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

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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

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

† 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

<table>
<thead>
<tr>
<th>Disease</th>
<th>US Cases</th>
<th>NJ Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia trachomatis infection</td>
<td>1,708,569</td>
<td>35,239</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>555,608</td>
<td>9,439</td>
</tr>
<tr>
<td>Syphilis</td>
<td>101,567</td>
<td>1,866</td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>67,537</td>
<td>1,875</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td>54,285</td>
<td>1,250</td>
</tr>
<tr>
<td><strong>Lyme disease</strong></td>
<td><strong>42,743</strong></td>
<td><strong>5,092</strong></td>
</tr>
<tr>
<td>HIV diagnoses</td>
<td>33,938</td>
<td>874</td>
</tr>
<tr>
<td>Invasive pneumococcal disease</td>
<td>19,780</td>
<td>678</td>
</tr>
<tr>
<td>Pertussis</td>
<td>18,975</td>
<td>465</td>
</tr>
<tr>
<td>Giardiasis</td>
<td>15,193</td>
<td>377</td>
</tr>
</tbody>
</table>
Estimates of Lyme disease underreporting

<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>
</tr>
<tr>
<td>NY</td>
<td>1991-4</td>
<td>4 X</td>
<td>Tick bite model(^3)</td>
</tr>
<tr>
<td>WI</td>
<td>1992-8</td>
<td>3 X</td>
<td>Record review (^4)</td>
</tr>
<tr>
<td>All</td>
<td>2008,10</td>
<td>8-10 X</td>
<td>Lab survey, (^5) claims data (^6)</td>
</tr>
</tbody>
</table>

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

Source: cdc.gov/lyme/stats/index.html
Geographic expansion of recorded *Ixodes scapularis*


**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.
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: K. Stafford, CT Agricultural Experiment Station
Asian longhorned tick

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

Tadhgh Rainey, James L. Occi, Richard G. Robbins, and Andrea Egizi

- August 1, 2017 on a sheep 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
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 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.

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
Tickborne diseases are a very important public health concern. They are increasing in the U.S. in incidence, distribution, and in the numbers of new disease agents. This increase is 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!

Acknowledgments:
Numerous staff in CDC’s Division of Vector-Borne 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.