



# MICHIGAN TRENDS IN TICKBORNE DISEASE 2016-2020



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- Tick Bite Prevention
- Tick Identification
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# ***Ixodes scapularis***

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**Blacklegged tick**



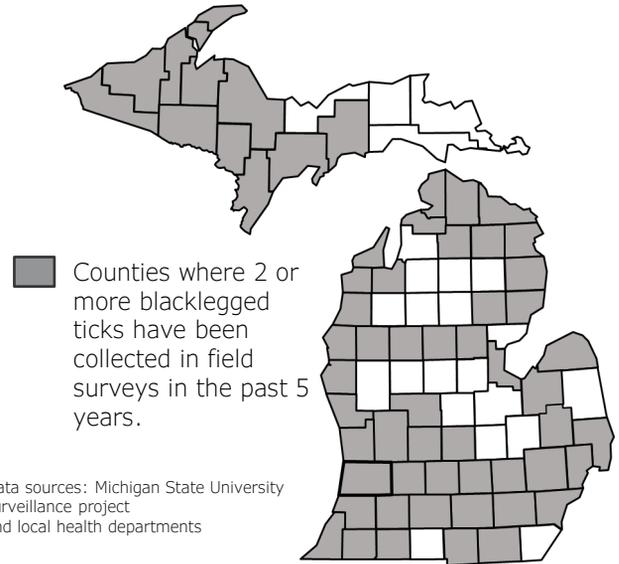
Adult female blacklegged tick. [Lennart Tange](#)



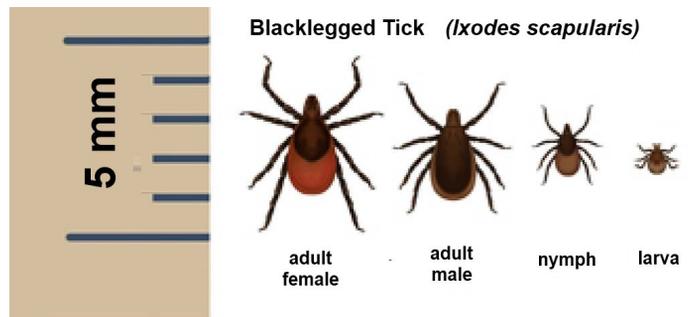
# The Blacklegged Tick (*Ixodes scapularis*)

- *Ixodes scapularis* (blacklegged tick) is the second most commonly encountered tick in Michigan, and can now be found in most parts of the upper and lower peninsulas.
- The blacklegged tick is small, which means that they can sometimes escape notice.
- In Michigan, blacklegged ticks are active anytime outdoor temperatures are above 40° F.

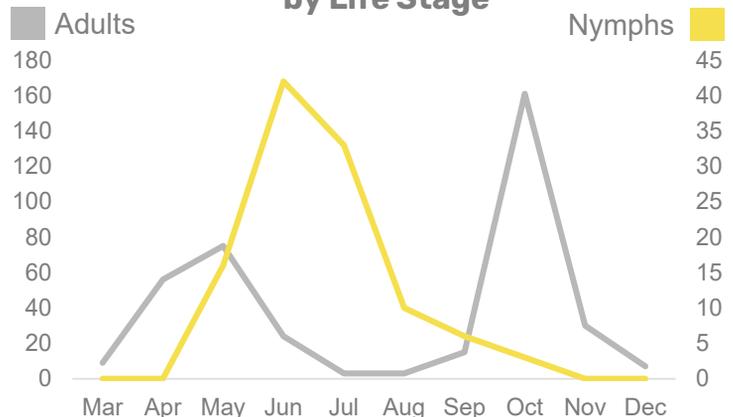
## Distribution in Michigan



## Size and Appearance



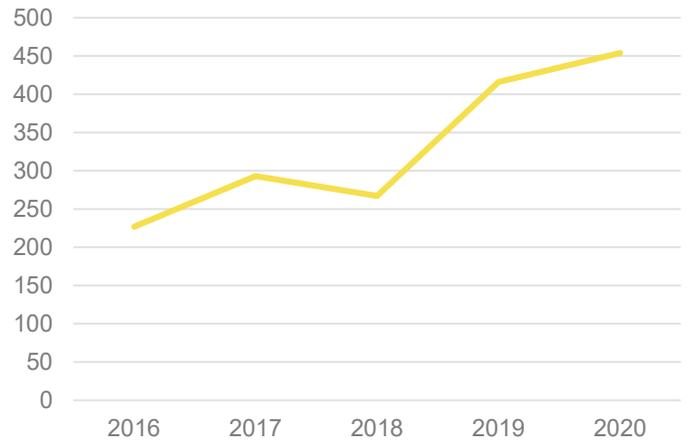
## Typical Monthly Blacklegged Tick Submissions, by Life Stage



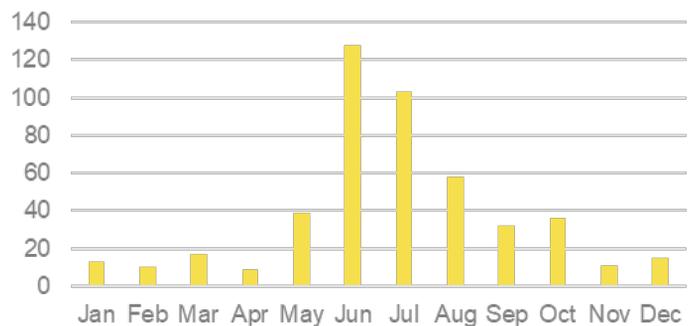
# LYME DISEASE

- Lyme disease is the most common vector-borne disease in Michigan.
- Lyme disease is spread to people by the bite of an infected blacklegged tick, *Ixodes scapularis*.
- Reported cases in Michigan have increased over time, as tick populations have spread across the state.
- People who spend time outdoors in wooded areas are the most at risk.
- Common early symptoms include a bull's-eye rash (erythema migrans), fever, chills, and muscular pain.
- If left untreated, later stage symptoms such as arthritis and Bell's palsy may appear weeks later.

