

#### Common ticks encountered in Michigan

Only the blacklegged tick transmits the Lyme disease pathogen



American dog tick Blacklegged tick (deer tick)



#### Lyme disease: background information

• Lyme disease is the most common vector-borne disease in the United States (Mead 2015)

• Vector: Ticks

• Main vector in northeastern and north central U.S.: *Ixodes scapularis* (AKA blacklegged and deer tick)

- Pathogen: Borrelia burgdorferi
  - Bacterium
  - Spirochete



#### Ecology of Lyme disease



#### Nymphal stage: the epidemiologically most important stage for humans!



# **70%** of infected persons have Erythema migrans (EM) rash



- ₭ Begins at the site of a tick bite after a delay of 3 to 30 days
- ✗ Expands gradually
- ₭ "Bull's-eye" appearance

MOHHS



Other symptoms 3 to 30 days after tick bite include:

- 🕷 Fever
- ¥ Chills
- Headache
- 🕷 Fatigue
- ✗ Muscle and joint aches
- ✗ Swollen lymph nodes
- Full recovery usually with early recognition & treatment with antibiotics

**M**DHHS



# Michigan passive public health surveillance





#### Reported Lyme disease cases in Michigan: 2015 EPI Curve



# 2016 Atypical Case Investigation

- July 12, 2016 MDHHS contacted by Washtenaw County public health regarding suspected Lyme carditis case with potential local exposure
  - Interview with patient and family: no history of travel, but walked dog frequently on family property. Pt reported embedded ticks in neck and scalp in early May, he thought they were "dog ticks"
- July 20, 2016 MDHHS receives convalescent specimens for confirmatory Lyme antibody testing
- July 27, 2016 Lyme positive antibody results confirmed by MDHHS Bureau of Laboratories

#### Media



#### **Important Considerations**

- Blacklegged ticks and Lyme disease were not previously thought to be established in Washtenaw Co.
  - Previous field surveillance has not detected populations
     Few tick submissions from the public
- Case report provided strong evidence of local exposure to ticks with resulting Lyme illness
- MDHHS EZID Section staff, Michigan State University faculty & students, and local public health proposed ecologic case follow-up to determine if Washtenaw County is an area of Lyme emergence

#### Field investigation (Aug. 28-Sept. 2, 2016)

#### Objectives:

To assess Lyme disease risk at case patient's residence, natural areas in Washtenaw County, and a control site by:

- a) Investigating the relative abundance of I. scapularis
- b) Determining the infection prevalence of *B*.
- burgdorferi in ticks and small mammal tissue biopsies



#### Methods



#### Results – trapping effort and success

 Table 1. Trapping effort and capture success for small mammals in southeastern

 Michigan (Waterloo SRA, Pinckney SRA, and the patient's residence), and at the Mid-Michigan Control Site. At each site, transects were trapped for 2 consecutive nights

 between August 28 - September 2, 2016.

Site	Mammals captured	Adjusted trap nights	Capture success (%)	Mark recapture population estimat	
Waterloo SRA	30	286	10.5	27.5	
Pinckney SRA	18	146	12.3	22	
Patient residence	3*	73	2.7	**	
Total for Southeast	50	505	9.9	51.5	
Mid-Michigan Control	46	290	15.9	165	
*1 found dead on prop	erty, **Insufficie	ent data to analyze			
	Contro	l site w/much high	er small mamn	nal nonulations	

Control site w/much higher small mammal populations



#### Results - on host ticks



Figure 2. Percentage of small mammals infested with *Ixodes scapularis* larvae at four sites in mid and southeastern Michigan; August 28 – September 2, 2016.

#### Results – dragging success

Table 2. Dragging success (L= larvae, N = nymphs) at four sites in mid and southeastern Michigan; August 28 –Sept 2, 2016.

Site	# Ticks (L / N)	Distance dragged (m <sup>2</sup> )	Overall dragging success (L / N)	Ticks/1000 m <sup>2</sup>	
Waterloo SRA	112/0	1470	0.076 / 0	76 / 0	
Pinckney SRA	0/0	1200	0 / 0	0/0	
Patient residence	0/0	240	0 / 0	0/0	
Mid-Michigan Control	124 / 3	1910	0.065 / 0.002	65 / 2	

#### Results - B. burgdorferi prevalence

 Table 3.
 Mammal captures, tick loads, dragged nymphs, B. burgdor/feri prevalence in hosts and ticks at four sites in Mid and SE Michigan, August 28 – September 2, 2016

