WISCONSIN DEPARTMENT of HEALTH SERVICES

Lyme Disease Diagnostics and Reporting

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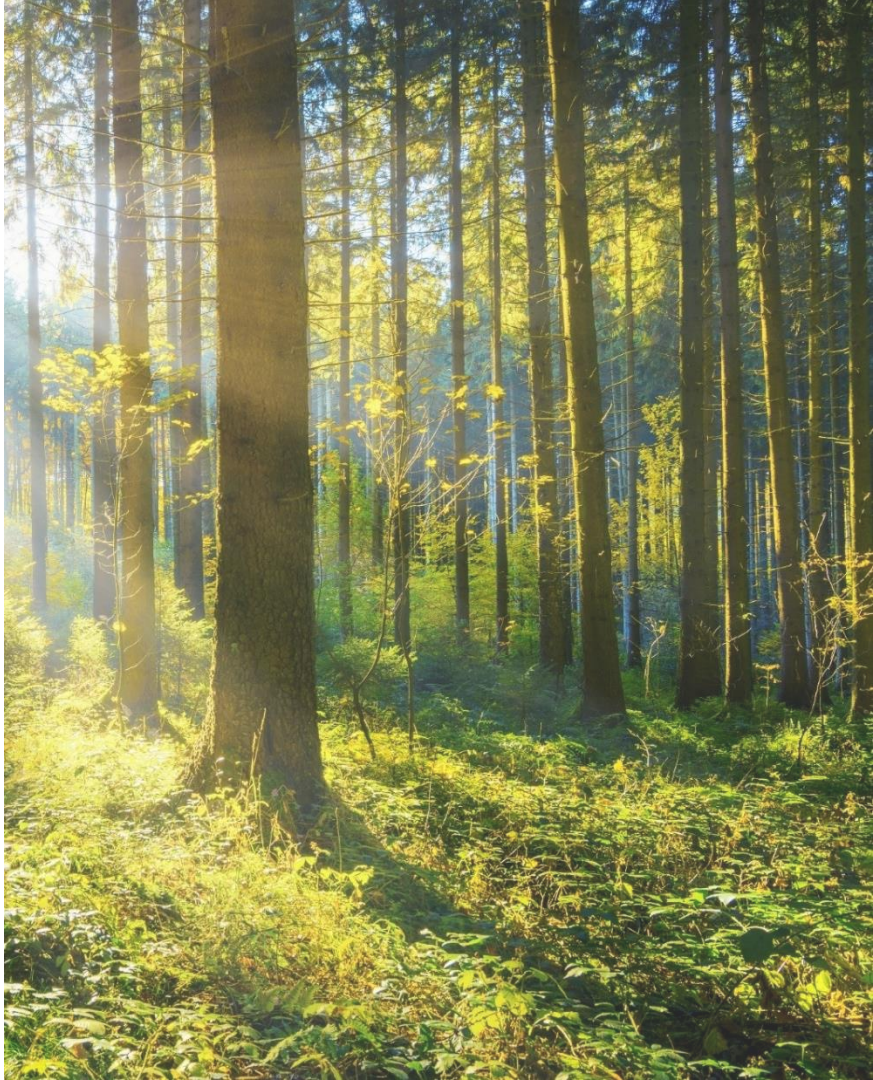
Vectorborne Disease Epidemiologist
May 27, 2026



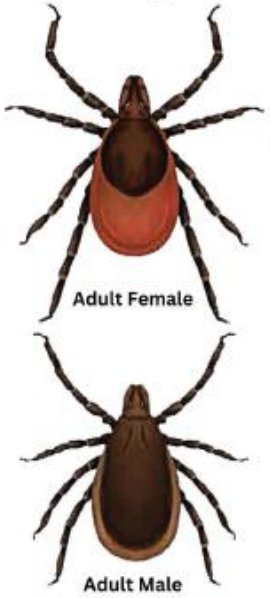
Agenda

- Overview of Vector-borne Disease Surveillance
- Lyme Disease Surveillance and Diagnostics
- Resources

Tick Surveillance

There are three tick species of medical importance in Wisconsin:

Blacklegged Tick
Ixodes scapularis



American Dog Tick
Dermacentor variabilis

Lone Star Tick
Amblyomma americanum

1

The **blacklegged (deer) tick** spreads nearly all tickborne illnesses in Wisconsin.

Common

Transmits:

Lyme disease

Anaplasmosis

Ehrlichiosis

Babesiosis

Hard tick relapsing fever

Powassan Virus

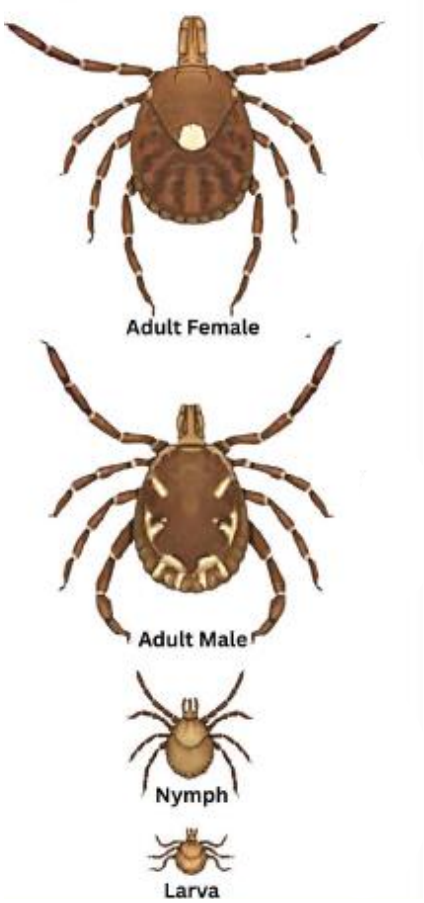
2

The **American dog (wood) tick** rarely spreads disease in Wisconsin.

- **Common**
- **Transmits:**
  Rocky Mountain spotted fever
  Tularemia

3

The **lone star tick** is only sporadically found in Wisconsin.



Uncommon

Transmits:

Ehrlichiosis

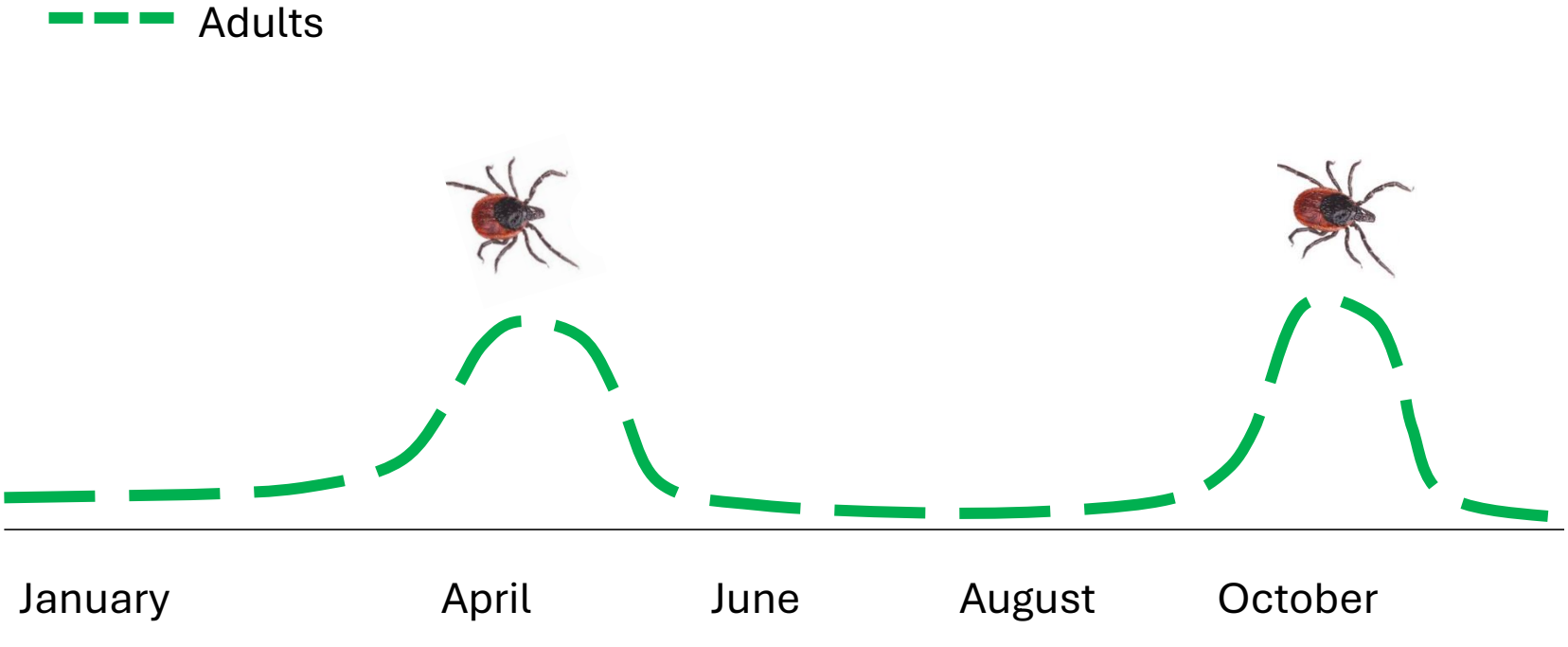
Tularemia

Heartland Virus

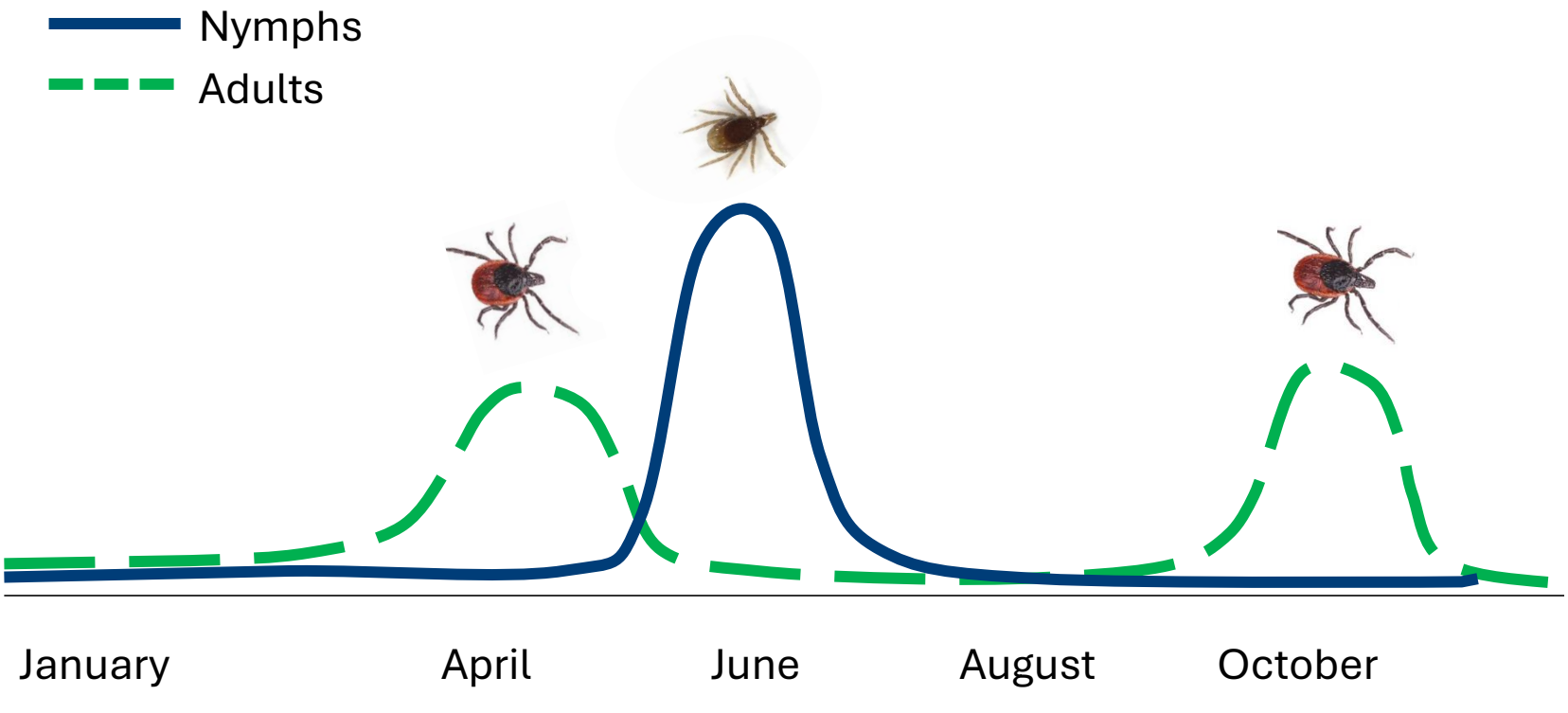
Bourbon Virus

Alpha-gal Syndrome

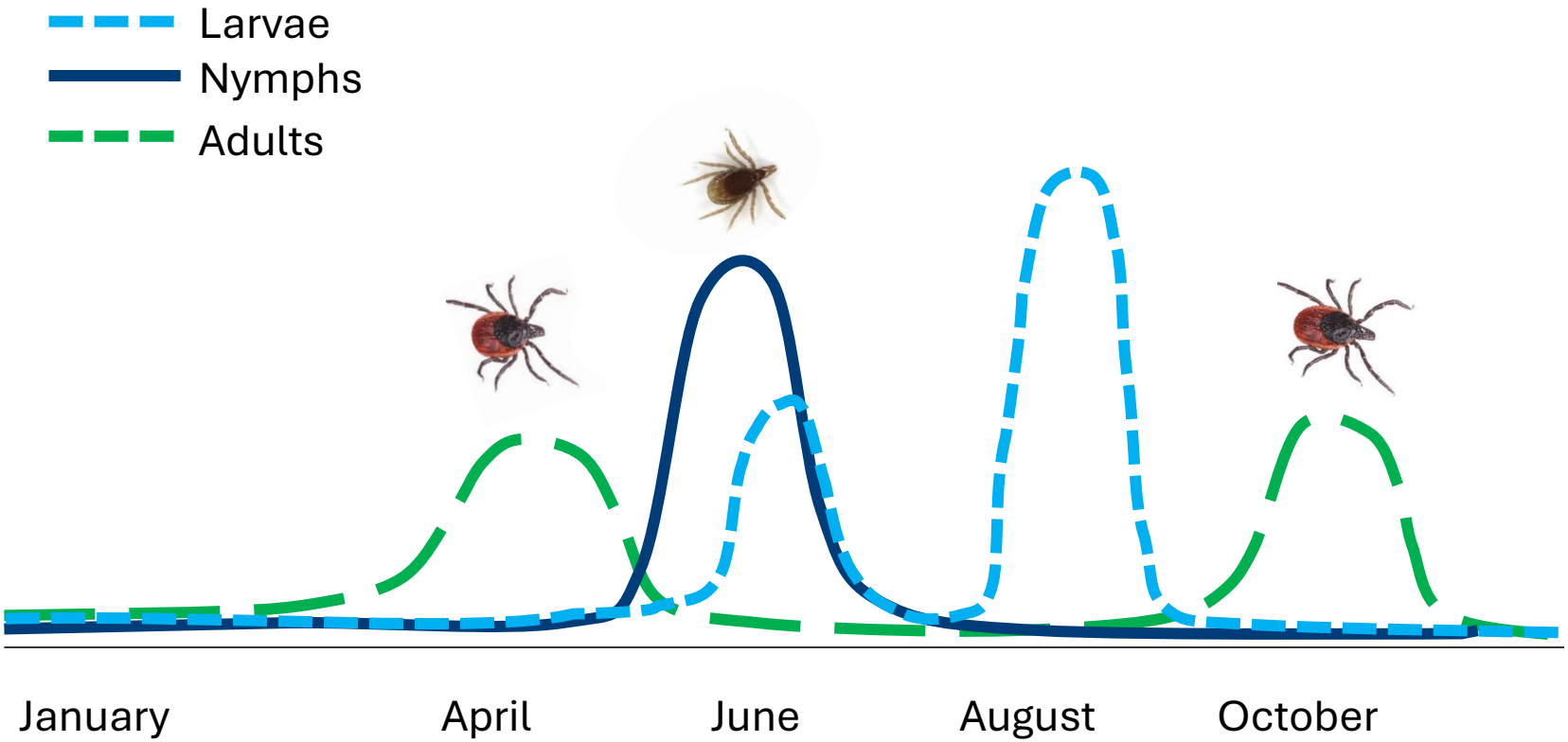
Blacklegged Tick Phenology



Blacklegged Tick Phenology



Blacklegged Tick Phenology



Vectorborne Diseases Surveillance Overview

Note: Data for 2025 are considered preliminary and subject to change. Final data cleaning and case enumeration is not complete