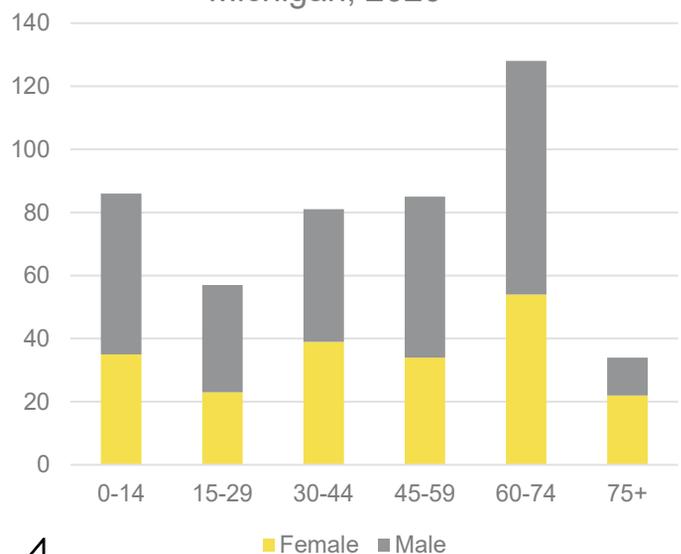
Annual Human Lyme Disease Cases, Michigan, 2016-2020



Reported Lyme Disease Cases in Michigan, 2020

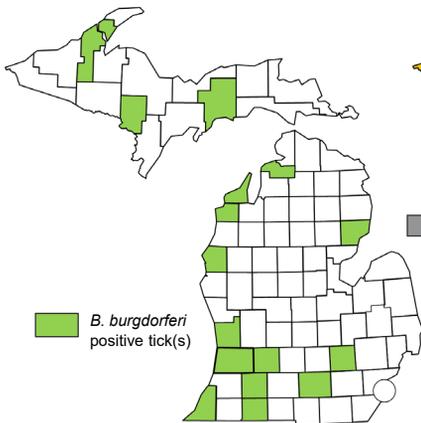


Lyme Disease Cases by Age and Sex, Michigan, 2020



# Lyme Disease Risk Map

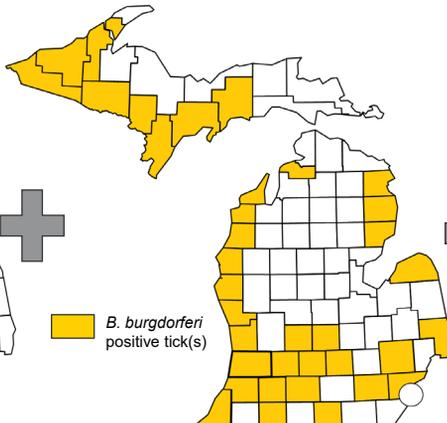
***B. burgdorferi*-positive tick submissions\*, 2017-2019**



*B. burgdorferi* positive tick(s)

\* County as reported by submitter

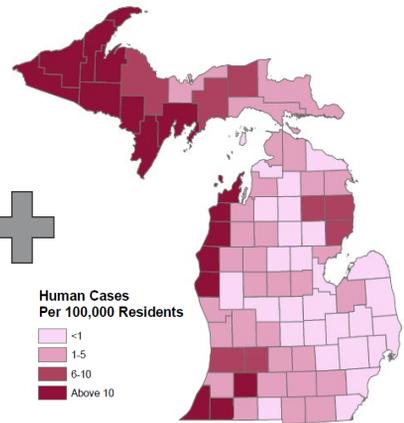
***B. burgdorferi*-infected ticks from tick drags, 2017-2019**



*B. burgdorferi* positive tick(s)

Data sources: Michigan State University surveillance project and local health departments

**Human Lyme Disease Cases, 2016-2020**



Human Cases Per 100,000 Residents

<1  
1-5  
6-10  
Above 10

## 2021 Michigan Lyme Disease Risk Map



County with known risk for Lyme Disease

- At least 2 confirmed local exposures, and/or
- Blacklegged ticks with Lyme bacteria

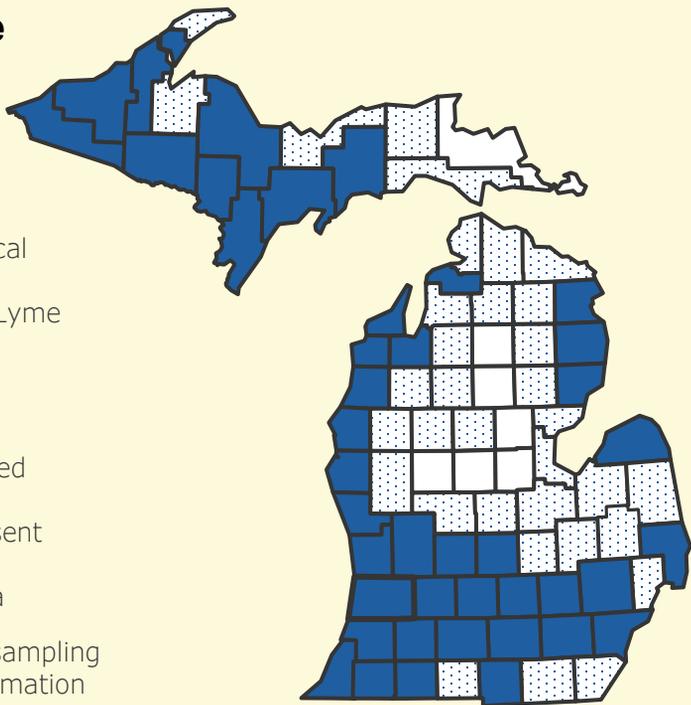


County with potential risk for Lyme disease

- Adjacent to a confirmed county and/or
- Blacklegged ticks present but not infected with Lyme disease bacteria



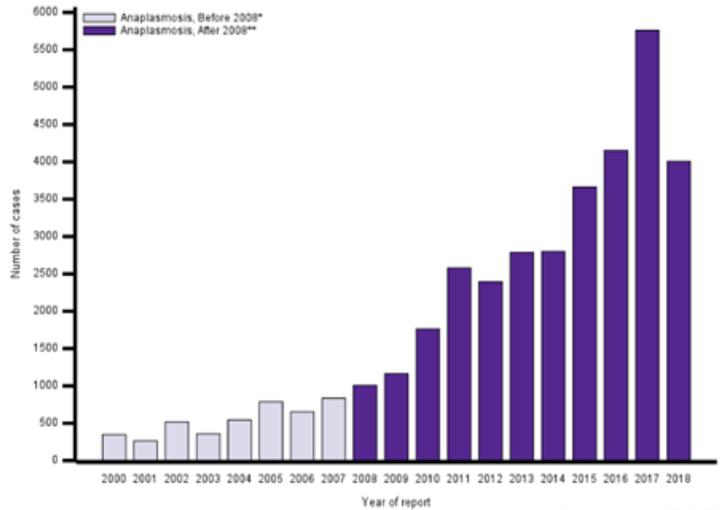
County with negative tick sampling information or lacking information



# ANAPLASMA

- The bacterium *Anaplasma phagocytophilum* causes a disease called anaplasmosis.
- Spread to people through the bite of infected *Ixodes scapularis* (blacklegged tick) in Michigan.
- First recognized as human disease in mid-1990's, nationally reportable disease in 1999.
- Reported cases have steadily increased in the U.S.
- The case fatality rate for anaplasmosis is low, at less than 1%.
- Seasonality of cases primarily linked to the peak in nymphal (immature) tick activity.
- An emerging disease risk in Michigan, tied to the emergence and spread of *Ixodes scapularis* ticks.

