Lyme Disease

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Lyme Disease
Borrelia burgdorferi

- spirochete: motile, corkscrew-shaped bacteria
- *B. burgdorferi* sensu lato
  - *B. burgdorferi* sensu stricto
  - *B. mayonii* (rare)
  - *B. garinii*
  - *B. afzelii*

U.S.

Europe

AAP Red Book 2021 · Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases

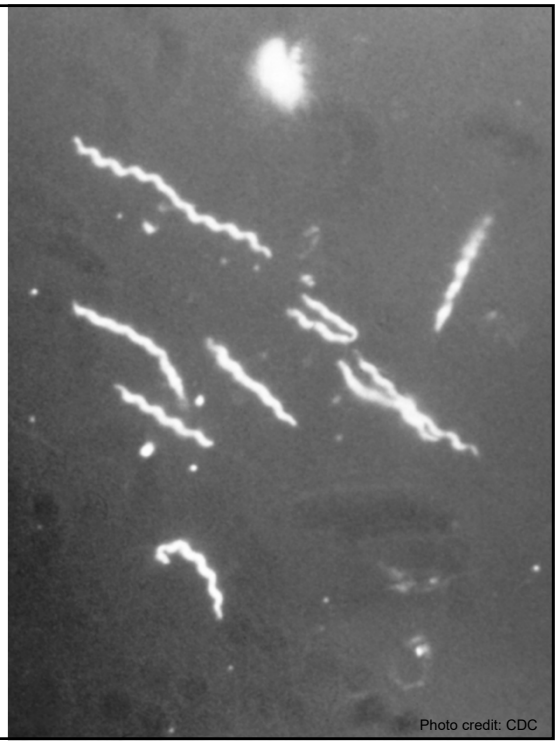
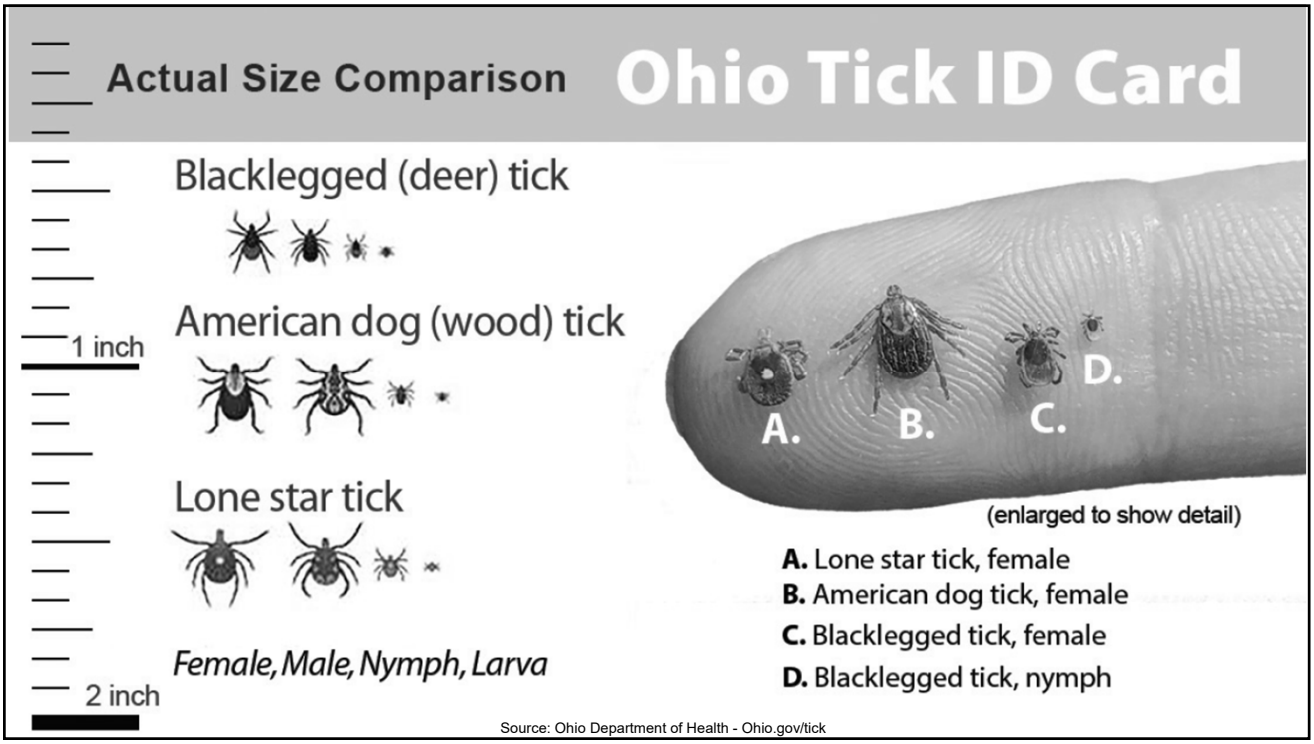