Locally Acquired Vector-borne Diseases

Lyme disease

Anaplasmosis

Babesiosis

Ehrlichia muris eauclairensis (EME)

Borreliosis (other than Lyme disease)

Powassan virus

West Nile virus

St. Louis encephalitis virus

Jamestown Canyon virus

La Crosse virus

Eastern equine encephalitis

Travel Associated Vector-borne Diseases

Ehrlichiosis (E. chaffeensis, E. ewingii)

Rocky mountain spotted fever

Other spotted fever rickettsiosis

Typhus fever rickettsiosis

Scrub typhus

Tick-borne encephalitis virus

Dengue virus

Chikungunya virus

Oropouche virus

Zika virus

Yellow Fever virus

Malaria

Vector-borne Diseases, 2025

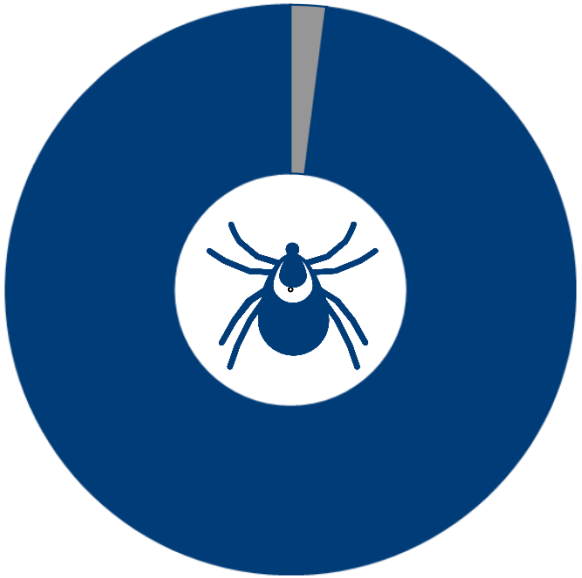
10,171

Tick-borne disease cases were enumerated in Wisconsin

73

Mosquito-borne disease cases were enumerated in Wisconsin

Tick-borne infections account for **99%** of all vector-borne disease cases in Wisconsin

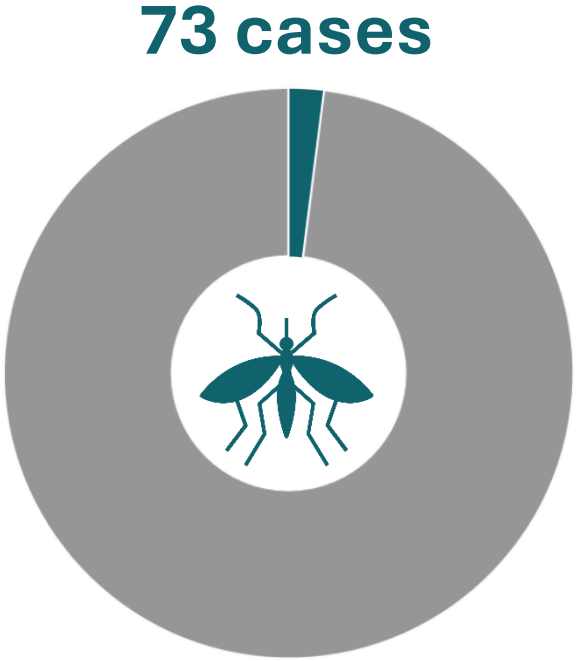


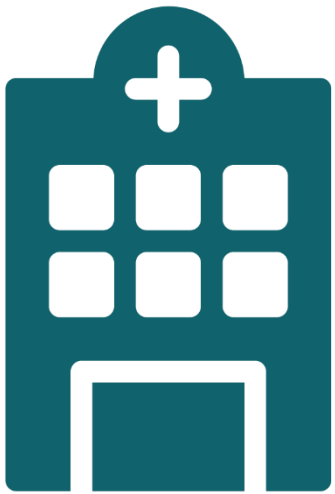
10,171 cases

Mosquito-borne

infections account for

1% of all vector-borne disease cases in Wisconsin



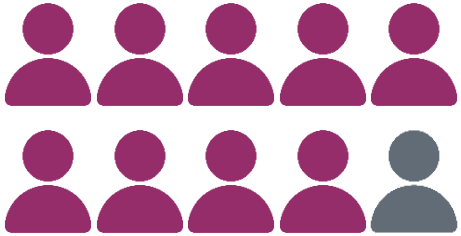


Mosquito-borne cases result in **6%** of vector-borne **hospitalizations**, but only account for 1% of reported cases.

Vector-borne disease-associated hospitalizations documented in WEDSS can provide insight into disease severity.

Reported Hospitalizations - WEDSS

Approximately **9** in 10 people reported with a case of **West Nile** or **Powassan virus** are hospitalized



Approximately **3** in 10 people reported with a case of **babesiosis** or **anaplasmosis** are hospitalized

Tick-borne disease cases increased in 2025

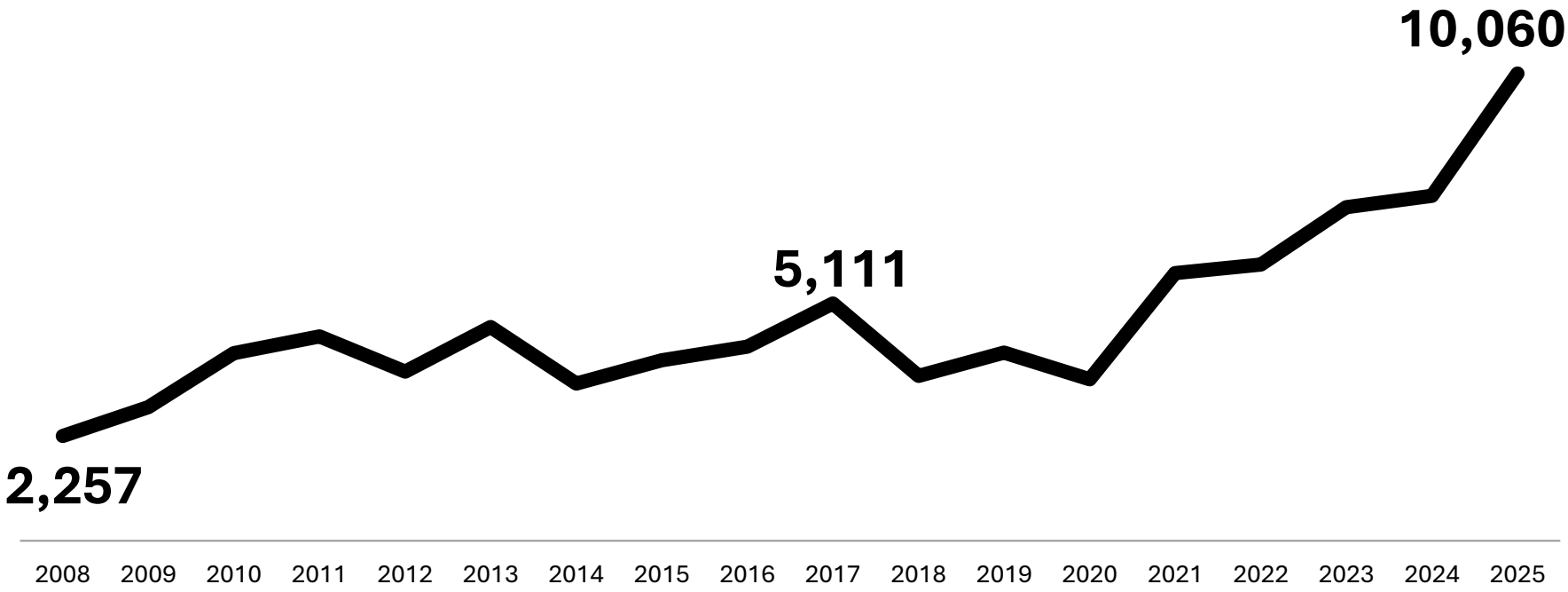
Note: Data for 2025 are considered preliminary and subject to change. Final data cleaning and case enumeration is not complete.

Blacklegged or Deer Tick

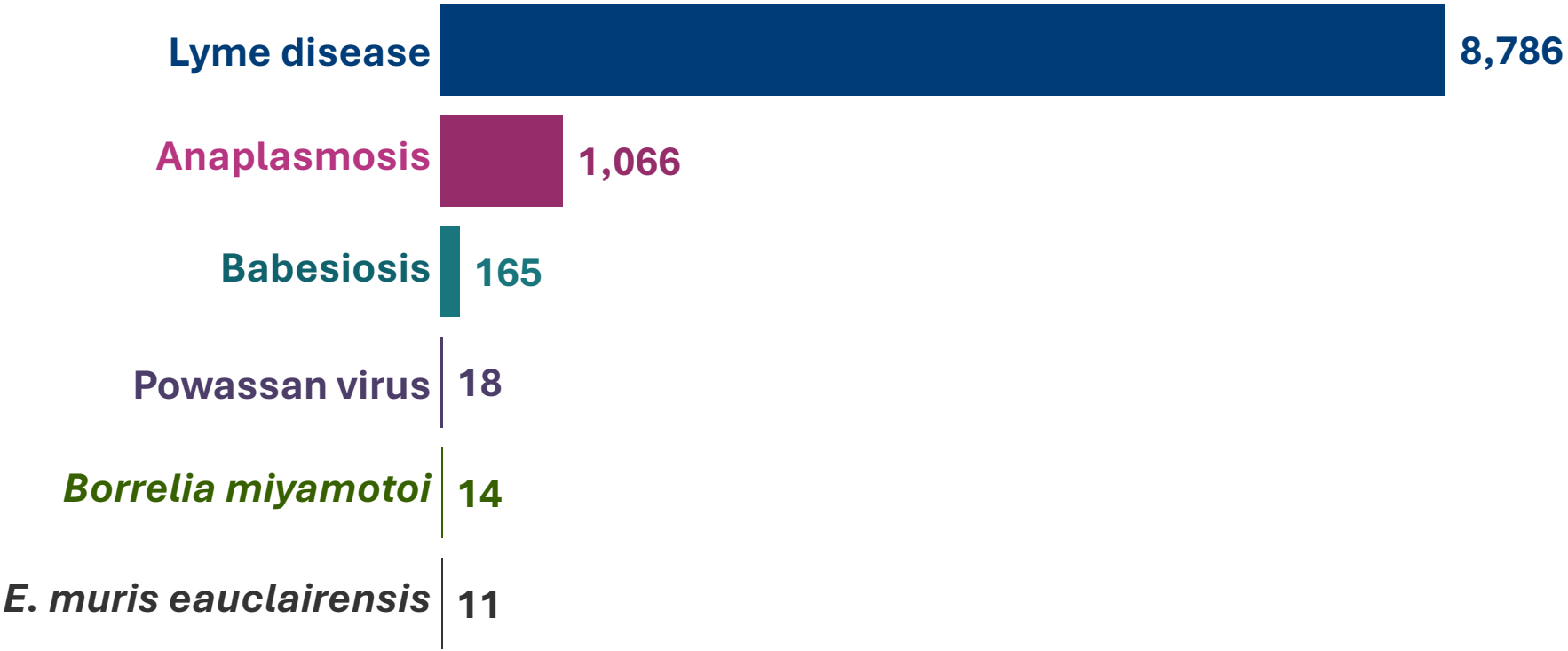
Transmits:

- Lyme disease
- Anaplasmosis
- Babesiosis
- Ehrlichiosis (*E. muris eauclairensis*)
- Hard tick relapsing fever (*Borrelia miyamotoi*)
- Powassan Virus

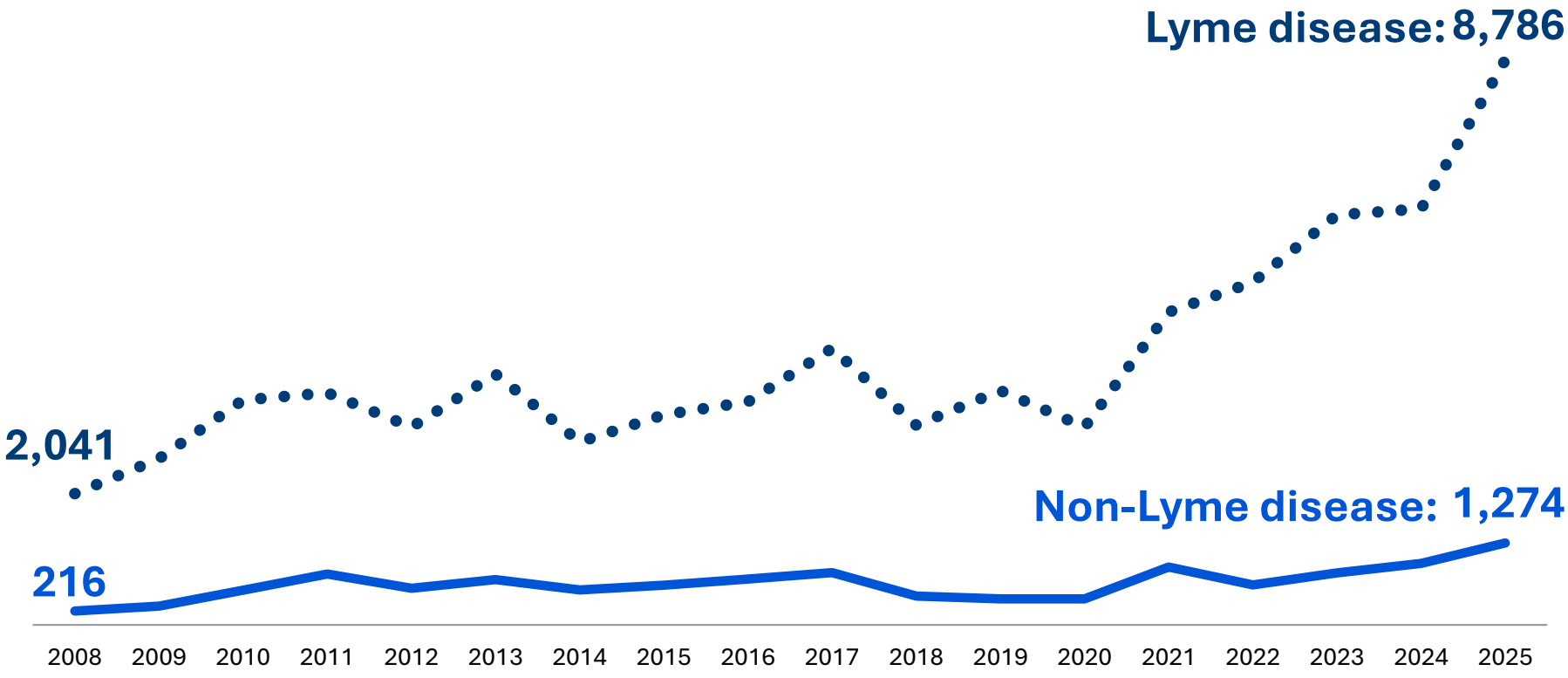
Blacklegged tick (deer tick) transmitted infections have been increasing.