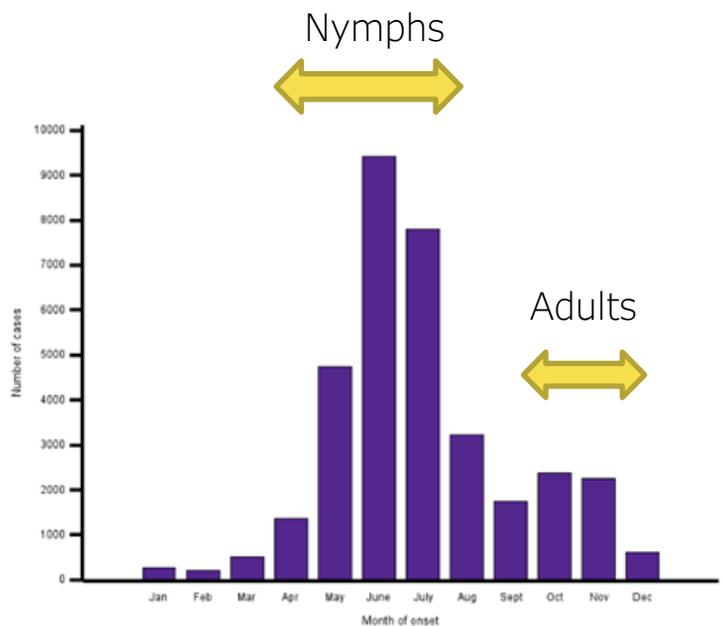
## Human Anaplasmosis Case Trends in the U.S.



Source: CDC

Human cases are increasing in the U.S.

## Seasonality



Seasonality most closely tied to blacklegged nymphal activity

Source: CDC

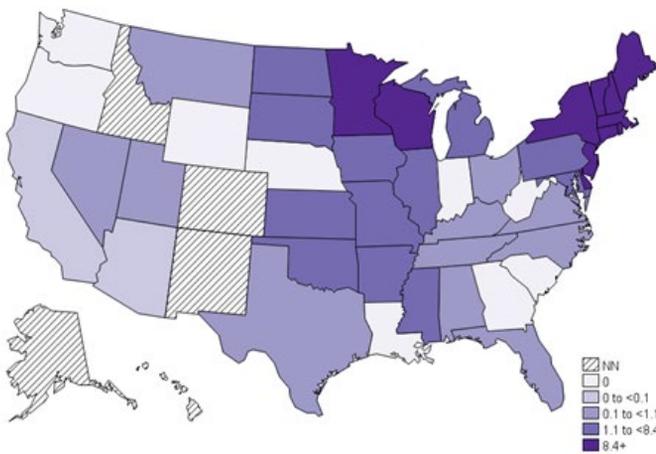
# Anaplasmosis Risk-U.S.

## Vector tick distribution



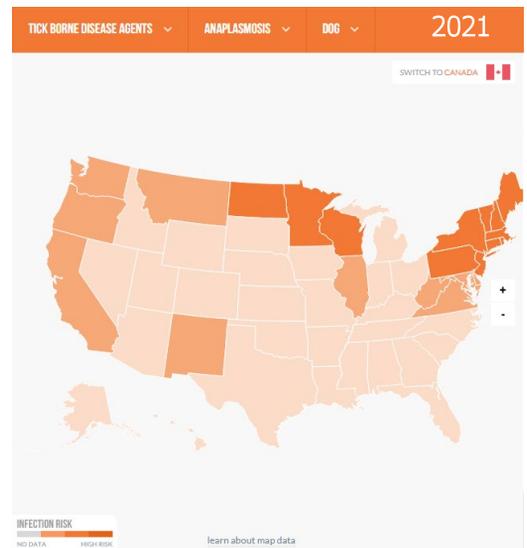
Source: CDC

## Prevalence of Anaplasmosis Cases-human and canine



Annual Reported human incidence (per million),  
Anaplasmosis, 2018

[CDC: Anaplasmosis](#)



[Companion Animal Parasite Council](#)

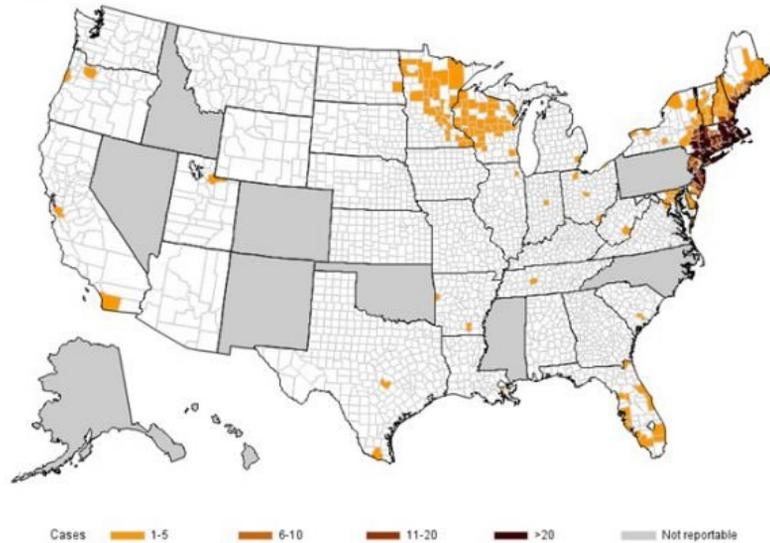
- Geographic distribution of human and animal cases in the U.S. align with presence of *I. scapularis* and *I. pacificus*.
- Eight states (VT, MA, RI, MN, MA, WI, NH, NY) account for 9 in 10 of all reported cases of anaplasmosis.



# BABESIA

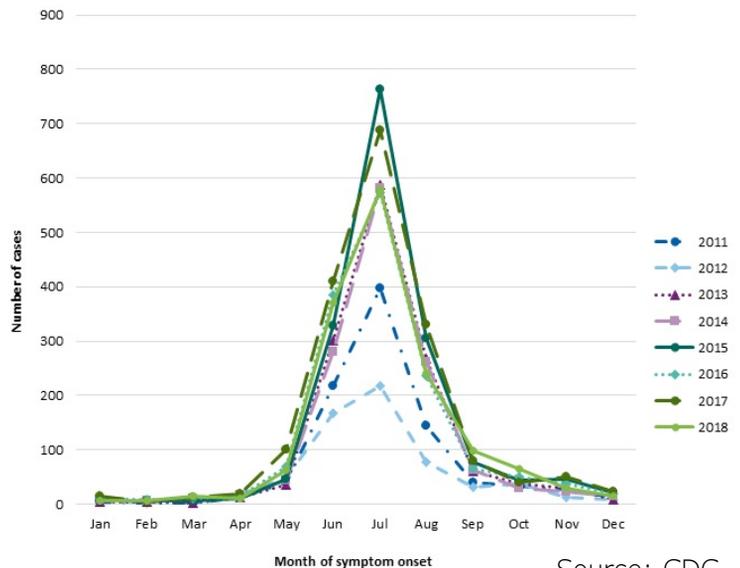
- ☼ The protozoal parasite *Babesia microti* (and a few other related species) infects red blood cells and causes the disease babesiosis.
- ☼ It is an emerging zoonotic disease with various wildlife hosts as reservoir species.
- ☼ Usually transmitted through bites from infected *Ixodes scapularis* (blacklegged) ticks; other modes include transfusion-associated and congenital (rare) infection.
- ☼ It is the most common blood transfusion-associated parasite (no tests have yet been licensed to screen asymptomatic blood donors).
- ☼ Seasonality of cases primarily linked to the peak in nymphal (immature) tick activity.

