



**REGISTER**  
FY21 Epi-tech Training

- **Registration is required:**
  - Register at: <https://tiny.army.mil/r/Qdo4/EpiTechFY21>
  - Log in with CAC, or follow prompts to Request access/Logon ID
  - Contact your service surveillance hub to receive monthly updates and reminders
- **Attendance:**
  - Please enter your full name/email/location into the DCS chat box to the left, or email your service hub
  - An attendance confirmation will be sent to your email; if you do not receive this message within 3 days, please contact your service hub
- **Reminder:**
  - Mute your phones by pressing the mute button or 0
  - DO NOT press the “hold” button as the rest of the conference will hear the hold music

## FY21 Epi-Tech Surveillance Training

Thursday, October 1, 2020 - Thursday, September 30, 2021  
DCS, Aberdeen Proving Ground, MD

### *Provided By*

U.S. Army Medical Command

<u>Activity ID</u>	<u>Course Director</u>	<u>CME Planner</u>
2020-0845	John Ambrose	Mimi C. Eng

### **Accreditation Statement**

The U.S. Army Medical Command is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

### **Credit Designation**

The U.S. Army Medical Command designates this Live Activity for a maximum of 5 AMA PRA Category 1 Credit(s)™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

**This is a required handout. It must be disseminated to each learner prior to the start of the activity.**

## Statement of Need/Gap Analysis

### **The purpose of this CME activity is to address the identified gap(s):**

1. Disease identification - Verification of disease by established case definitions have been utilized by the local health departments, Centers for Disease Control and Prevention, World Health Organization, and the Department of Defense. With the every changing list of reportable medical events and new emerging infections, case definitions change rapidly. Army epidemiologist conduct verification studies that monitor the efficiency of reporting by local public health experts and have concluded that completeness percentages for reportable medical events range as low as 35% for select diseases.
2. Outbreak reporting - Recent evidence have demonstrated that outbreak reporting and communication between public health agencies is poor. In fact, the Army failed to report six outbreaks in the DRSi between June 2016 and September 2016.
3. Surveillance techniques - Surveillance of common communicable diseases continues to be a problem among local MTFs. In fact, cases of campylobacter were not investigated in 2015 for PACOM MTFs, while 2016 cases of salmonella were not investigated. Civilian public health agencies are required to conduct investigations into all reportable medical events. However, DoD facilities often do not take initiative to conduct this investigation.

## Learning Objectives

1. Based on case presentation, enhance your ability to improve case finding and surveillance practices within your local MTF.

## Target Audience / Scope of Practice

**Target Audience:** The intended audience for this educational activity includes preventive medicine physicians, community health nurses, public health nurses, and epidemiology technicians.

**Scope of Practice:** This activity will improve the performance of preventive medicine personnel who conduct surveillance activities in inpatient and outpatient settings.

## **Disclosure of Faculty/Committee Member Relationships**

It is the policy of the U.S. Army Medical Command that all CME planning committee/faculty/authors disclose relationships with commercial entities upon invitation of participation. Disclosure documents are reviewed for potential conflicts of interest and, if identified, they are resolved prior to confirmation of participation.

### **Faculty Members**

- |                   |                               |
|-------------------|-------------------------------|
| Bylsma, Victoria  | - No information to disclose. |
| Gillooly, Paul    | - No information to disclose. |
| Kebisek, Julianna | - No information to disclose. |
| Montgomery, Jay   | - No information to disclose. |

### **Committee Members**

- |                       |                               |
|-----------------------|-------------------------------|
| Ambrose, John         | - No information to disclose. |
| Bowman, Wendi         | - No information to disclose. |
| Bylsma, Victoria      | - No information to disclose. |
| Constantino, Joycelyn | - No information to disclose. |
| Diaz, Rolando         | - No information to disclose. |
| Eng, Mimi             | - No information to disclose. |
| Kebisek, Julianna     | - No information to disclose. |
| Riegodedios, Asha     | - No information to disclose. |

## **Acknowledgement of Commercial Support**

There is no commercial support associated with this educational activity.

# Emerging Tick-borne Diseases



**U.S. ARMY PUBLIC HEALTH CENTER**



Julie Kebisek, MPH

Epidemiologist, Clinical Public Health and Epidemiology  
U.S. Army Public Health Center

The views expressed in this presentation are those of the author(s) and do not necessarily reflect the official policy of the Department of Defense, Department of the Army, U.S. Army Medical Department or the U.S. Government.



- Vector-borne surveillance paraprofessional, Minnesota Department of Health, 2014 – 2016
- Epidemiologist, US Army Public Health Center, 2017 - present

By the end of this presentation, the attendees should be able to:

- 1) Understand the trends in emerging tick-borne diseases
- 2) Understand the laboratory interpretations and case definitions for select emerging tick-borne RMEs
- 3) Identify the important elements of tick control





- **Emerging**: Infectious diseases whose incidence in humans has increased in the past two decades or threatens to increase in the near future. These diseases include:
  - New infections resulting from **changes or evolution** of existing organisms
  - Known infections spreading to **new geographic areas** or populations
  - Previously unrecognized infections appearing in areas undergoing **ecologic transformation**
  - Old infections reemerging as a result of **antimicrobial resistance** in known agents or breakdowns in public health measures
  
- **Endemic**: regularly found among particular people or animals or in a certain area

## Emerging tick-borne diseases (TBDs) of concern:

- Lyme Disease (*Borrelia burgdorferi* and other species)
- Spotted Fever Rickettsiosis (*Rickettsia* species)
- Human Anaplasmosis (*Anaplasma phagocytophilum*)
- Human Ehrlichiosis (*Ehrlichia* species)
- Relapsing Fever (*Borrelia miyamotoi* and other species)

## Other emerging TBDs not covered in this presentation:

- Babesiosis (*Babesia* species)
- Crimean-Congo Hemorrhagic Fever Virus (*Bunyavirales*)
  - Of particular concern in European region
- Severe Fever with Thrombocytopenia Syndrome, Heartland virus, and Bourbon Virus
- Tick-Borne Encephalitis Virus and Powassan Virus (*Flaviviridae*)
  - Of particular concern in European region

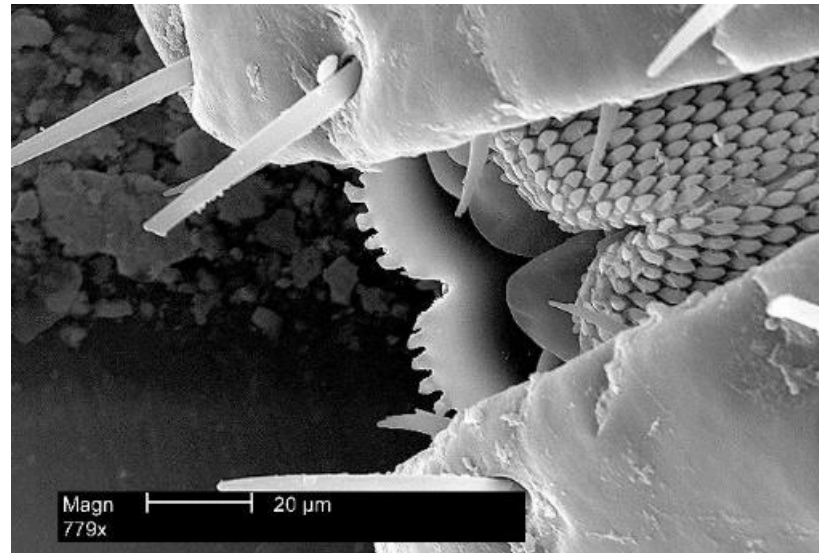
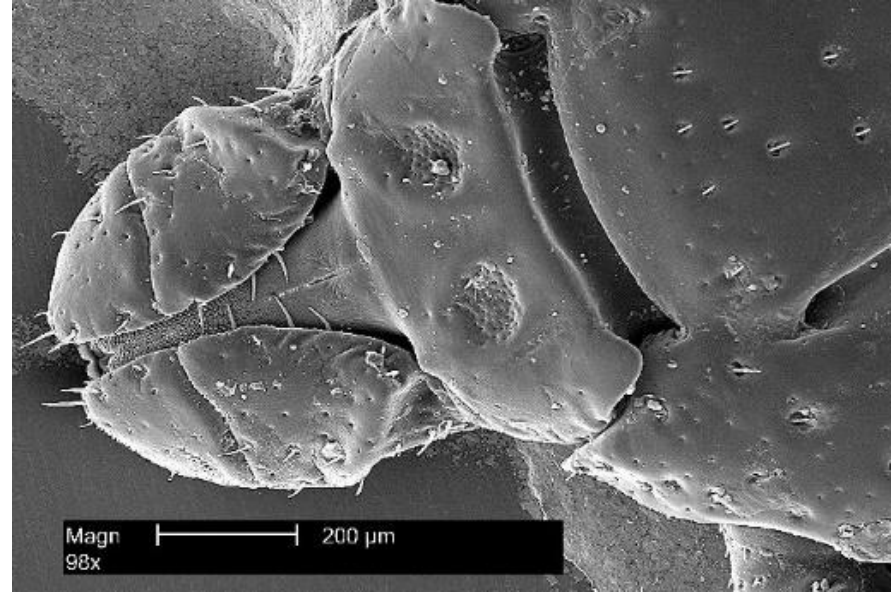
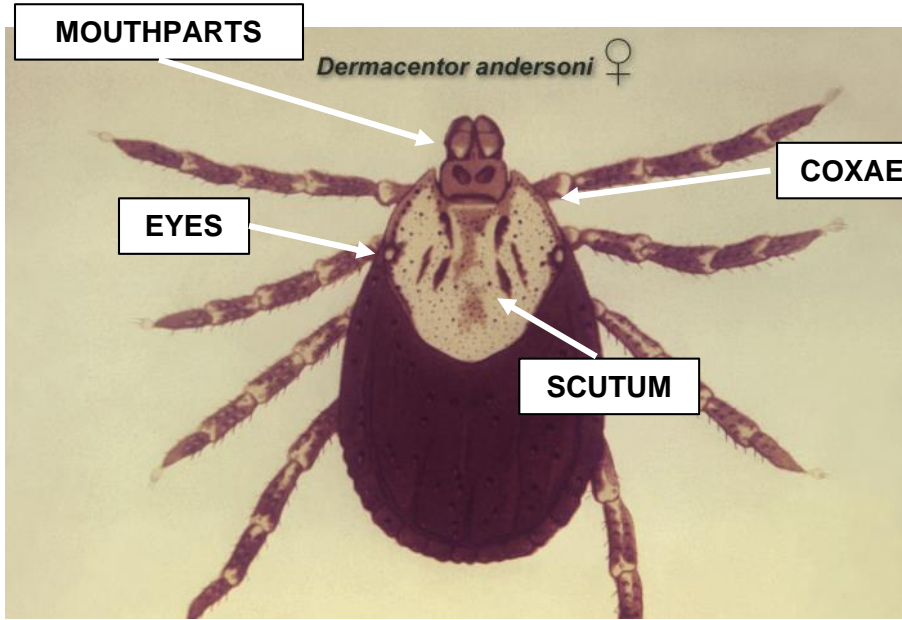
- Eggs are typically hatched in the spring, become larva in the summer, then hibernate during winter beneath the soil, and finally emerge the following spring as a nymph
- Nymphs have no gender so all nymphs take their first blood meal and mature into adults over the summer and full mature by the fall. Females will then have another blood meal and then lay eggs before dying.
- Ticks find their hosts by detecting animals' breath and body odors, or by sensing body heat, moisture, and vibrations
- Duration of the tick's spring activity will depend on its overwintering success