Photo credit: CDC

The Vector

- Blacklegged tick (*Ixodes scapularis*)
  - Widely distributed in eastern U.S.
- Western blacklegged tick (*Ixodes pacificus*)
  - Pacific coast states
- Feed on mammals, birds, reptiles, amphibians
- Other diseases carried: anaplasma, ehrlichia, babesia, Powassan virus

Photo source: phil.cdc.gov, Scott Bauer, Agricultural Research Service



Source: Ohio Department of Health - Ohio.gov/tick

Lyme Disease: A Zoonosis

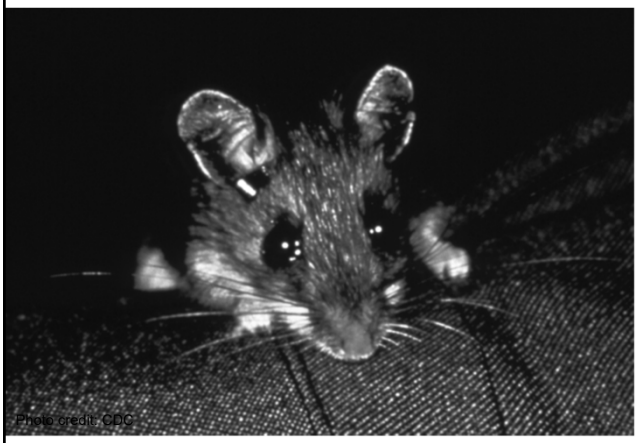