## Reported cases of babesiosis by county of residence, 2018



Source: CDC

## Seasonality



Source: CDC

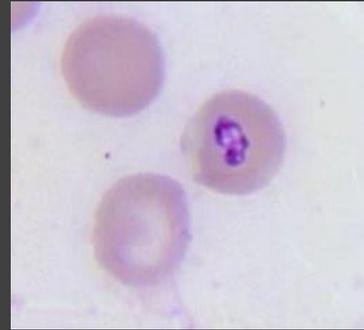
Babesiosis is a nationally notifiable condition and reportable in 40 states, including Michigan. Cases should be reported using the Babesiosis specific case investigation form in the Michigan Disease Surveillance System (MDSS). The national case definition can be found at: [Babesiosis | 2011 Case Definition \(cdc.gov\)](https://www.cdc.gov/babesiosis/case-definition).

# BABESIOSIS

- ☼ Symptoms may be flu-like (see box).
- ☼ Some people who are infected feel fine and do not have any symptoms.
- ☼ Babesiosis may also cause hemolytic anemia.
- ☼ Babesiosis can be severe and life-threatening in people who are elderly, have a weak immune system, have chronic health conditions, or do not have a spleen.
- ☼ Babesiosis cases are rare in Michigan and often associated with travel to endemic areas.

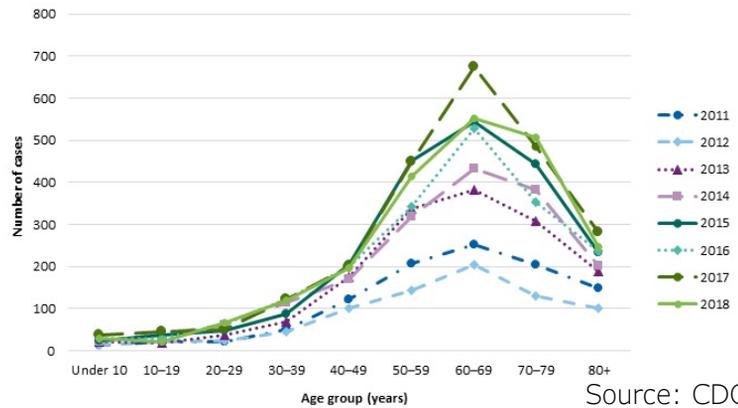
## Symptoms of Babesiosis

- 🕒 Fever (may come and go)
- 🕒 Chills and sweats
- 🕒 Headache
- 🕒 Body ache
- 🕒 Nausea
- 🕒 Fatigue



Blood smear showing larger trophic stage of *Babesia microti* in erythrocyte.  
CDC/Dr. George Healy

## Age Distribution



Source: CDC

YEAR	Confirmed and Probable Human Cases of Babesiosis, Michigan
2016	3
2017	3
2018	2
2019	1
2020	1
<b>TOTAL</b>	<b>10</b>

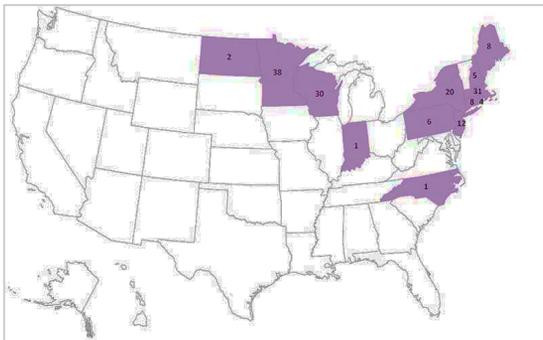
## Notable Michigan babesiosis cases

- 2015: Blood transfusion-acquired case; donor resided in a Babesia-endemic state
- 2017: an unusual infection of *Babesia divergens*-like (MO-1) was diagnosed by examination of a blood smear from a Michigan resident who had no spleen

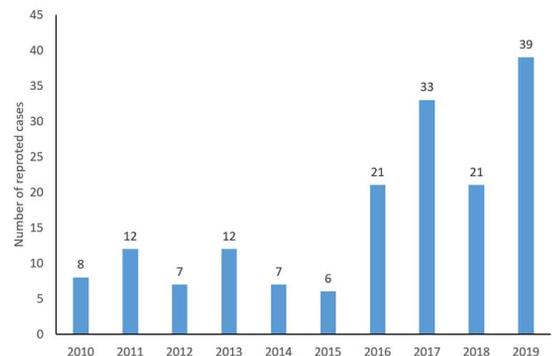
# POWASSAN VIRUS

- ☼ Rare but often severe disease spread by the bite of an infected *Ixodes* species tick.
- ☼ A member of the tick-borne encephalitis group of flaviviruses.
  - Two related lineages; Powassan virus (POWV) and deer tick virus (DTV)
  - Have different vectors/reservoir hosts in North America
    - POWV: *Ixodes cookei*/groundhog and striped skunk
    - DTV: *Ixodes scapularis*/white-footed mouse
  - Can only be differentiated by genetic sequence analysis.
- ☼ Cases are increasing in recent years (see graph)
- ☼ Most cases occur in the late spring through mid-fall, reflecting *Ixodes sp.* tick activity.
- ☼ Initial symptoms include fever, headache, vomiting, weakness which may progress to confusion, loss of coordination, trouble speaking and seizures.
- ☼ Requires specialized testing (not part of routine arbovirus PCR or serologic panels).
- ☼ Reportable condition in Michigan.
- ☼ Most recent case of Powassan virus infection in a Michigan resident was in 2001.