A questing black-legged tick



Larvae, nymph, and adult female black-legged tick

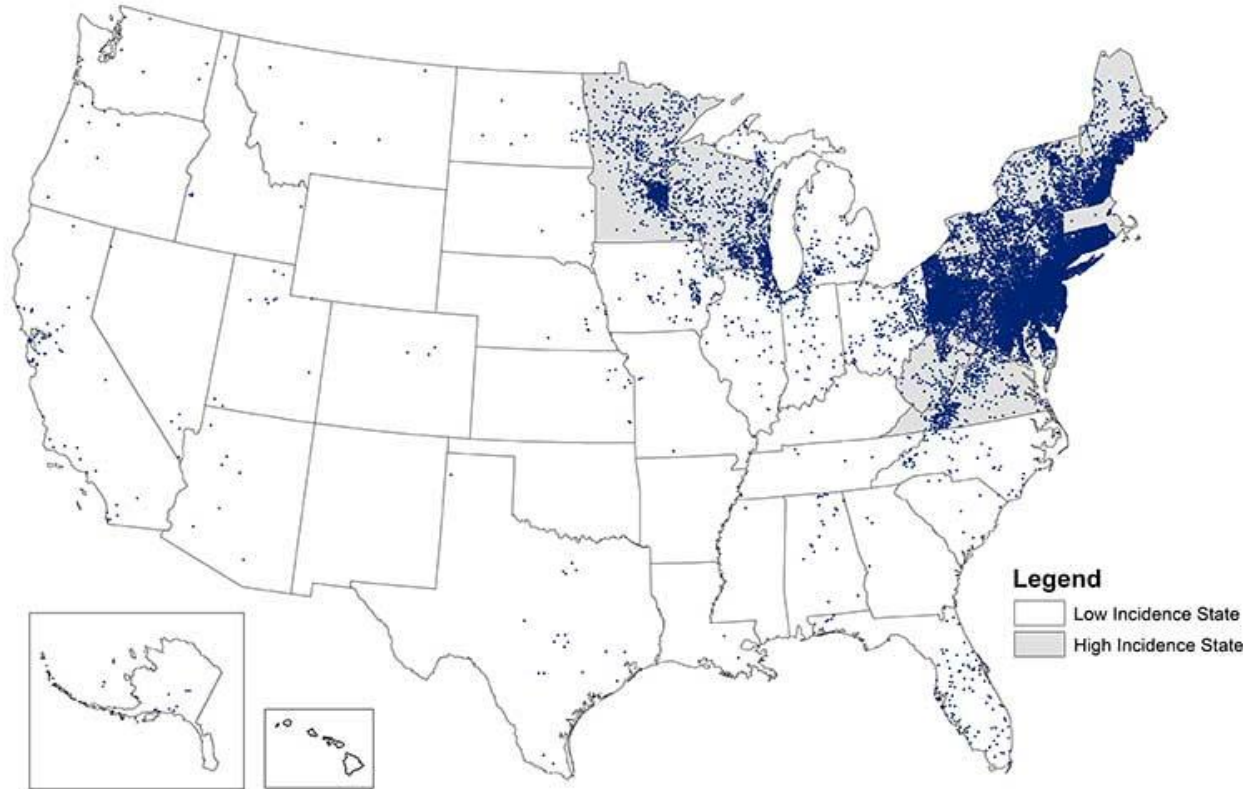




1. Use fine-tipped tweezers to grasp the tick as close to the skin surface as possible
2. Pull upward with steady, even pressure, Don't twist or jerk the tick; this can cause the mouth-parts to break off and remain in the skin. If this happens, remove the mouth-parts with tweezers. If you are unable to remove the mouth easily with clean tweezers, leave it alone and let the skin heal
3. After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol or soap and water
4. Never crush the tick with your fingers. Dispose of a live tick by putting it in alcohol, placing it in a sealed bag or container, wrapping it tightly in tape, or flushing it down the toilet.

**DO NOT paint the tick with petroleum jelly or nail polish, or use heat to detach the tick from the skin.**

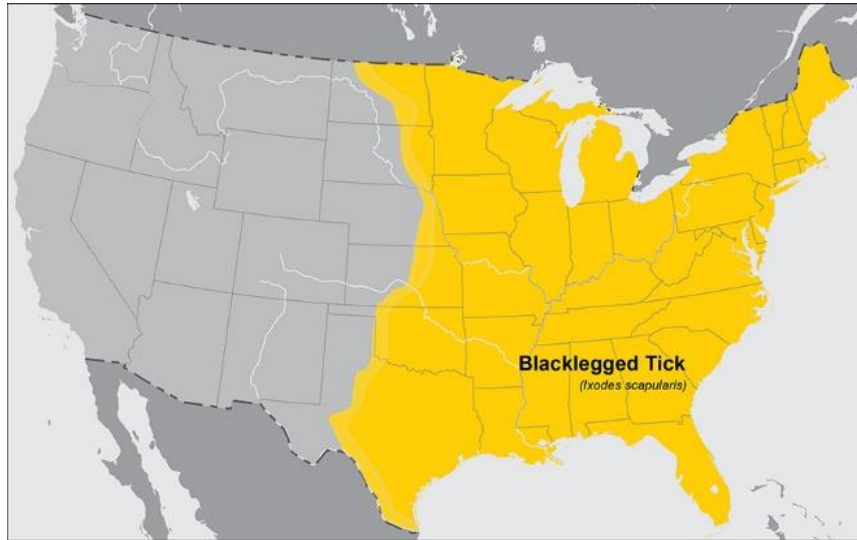
# Lyme Disease



2018 Map of Reported Cases of Lyme Disease by county, CDC.

- **Endemic Lyme disease**

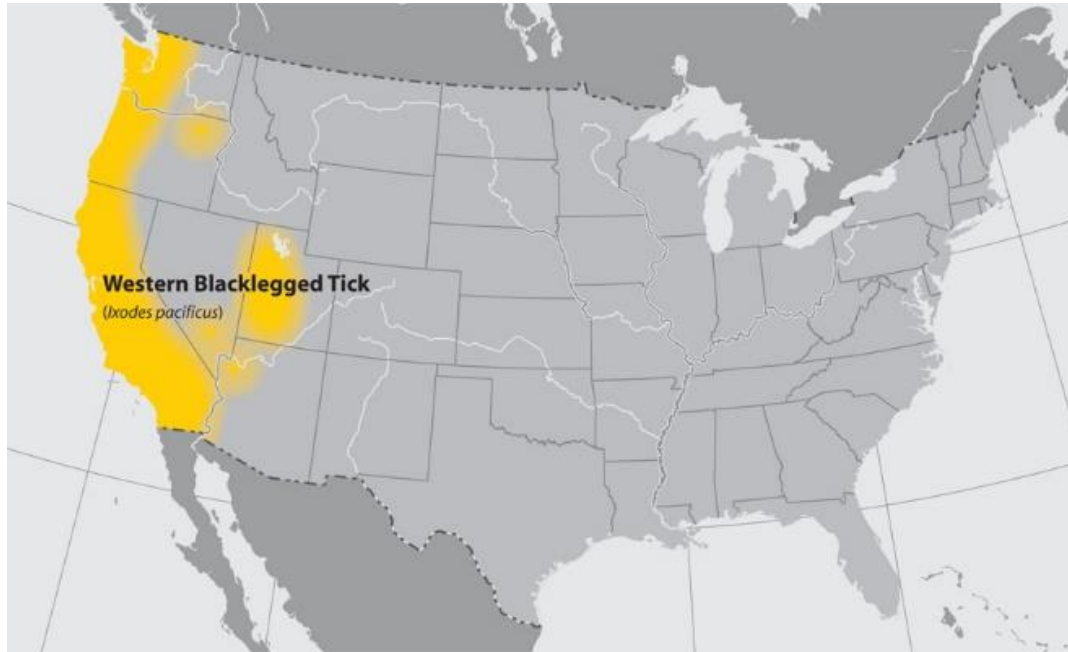
- Endemicity is defined as a county in which at least two confirmed cases have been acquired or in which established populations of a known tick vector are infected with *B. burgdorferi* (per the 2020 Armed Forces Reportable Medical Event (RME) Guidelines and Case Definitions)



**Habitat type:** Deciduous forest, wooded, brushy areas. Will climb vegetation (like tall grasses or knee-high branches) and wait for hosts to pass by. They cannot climb trees and do not fall from high branches.