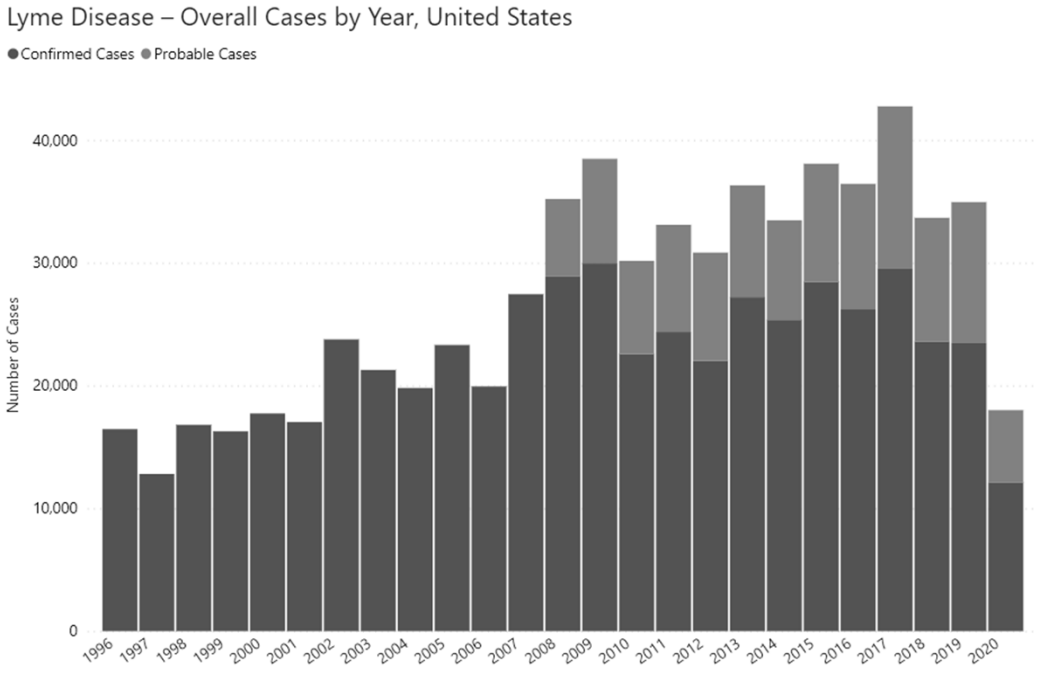
Photo credit: CDC

- Reservior: small rodents
  - In Eastern U.S., especially the white-footed mouse
- Dead-end hosts: white-tailed deer, humans

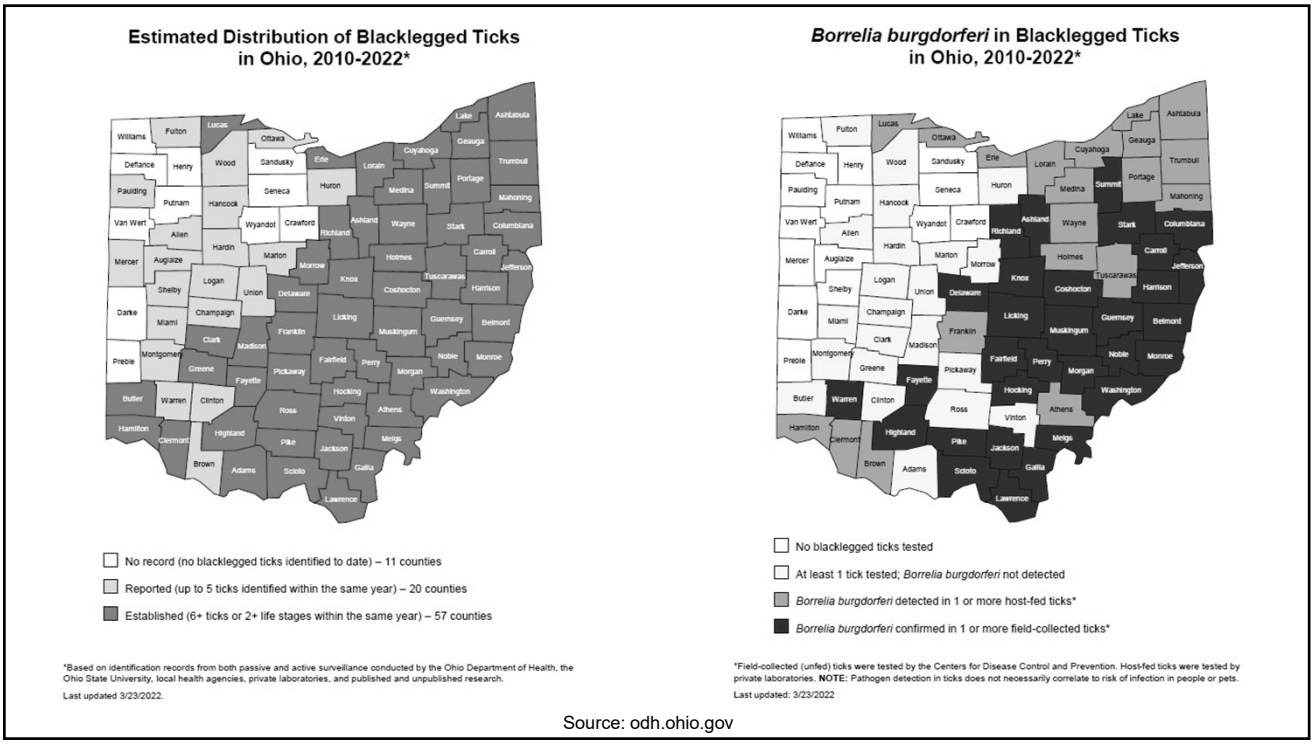
Lyme Epidemiology

- Annual cases (CDC):
  - Insurance records: ~476,000/yr
  - Nationally Notifiable Diseases Surveillance System (passive reporting):
    - » ~35,000 reported/yr
    - » Top 3 states in 2019: PA, NY, NJ
    - » Most common in June, July
    - » Bimodal age peaks: 5-9y, 55-59y