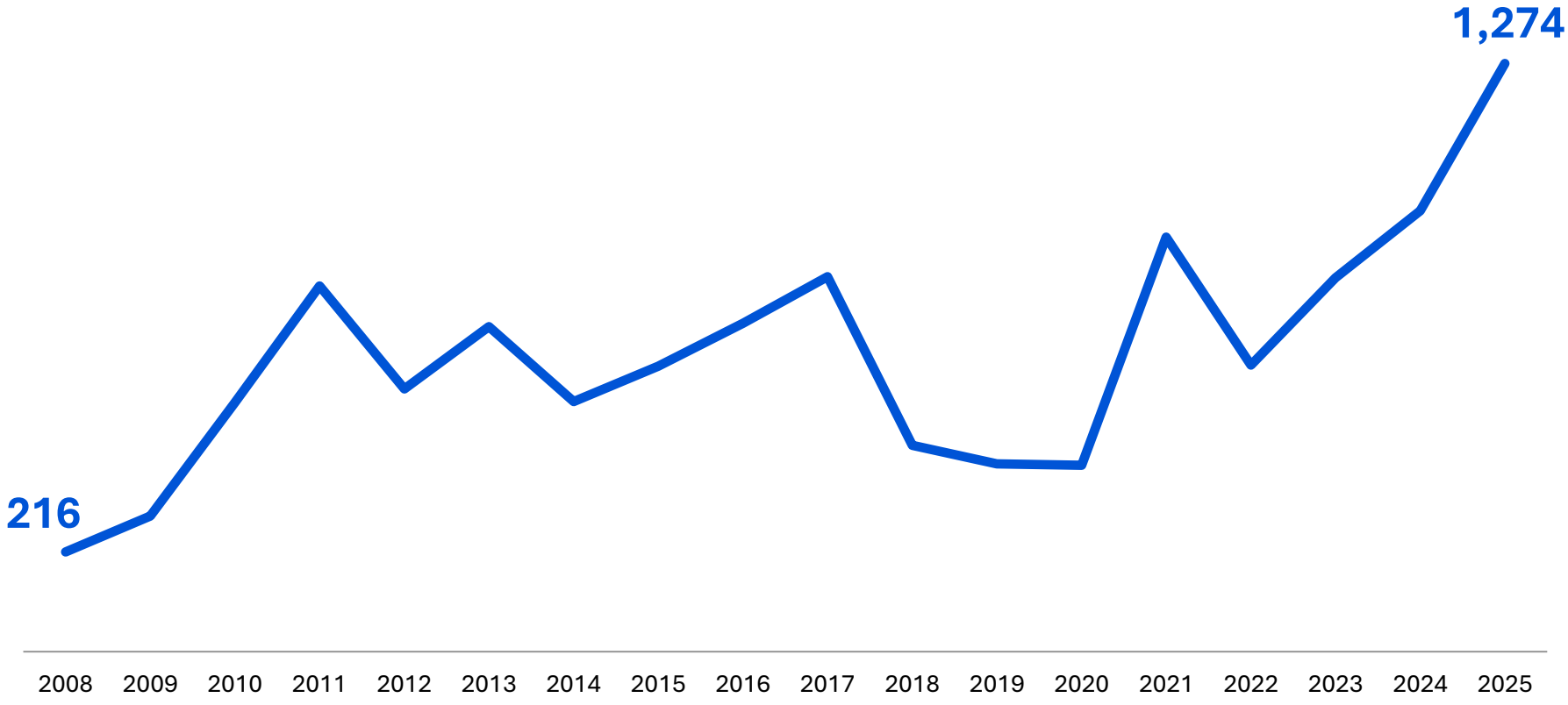
Select Tick-borne Infections, 2025



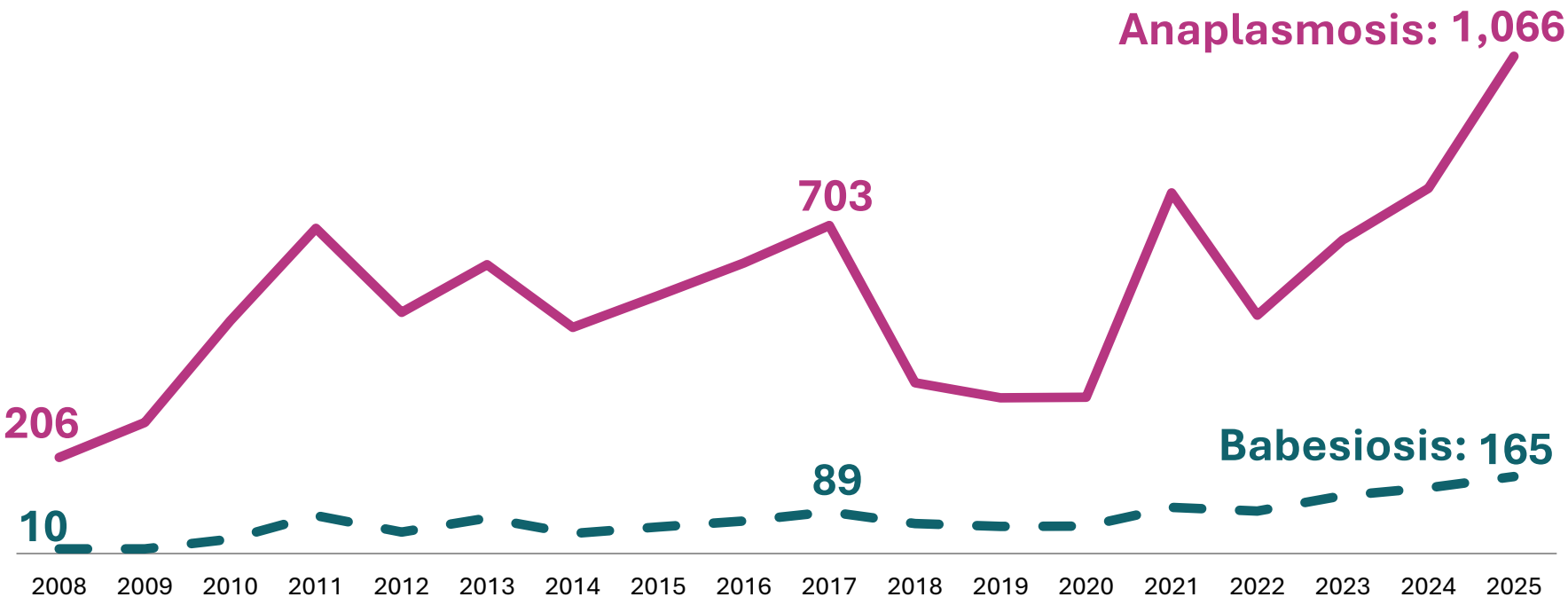
Reported Lyme disease and non-Lyme cases transmitted by the deer tick have risen.



Reported non-Lyme cases transmitted by the deer tick have risen.



Anaplasmosis and babesiosis have been increasing.

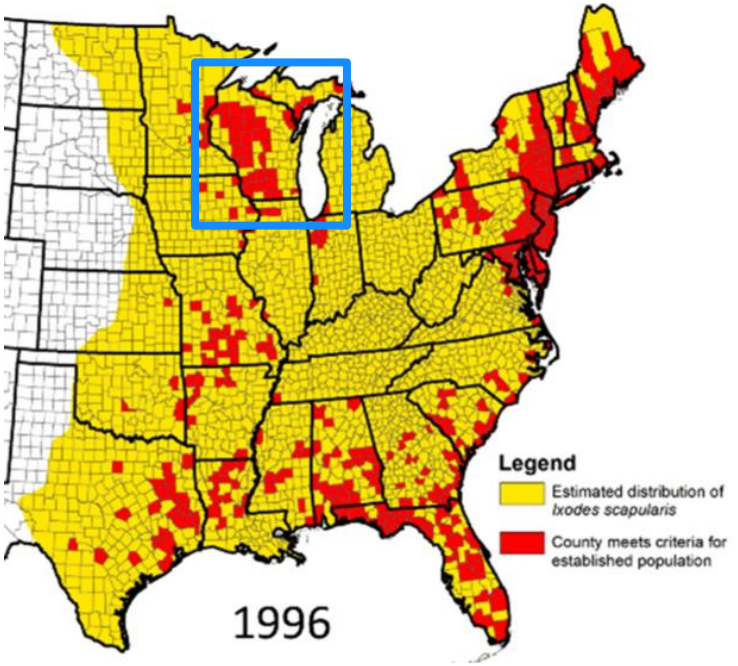


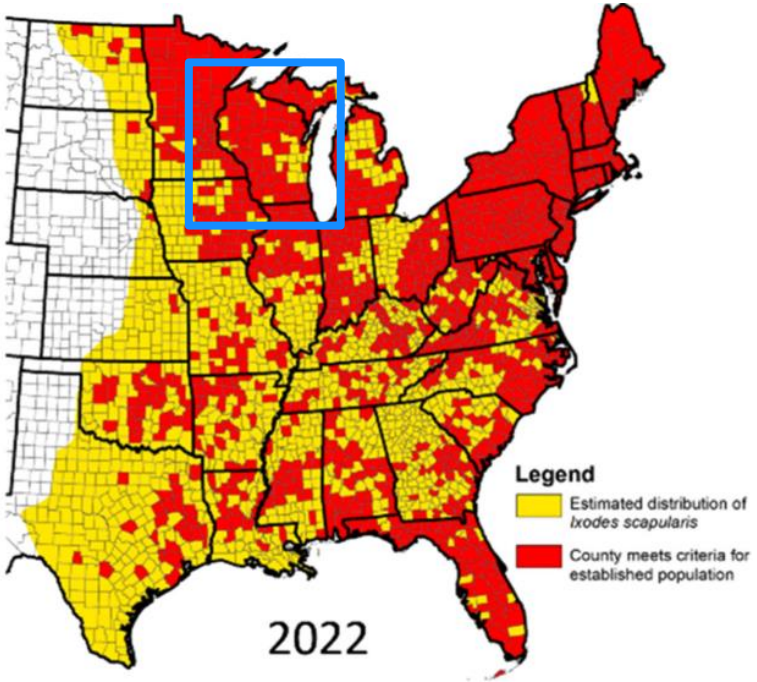
Why are cases increasing?

Likely a combination of factors:

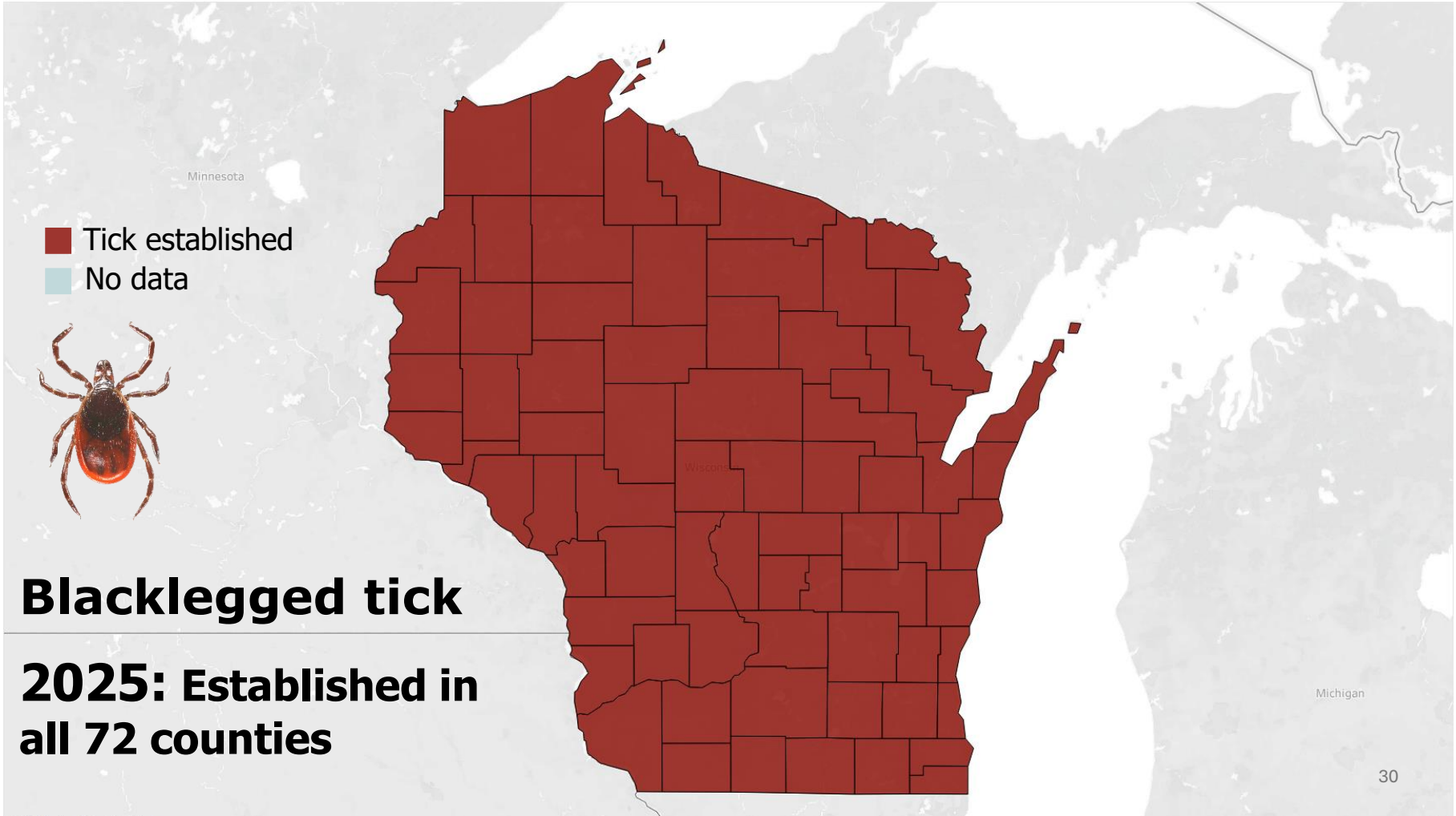
- Expanding geographic range of the tick.
- Increasing days of the year with favorable conditions for ticks to be active and biting.
- Changing test methodology and practices.
- Changes is surveillance practices.

Expansion of blacklegged tick to all counties in the state.





Eisen and Eisen, 2023: https://doi.org/10.1016/j.ttbdis.2023.102233



Blacklegged tick

2025: Established in all 72 counties

More days of the year for ticks to be active and biting.

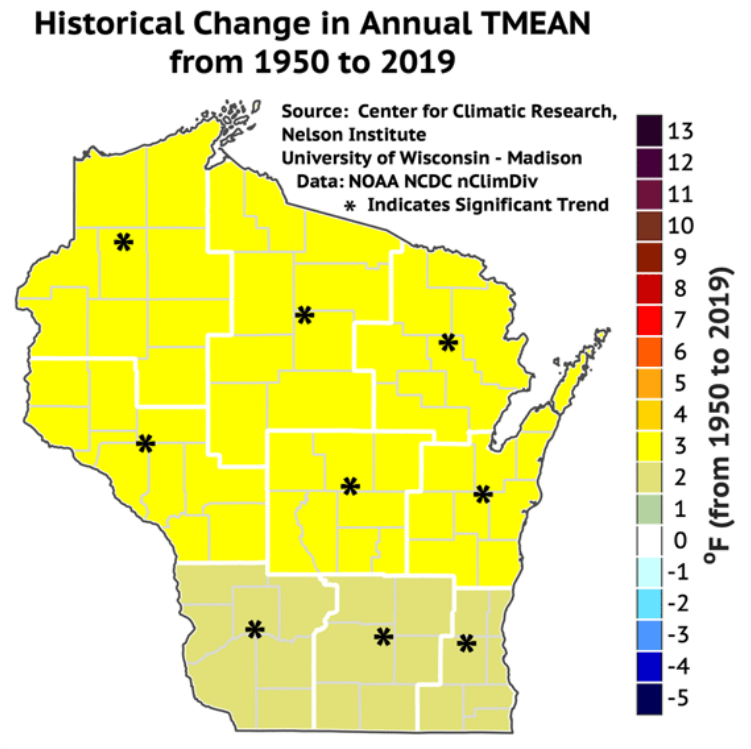
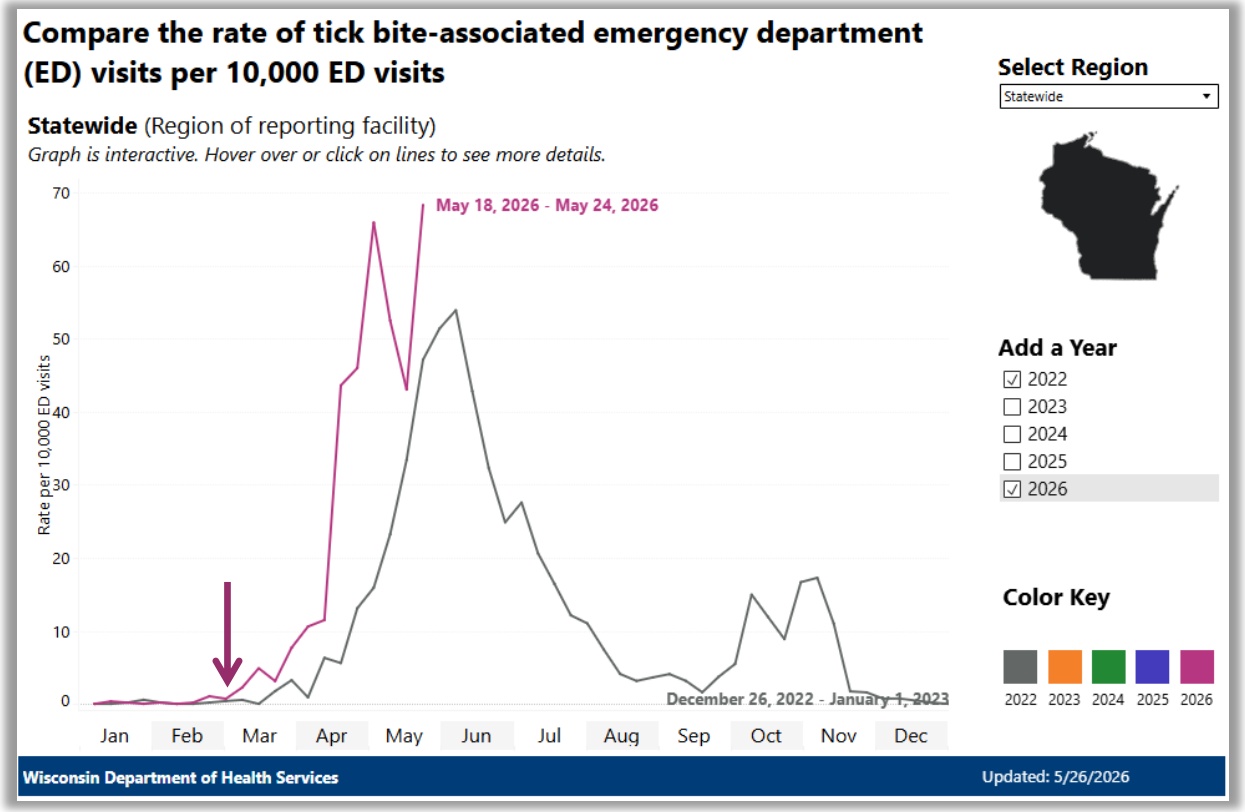


FIGURE 2: Wisconsin temperature change from 1950-2019 for each of Wisconsin's nine climate divisions (white borders). Asterisks indicate that the temperature trend is statistically significant. Source: Wisconsin Initiative on Climate Change Impacts.