**Habitat type:** Grasslands, woodland grass, brushy areas. Will climb vegetation (like tall grasses or knee-high branches) and wait for hosts to pass by.

- **Erythema migrans (EM) per the 2020 Armed Forces RME Guidelines and Case Definitions**

- Must be greater than or equal to 5 centimeters in diameter
- May expand over time
- May be multiple rashes
- A localized reaction at the site of the tick bite **does not** qualify as an EM rash if less than 5cm in diameter



- **Late manifestations (days to months after tick bite)**
  - Involvement of the musculoskeletal system, nervous system, or cardiovascular system



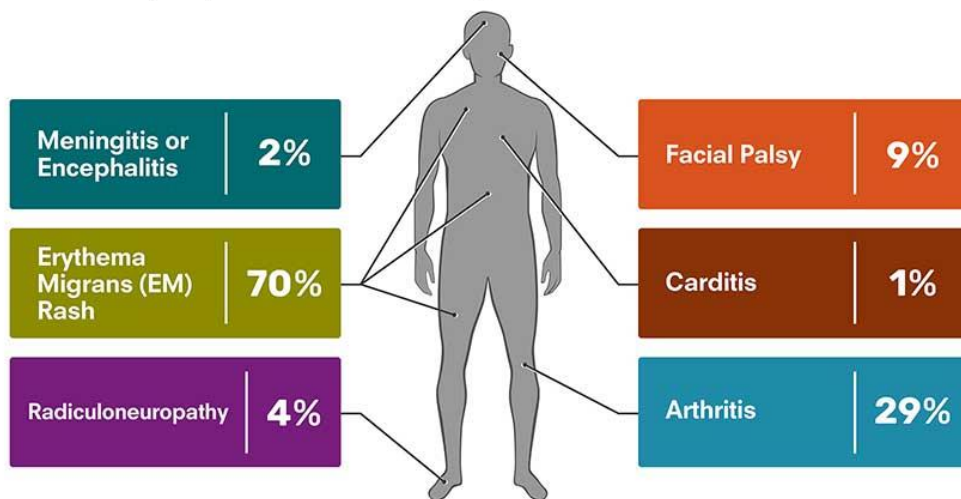
Facial palsy



Swollen joints

## LYME DISEASE

Relative frequency of clinical features among confirmed cases - United States, 2008-2018



Data on signs/symptoms available only for 62% of 288,107 confirmed cases.

<https://www.cdc.gov/lyme/stats/graphs.html>

- **Musculoskeletal system involvement:**

- Arthritis with severe joint pain & swelling, particularly in knees/other large joints
- Intermittent pain in tendons, muscles, joints, and bones
- Facial palsy

- **Nervous system involvement:**

- Shooting pains, numbness, or tingling in hands or feet
- Nerve pain

- **Cardiovascular system involvement:**

- Heart palpitations or irregular heart beat
- Episodes of dizziness or short breath

- Patients from the United States had significantly shorter duration of erythema migrans at diagnosis (4 days vs 7 days), greater frequency of associated symptoms (78% vs 29%), and greater number of associated symptoms (4 symptoms vs 0 symptoms).
- Lower occurrence of development of arthritis following *B. burgdorferi* infection in Europe, however, higher frequency of Lyme neuroborreliosis than compared to the U.S.

Cerar, T., Strle, F., Stupica, D., Ruzic-Sabljić, E., McHugh, G., Steere, A.C., Strle, K. (2016). Differences in Genotype, Clinical Features, and Inflammatory Potential of *Borrelia burgdorferi* sensu stricto Strains from Europe and the United States. *Emerging Infectious Diseases*, 22(5), 818-827. <https://dx.doi.org/10.3201/eid2205.15180>

- **Laboratory Confirmation**

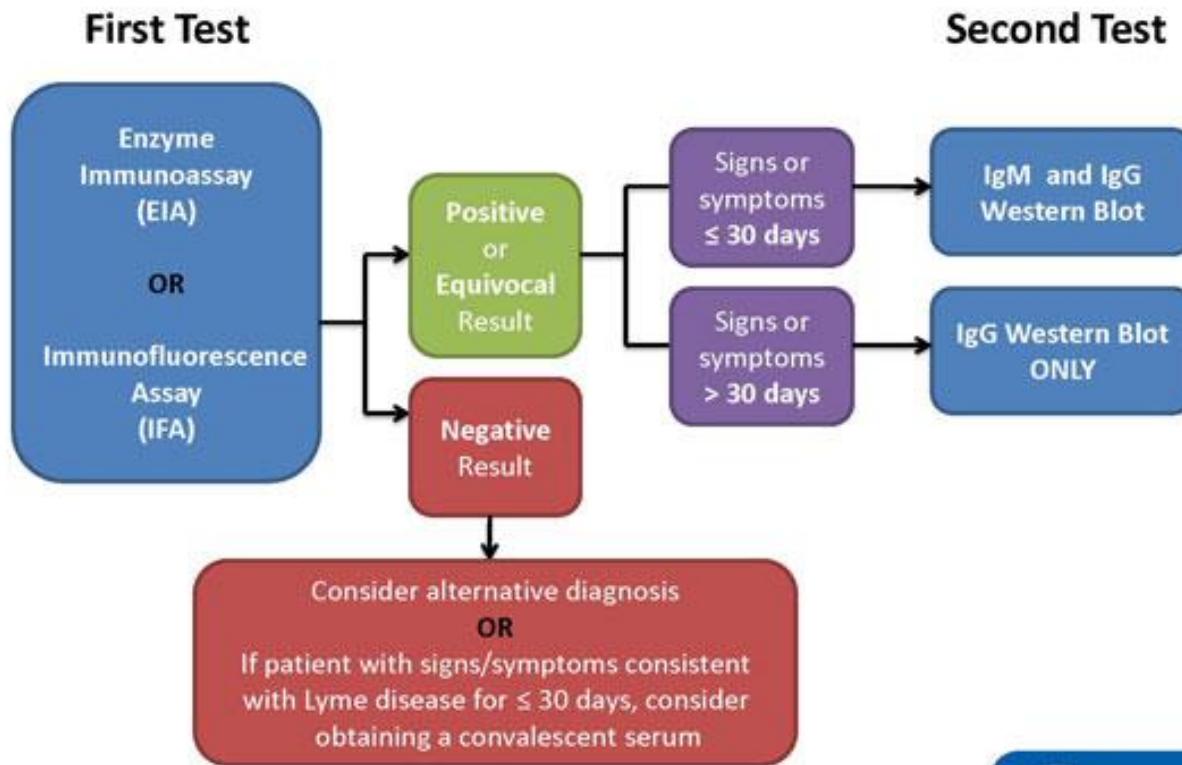
- *B. burgdorferi* identified by culture by any clinical specimen
- Two-tiered testing: *B. burgdorferi* positive IgM/IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgM Western Blot only when  $\leq 30$  days of symptom onset
- Two tiered testing: *B. burgdorferi* positive IgM/IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgG Western Blot at any point during illness
- Single-tier testing: *B. burgdorferi* positive IgG antibody by Western blot

Per the 2020 Armed Forces RME Guidelines and Case Definitions

Lyme Disease Ab  
Total Screen

Lyme Disease  
Ab WB

## Two-Tiered Testing for Lyme Disease



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





Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
Borrelia burgdorferi DNA PCR	Site / Specimen	13 Jun 2020 2347	Units	Ref Range
Borrelia burgdorferi DNA	BLOOD	Negative <i><r>		Negative