www.cdc.gov

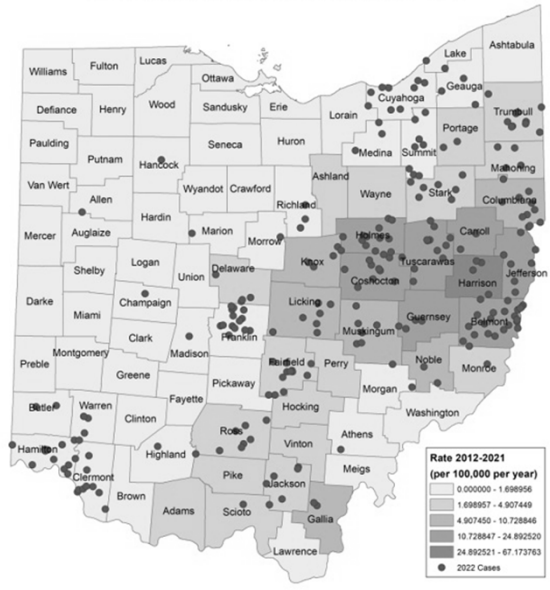


https://www.cdc.gov/lyme/datasurveillance/surveillance-data.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Flyme%2Fdatasurveillance%2Frecent-surveillance-data.html



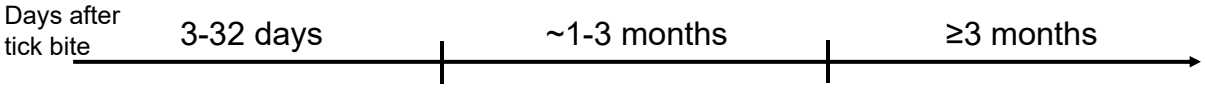
Source: odh.ohio.gov

Lyme Disease in Ohio
2022* Cases Compared to Incidence 2012 – 2021



Source: Ohio Department of Health.
* Data as of 09/16/2022, 244 cases.
County-level data are based on the county of residence of the case.

Manifestions of Lyme



Early Localized
- single erythema migrans

Early Disseminated
- multiple erythema migrans
- cranial nerve palsies (esp CN7)
- meningitis
- radiculitis
- carditis

Late
- arthritis

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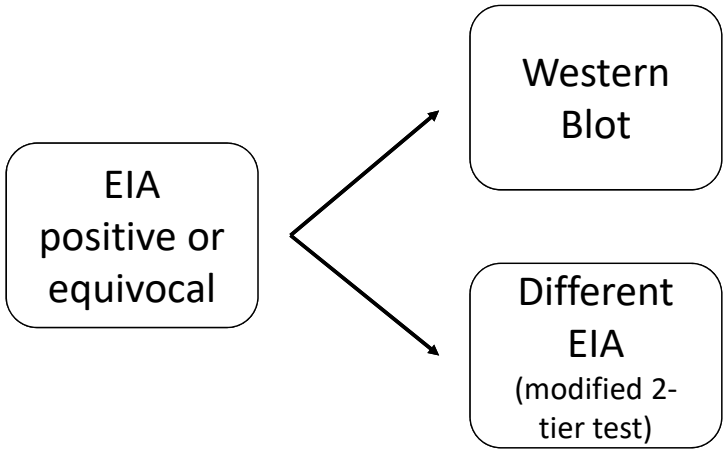
Diagnosis