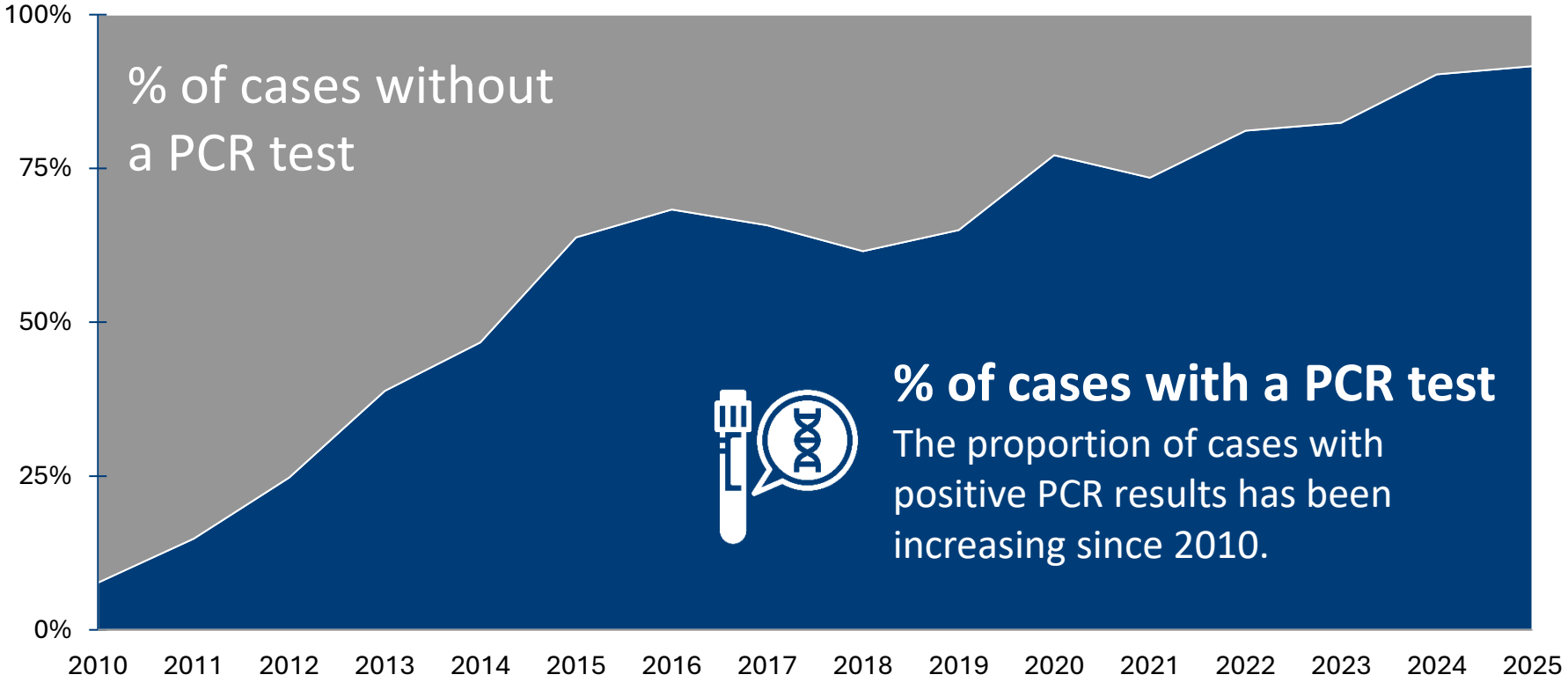
More days of the year for ticks to be active and biting.



Changes in clinical tests and testing practices.

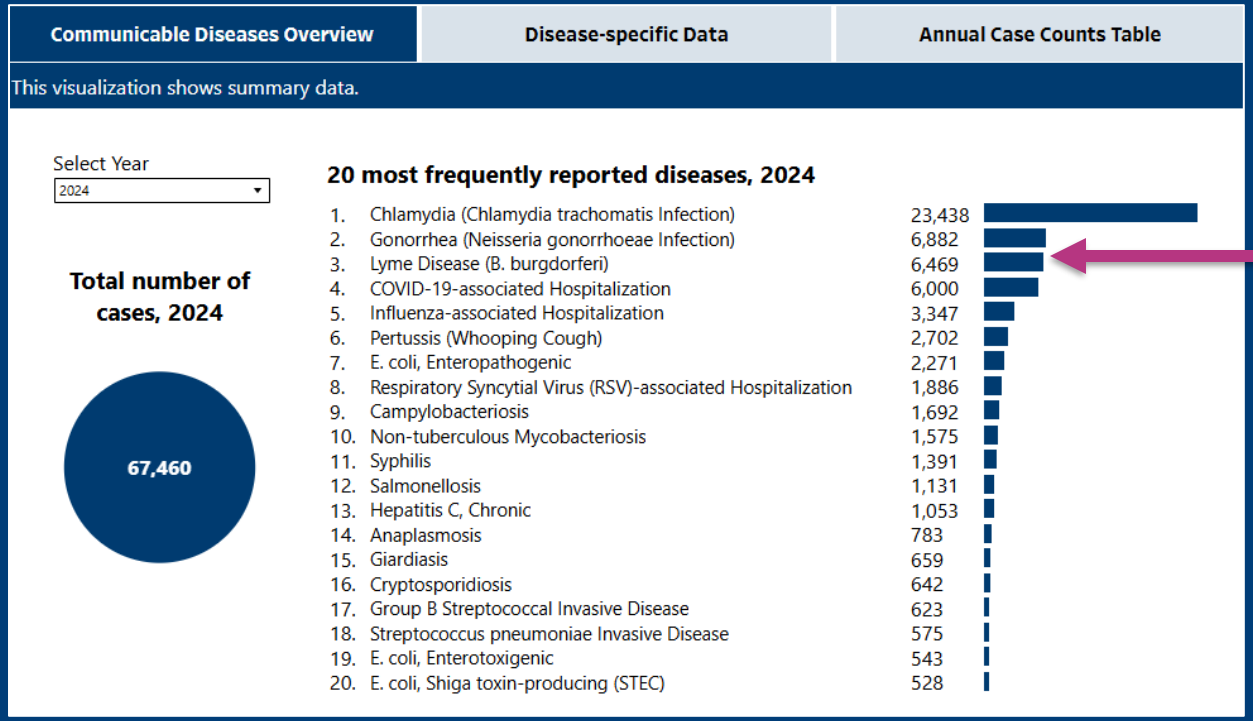
- Modified two-tier test for Lyme disease testing.
- Tick testing panels are more common.
- Shift from mostly serologic based testing to more molecular testing (PCR) for non-Lyme tickborne infections, including molecular panels.

Anaplasmosis Cases by Test Method



Lyme disease surveillance

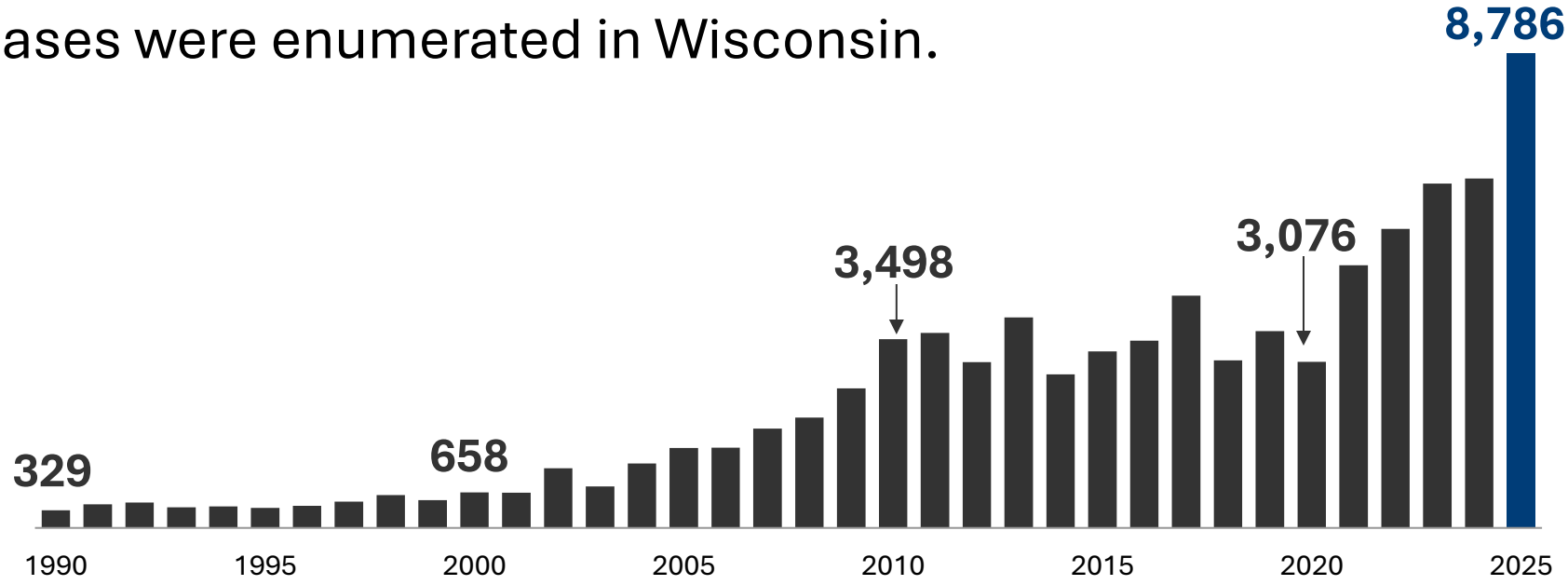
Lyme Disease was the third most reported communicable disease in 2024



https://www.dhs.wisconsin.gov/disease/communicable-disease-surveillance-data.htm

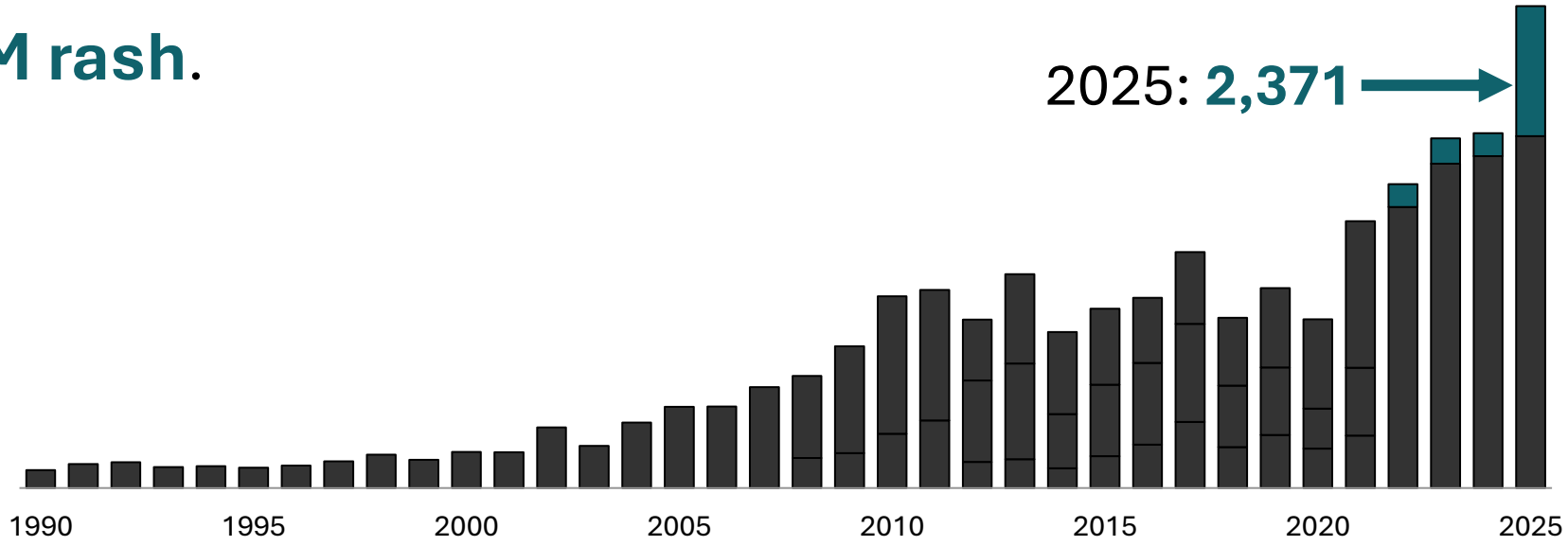
Lyme Disease Cases Increasing

In 2025, **8,786** confirmed and probable Lyme disease cases were enumerated in Wisconsin.



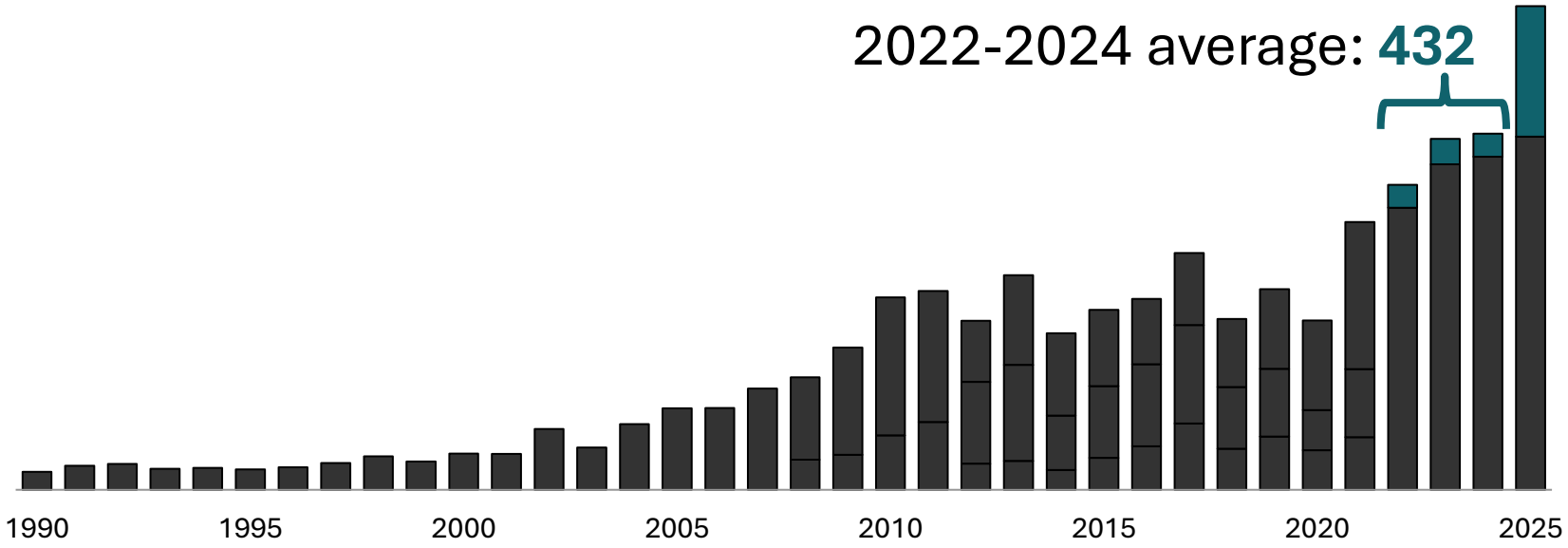
Lyme Disease Cases Increasing

Most of the **2025** increase in reported Lyme disease cases is attributed to an increase in confirmed cases of **EM rash**.