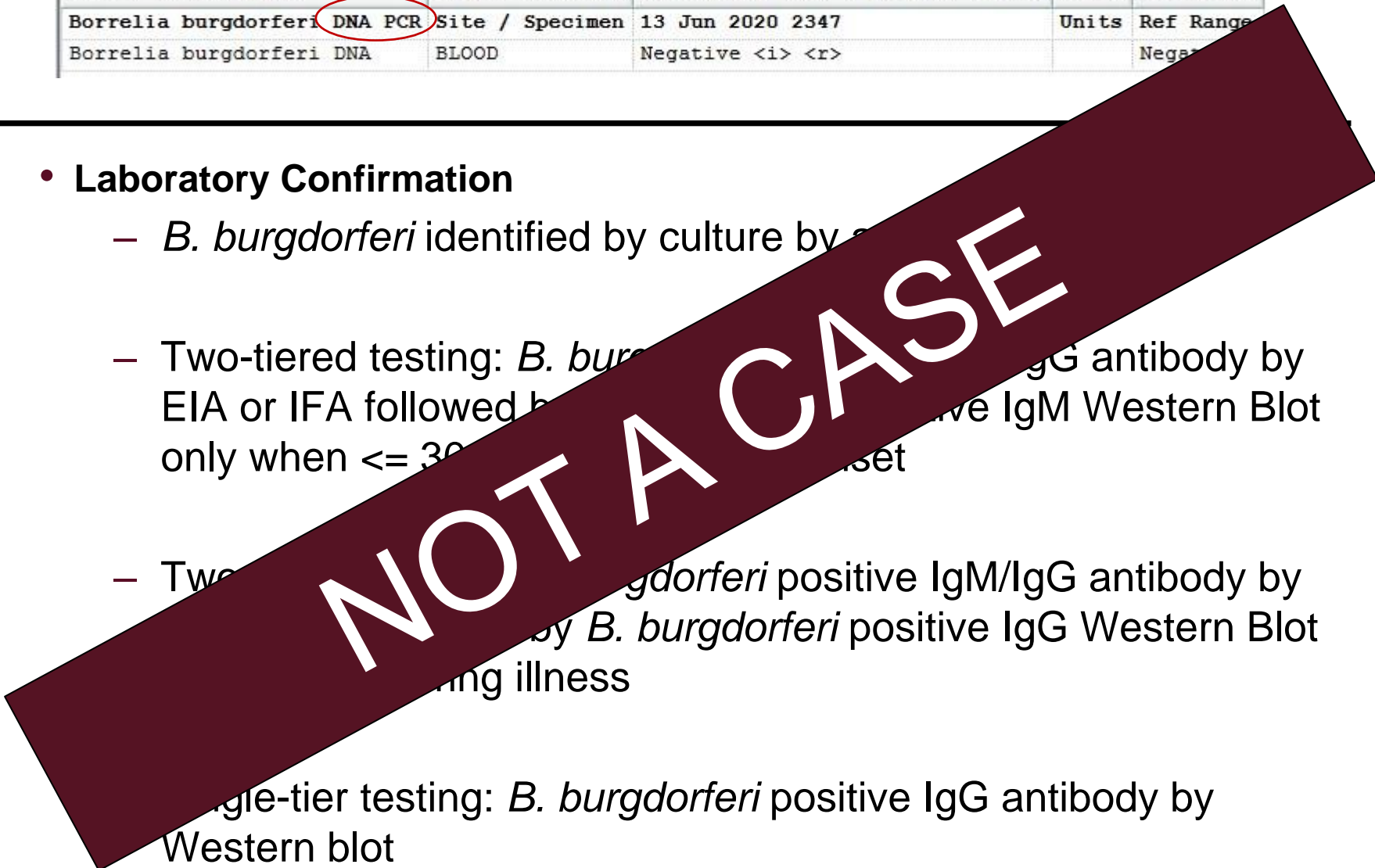
- **Laboratory Confirmation**

- *B. burgdorferi* identified by culture by any clinical specimen
- Two-tiered testing: *B. burgdorferi* positive IgM/IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgM Western Blot only when  $\leq 30$  days of symptom onset
- Two tiered testing: *B. burgdorferi* positive IgM/IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgG Western Blot at any point during illness
- Single-tier testing: *B. burgdorferi* positive IgG antibody by Western blot

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
Borrelia burgdorferi DNA PCR	Site / Specimen	13 Jun 2020 2347	Units	Ref Range
Borrelia burgdorferi DNA	BLOOD	Negative <i><r>		Negat

- **Laboratory Confirmation**

- *B. burgdorferi* identified by culture by *B. burgdorferi*
- Two-tiered testing: *B. burgdorferi* positive IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgM Western Blot only when  $\leq 30$  days of illness
- Two-tiered testing: *B. burgdorferi* positive IgM/IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgG Western Blot only when  $\leq 30$  days of illness
- Single-tier testing: *B. burgdorferi* positive IgG antibody by Western blot



Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
Lyme Disease Ab Total <b>Screen</b>	Site / Specimen	10 Mar 2021 1520	Units	Ref Range
Borrelia burgdorferi Ab	SERUM	1.22 (H) <i>	ISR	0.00-0.90

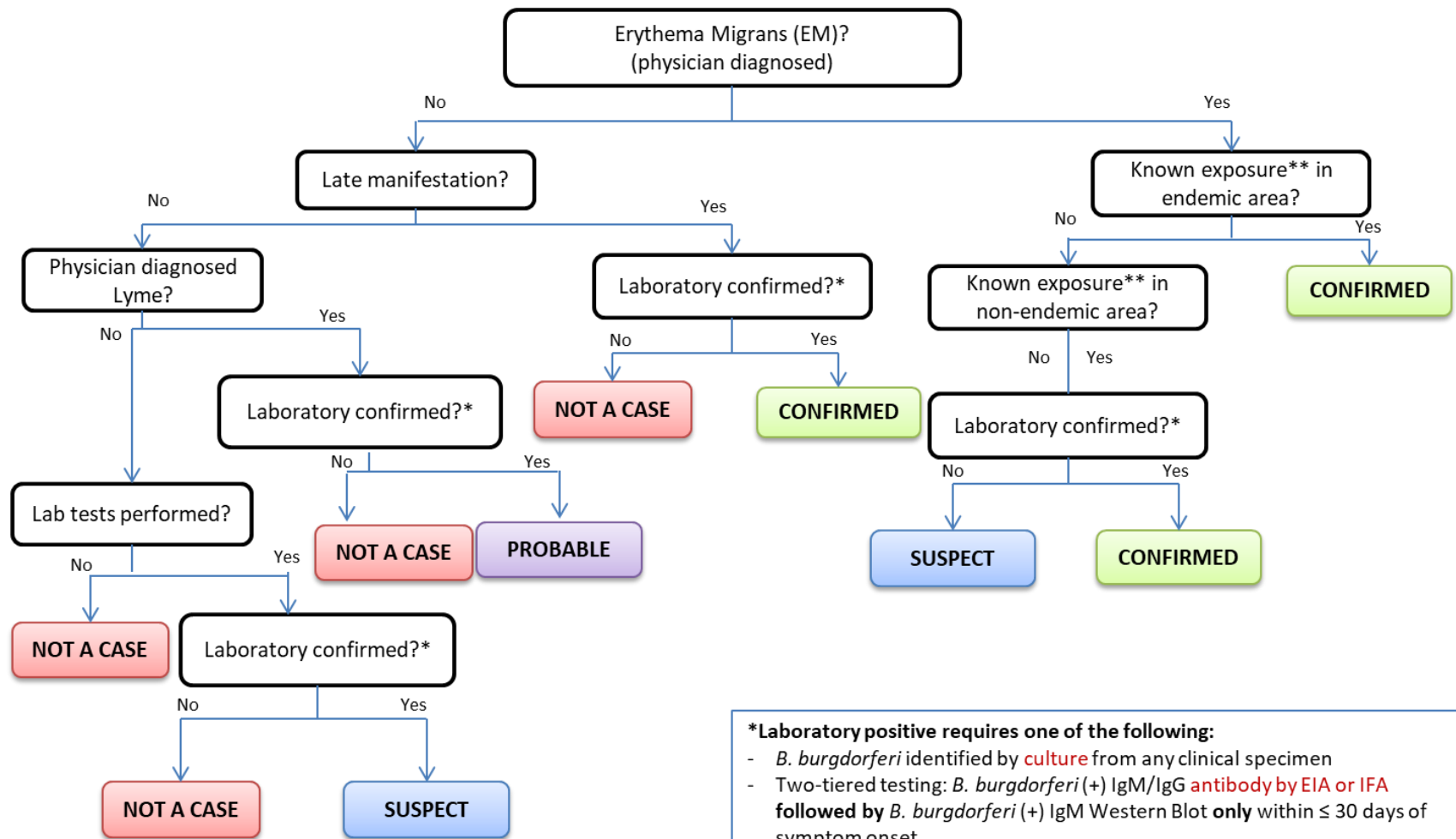
Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
Lyme Disease <b>Ab WB</b>	Site / Specimen	10 Mar 2021 1520	Units	Ref Range
Borrelia burgdorferi 93kD Ab IgG	SERUM	Present (H) ①		
Borrelia burgdorferi 66kD Ab IgG	SERUM	Absent		
Borrelia burgdorferi 58kD Ab IgG	SERUM	Present (H) ②		
Borrelia burgdorferi 45kD Ab IgG	SERUM	Present (H) ③		
Borrelia burgdorferi 41kD Ab IgG	SERUM	Present (H) ④		
Borrelia burgdorferi 39kD Ab IgG	SERUM	Present (H) ⑤		
Borrelia burgdorferi 30kD Ab IgG	SERUM	Absent		
Borrelia burgdorferi 28kD Ab IgG	SERUM	Absent		
Borrelia burgdorferi 23kD Ab IgG	SERUM	Present (H) ⑥		
Borrelia burgdorferi 18kD Ab IgG	SERUM	Absent		
Borrelia burgdorferi Ab IgG Band Pattern	SERUM	Positive (H) <i>		
Borrelia burgdorferi 41kD Ab IgM	SERUM	Present (H) ①		
Borrelia burgdorferi 39kD Ab IgM	SERUM	Absent		
Borrelia burgdorferi 23kD Ab IgM	SERUM	Absent		
Borrelia burgdorferi Ab IgM Band Pattern	SERUM	Negative <i>		

- **Laboratory Confirmation**

- *B. burgdorferi* identified by culture by any clinical specimen
- Two-tiered testing: *B. burgdorferi* positive IgM/IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgM Western Blot only when  $\leq 30$  days of symptom onset
- Two tiered testing: *B. burgdorferi* positive IgM/IgG antibody by EIA or IFA followed by *B. burgdorferi* positive IgG Western Blot at any point during illness
- Single-tier testing: *B. burgdorferi* positive IgG antibody by Western blot



# Lyme Disease: Case Definition



**\*\* Exposure** is defined as having been (≤30 days before onset of EM) in wooded, brushy, or grassy areas in a county in which Lyme disease is endemic. History of tick bite is not required.