- Clinical – erythema migrans
- Serology
  - IgM:
    - » appears 3-4 weeks after infection → peaks at 6-8 weeks → declines but may remain elevated for years despite cure
  - IgG:
    - » appears 4-8 weeks after infection
  - If treated early, may not develop antibodies

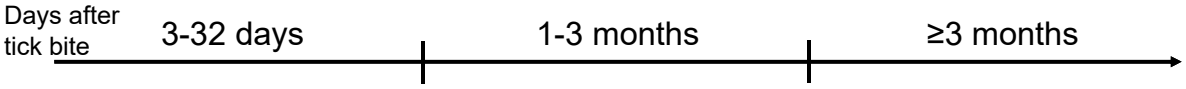
Lyme Serology

- Enzyme immunoassay (EIA)
  - cross reacts with many other infections or spirochetes of normal oral flora
- Immunoblot (Western blot)
  - IgM: Abs to 3 proteins (must have 2)
  - IgG: Abs to 10 proteins (must have 5)

2-Tier Testing



Lyme Stage & Serology



Early Localized
- single erythema migrans

- Serology often negative
- Classic EM: don't test
- Atypical rash: test; may need repeat in 2-3 wks

Early Disseminated
- multiple erythema migrans
- cranial nerve palsies (esp CN7)
- meningitis
- radiculitis
- carditis

- IgG usually positive
- Symptoms >30 d: disregard IgM

Late
- arthritis

- IgG positive
- Disregard IgM

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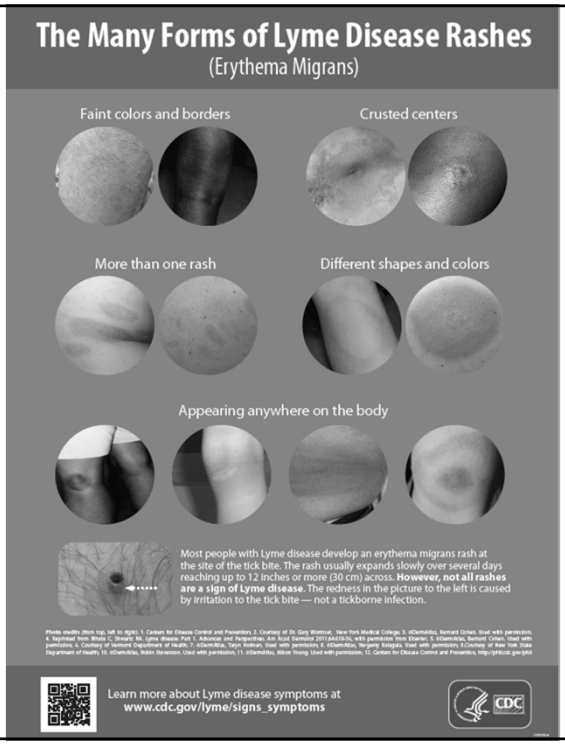
Erythema Migrans

- Classic: target lesion with central clearing
- Gradual expansion
- May have systemic symptoms:
  - Fever
  - Headache
  - Myalgia/Arthralgia
  - Fatigue
  - Lymphadenopathy



EM Treatment

- Single or multiple EM:
  - doxycycline x 10 days
  - amoxicillin x 14 days
  - cefuroxime x 14 days
  - azithromycin x 7 days (if cannot use above drug)
- Doxy in children <8y? OK for courses <21 days

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Facial Nerve Palsy


Personal patient of Joshua Watson

- Lasts 2-8 wks
- Usually resolves completely
- Treatment:
  - Doxycycline x 14-21 days
  - no impact on course of CN7 palsy
  - used to prevent late disease

IDSA Lyme Disease Guidelines: Lantos et al. *Clin Infect Dis* 2021

Facial Nerve Palsy


Personal patient of Joshua Watson

- Steroid?
  - If Lyme Disease known: unclear benefit vs harm
  - Patients ≥16y with CN7 palsy of unknown cause:
    - » steroid recommended within 72h onset
    - » based on benefit for idiopathic CN7 palsy