Powassan virus neuroinvasive disease by state, 2010-2019



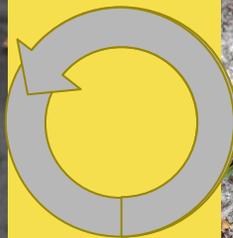
Powassan virus neuroinvasive disease by year, 2010-2019



Source: CDC



CDC: nymphal blacklegged tick



CDC: white-footed mouse

# Other Tickborne Bacterial Pathogens

## *Ehrlichia muris eauclairensis*

- First human cases discovered in 2009 in Wisconsin and Minnesota.
- Considered an emerging zoonotic tick-borne disease in the Upper Midwest.
- Has been detected in *Ixodes scapularis* ticks in WI, MN; ecologic studies are ongoing.
- Symptoms may include fever, headache, malaise, myalgia, GI signs, altered mental status, rash (more common in children).
- First identified in a Michigan patient in 2013. While it was not confirmed that the patient was exposed in Michigan, evidence points to significant tick exposure locally in the Upper Peninsula.
- Early recognition and treatment with doxycycline can prevent death and severe illness.
- Definitive diagnosis requires specialized testing, Mayo Clinic Laboratories has developed a PCR assay to detect *E. muris eauclairensis*.
- *E. muris eauclairensis* is reportable in Michigan, under "Ehrlichiosis, Anaplasmosis Undetermined" in the MDSS System (Ehrlichia Chaffeensis Infection | Ehrlichiosis and Anaplasmosis | 2008 Case Definition)

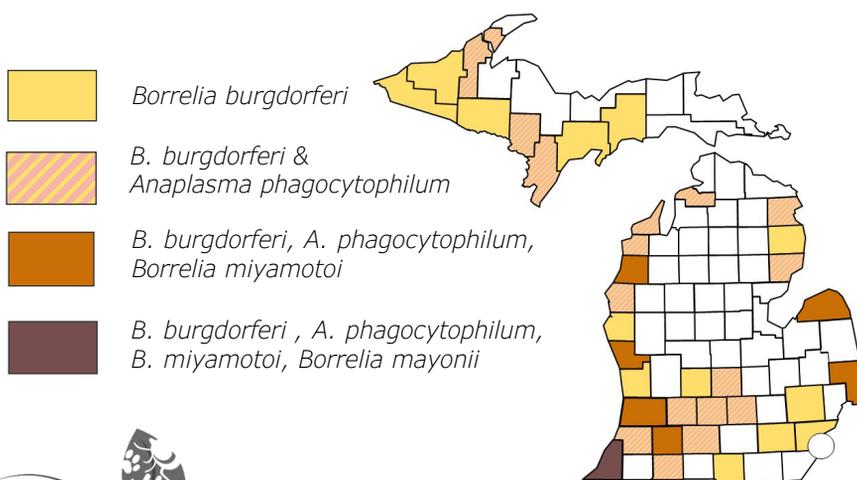
## *Borrelia mayonii*

- Another *Borrelia* species known to cause Lyme disease in North America.
- In 2019, 2 of 38 host-seeking blacklegged ticks collected in Berrien County Michigan tested positive for *B. mayonii*.

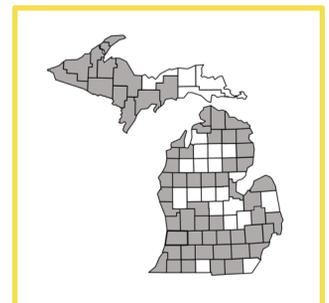
## *Borrelia miyamotoi*

- Most closely related to bacteria that cause tickborne relapsing fever, more research is needed to understand role in human illness.
- Causes fever, chills, headache, myalgia and arthralgia
- Has been detected in a small number of blacklegged ticks in Michigan (see below)

### Michigan Counties with Pathogen Positive Blacklegged Ticks, 2017-2019\*



Distribution mirrors *Ixodes scapularis* tick presence



\*Host-seeking ticks are collected by dragging. Uncolored counties may not have been sampled. Map reflects pathogen presence only, not prevalence. To date, *Babesia microti* has not been detected.

# ***Dermacentor variabilis***

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**American dog tick**



Adult female American dog tick, [Dann Thombs](#)



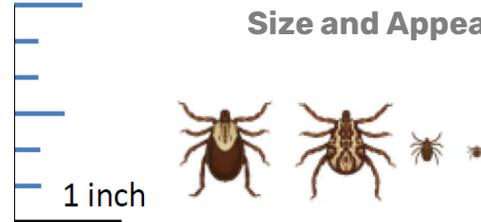
# The American Dog Tick (*Dermacentor variabilis*)

- *Dermacentor variabilis* (American dog tick) is the most commonly encountered tick in Michigan and can be found throughout the state.
- Adult American dog ticks bite humans and pets, but very rarely transmit disease.
- In Michigan, adult American dog ticks are commonly found in the spring and summer months (April-August). Adults are the only life stage normally encountered by humans.

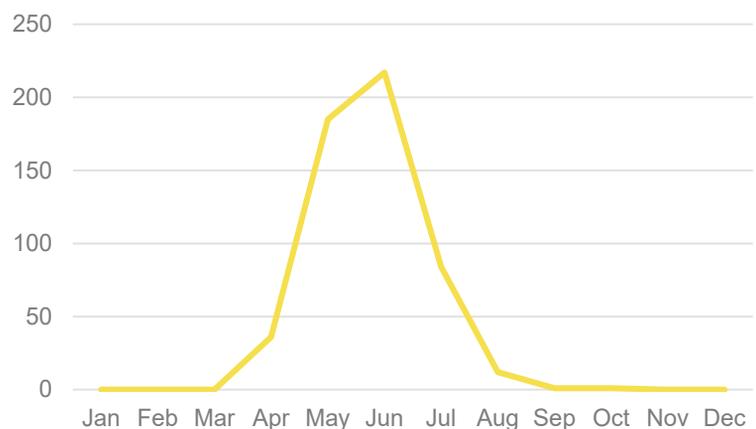
## Distribution in Michigan



## Size and Appearance



## Typical Monthly American Dog Tick Submissions

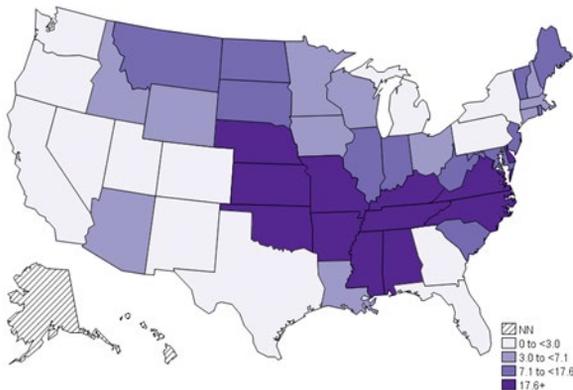


# Rocky Mountain Spotted Fever (RMSF)/ Spotted Fever Rickettsioses (SFR) Group

American dog tick  
(*Dermacentor variabilis*) in  
Eastern, Central  
and Western  
U.S.