**Endemicity** is defined as a county in which at least 2 confirmed cases have been acquired or established populations of the tick vector are infected with *B. burgdorferi*.

**\*Laboratory positive requires one of the following:**

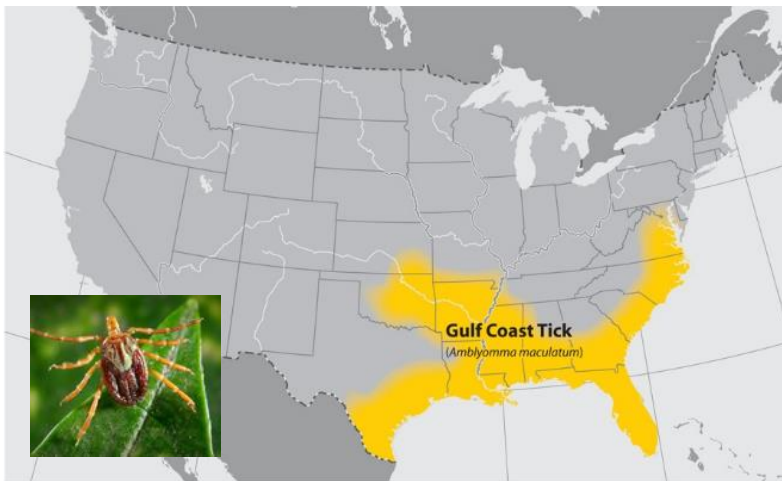
- *B. burgdorferi* identified by **culture** from any clinical specimen
- Two-tiered testing: *B. burgdorferi* (+) IgM/IgG **antibody by EIA or IFA** followed by *B. burgdorferi* (+) IgM Western Blot **only** within ≤ 30 days of symptom onset
- Two-tiered testing: *B. burgdorferi* (+) IgM/IgG **antibody by EIA or IFA** followed by *B. burgdorferi* (+) IgG Western Blot **at any point** during illness
- Single-tier testing: *B. burgdorferi* (+) IgG antibody by Western Blot

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\*Two-tier = IgM with at least 2/3 bands **AND** IgG with at least 5/10 bands

\*Single-tier = IgM with at least 2/3 bands **OR** IgG with at least 5/10 bands

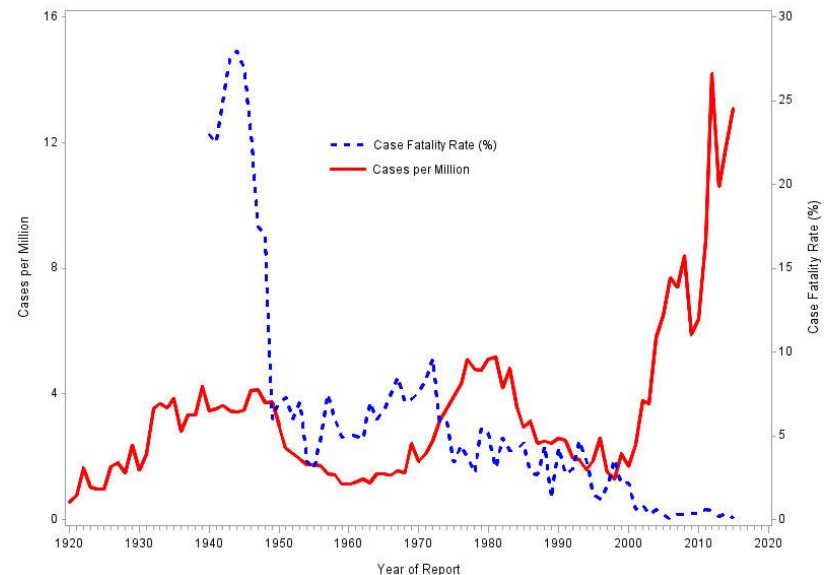
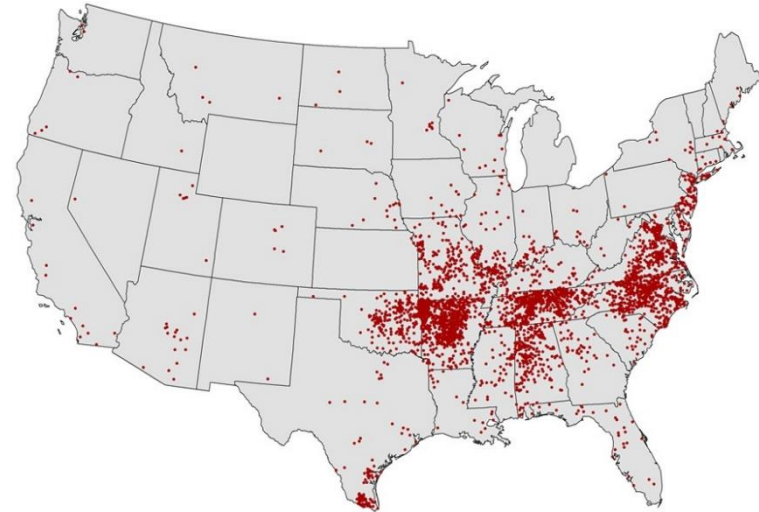
# Spotted Fever Rickettsiosis (SFR)



**Habitat type:** Wooded, shrubby, and long-grass areas, and areas where rodents may be (shrubs, weeds, tall grass, among clutter and debris).



- Spotted Fever Rickettsiosis (SFR): Captures cases of Rocky Mountain Spotted Fever, *Rickettsia parkeri* rickettsiosis, Pacific Coast tick fever, and rickettsialpox
- Cases have been reported throughout the contiguous U.S., although five states (AR, MO, NC, TN, VA) account for over 50% of SFR cases
- Incidence has risen over the years as mortality has decreased
- Difficult to identify between rickettsial species using common serologic tests



<https://www.cdc.gov/rmsf/stats/index.html>

## Signs and symptoms include:

- Fever
- Headache
- Rash
- Nausea
- Vomiting
- Stomach pain
- Muscle pain
- Lack of appetite



Late stage rash in a patient with RMSF

## Rash

- Usually develops 2-4 days after fever begins
- Some look like red splotches and some look like pinpoint dots
- Almost all patients with SFR develop a rash, if often does not appear early in illness

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Rickettsial Fever Group IgG/M</b>	Site / Specimen	22 Mar 2021 1658	Units	Ref Range
Rickettsia rickettsii Spotted Fever Group Ab IgM	SERUM	<1:64 <i>	Titer units	<1:64
Rickettsia Typhus Group Ab IgM	SERUM	<1:64 <i>	Titer units	<1:64
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	<b>1:256 (H) &lt;i&gt;</b>	Titer units	<1:64
Rickettsia Typhus Group Ab IgG	SERUM	<1:64 <i>	Titer units	<1:64

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Rocky Mountain Spotted Fever Group Ab IgG+IgM</b>	Site / Specimen	24 Mar 2021 1227	Units	Ref Range
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	Negative		Negative
Rickettsia rickettsii Spotted Fever Group Ab IgM	SERUM	<b>1.12 (H) &lt;i&gt;</b>	Index	0.00-0.89

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>RMSF IgG IFA</b>	Site / Specimen	11 Mar 2021 1340	Units	Ref Range
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	<b>1:64 (H) &lt;i&gt;</b>		Neg <1:64

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Rocky Mountain Spotted Fever Group Ab IgG+IgM</b>	Site / Specimen	23 Sep 2020 1019	Units	Ref Range
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	<1:64		Neg:<1:64
Rickettsia Typhus Group Ab IgG	SERUM	<1:64		Neg:<1:64
Rickettsia rickettsii Spotted Fever Group Ab IgM	SERUM	<1:64		Neg:<1:64
Rickettsia Typhus Group Ab IgM	SERUM	<b>1:64 (H)</b>		Neg:<1:64

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
Rickettsial Fever Group IgG/M	Site / Specimen	22 Mar 2021 1658	Units	Ref Range
Rickettsia rickettsii Spotted Fever Group Ab IgM	SERUM	<1:64 <i>	Titer units	<1:64
Rickettsia Typhus Group Ab IgM	SERUM	<1:64 <i>	Titer units	<1:64
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	1:256 (H) <i>	Titer units	<1:64
Rickettsia Typhus Group Ab IgG	SERUM	<1:64 <i>	Titer units	<1:64

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
Rocky Mountain Spotted Fever Group Ab IgG+IgM	Site / Specimen	24 Mar 2021 1227	Units	Ref Range
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	Negative		Negative
Rickettsia rickettsii Spotted Fever Group Ab IgM	SERUM	1.12 (H) <i>	Index	0.00-0.89