IDSA Lyme Disease Guidelines: Lantos et al. *Clin Infect Dis* 2021

Meningitis

- Lymphocytic pleocytosis
  - 50-250 WBCs, normal glucose, modestly inc. protein
- CSF:serum antibody index
  - simultaneous Lyme serology in CSF and serum
  - elevated level indicates intrathecal antibody production
- PCR in CSF: low-yield

Meningitis

- Potential accompanying problems:
  - papilledema, intracranial hypertension
    - » particularly in children
    - » may occur without CSF pleocytosis
  - CN palsies, radiculopathy
- Meningitis treatment:
  - doxycycline x 14-21 days
  - IV ceftriaxone x 14-21 days
- Other CNS: encephalitis, myelitis, cerebellar ataxia

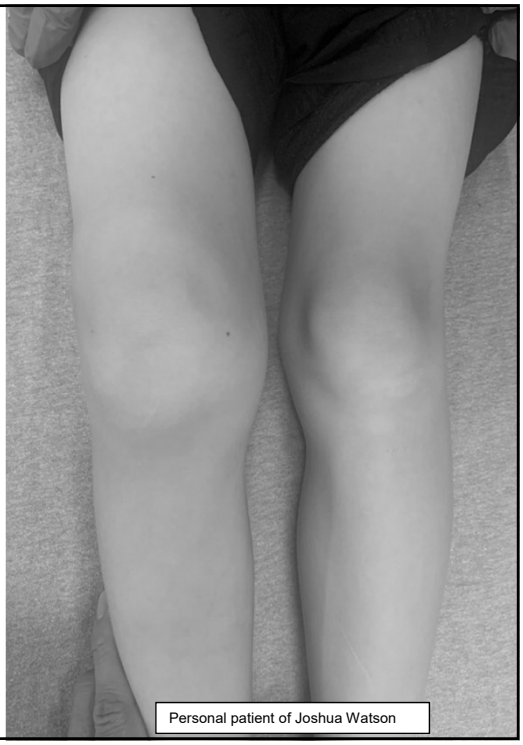
Carditis

- Varying degrees of AV block
  - complete heart block rare
- ECG for all patients with Lyme?
  - No. Only recommended if symptoms
    - » syncope, presyncope, palpitations, dyspnea
- Treatment:
  - doxycycline, amoxicillin, or cefuroxime x 14-21d
  - if hospitalized, ceftriaxone

Arthritis

- Mono- or oligoarticular
- Typically large joints (knee in >90%)
- Joint swelling & effusion out of proportion to pain
- Baker cyst may occur
- Diagnosis:
  - Serology (positive IgG)
  - PCR from synovial fluid or tissue

AAP Red Book 2021 · Principles and Practice of Pediatric Infectious Diseases



Lyme vs Septic Arthritis

	Lyme Arthritis	Septic Arthritis
Range of motion	Mildly limited	Severely limited
Systemic symptoms	Well appearing, often afebrile	Fever, irritability, malaise
Serum ANC	<10,000	≥10,000
ESR	<40	≥40
C-Reactive Protein (mg/dL)	<4	≥4
Joint fluid WBC (typical)	40,000-80,000	>50,000
Joint fluid differential	Neutrophil predominant in both cases	

ANC, absolute neutrophil count

Principles and Practice of Pediatric Infectious Diseases · Deanehan et al. *Pediatrics* 2013 · Baldwin et al. *J Bone Joint surg Am* 2016

Lyme Arthritis Management

- Initial treatment
  - doxycycline, amoxicillin, or cefuroxime x 28d
  - swelling may take weeks to resolve
  - some have no/minimal response
  - may develop inflammation of another joint during treatment
  - post-infectious inflammatory arthritis may develop

AAP Red Book 2021 · IDSA Lyme Disease Guidelines: Lantos et al. *Clin Infect Dis* 2021

Lyme Arthritis Management

- Mild residual swelling after initial treatment?
  - observation vs 2nd course of oral antibiotic
- No/minimal response to initial treatment?
  - IV ceftriaxone x 14-28d
- No/minimal response to IV course?
  - Refer to Rheumatology

