<https://www.cdc.gov/ticks/tickbornediseases/TickborneDiseases-P.pdf>

Lyme disease home page:

<https://www.cdc.gov/lyme/index.html>

CDC Asian longhorned tick page:

<https://www.cdc.gov/ticks/longhorned-tick/index.html>

LYME DISEASE: What you need to know

- How it's spread
- Where it's found
- How it's prevented
- How it's diagnosed
- How it's treated

how to remove a tick

1. Use fine-tipped tweezers to grasp the tick as close to the skin's surface as possible.
2. Pull upward with steady, even pressure to remove the tick. Avoid twisting or jerking.
3. Clean the bite area and your hands with rubbing alcohol, iodine scrub, or soap and water.

Notes:

- Remove the tick as soon as possible.
- If tick mouthparts remain in the skin, leave them alone. In most cases, they will fall out in a few days.
- Don't use nail polish, petroleum jelly, or a hot match to make the tick detach.
- If you develop a fever or rash within several weeks of removing a tick, see your doctor. Be sure to tell the doctor about your recent tick bite, when the bite occurred, and where you most likely acquired the tick.

Don't Let a Tick Make You Sick!

Keep ticks away!

- Wear repellent on your bare skin or wear clothes that have repellent built-in.
- Check for ticks at the end of each day.
- Take a shower too! It will help wash off the ticks you can't see.
- Change clothes. Don't put on your old clothes that might have ticks still crawling on them.
- Avoid taking short cuts through thick brush and grass.

Hey Grown-Ups!

- Make sure that the repellent you're using contains 20% or more of the active ingredient (like DEET).
- Help younger kids apply repellent and keep it away from eyes, mouth and hands.

Illustrations courtesy of Jerome Margu.

National Center for Emerging and Zoonotic Infectious Diseases
Division of Vector-Borne Diseases | Bacterial Diseases Branch

Summary and Conclusions

- Tickborne diseases are a very important public health concern
- Tickborne diseases are increasing in the U.S. in incidence, distribution, and in the numbers of new disease agents
- Tickborne diseases are increasing due to increasing exposure to infected ticks, largely from increasing deer populations and other changes in natural or built environments
- In the absence of vaccines in the U.S., primary prevention focuses on reducing exposure to ticks and quickly removing any ticks on people or their clothing

Thank you for your time and interest!



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Diseases

The findings and conclusion in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.