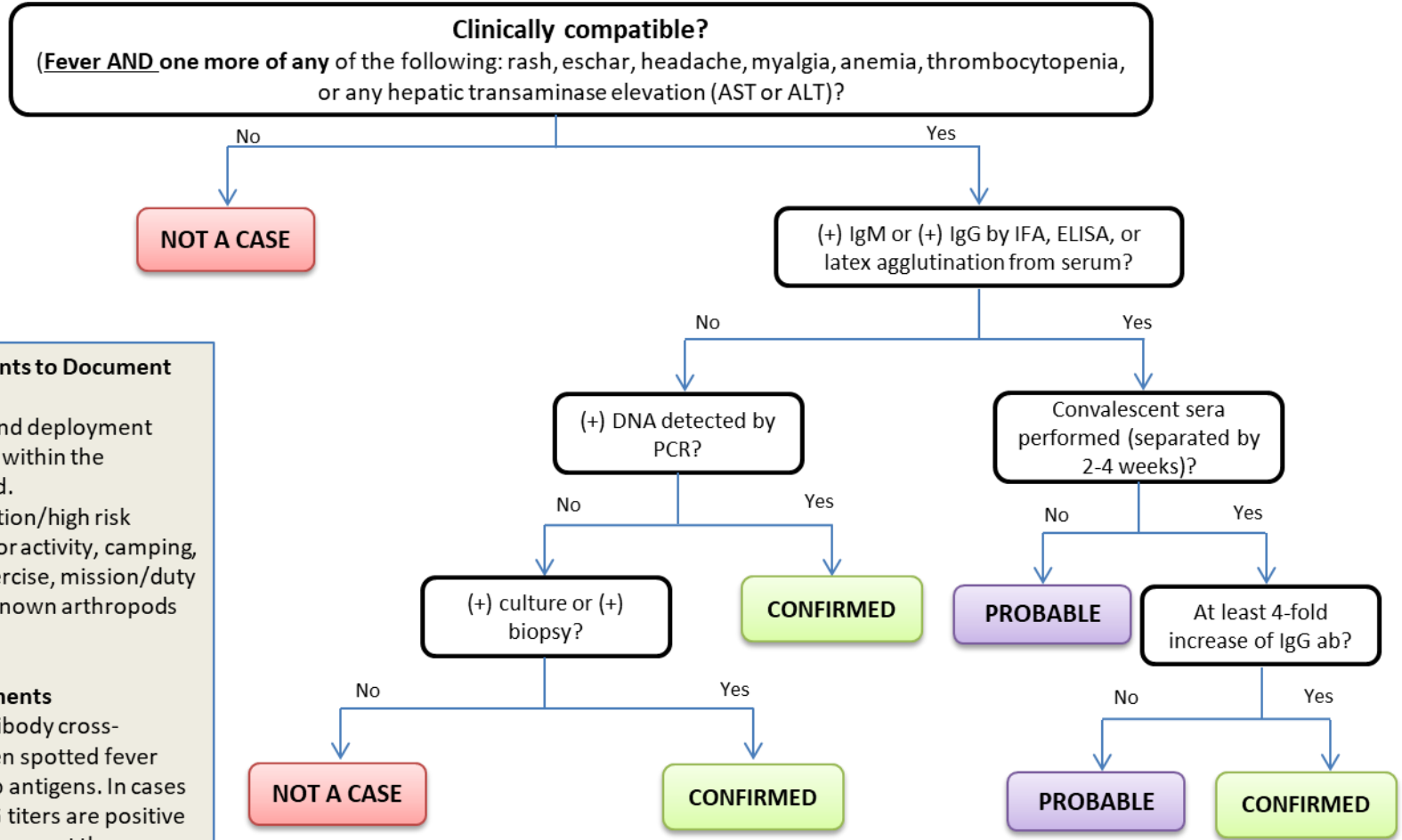
Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
RMSF IgG IFA	Site / Specimen	11 Mar 2021 1340	Units	Ref Range
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	1:64 (H) <i>		Neg <1:64

**REPORTABLE**  
(if symptomatic)

## REPORTABLE

As Typhus Fever, if patient is symptomatic

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Rocky Mountain Spotted Fever Group Ab IgG+IgM</b>	<b>Site / Specimen</b>	<b>23 Sep 2020 1019</b>	<b>Units</b>	<b>Ref Range</b>
Rickettsia rickettsii Spotted Fever Group Ab IgG	SERUM	<1:64		Neg:<1:64
Rickettsia Typhus Group Ab IgG	SERUM	<1:64		Neg:<1:64
Rickettsia rickettsii Spotted Fever Group Ab IgM	SERUM	<1:64		Neg:<1:64
Rickettsia Typhus Group Ab IgM	SERUM	<b>1:64 (H)</b>		Neg:<1:64



**Required Comments to Document**

- Relevant travel and deployment history occurring within the incubation period.
- Potential occupation/high risk exposure (outdoor activity, camping, hunting, field exercise, mission/duty related, etc.) to known arthropods (ticks).

**Comments**

- There can be antibody cross-reactivity between spotted fever and typhus group antigens. In cases where IgM or IgG titers are positive for both diseases, report the case under the disease most consistent with the case's clinical presentation, exposure history, and travel history.

# Ehrlichiosis/Anaplasmosis



**Lone Star Tick Habitat type:** Wooded areas, particularly in second-growth forests with thick underbrush, where white-tailed deer reside

**Blacklegged Tick Habitat type:** Deciduous forest, wooded, brushy areas. Will climb vegetation (like tall grasses or knee-high branches) and wait for hosts to pass by. They cannot climb trees and do not fall from high branches.

<https://www.cdc.gov/ehrlichiosis/transmission/index.html>

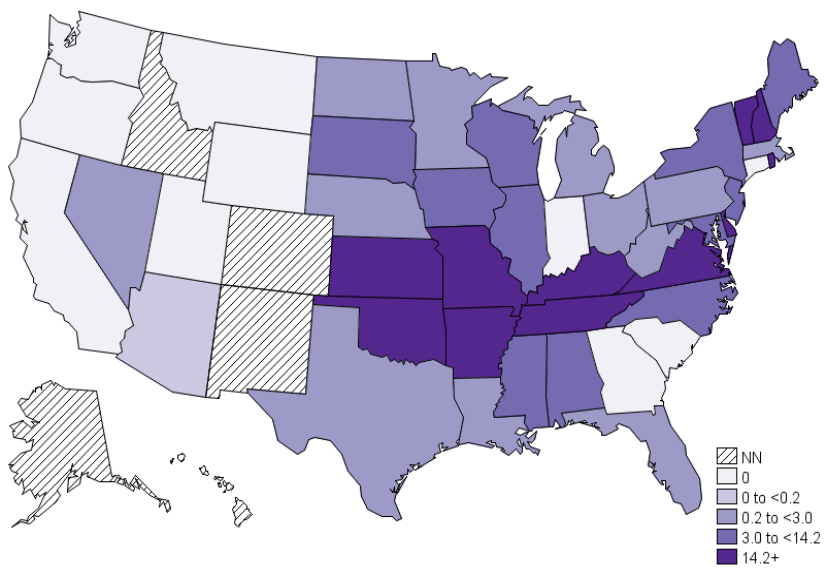




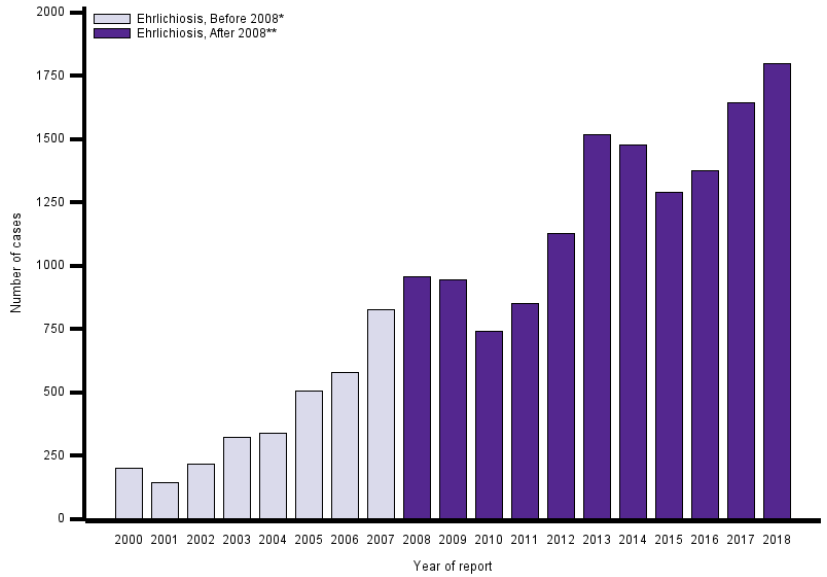
- **Where found:** eastern United States, but more common in the south
- **Transmits:** *Ehrlichia chaffeensis* and *E. ewingii* (which cause Human Ehrlichiosis), *Francisella tularensis* (tularemia), Heartland virus (Heartland virus disease), Bourbon Virus (Bourbon virus disease), and Southern tick-associated rash illness (STARI)
- **Comments:** Greatest risk of being bitten is in early spring through late fall. Very aggressive tick that bites humans. Associated with an allergic reaction to red meat.