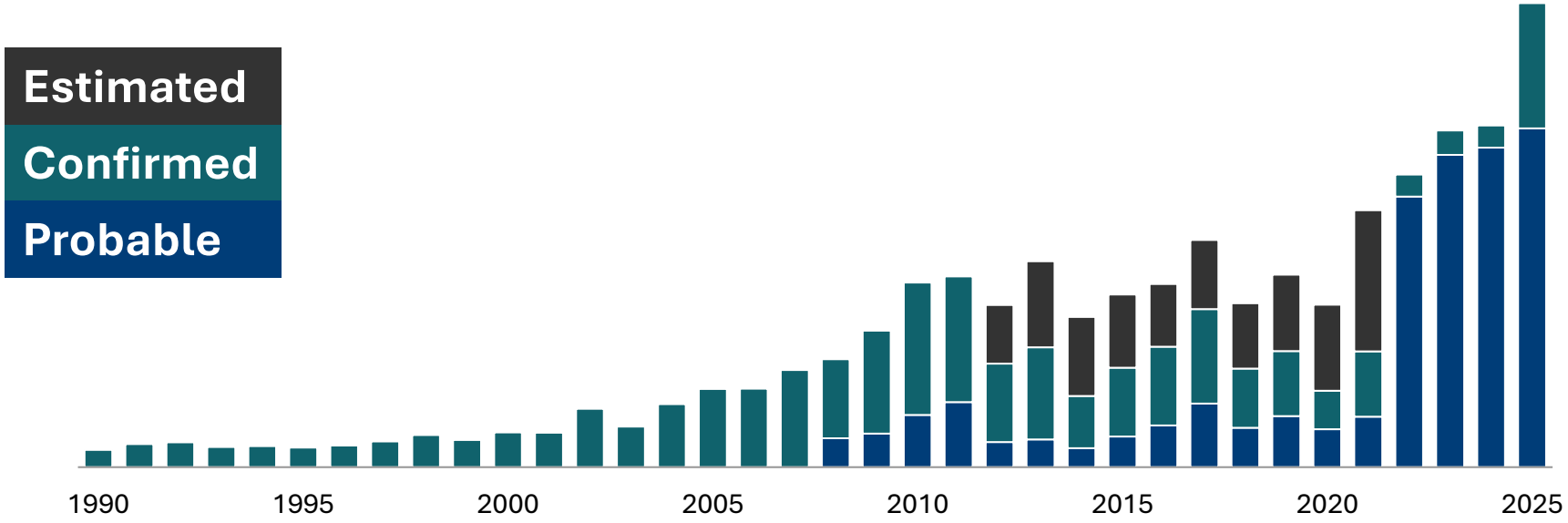
Lyme Disease Cases Increasing

The average cases during the previous three years was **432** cases of confirmed EM rash.



Lyme Disease Cases Increasing

Changes in case definitions and surveillance practices affect how we enumerate cases.



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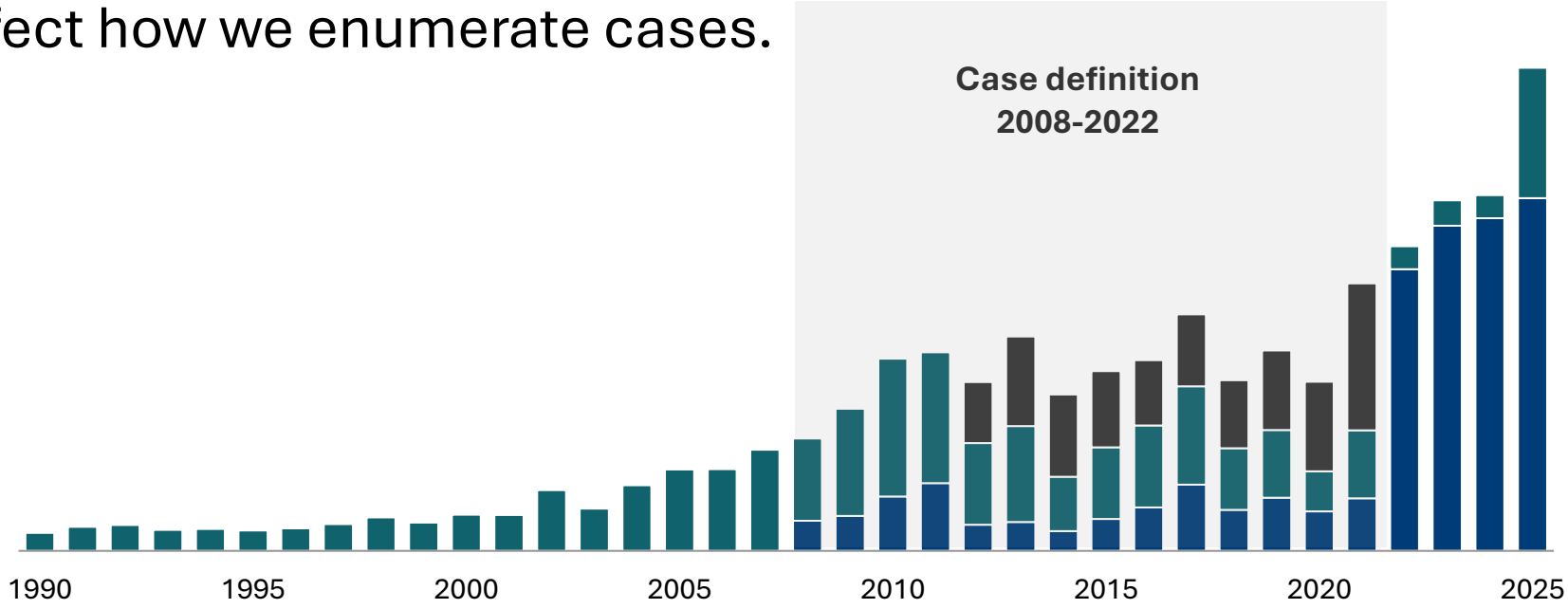

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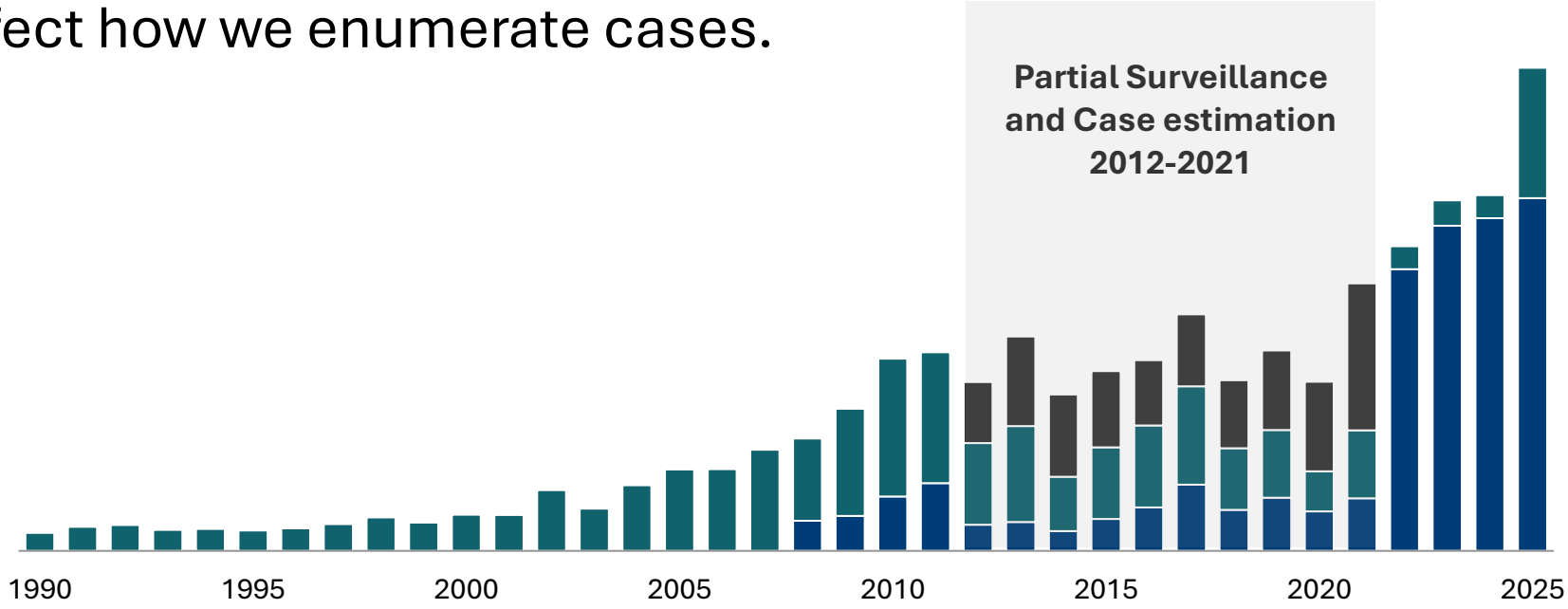

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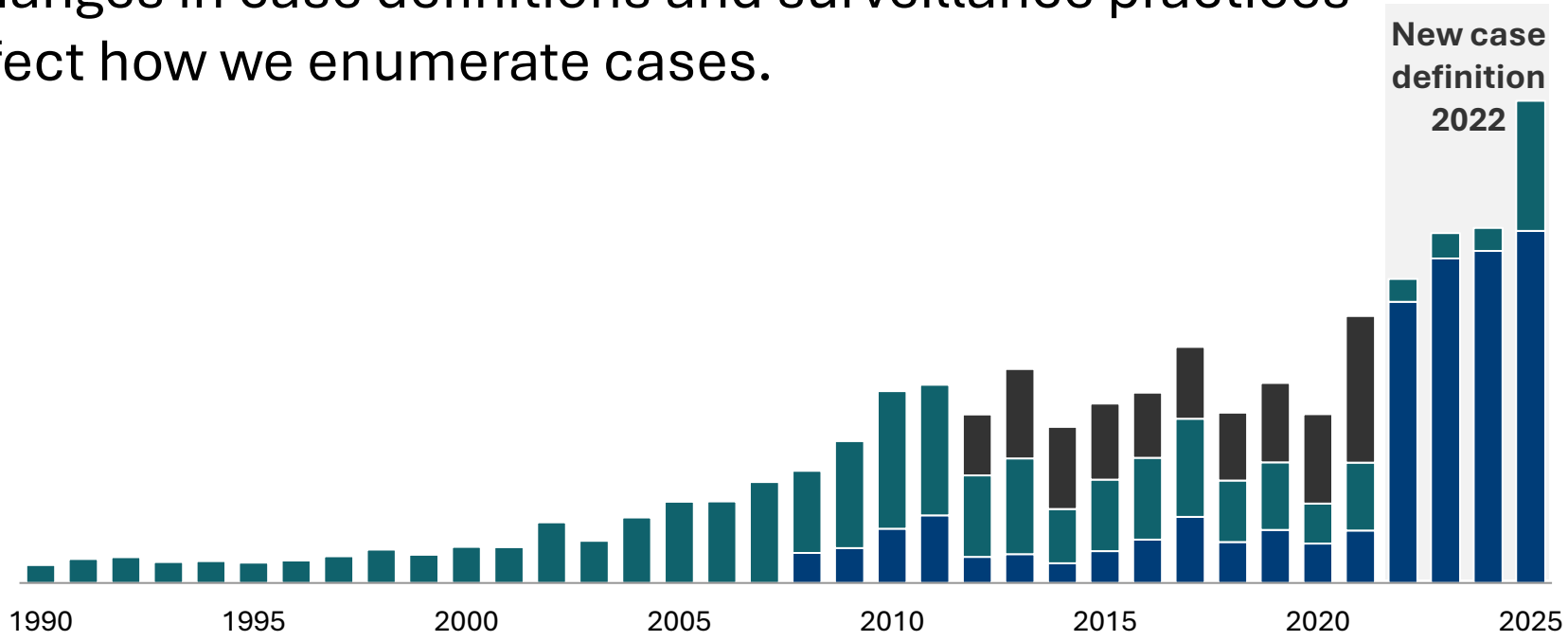


Lyme disease

Etiologic agents: *Borrelia burgdorferi* and *Borrelia mayonii*

Lyme Disease

In Wisconsin, Lyme disease is caused by a bacterial infection with ***Borrelia burgdorferi*** or, rarely, ***Borrelia mayonii***.

Lyme disease is spread by the **blacklegged tick.** The tick must be **attached for at least 24 – 36 hours** to spread disease.

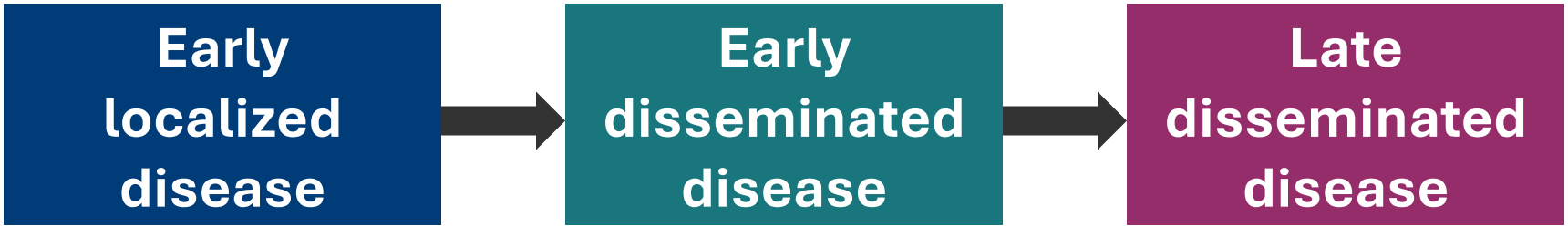
Incubation period is **3 – 30 days**.

B. mayonii was **discovered in 2013** in patients from **Wisconsin** and **Minnesota** thought to have *B. burgdorferi* infections.

Clinical Stages of Lyme Disease

Lyme disease is a multi-phase and multi-system disease that starts with early localized manifestations.