Rocky Mountain  
wood tick  
(*Dermacentor andersoni*) in  
the Rocky  
Mountain states



Annual incidence  
(per million  
persons)  
for  
SFR in the  
U.S., 2018

Source: CDC

YEAR	Confirmed and Probable Human Cases of RMSF/SFR, Michigan
2016	12
2017	13
2018	16
2019	10
2020*	3
<b>TOTAL</b>	<b>54</b>

- RMSF is one of the deadliest tickborne diseases in the U.S., caused by *Rickettsia rickettsia*.
- SFR includes *R. rickettsia*, *R. parkeri*, Pacific Coast tick fever, and rickettsialpox.
  - Common serologic tests cannot distinguish them.
- Transmitted by several tick species, depending on location (maps on left).
- The brown dog tick (*Rhipicephalus sanguineus*) spreads RMSF in the Southwest U.S.
- Can be rapidly fatal if not treated with antibiotics (doxycycline) within 5 days of symptom onset.
- Early treatment is critical to survival and should be initiated based on clinical signs and patient history. Do not delay for lab results or a negative test on initial specimens.
- Five states (NC, OK, AR, TN, MO) account for >60% of RMSF cases.
- Locally acquired cases of RMSF are rare in Michigan, despite the common presence of the dog ticks, *Dermacentor variabilis*.
  - Includes the death of a child from Cass County in 2000.
  - Of 5 confirmed RMSF/SFR cases from 2016-2020, 2 had tick exposures in Michigan.

\* In 2020, the [CSTE Case Definition for Spotted Fever Rickettsiosis](#) was updated. Previous probable cases now more likely to be categorized as suspect.

# Emerging tick species

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***Amblyomma americanum*** (Lone star tick)  
and  
***Haemaphysalis longicornis***  
(Asian longhorned tick)



***Amblyomma americanum***



***Haemaphysalis longicornis***  
James Gathany, CDC PHIL

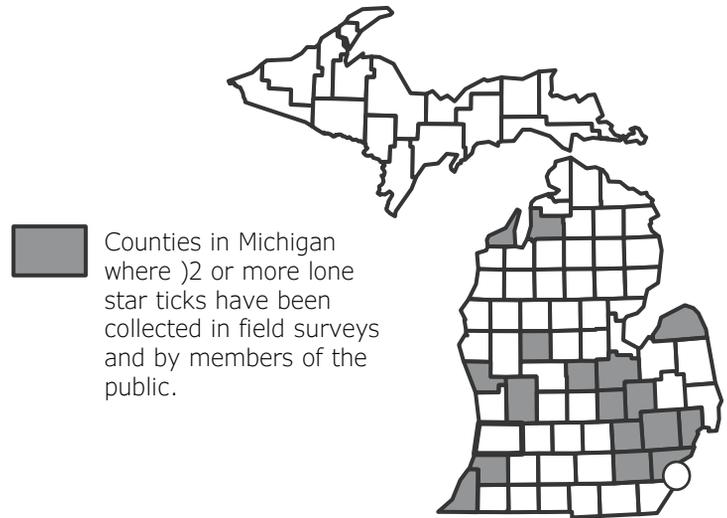


# *Amblyomma americanum* (Lone star tick)

- Aggressive, generalist feeder.
- Hides in leaf litter and can pursue hosts for short distances instead of waiting for hosts to pass by.
- Geographic range is across the south and eastern US, has recently expanded into the southwest corner of Michigan.
- Can transmit ehrlichiosis\*, tularemia, Bourbon virus, Heartland virus and southern tick-associated rash illness (STARI).
- Bites may be associated with alpha-gal syndrome (also known as red meat allergy).

\*More information about ehrlichiosis can be found on pages 26.

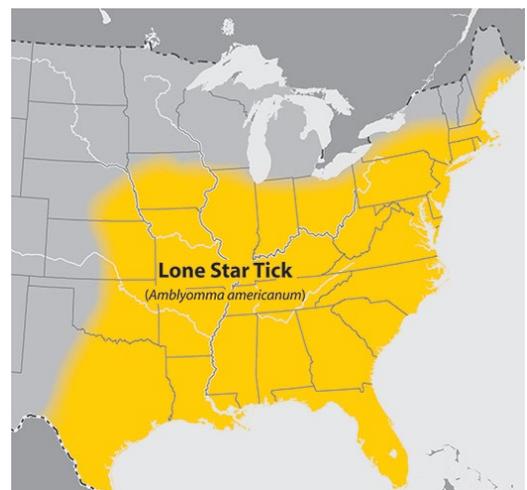
## Distribution in Michigan, 2017-2020



## Size and Appearance



## Distribution in the U.S, 2011



# Alpha-gal Syndrome (AGS)

also known as red meat allergy

## What is alpha-gal?

- Alpha-gal (full name: galactose- $\alpha$ -1,3-galactose) is a sugar molecule found in most mammals and products made from mammals
- **Not** normally found in fish, reptiles, birds, or humans

## What is AGS?

- A serious, potentially life-threatening allergic reaction that may occur after a person eats red meat or is exposed to products containing alpha-gal
- AGS may be triggered by the bite of a lone star tick – but more research is needed to understand why
- Most cases reported to date are among people living in the southeastern US
- Diagnosed by an allergist or other knowledgeable healthcare provider

## What are some symptoms of AGS?

- Rash, hives
- Nausea, vomiting, stomach pain
- Difficulty breathing
- Drop in blood pressure
- Dizziness, faintness
- Symptoms commonly appear 3-6 hours after a person eats red meat or is exposed to products containing alpha-gal
- Differ from person-to-person
- AGS may recede over time in some people



↑ Rash and hives that may appear after a patient with AGS is exposed to or consumes products containing alpha-gal

Source: CDC



# *Haemaphysalis longicornis* (Asian longhorned tick)



↑ Appearance and relative size of nymphal (left) and adult female (right) Asian longhorned ticks  
Source: CDC

- Invasive species first found in the US in 2017
- As of Oct. 2020, has been found in 15 states, but NOT in Michigan
- Females can reproduce without mating, so populations can grow *fast*
- Generalist feeder

## What you should do if you think you found an Asian longhorned tick

1. Remove tick(s) from people and animals as quickly as possible.
  - See [page 21](#) for instructions on how to remove ticks safely.
2. Save the tick(s) in in a small clean sealable container.
3. Contact MDHHS EZID to verify tick identification.
  - See [page 22](#) for instructions on sending ticks to MDHHS EZID for identification

# Resources

- **Tick Bite Prevention**
- **Tick Identification**
- **Diagnostic Testing for Tickborne Disease**
- **Treatment for Tickborne Rickettsial Diseases**
- **Provider Fact Sheets**
  - Lyme Disease
  - Anaplasmosis / Ehrlichiosis
  - Rocky Mountain Spotted Fever (and Spotted Fever Rickettsiosis)