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
Alpha-Gal IgE	Site / Specimen	22 Mar 2021 1658	Units	Ref Range
Alpha-Gal IgE	SERUM	<0.10 <i> <r>	kU/L	<0.10

## Annual reported incidence for *E. chaffeensis*



## Ehrlichiosis cases reported to CDC



- Most frequently reported from South Eastern and South-Central U.S., from the East Coast extending westward to Texas
- In 2018, four states (MO, AR, NY, VA) accounted for more than half of all reported cases of ehrlichiosis
- Ehrlichiosis caused by *E. muris* has been found in patients living in Minnesota and Wisconsin

<https://www.cdc.gov/ehrlichiosis/stats/index.html>

## Early Illness (first 5 days of illness), usually mild or moderate and may include:

Fever, chills

Severe headache

Muscle aches

Nausea, vomiting, diarrhea, loss of appetite

Confusion

Rash (more common in children)

## Late Illness (Rare. May occur if treatment is delayed or if other medical conditions are present)

Damage to the brain or nervous system (e.g. inflammation of the brain and surrounding tissue)

Respiratory failure

Uncontrolled bleeding

Organ failure

Death

Rash (more common in children)

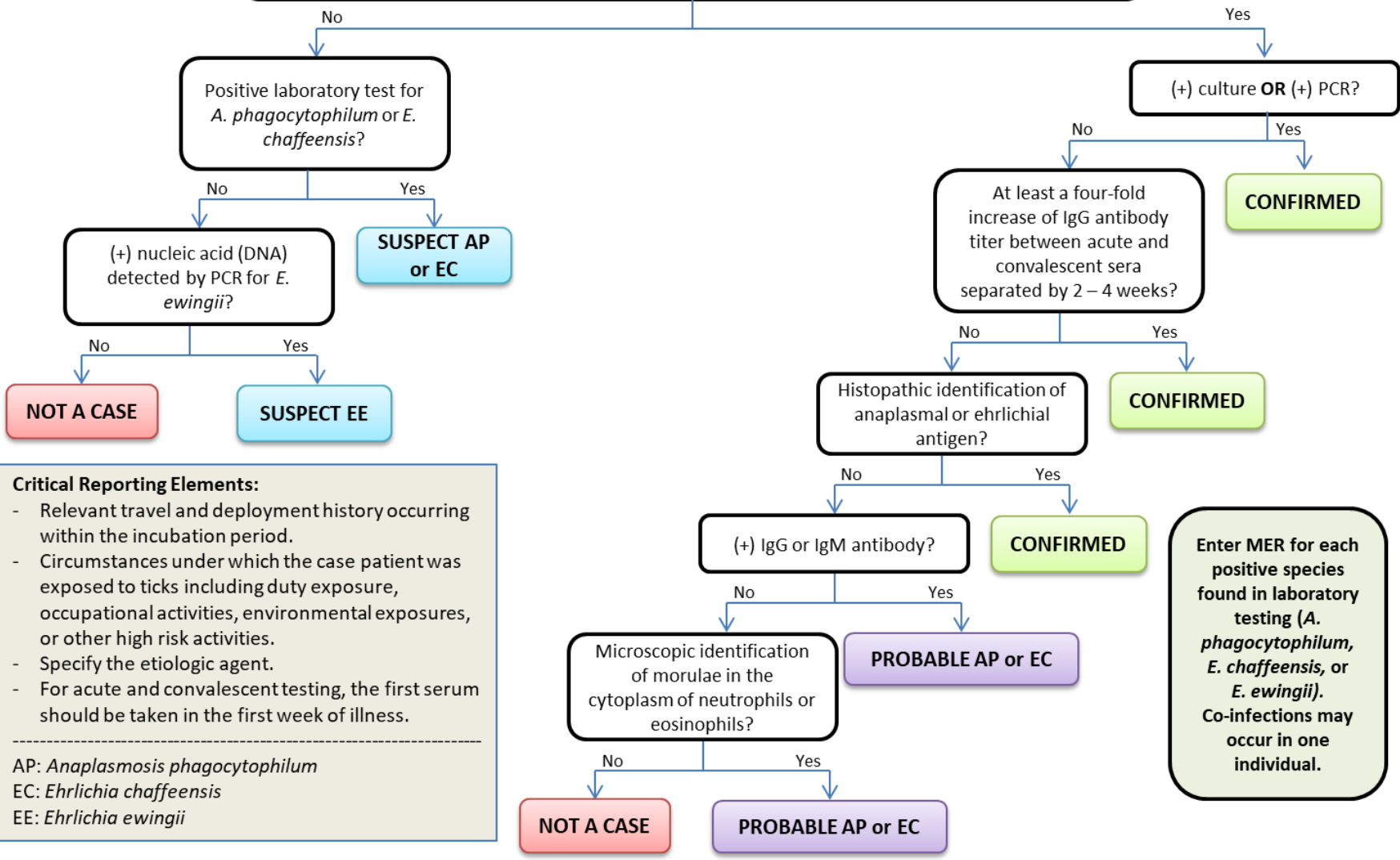
Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Ehrlichia chaffeensis DNA PCR</b>	Site / Specimen	04 Sep 2020 1930	Units	Ref Range
Ehrlichia chaffeensis DNA	BLOOD	Positive (H) <i> <r>		Negative

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Anaplasma phagocytophilum DNA PCR</b>	Site / Specimen	04 Sep 2020 1930	Units	Ref Range
Anaplasma phagocytophilum DNA (HGE)	BLOOD	Negative <i> <r>		Negative

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Ehrlichia Ab Panel</b>	Site / Specimen	04 Sep 2020 1930	Units	Ref Range
Ehrlichia chaffeensis Ab IgG	SERUM	Negative		Neg:<1:64
Ehrlichia chaffeensis Ab IgM	SERUM	Negative <i>		Neg:<1:20
Anaplasma phagocytophilum Ab IgG (HGE Ab)	SERUM	Negative <i>		Neg:<1:64
Anaplasma phagocytophilum Ab IgM (HGE Ab)	SERUM	Negative <i> <r>		Neg:<1:20

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range
<b>Ehrlichia chaffeensis Ab Panel</b>	Site / Specimen	22 Mar 2021 1658	Units	Ref Range
Ehrlichia sp. Ab IgG	SERUM	Negative		Neg:<1:64
Ehrlichia sp. Ab IgM	SERUM	Negative <i>		Neg:<1:20

**Meets clinical description?**  
 Tick borne illnesses characterized by fever **AND** one or more of the following: headache, myalgia, malaise, anemia, leukopenia, thrombocytopenia, or elevated hepatic transaminases.



**Critical Reporting Elements:**

- Relevant travel and deployment history occurring within the incubation period.
- Circumstances under which the case patient was exposed to ticks including duty exposure, occupational activities, environmental exposures, or other high risk activities.
- Specify the etiologic agent.
- For acute and convalescent testing, the first serum should be taken in the first week of illness.

---

AP: *Anaplasmosis phagocytophilum*  
 EC: *Ehrlichia chaffeensis*  
 EE: *Ehrlichia ewingii*

Enter MER for each positive species found in laboratory testing (*A. phagocytophilum*, *E. chaffeensis*, or *E. ewingii*). Co-infections may occur in one individual.

# Relapsing Fever



*Ornithodoros hermsi*



*Argasidae sp.*

- *O. hermsi* prefers coniferous forests at altitudes of 1500 to 8000 feet, where it feeds on squirrels and chipmunks
- *O. parkeri* are found at lower altitudes in the Southwest, where they inhabit caves and the burrows of ground squirrels, prairie dogs, and burrowing owls
- *O. turicata* occurs in caves and ground squirrel or prairie dog burrows in the plains regions of the Southwest, feeding off these animals and occasionally burrowing owls or other burrow- or cave-dwelling animals

## Cases of Tick-borne Relapsing Fever – United States, 1990 - 2011



■ Each dot, placed randomly within the county of exposure (where known), represents one case.



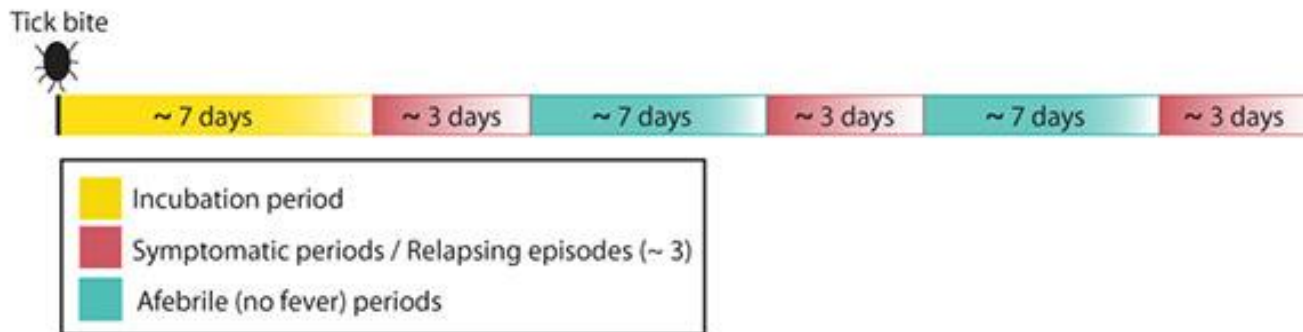
■ Each dot, placed randomly within the county of residence, represents one case.

- Most cases occur in the summer months while people vacation and sleep in rodent-infested cabins
- Can also occur in winter months
- Fires started to warm a cabin are sufficient to activate ticks resting in the walls and woodwork

<https://www.cdc.gov/relapsing-fever/distribution/index.html>



Symptom	Frequency of Symptom	Sign	Frequency of Sign
Headache	94%	Confusion	38%
Myalgia	92%	Rash	18%
Chills	88%	Jaundice	10%
Nausea	76%	Hepatomegaly	10%
Arthralgia	73%	Splenomegaly	6%
Vomiting	71%	Conjunctival injection	5%
Abdominal pain	44%	Eschar	2%
Dry cough	27%	Meningitis	2%
Eye pain	26%	Nuchal rigidity	2%
Diarrhea	25%		
Photophobia	25%		
Neck pain	24%		



<https://www.cdc.gov/relapsing-fever/clinicians/index.html>

Test / Result Name	Site / Specimen	Collection Date / Results Values	Units	Ref Range	RESULT COMMENTS:
Referral Test Miscellaneous	Site / Specimen	29 Sep 2015 1121 <o>	Units	Ref Range	Tick-Borne Relapsing Fever Serology Bh WCS: Positive
Miscellaneous Reference Test	BLOOD	COMMENT <r>			Sample collected 9/3/15 and current sample collected approx. 3 weeks later were tested in parallel by EIA and Western blot (IgM and IgG). Reactivity increased in all tests going from Equivocal to Postiive in each.  Diagnosis should be made on appropriate clinical history, exposure to infection and laboratory test results. Diagnosis should not be made based only on test results.