Untreated Lyme disease may progress:



Typical Manifestations by Phase

Early localized disease

3 – 30 days

Erythema migrans (EM) rash

Flu-like symptoms

Lymphadenopathy

Early disseminated disease

1 to 2 months

Multiple EM rashes

Facial palsy

Meningitis

Heart block

Late disseminated disease

3 or more months

Arthritis

Radiculoneuropathy

Cognitive impairment

EM rash

- Occurs in 70–80% of cases
- Incubation period: 3–30 days (average: 11 days)
- Typically round and red, gray, or brown depending on skin tone
- Rarely painful or itchy
- Expands slowly over multiple days (>5 cm in diameter)

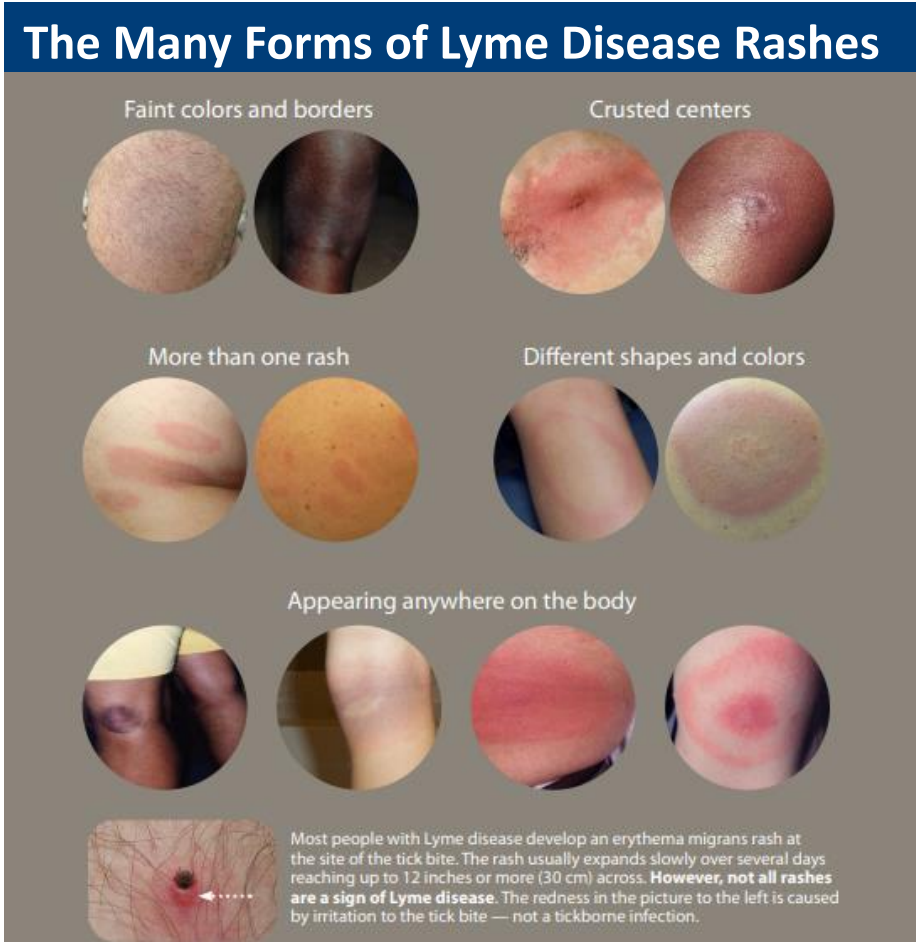


Image Source CDC: www.cdc.gov/lyme/resources/NCEZID_rash_poster3r1-508.pdf

Diagnosis and treatment of Lyme disease during early phases of the disease usually will result in full and rapid recovery.

Lyme Disease Serology

Phase of disease affects test sensitivity.

Early localized disease

3 - 30 days

Serologic tests **may be negative** during the first few weeks of infection. Diagnosis should be made clinically.

Lyme Disease Serology

Phase of disease affects test sensitivity.

Early localized disease

3 - 30 days

Serologic tests **may be negative** during the first few weeks of infection. Diagnosis should be made clinically.

Early disseminated disease

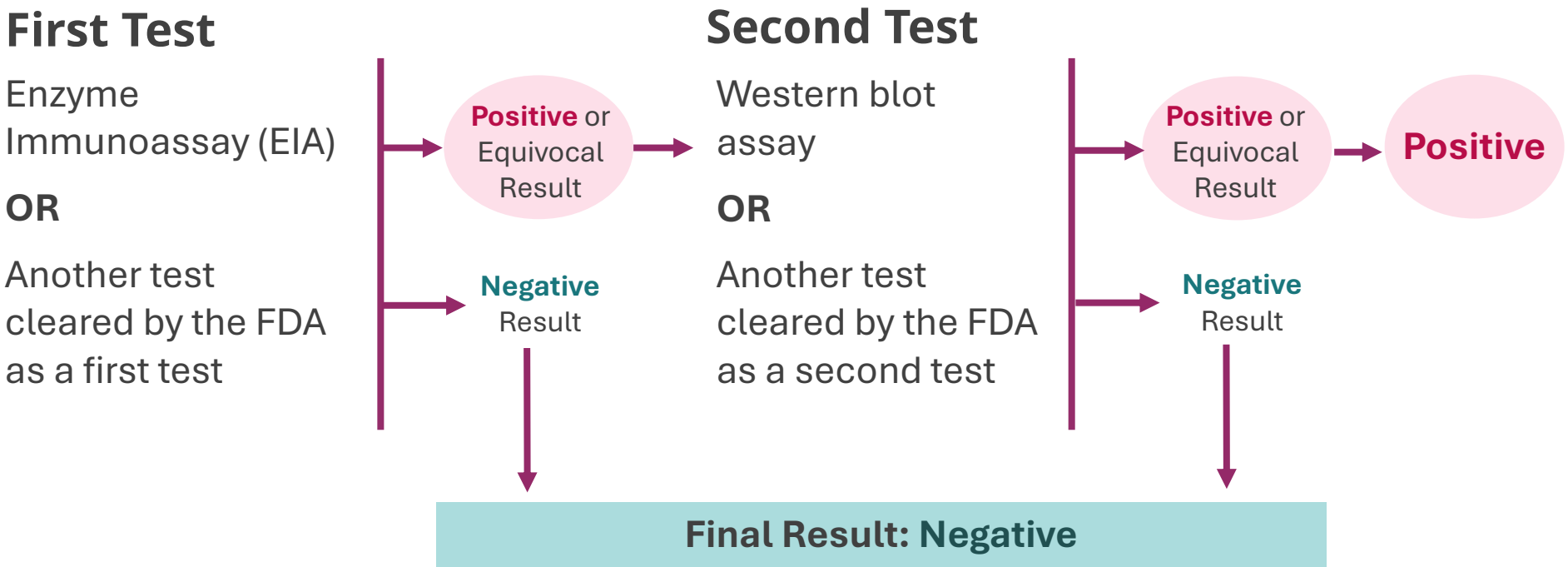
1 to 2 months

Late disseminated disease

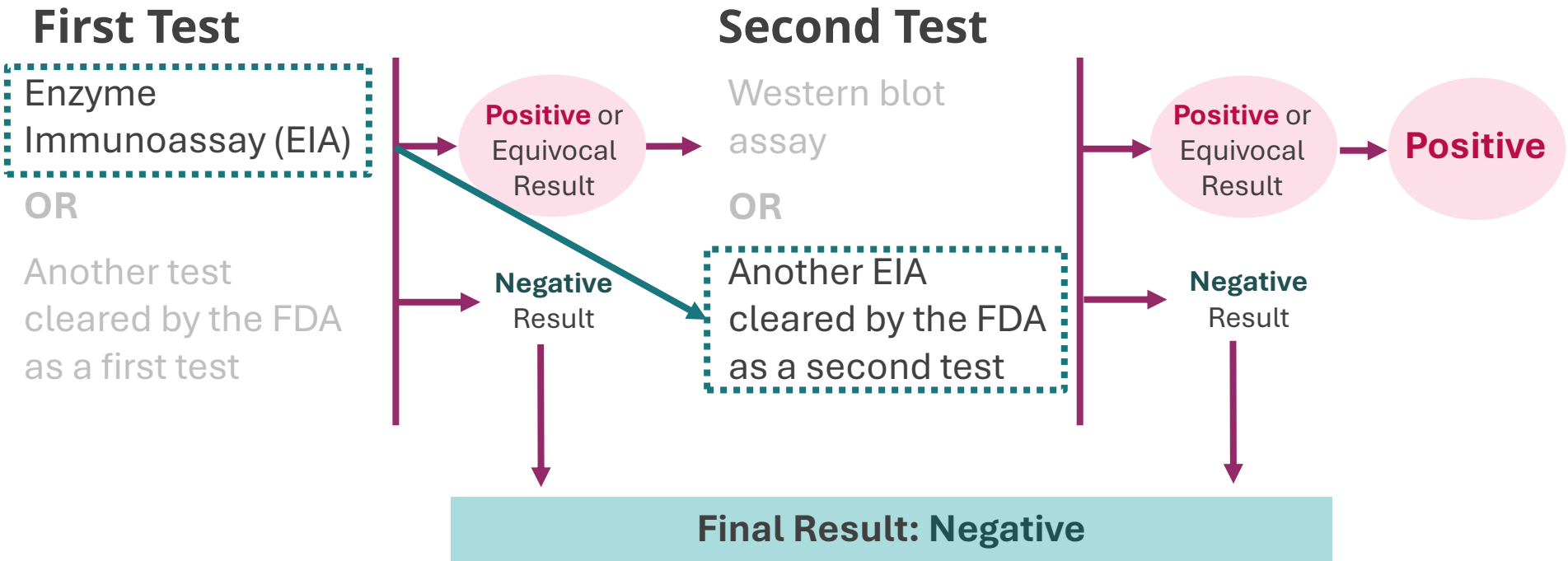
3 or more months

Serologic tests **are highly sensitive** for patients with disseminated disease. Diagnosis should be made based on **both** compatible **signs and symptoms** and positive laboratory results using recommended **two-tiered serologic testing** protocols.

Two-tiered serologic tests for laboratory diagnosis of Lyme disease



Modified two-tiered testing (MTTT)



Modified Two-tiered Testing (MTTT)

Two EIA tests can be conducted sequentially or simultaneously.

Advantages of using MTTT:

- ⟶ Greater objectivity of test result interpretation
- ⟶ Faster turnaround time
- ⟶ Evidence of increased test sensitivity during early stages of disease

CDC MMWR: Updated Recommendations for Serologic Diagnosis of Lyme Disease

Treatment for Early Disease

Adults with **early localized** Lyme disease

Drug	Dose	Frequency	Duration
Doxycycline	100 mg orally	Twice daily	**10 – 14 days**
Amoxicillin	500 mg orally	Three times daily	**14 days**
Cefuroxime	500 mg orally	Twice daily	**14 days**

Note: Azithromycin may be used if necessary, although it is less effective and patient should be monitored to make sure symptoms resolve.

Treatment for Early Disease

Children with early localized Lyme disease

Drug	Dosage	Max	Duration
Doxycycline	4.4 mg/kg per day orally (divided into 2 doses)	100 mg per dose	**10 – 14 days**
Amoxicillin	50 mg/kg per day orally (divided into 3 doses)	500 mg per dose	**14 days**
Cefuroxime	30 mg/kg per day orally (divided into 2 doses)	500 mg per dose	**14 days**

Note: Azithromycin may be used if necessary, although it is less effective and patient should be monitored to make sure symptoms resolve.

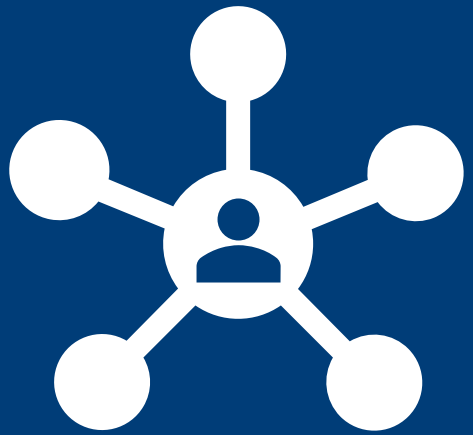
Patients with disseminated disease

Duration of treatment and route vary based on clinical presentation.

- Lyme Arthritis
- Lyme carditis
- Neurologic Lyme disease

Consult treatment guidance published by the by the **Infectious Diseases Society of America**, American Academy of Neurology, and American College of Rheumatology.

https://pubmed.ncbi.nlm.nih.gov/33257476/



Reporting to Public Health

LOINC Codes

- Most laboratory results are reported to public health agencies electronically, through HL7 messaging.
- **LOINC codes** are used in HL7 messaging to identify the specific test type and interpretation.
  - **83081-0**: B. burgdorferi IgG+IgM Ab in serum by **immunoassay**
  - **62341-3**: B. burgdorferi IgG+IgM Ab in serum by **immunoblot**
  - **9586-9**: B. burgdorferi Ab **interpretation** in serum
  - **32667-8**: B. burgdorferi **DNA in blood by NAA**

LOINC Codes

- There are now specific LOINC codes available for Modified Two-Tiered Testing (MTTT).
- Using the **appropriate LOINC codes** is critical to helping public health enumerate cases accurately.

→ LOINC codes can differentiate a **Tier 1 immunoassay** as part of a **STTT** algorithm from a **Tier 2 immunoassay** as part of a **MTTT** algorithm.

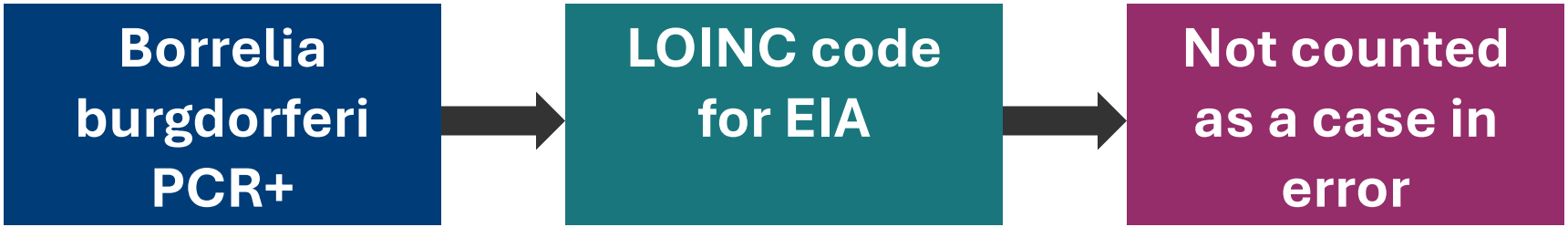
Examples of MTTT Specific LOINC Codes

- **101352-3**: B. burgdorferi Ab **IgG and IgM with reflex to immunoassay** panel
- **101356-4**: B. afzelii + burgdorferi + garinii Ab **interpretation** serum by **MTTT**
- **101353-1**: B. burgdorferi Ab **interpretation** in serum qualitative by **MTTT**

https://loinc.org/101352-3

Importance of LOINC codes

- Please check the LOINC codes assigned for each Lyme disease assay to ensure they are appropriate.



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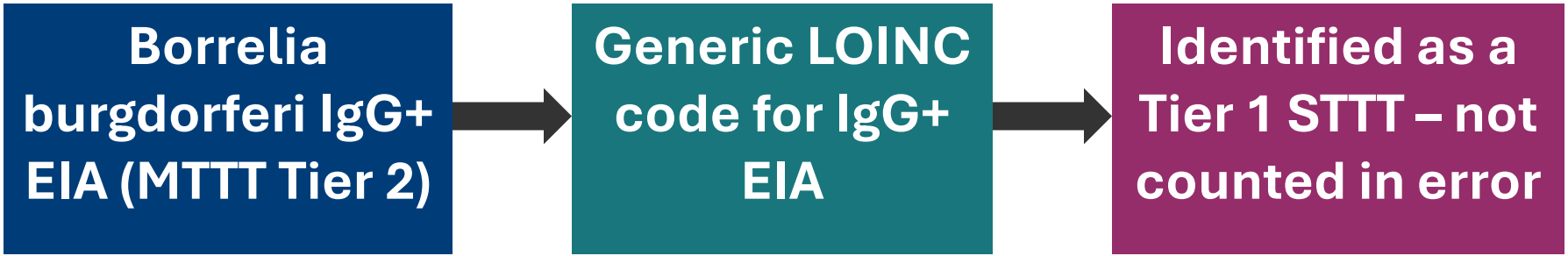
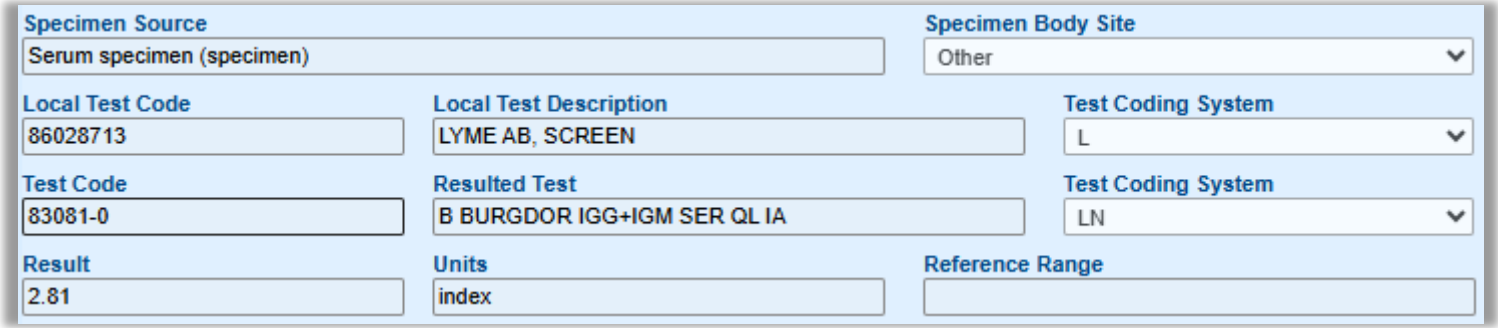
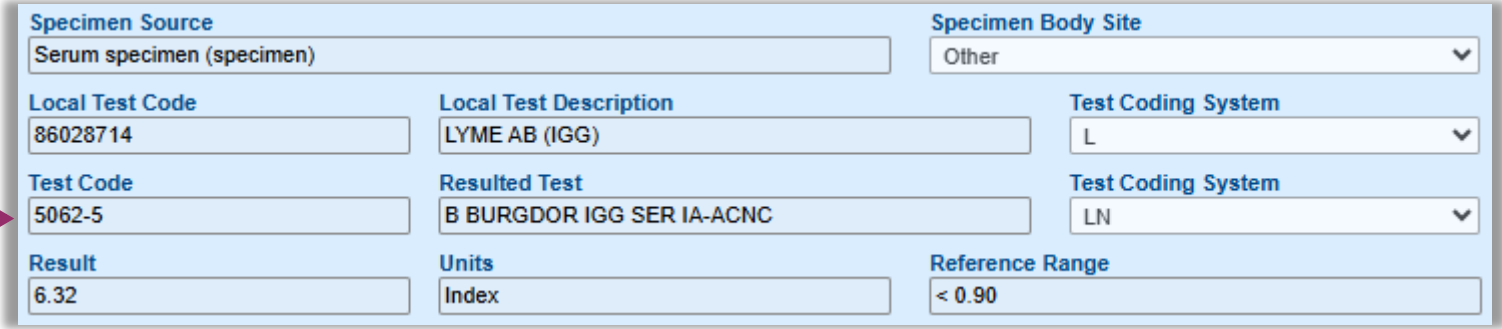