# Tick Bite Prevention

## Be aware of your surroundings!

- People and pets most often encounter ticks in shady, moist wooded and grassy areas and fields near wooded areas
- Ticks are most active in Michigan April-September, but can be active when outdoor temperatures are at least 40°F
- Ticks are rarely encountered indoors unless brought inside on a person's clothing or by a pet

## Take precautions before visiting areas with ticks

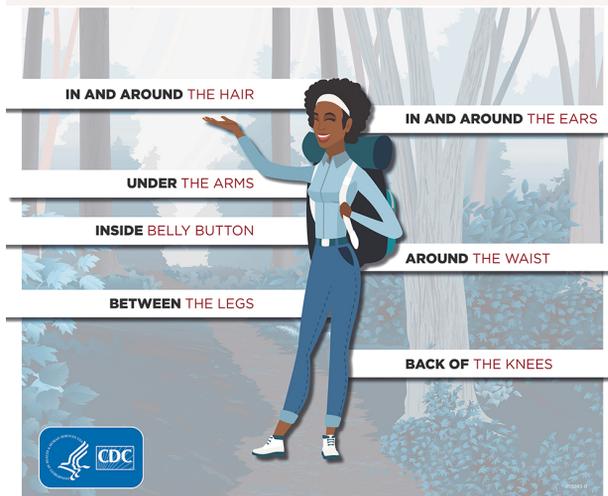
- Apply EPA-registered insect repellent to skin or clothing according to the label's instructions
- Walk in the center of trails and avoid walking in areas with tall grass and brush
- Check yourself and pets all over for ticks after spending time outdoors
- Talk to your vet about tick bite prevention products for your pets

## Tick Removal

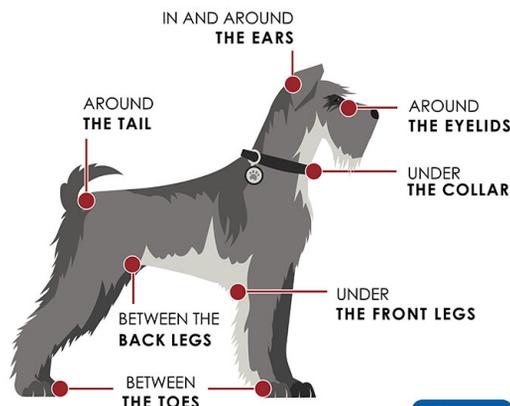
1. With fine-tipped tweezers or a tick removal key, grasp the tick as close to the skin as possible.
2. Slowly and firmly pull the tick straight out. Do not twist, spin, or jerk the tick.
  - The tick's mouthparts may remain in the skin. If the mouthparts cannot be removed easily, leave the bite site alone to heal.
3. Wash the bite site and your hands with soap and water, then apply an antiseptic to the bite site
4. Save the tick in a small, clean sealable container for later identification.

Check your clothing and body for ticks after being outdoors in grassy, brushy, or wooded areas where ticks live!

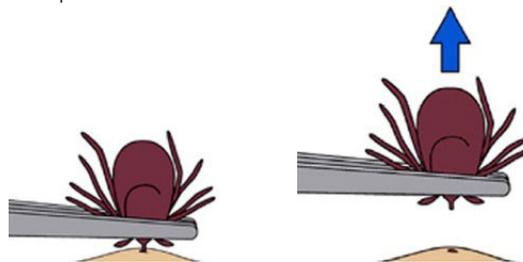
CHECK THESE PARTS OF YOUR BODY AND YOUR CHILD'S BODY FOR TICKS:



## WHERE TO CHECK YOUR PET FOR TICKS



↑ Conduct a full-body check for ticks after spending time outdoors. Ticks can attach anywhere on the body but tend to prefer the locations indicated above.



↑ With tweezers or tick removal key, grab an attached tick as close to your skin as possible, then slowly and firmly pull straight up to remove the tick.

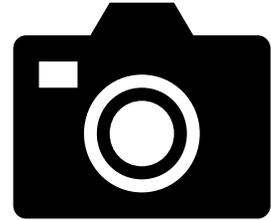
# Tick Identification

MDHHS EZID offers tick identification free of charge to Michigan residents and visitors



*via specimens mailed to us*

OR



*via photos sent over e-mail*

1. Place the tick in a clean, small, sealable container (e.g., an old pill bottle).
2. Print and complete the [Tick Identification Form](#).
3. Mail the container with the tick along with the identification form in a padded envelope to:

Michigan Department of Health and Human Services  
EZID Section  
333 S Grand Avenue, 3rd Floor  
PO Box 30195  
Lansing, Michigan 48933

4. On the outside of the envelope write "FRAGILE" or "HANDLE WITH CARE" to help prevent damage to the package when shipped.

Tick submission kits may also be available from your local health department.

1. Place the tick on a well-lit background.
2. Take a picture as close to the tick as possible, making sure the picture is not blurry.
3. Flip the tick over. Take a picture of this side of the tick like in step 2.
4. Email the two pictures and information about when and where you likely encountered the tick to:

[MDHHS-Bugs@michigan.gov](mailto:MDHHS-Bugs@michigan.gov)

**GOT A TICK?  
SUBMIT A PIC!**

Click here for more information on picture ID



# Diagnostic Testing for Tickborne Disease (TBD)

## \*Healthcare Provider Awareness\*

Healthcare providers in Michigan should be aware of the potential for a variety of tick-borne illnesses in people with or without a travel history.

### Molecular Assays

- Detect pathogens in whole blood, serum, CSF, and other specimens.
- A variety of commercial laboratories provide FDA approved assays
- The MDHHS Bureau of Laboratories offers a [Rickettsia RT-PCR assay](#) for whole blood
- [Mayo Clinic Laboratories](#) has specialized assays for several emerging TBD pathogens including *E. muris euclariensis*, *B. mayonii* and *B. miyamotoi*,
- The Centers for Disease Control and Prevention can also offer [specialized diagnostic testing](#) for emerging pathogens. Physicians with suspect cases of an emerging TBD can contact MDHHS at 517-355-8165 to discuss options for diagnostic testing at CDC.

### Serology (antibody detection):

#### Anaplasmosis, ehrlichiosis, RMSF

- Demonstration of a four-fold rise in IgG specific antibodies in specimens collected 2-4 weeks apart.
  - Antibodies can frequently be negative in the first 7-10 days and cannot be relied upon for confirmation

#### Lyme Disease

- The MDHHS Bureau of Laboratories offers CDC-recommended two-step [Lyme Antibody assays](#).

#### Powassan virus

- Detection of IgM antibodies in CSF.
- Limited availability through commercial laboratories or the CDC.
- Physicians with suspect cases of Powassan virus can contact MDHHS at 517-355-8165 to discuss options for diagnostic testing at CDC.