- Laboratory testing for Tick-borne Relapsing Fever may include direct microscopic observation of relapsing fever spirochetes using dark field microscopy or stained peripheral blood smears
- Other bacteria, such as *Heliobacter*, may appear morphologically similar, so it is important to consider clinical and geographical characteristics of the case when making a diagnosis of TBRF based on microscopy.

## Recommendations and considerations:

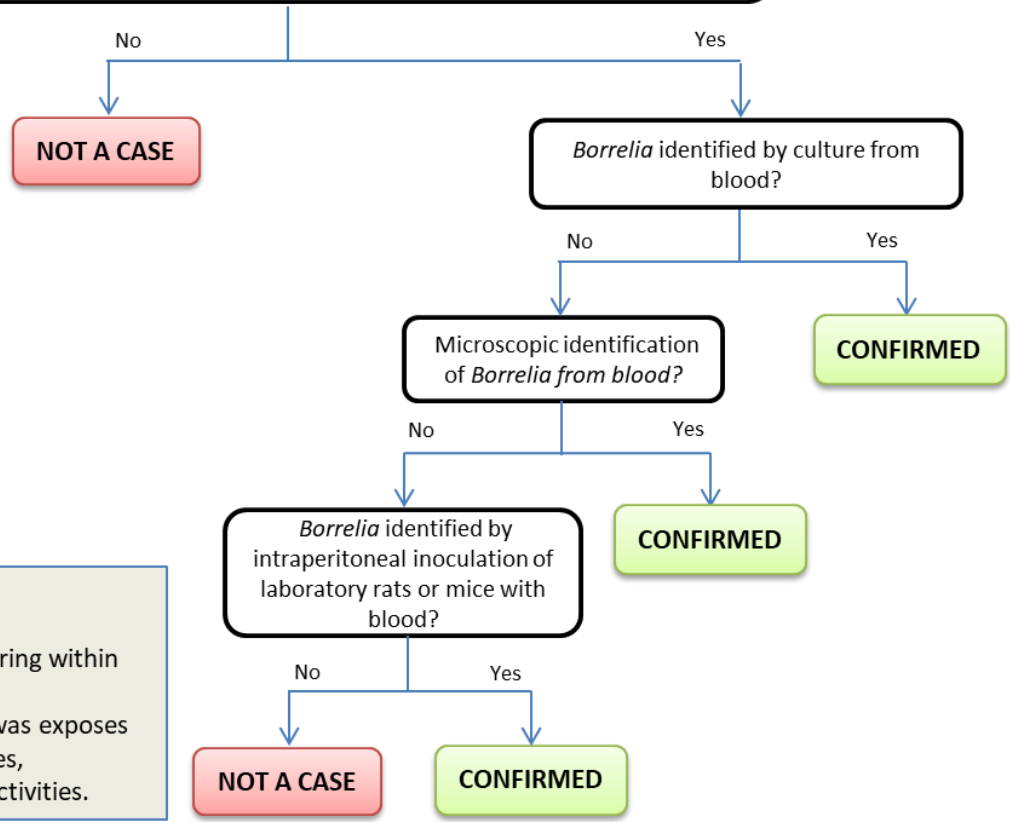
- Serum taken early in infection may be negative, so it is important to take a serum sample during the convalescent period (at least 21 days after symptom onset)
- Additional testing, such as serology or culture, is recommended
- Early antibiotic treatment may limit the antibody response

## Relapsing Fever

(*Borrelia* species)

Common Name: Tick-borne Relapsing Fever (TBRF), Louse-borne Relapsing Fever (LBRF)

**Clinically compatible?**  
 High fever, headache, muscle and joint aches, or nausea. Fever typically lasts 2 to 9 days and alternates with afebrile periods of 2 to 4 days. The total number of relapses varies from a single incident to over ten.



**Critical Reporting Elements:**

- Relevant travel and deployment history occurring within the incubation period.
- Circumstances under which the case patient was exposed including duty exposure, occupational activities, environmental exposures, or other high risk activities.

# Vector Control

- 1. Treat clothing and gear with products containing 0.5% permethrin**
  - Can be used to treat boots, clothing and camping gear, and remain protective through several washes
  - Soldiers with permethrin-treated uniforms were found to have a higher concentration of permethrin in their bodies compared to the general population, but the concentrations were lower than the threshold for toxicity
  
- 2. Use EPA-registered insect repellents containing DEET, picaridin, IR3535, oil of lemon eucalyptus (OLE), para-menthane-diol (PMD), or 2-undecanone**
  - Do not use products containing OLE or PMD on children under 3 years old
  - Use sprays with at least 20% DEET. Any more DEET is not proven to be more successful at preventing ticks
  
- 3. Avoid contact with ticks**
  - Avoid wooded and brushy areas with high grass and leaf litter
  - Walk in the center of trails.
  
- 4. Check yourself and/or your family for ticks after spending time in tick habitat**
  - Put clothing in dryer to kill any ticks (do not wash first)
  - Frequently washing permethrin-treated uniforms will lower the amount of permethrin on the uniform. Replace your uniform if old.

## 1. Vector surveillance

- (Army) Performed by regions and consolidated by APHC (VBD dashboard)

## 2. Source reduction, vegetation control, & habitat modification

- Remove leaf litter
- Clear tall grasses and brush around homes and at the edge of lawns
- Place a 3-ft wide barrier of wood chips or gravel between lawns and wooded areas to restrict tick migration into recreational areas
- Mow the lawn frequently
- Stack wood neatly and in a dry area (discourages rodents)
- Keep playground equipment, decks, and patios away from yard edges and trees
- Discourage unwelcome animals (such as deer, raccoons, and stray dogs) from entering your yard by constructing fences
- Remove old furniture, mattresses, or trash from the yard that may give ticks a place to hide

## 3. Targeting immature and adult ticks

- Insecticide, biological and chemical agents

[Download the CDC's Tick Management Handbook](#)

Choose a Table view

Pathogen

LOCATION FILTERS

Select Region

- (All)
- Atlantic
- Central
- Europe
- Pacific

Select State/Country

(All)

Select Location

(All)

SEASONAL FILTERS

Select Year

- (All)
- 2018
- 2019
- 2020

Select Month

(All)

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INTEGRATED VECTOR-BORNE DISEASE SURVEILLANCE

All Region --- All State/Country --- All

Date Range: All months, All years

**VECTOR DATA**

Mosquito-borne Pathogens

West Nile virus disease	0%
Chikungunya virus disease	0%
DENV	0%
MALARIA	0%

Click the logo to access Region-specific mosquito-borne data in more depth

\*Data sources: PHC-Atlantic, PHC-Europe, PHC-Central

Tick-borne Pathogens

Lyme disease	12%
Anaplasma spp.	2%
Borrelia spp.	2%
Ehrlichia spp.	2%
Babesia spp.	1%
Rickettsia spp.	1%
Tick-borne encephalitis	0%
Crimean-Congo hemorrhagic fever	0%

Click the logo to access Region-specific tick-borne data in more depth

\*Data sources: PHC-Atlantic, PHC-Europe, Miltick

**HUMANS**

Spotted Fever Rickettsiosis	187
Lyme disease	148
Malaria	64
Ehrlichiosis & Anaplasmosis	19
Dengue virus disease	5
Leishmaniasis	5
Arboviral disease	3
Chikungunya virus disease	2
Zika virus disease	2
Trypanosomiasis	1
Typhus Fever	1

Click the logo to view the Armed Forces Reportable Medical Events - Guidelines and Case Definitions

**Running Total of VBD Human Cases**

Disease: Lyme disease

Select Year: (All)

\*Data source: Disease Reporting System Internet (DRSI)

**ANIMALS**

Military Working Animals

Lyme disease	13
Ehrlichiosis	30
Anaplasmosis	2
Leishmaniasis	1

Privately Owned Animals

Ehrlichiosis	213
Lyme disease	209
Anaplasmosis	90
Leishmaniasis	3

Click the logo to access Region-specific zoonotic disease data and case definitions in more depth

\*Data source: Government & Privately-owned Animal Worldwide Surveillance System

<https://carepoint.health.mil/sites/ENTO/VBD>

CAC-enabled, use Google Chrome

Roles and responsibilities are outlined in AFI 48-102 Air Force Medical Entomology Program, and AFMAN 48-105

- Provide consultation to the PH workforce worldwide
  - Any issues, surveillance inquiries, medical zoology, living hazards, risk assessments
  - Laboratory provides analyses of arthropod samples (except PACAF has their own lab)
- Evaluate new methods and technologies for PH for use in the field
- Conduct training and provide informational resources
- Provide support for pest management related EOH concerns

## Contact Information

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<https://kx.health.mil/kj/kx7/PublicHealth/Pages/content.aspx#/Comm/Ento>



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