IDSA Lyme Disease Guidelines: Lantos et al. *Clin Infect Dis* 2021

Treatment Summary

	Antibiotic	Duration (days)
Erythema migrans	Doxycycline	10
	Amoxicillin, cefuroxime	14
	Azithromycin	7
Cranial nerve palsy	Doxycycline	14-21
Meningitis	Doxycycline	14-21
	Ceftriaxone	14-21
Carditis	Doxycycline, amoxicillin, cefuroxime	14-21
	Ceftriaxone	14-21
Arthritis – initial	Doxycycline, amoxicillin, cefuroxime	28
Arthritis – refractory	Doxycycline, amoxicillin, cefuroxime	28
	Ceftriaxone	14 (up to 28)

IDSA Lyme Disease Guidelines: Lantos et al. *Clin Infect Dis* 2021

Post-Treatment Lyme Disease Syndrome

- Pain, fatigue, difficulty thinking lasting >6 months
- Cause unclear
  - autoimmune? persistent infection? other?
  - important to consider other diagnoses
- No proven treatment, but demonstrated harm from prolonged antibiotics
- Most gradually improve over months

https://www.cdc.gov/lyme/postlds/index.html

Prophylaxis

- High-risk tick bites:
  - Blacklegged tick
  - Occurred in highly endemic area
  - Tick attached for ≥36 hrs (ie, engorged)
- Must provide within 72 hrs of tick removal
- Doxycycline 4.4 mg/kg (200 mg max) x 1 dose

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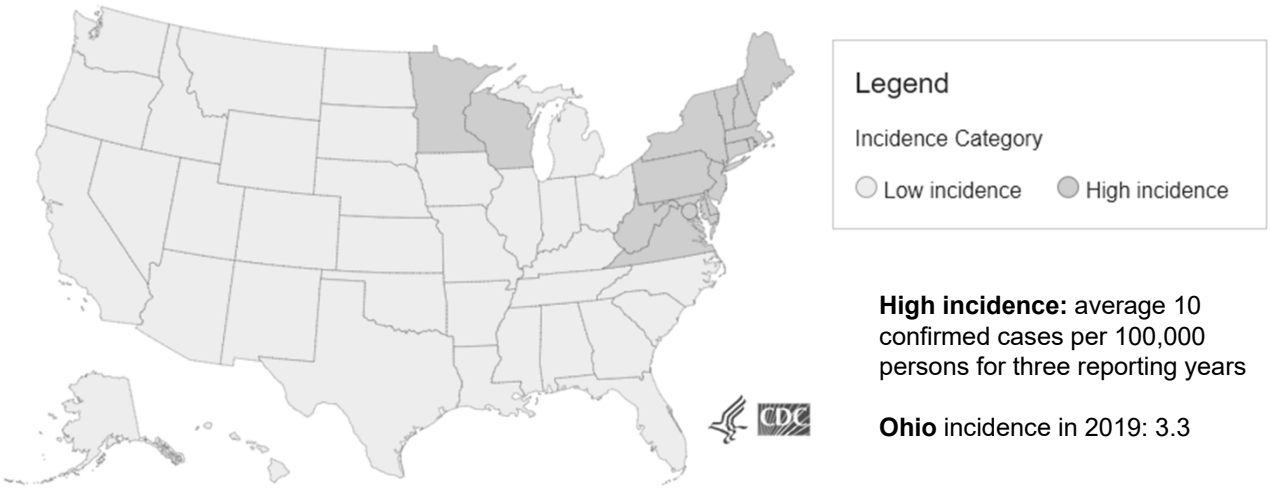
Prophylaxis

NOT currently recommended in OH



High incidence: average 10 confirmed cases per 100,000 persons for three reporting years

Ohio incidence in 2019: 3.3

https://www.cdc.gov/lyme/datasurveillance/maps-recent.html

Thank you!

Photo: agriculture.vermont.gov