# Treatment for Tickborne Rickettsial Diseases



- ✓ Doxycycline is the recommended antibiotic treatment for all suspected rickettsial diseases (RMSF/SFR, anaplasmosis, ehrlichiosis) in adults and children of all ages.
- ✓ Doxycycline is most effective at preventing severe complications from developing if it is started early in the course of disease.
- ✓ Early treatment saves lives.

**Doxycycline**  
saves lives!



Click to learn more.

## Early-stage RMSF



## Later-stage RMSF

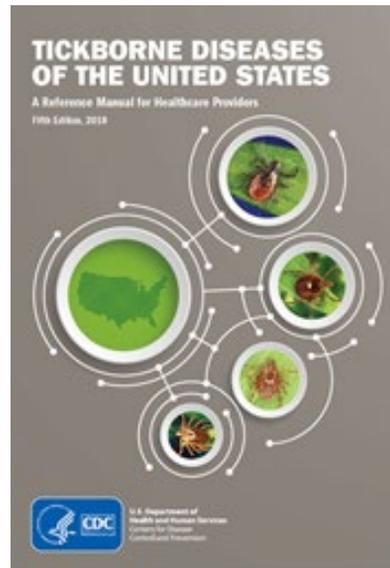


TABLE 3. Recommended treatment for tickborne rickettsial diseases

Age category	Drug	Dosage	Maximum	Duration
Adults*	Doxycycline	100 mg twice per day, orally or IV	100 mg per dose	At least 3 days after fever subsides and until evidence of clinical improvement is noted; minimum treatment course of 5–7 days <sup>†</sup>
Children weighing <100 lbs (45 kg)	Doxycycline	2.2 mg/kg of body weight per dose twice per day, orally or IV	100 mg per dose	

Source: CDC, Division of Vector-Borne Diseases. Tickborne diseases of the United States, a reference manual for health care providers. 3rd ed. Atlanta, GA: US Department of Health and Human Services, CDC; 2015. <http://www.cdc.gov/lyme/resources/tickbornediseases.pdf>

Abbreviation: IV = intravenously.

\* Guidance is available for the treatment of suspected tickborne rickettsial disease during pregnancy (see Pregnancy and Lactation).

<sup>†</sup> Treatment for patients with anaplasmosis should be extended to 10 days if concurrent Lyme disease is suspected, or alternatively, another antimicrobial with efficacy against *Borrelia burgdorferi* should be included.

# Lyme Disease

## Healthcare Provider Factsheet

abridged from IDSA & CDC



### Symptoms

- Incubation period: 3-30 days after a bite from an infected blacklegged tick
- Early localized symptoms may include erythema migrans (EM), flu-like symptoms, lymphadenopathy
- Later disseminated symptoms may include multiple secondary rashes, Bell's palsy, arthritis, carditis, and more

↑ "Bulls-eye" form of EM (top) and dark purple lesion form of EM (bottom)  
Source: CDC

### Diagnosis

- Two-step testing of symptomatic patients is recommended
- Cases with erythema migrans can be diagnosed clinically and treated without waiting on laboratory testing
  - When a clinical diagnosis is made, the case must be reported to the local health department directly



### Treatment

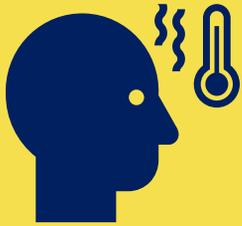
- Early localized Lyme disease may be treated with twice-daily oral doxycycline for 10-21 days in the following recommended dosages:
  - Adults: 100 mg
  - Children – 4.4 mg/kg body weight, maximum 100 mg/dose
- Later disseminated Lyme disease may require longer treatment (up to 28 days)



# Anaplasmosis/Ehrlichiosis Healthcare Provider Factsheet

abridged from CDC.gov

## Symptoms



- Incubation period: 5-14 days after bite from an infected tick
- Early illness (1-5 days): fever/chills, headache, myalgia, gastrointestinal symptoms, rash (ehrlichiosis)
- Late illness (delayed treatment, very young or older age, immune suppressed): respiratory/organ failure, coagulopathies, death

## Diagnosis

- Consider tickborne disease in patients with non-specific febrile illness in spring and summer when ticks are active
- Base on clinical signs & symptoms, then later confirm with laboratory tests
- Treatment should never be delayed or withheld pending laboratory results



## Treatment



- Doxycycline is first line treatment for patients of all ages
- Recommended dosages:
  - Adults – 100 mg every 12 hours
  - Children < 45 kg (100 lbs) – 2.2 mg/kg body weight given 2x/day
- Duration: 10-14 days



The guide for diagnosing and treating ehrlichiosis and anaplasmosis may be read in its entirety at:  
<https://www.cdc.gov/mmwr/volumes/65/rr/pdfs/rr6502.pdf>

# Rocky Mountain Spotted Fever/ Spotted Fever Rickettsiosis (RMSF/SFGR) Healthcare Provider Factsheet

abridged from CDC.gov

## Symptoms

- Incubation period: 3-12 days after a bite from an infected tick
- Early illness (days 1-4) may include: fever, headache, GI symptoms, rash and more
- Late/severe illness (day 5+; children <10, people with G6PD deficiency) may include: multiorgan system damage, necrosis, respiratory compromise, altered mental status

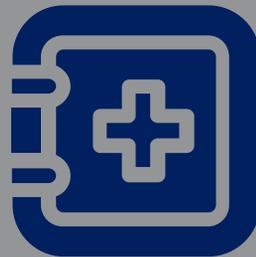


↑ Examples of early (top) and late (bottom) stage rashes

Source: CDC

## Diagnosis

- RMSF can be rapidly fatal if not treated within the first 5 days of symptoms
- Base on clinical signs & symptoms, then later confirm with laboratory tests
- Treatment should never be delayed or withheld pending laboratory results



## Treatment

- Doxycycline is first line treatment for patients of all ages
- Recommended dosages:
  - Adults – 100 mg every 12 hours
  - Children < 45 kg (100 lbs) – 2.2 mg/kg body weight given 2x/day
- Duration: at least 5-7 days



The guide for diagnosing and treating RMSF may be read in its entirety at: <https://www.cdc.gov/mmwr/volumes/65/rr/pdfs/rr6502.pdf>

# More Tools and Resources

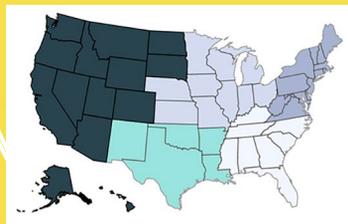
## Websites:

- [EPA: Find the Repellent that is Right for You](#)
- [Consumer Reports Insect Repellent Buying Guide](#)
- [TickEncounter: Is it is Tick?](#)
- [MDHHS Michigan Disease Mapper](#)
- [MDHHS MiTracking Data Portal: Ticks reported in Michigan by year](#)

## Apps:



[The Tick App](#)



[CDC Tick bite data tracker](#)



"If you seek a pleasant peninsula, look about you."