Appropriate LOINC Code Example in WEDSS

First Tier EIA
Total Ab →

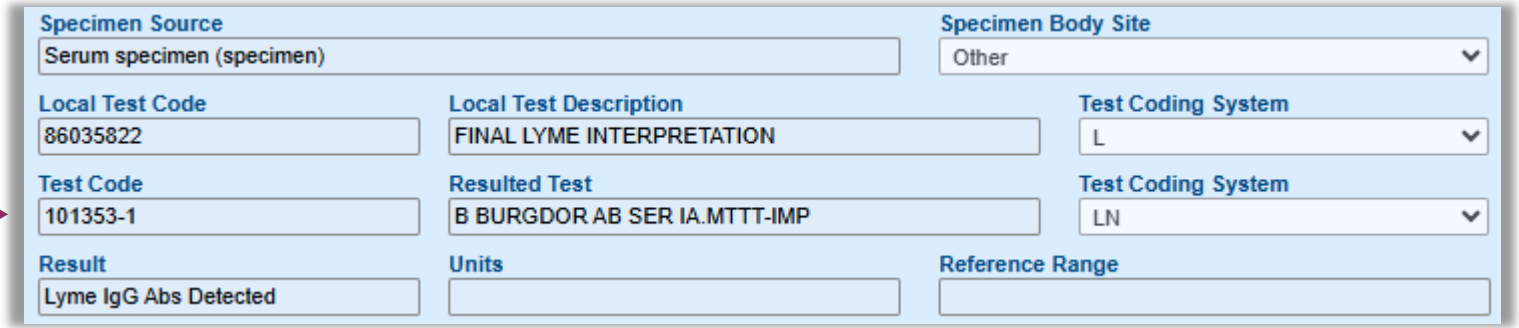


Second Tier EIA
IgG specific →



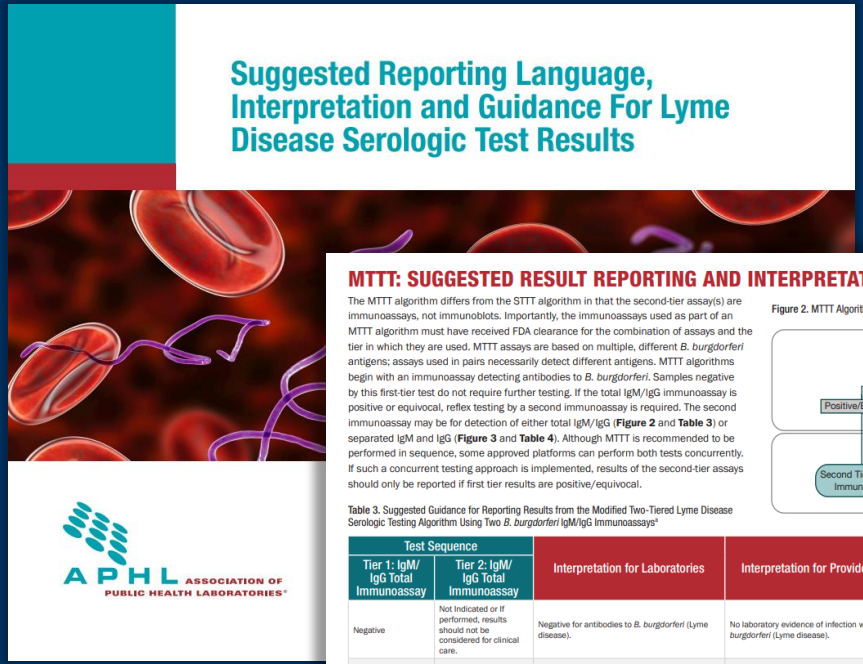
Appropriate LOINC Code Example in WEDSS

MTTT Specific Interpretation Code →



Resources

APHL: Guidance for Lyme Disease Serology



Suggested Reporting Language, Interpretation and Guidance For Lyme Disease Serologic Test Results

APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES

MTTT: SUGGESTED RESULT REPORTING AND INTERPRETATION

The MTTT algorithm differs from the STTT algorithm in that the second-tier assay(s) are immunoassays, not immunoblots. Importantly, the immunoassays used as part of an MTTT algorithm must have received FDA clearance for the combination of assays and the tier in which they are used. MTTT assays are based on multiple, different *B. burgdorferi* antigens; assays used in pairs necessarily detect different antigens. MTTT algorithms begin with an immunoassay detecting antibodies to *B. burgdorferi*. Samples negative by this first-tier test do not require further testing. If the total IgM/IgG immunoassay is positive or equivocal, reflex testing by a second immunoassay is required. The second immunoassay may be for detection of either total IgM/IgG (**Figure 2** and **Table 3**) or separated IgM and IgG (**Figure 3** and **Table 4**). Although MTTT is recommended to be performed in sequence, some approved platforms can perform both tests concurrently. If such a concurrent testing approach is implemented, results of the second-tier assays should only be reported if first tier results are positive/equivocal.

Figure 2. MTTT Algorithm 1 - Two Total IgM/IgG Immunoassays

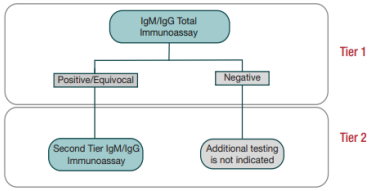


Table 3. Suggested Guidance for Reporting Results from the Modified Two-Tiered Lyme Disease Serologic Testing Algorithm Using Two *B. burgdorferi* IgM/IgG Immunoassays[a]

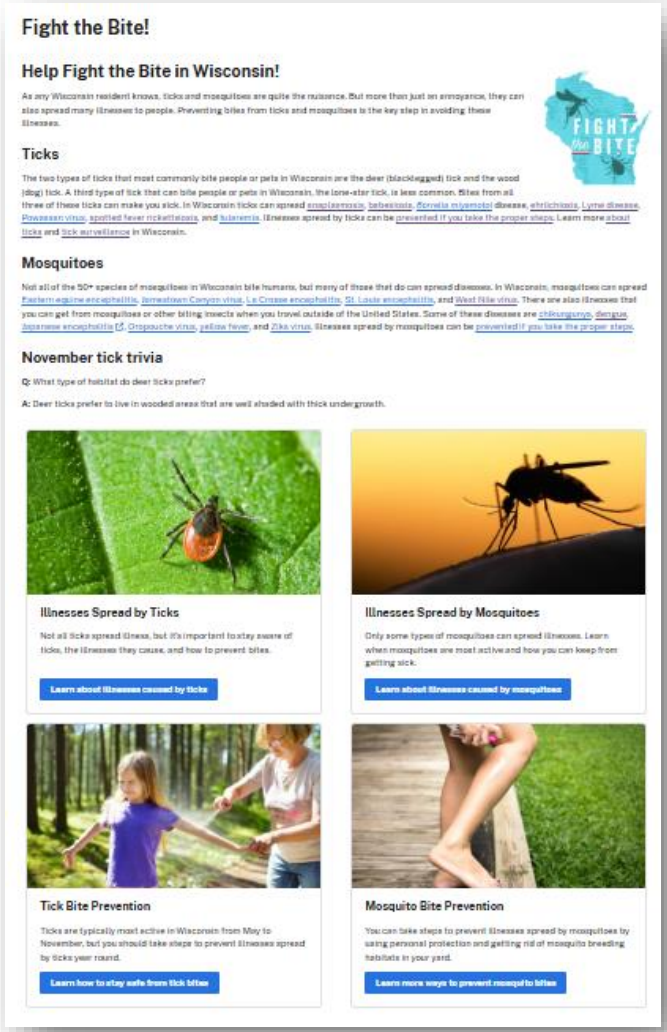
Test Sequence		Interpretation for Laboratories	Interpretation for Providers	Comments/Further Actions (may be included on the laboratory report)
Tier 1: IgM/ IgG Total Immunoassay	Tier 2: IgM/ IgG Total Immunoassay			
Negative	Not Indicated or If performed, results should not be considered for clinical care.	Negative for antibodies to *B. burgdorferi* (Lyme disease).	No laboratory evidence of infection with *B. burgdorferi* (Lyme disease).	Negative results may occur in patients recently infected (≤14 days) with *B. burgdorferi*. If recent infection is suspected, repeat testing on a new sample collected in 7–14 days is recommended.
Positive/ Equivocal	Negative	Antibodies to *B. burgdorferi* (Lyme disease) not confirmed.	No laboratory evidence of infection with *B. burgdorferi* (Lyme disease).	Negative results may occur in patients recently infected (≤14 days) with *B. burgdorferi*. If recent infection is suspected, repeat testing on a new sample collected in 7–14 days may be considered to confirm infection.
Positive/ Equivocal	Positive/Equivocal[b]	IgM- and/or IgG-class antibodies to *B. burgdorferi* (Lyme disease) detected. Specific antibody class detected cannot be determined.	Results are consistent with *B. burgdorferi* infection (Lyme disease) in the recent or remote past. Antibodies may remain detectable for months to years following resolution of infection.	Timing of infection (acute/recent vs. past) cannot be determined by these assays. Clinical correlation is required. Results should not be used to monitor or establish adequate response to therapy. Response to therapy is confirmed through resolution of clinical symptoms; additional laboratory testing should not be performed. If both tiers are equivocal consider repeat testing in 7–14 days if clinically warranted.

a Testing must be performed using assays that have been FDA-cleared together for this purpose.
b Equivocal results from the Tier 2 Immunoassay should be reported as positive per the package insert and interpreted as supportive evidence for the presence of IgM/IgG antibodies and exposure to B. burgdorferi.

https://www.cdc.gov/lyme/media/pdfs/2024/05/Suggested-Reporting-Language-Interpretation-and-Guidance-Regarding-Lyme-Disease-Serologic-Test-Results.pdf

Fight the Bite

dhs.wisconsin.gov/fight-bite/index.htm



Fight the Bite!

Help Fight the Bite in Wisconsin!

As any Wisconsin resident knows, ticks and mosquitoes are quite the nuisance. But more than just an annoyance, they can also spread many illnesses to people. Preventing bites from ticks and mosquitoes is the key step in avoiding these illnesses.

Ticks

The two types of ticks that most commonly bite people or pets in Wisconsin are the deer (blacklegged) tick and the wood (dog) tick. A third type of tick that can bite people or pets in Wisconsin, the lone-star tick, is less common. Bites from all three of these ticks can make you sick. In Wisconsin ticks can spread anaplasmosis, babesiosis, Borrelia miyamotoi disease, ehrlichiosis, Lyme disease, Powassan virus, spotted fever rickettsiosis, and tularemia. Illnesses spread by ticks can be prevented if you take the proper steps. Learn more about ticks and tick surveillance in Wisconsin.

Mosquitoes

Not all of the 50+ species of mosquitoes in Wisconsin bite humans, but many of those that do can spread diseases. In Wisconsin, mosquitoes can spread Eastern equine encephalitis, Jamestown Canyon virus, La Crosse encephalitis, St. Louis encephalitis, and West Nile virus. There are also illnesses that you can get from mosquitoes or other biting insects when you travel outside of the United States. Some of these diseases are chikungunya, dengue, Japanese encephalitis, Oropouche virus, yellow fever, and Zika virus. Illnesses spread by mosquitoes can be prevented if you take the proper steps.

November tick trivia

Q: What type of habitat do deer ticks prefer?

A: Deer ticks prefer to live in wooded areas that are well shaded with thick undergrowth.

Illnesses Spread by Ticks

Not all ticks spread illness, but it's important to stay aware of ticks, the illnesses they cause, and how to prevent bites.

Learn about illnesses caused by ticks

Illnesses Spread by Mosquitoes

Only some types of mosquitoes can spread illnesses. Learn when mosquitoes are most active and how you can keep from getting sick.

Learn about illnesses caused by mosquitoes

Tick Bite Prevention

Ticks are typically most active in Wisconsin from May to November, but you should take steps to prevent illnesses spread by ticks year round.

Learn how to stay safe from tick bites

Mosquito Bite Prevention

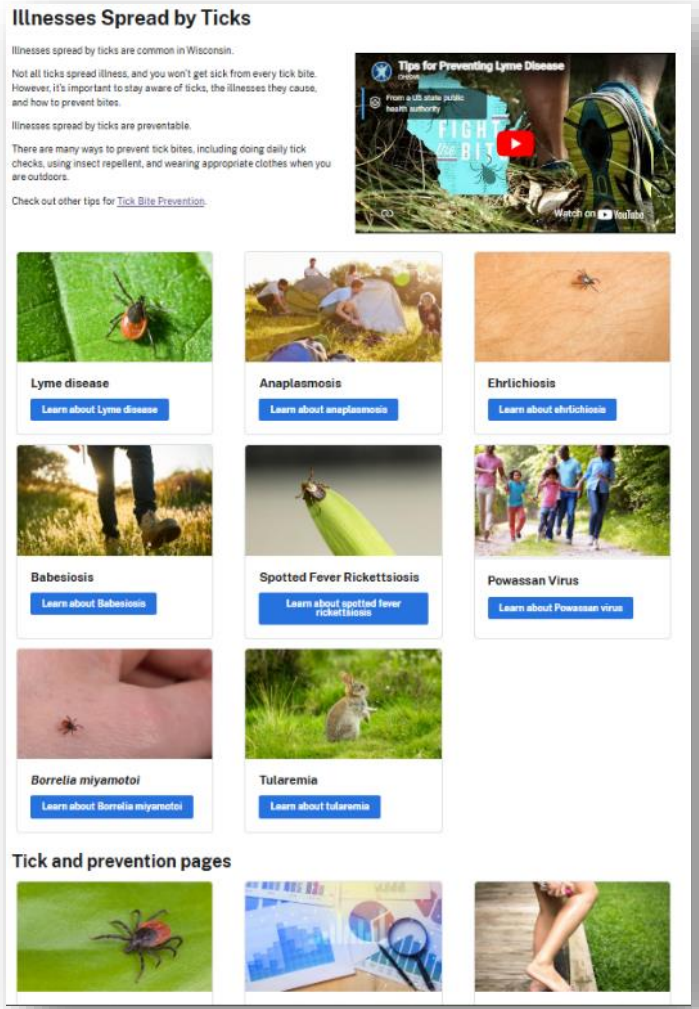
You can take steps to prevent illnesses spread by mosquitoes by using personal protection and getting rid of mosquito breeding habitats in your yard.

Learn more ways to prevent mosquito bites

From this page you can access tick and mosquito pages about illnesses and prevention.

Illnesses Spread by Ticks

dhs.wisconsin.gov/tick/index.htm

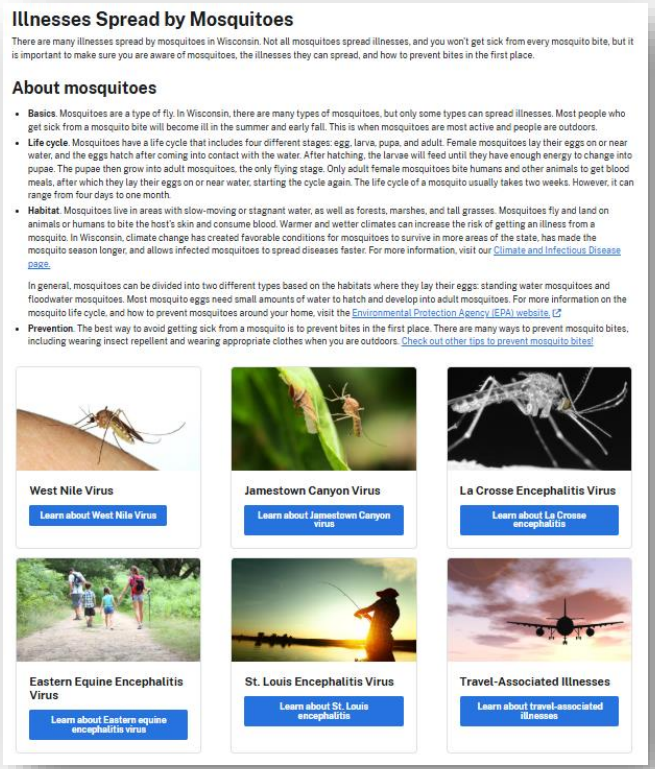


This page links to all tick-specific pages, including:

- Disease-specific pages
- Tick and vector information
- Prevention

Illnesses Spread by Mosquitoes

dhs.wisconsin.gov/mosquito/index.htm



Illnesses Spread by Mosquitoes

There are many illnesses spread by mosquitoes in Wisconsin. Not all mosquitoes spread illnesses, and you won't get sick from every mosquito bite, but it is important to make sure you are aware of mosquitoes, the illnesses they can spread, and how to prevent bites in the first place.

About mosquitoes

- **Basics**. Mosquitoes are a type of fly. In Wisconsin, there are many types of mosquitoes, but only some types can spread illnesses. Most people who get sick from a mosquito bite will become ill in the summer and early fall. This is when mosquitoes are most active and people are outdoors.
- **Life cycle**. Mosquitoes have a life cycle that includes four different stages: egg, larva, pupa, and adult. Female mosquitoes lay their eggs on or near water, and the eggs hatch after coming into contact with the water. After hatching, the larvae will feed until they have enough energy to change into pupae. The pupae then grow into adult mosquitoes, the only flying stage. Only adult female mosquitoes bite humans and other animals to get blood meals, after which they lay their eggs on or near water, starting the cycle again. The life cycle of a mosquito usually takes two weeks. However, it can range from four days to one month.
- **Habitat**. Mosquitoes live in areas with slow-moving or stagnant water, as well as forests, marshes, and tall grasses. Mosquitoes fly and land on animals or humans to bite the host's skin and consume blood. Warmer and wetter climates can increase the risk of getting an illness from a mosquito. In Wisconsin, climate change has created favorable conditions for mosquitoes to survive in more areas of the state, has made the mosquito season longer, and allows infected mosquitoes to spread diseases faster. For more information, visit our Climate and Infectious Disease page.

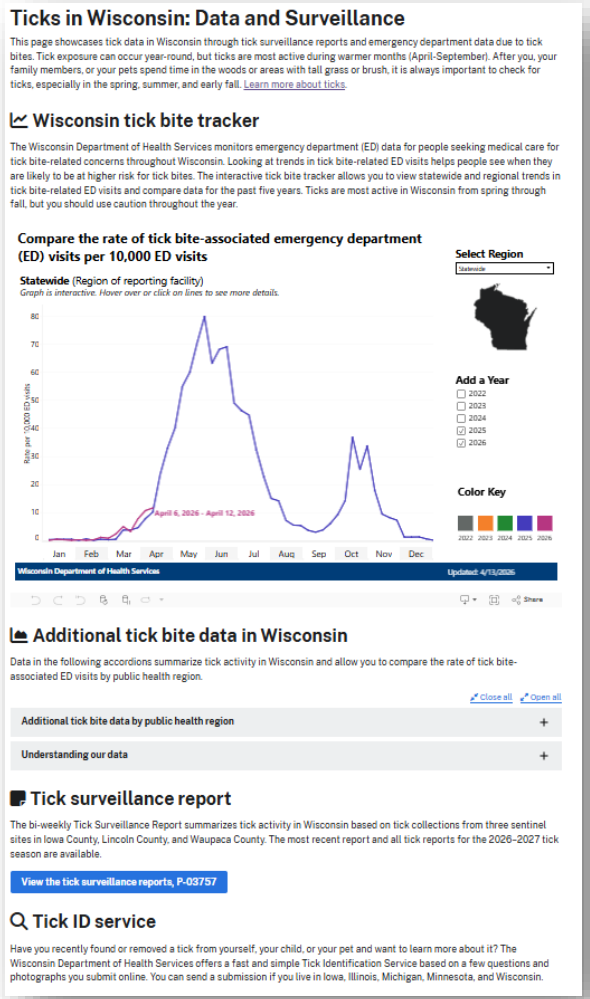
  In general, mosquitoes can be divided into two different types based on the habitats where they lay their eggs: standing water mosquitoes and floodwater mosquitoes. Most mosquito eggs need small amounts of water to hatch and develop into adult mosquitoes. For more information on the mosquito life cycle, and how to prevent mosquitoes around your home, visit the Environmental Protection Agency (EPA) website.
- **Prevention**. The best way to avoid getting sick from a mosquito is to prevent bites in the first place. There are many ways to prevent mosquito bites, including wearing insect repellent and wearing appropriate clothes when you are outdoors. Check out other tips to prevent mosquito bites!

This page links to all mosquito-specific pages, including:

- Disease-specific pages
- Travel-associated infections
- Prevention

Ticks in Wisconsin

dhs.wisconsin.gov/tick/wisconsin.htm



Ticks in Wisconsin: Data and Surveillance

This page showcases tick data in Wisconsin through tick surveillance reports and emergency department data due to tick bites. Tick exposure can occur year-round, but ticks are most active during warmer months (April-September). After you, your family members, or your pets spend time in the woods or areas with tall grass or brush, it is always important to check for ticks, especially in the spring, summer, and early fall. Learn more about ticks.

Wisconsin tick bite tracker

The Wisconsin Department of Health Services monitors emergency department (ED) data for people seeking medical care for tick bite-related concerns throughout Wisconsin. Looking at trends in tick bite-related ED visits helps people see when they are likely to be at higher risk for tick bites. The interactive tick bite tracker allows you to view statewide and regional trends in tick bite-related ED visits and compare data for the past five years. Ticks are most active in Wisconsin from spring through fall, but you should use caution throughout the year.

Compare the rate of tick bite-associated emergency department (ED) visits per 10,000 ED visits

Statewide (Region of reporting facility)

Graph is interactive. Hover over or click on lines to see more details.

Select Region

Add a Year

2022
2023
2024
2025
2026

Color Key

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Wisconsin Department of Health Services

Updated: 4/13/2026

Additional tick bite data in Wisconsin

Data in the following accordions summarize tick activity in Wisconsin and allow you to compare the rate of tick bite-associated ED visits by public health region.

Close all Open all

Additional tick bite data by public health region +

Understanding our data +

Tick surveillance report

The bi-weekly Tick Surveillance Report summarizes tick activity in Wisconsin based on tick collections from three sentinel sites in Iowa County, Lincoln County, and Waupaca County. The most recent report and all tick reports for the 2026-2027 tick season are available.

View the tick surveillance reports, P-03757

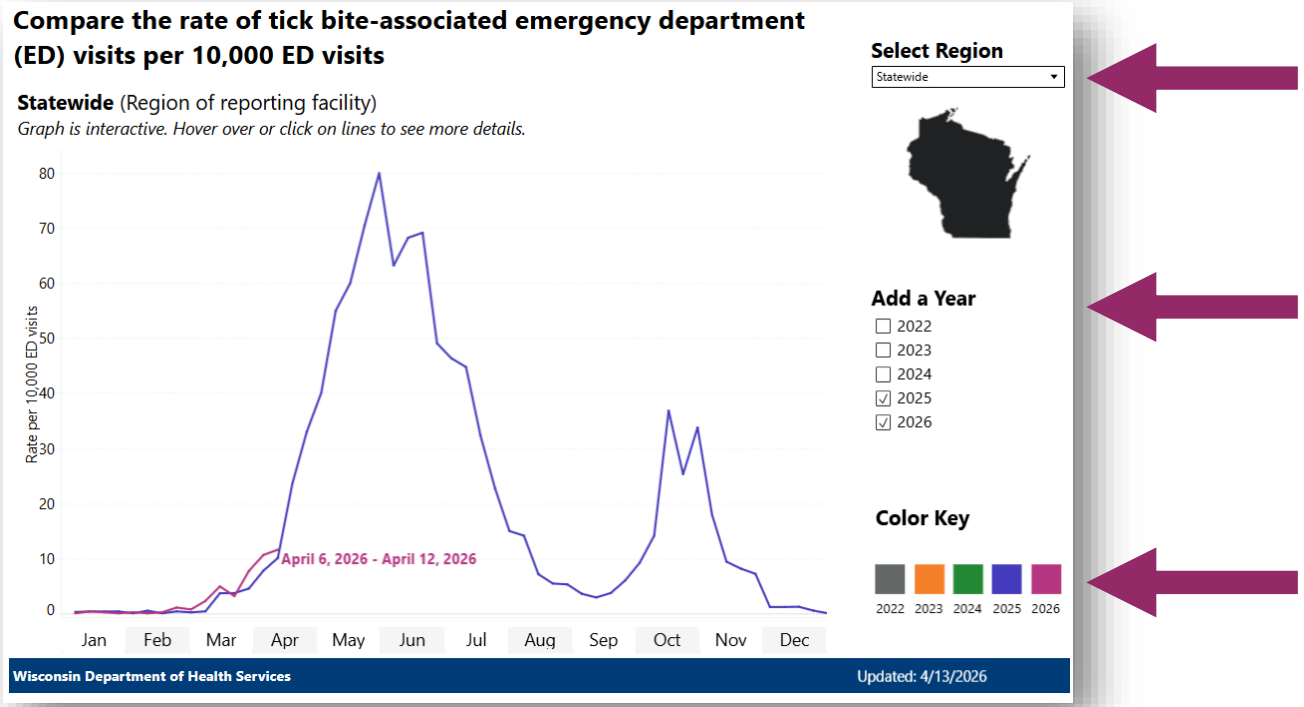
Tick ID service

Have you recently found or removed a tick from yourself, your child, or your pet and want to learn more about it? The Wisconsin Department of Health Services offers a fast and simple Tick Identification Service based on a few questions and photographs you submit online. You can send a submission if you live in Iowa, Illinois, Michigan, Minnesota, and Wisconsin.

This page includes:

- Tick bite tracker
- Tick surveillance report
- Tick ID service

Wisconsin Tick Bite Tracker

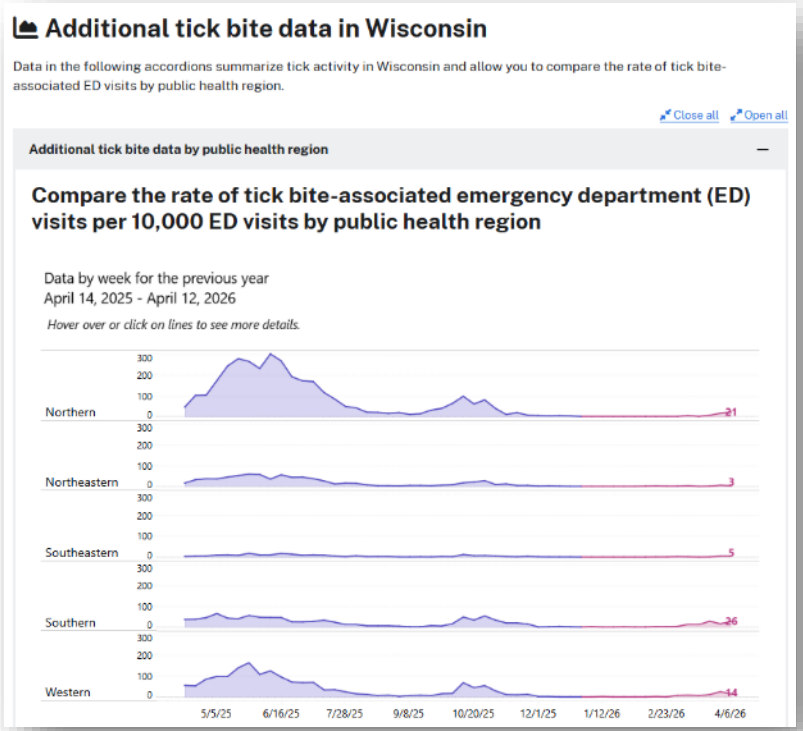


dhs.wisconsin.gov/tick/wisconsin.htm

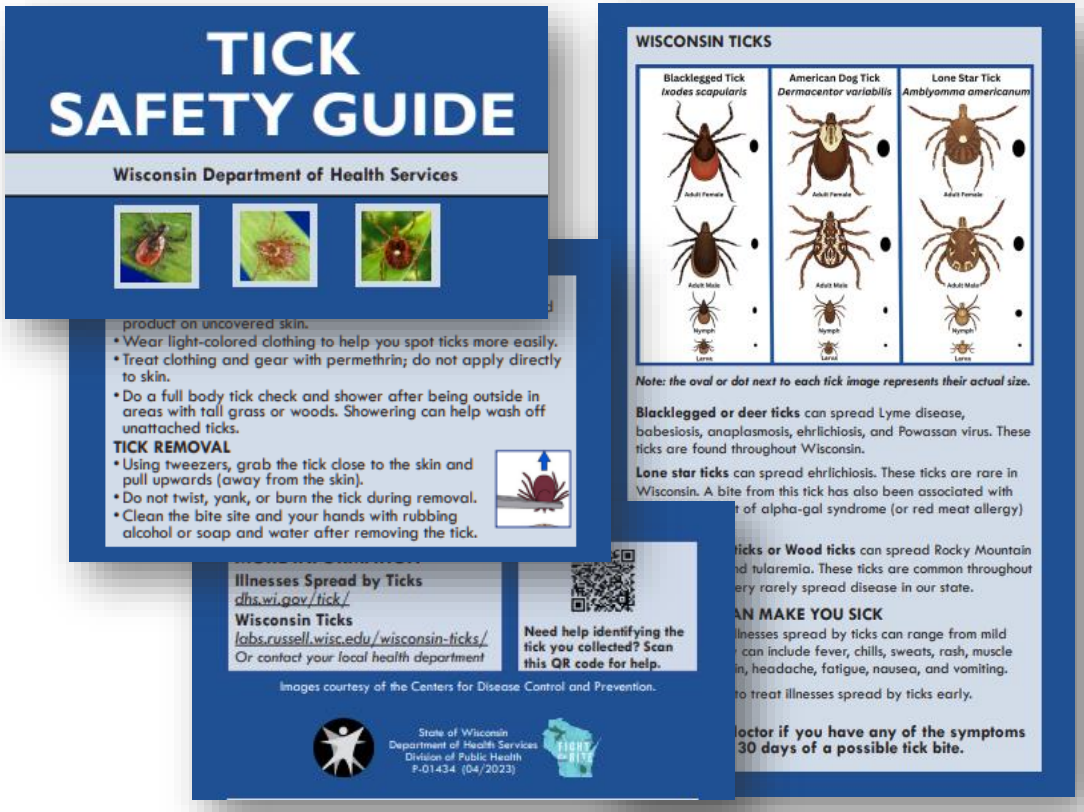
Wisconsin Tick Bite Tracker

- Displays proportion of visits to emergency departments (EDs) in Wisconsin that were tick-bite associated visits.
- Displayed as a rate:
  Tick bite associated visits per 10,000 visits
- Data available by public health region

Regional Comparison View



Tick Safety Guide



Wallet sized card that can be ordered for free on the DHS website in multiple languages.

View card options:
dhs.wisconsin.gov/library/collection/p-01434

Order here:
dhs.wisconsin.gov/forms/printformsonline.htm

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FIGHT the BITE