 Site
 Waterloo
 PR
 Pinckney Control

Site	waterioo		Fillokiley	Control
No. of mammals captured	30	3*	18	46
No. of biopsies tested	23	3	13	41
No. of positive biopsies	0	1	0	0
Host infection prevalence	0%	33%	0%	0%
Total no. on-host larvae	14	0	2	261
Total no. on-host nymphs	0	0	0	0
Average no. of ticks per mammal	0.47	0	0.11	5.67
Range in no. of ticks per mammal	0-5	0	0-1	0 - 50
No. of positive ticks	0	0	0	0
On-host tick infection prevalence	0%	No data	0%	0%
Total no. dragged nymphs	0	0	0	3
No. of positive nymphs	0	0	0	0
Questing nymph infection prevalence	No data	No data	No data	0%
Iotai no. on-host iarvæe Totai no. on-host iarvæe Totai no. on-host mymbis Range in no. of licks per mammal No. of positive ticks On-host tick inflection prevalence Total no. dragged nymphs No. of positive nymphs Questing nymph infecton prevalence	14 0 0.47 0-5 0 0% 0 0 0 No data	0 0 0 0 0 No data 0 0 0 No data	2 0 0.11 0-1 0% 0 0 0 No data	261 0 5.67 0 - 50 0 0% 3 0 0%

\* 1 found deceased on property

#### Discussion

- Ecologic case follow-up studies help document the expanding distribution of *I. scapularis*, and provided valuable information regarding Lyme disease risk
- Waterloo and Pinckney SRA's are now considered to have established populations of *I. scapularis*
- Waterloo and Pinckney SRA's span Livingston, Washtenaw, and Jackson Counties, so additional field studies may document further population spread in those counties
- \* *B. burgdorferi* has been documented in Washtenaw Co. wildlife
- It is likely that Lyme disease risk will continue to expand into suitable habitats





# Fall 2016 Field Surveillance Results

- Dates: Range from Oct. 11-Nov. 16, 2016
- Total meters dragged: 48,005 m<sup>2</sup>
- 400 ticks collected
  - 1 blacklegged nymph
  - 399 blacklegged adults
- Ticks collected in 6/12 counties
- Preliminary pathogen testing: Infection detected in Washtenaw and Iosco Counties





# www.michigan.gov/lymeinfo





#### More resources available online





www.michigan.gov/lyme

www.cdc.gov/lyme



# Why is the Lyme disease definition changing?

- As with other nationally notifiable conditions, CDC works with states and territories on an ongoing basis to discuss ways to simplify and improve surveillance for Lyme disease.
- This new case definition is the result of several years of collaboration to create more standardized criteria to determine likelihood of exposure to Lyme disease.

#### Key changes to the definition

- Testing of cerebrospinal fluid (CSF) is no longer required for the reporting of encephalomyelitis.
- 2. Criteria to distinguish a new case from an existing case have been added.
  - Case not previously reported to public health authorities

#### Key changes to the definition

- 3. Exposure
  - In the PAST: Exposure has been defined as residence in or travel to a wooded, brushy, or grassy area in an "endemic" county, which proved to be an unstandardized classification.
  - NOW (2017): Likelihood of exposure will be assessed based on residence in or travel to a wooded, brushy, or grassy area in a state that consistently reports a high incidence of Lyme disease (>10 per 100,000 population).
    - Confirmation of cases with only an erythema migrans rash and without exposure in a high incidence state <u>requires</u> <u>laboratory evidence of infection.</u>

#### High vs. Low Incidence States

- The U.S. is now divided into high- or low-incidence Lyme disease states
- **High-incidence**: at least 10 confirmed cases/ 100,000 for the previous three reporting years
- Low-incidence: less than 10 confirmed cases/ 100,000 for the previous three reporting years
- Michigan is considered a LOW-incidence state



#### What are the high-incidence states?

- Connecticut (CT)
- New Jersey (NJ)
- Delaware (DE)
- Maine (ME)
- Maryland (MD)
- Massachusetts (MA)
- Minnesota (MN)
- New Hampshire (NH)
- New York (NY)
- Pennsylvania (PA)
- Rhode Island (RI)
- Rhode Island (
- Vermont (VT)
- Virginia (VA)
- Wisconsin (WI)

#### Exposure change

- Now, you need to ask if the patient has traveled to a high-incidence state within 30 days before the onset of signs/symptoms
- If he/she did NOT travel to a high-incidence state, we will no longer classify a patient with an EM who lacks laboratory evidence, as a confirmed case

#### Key changes to the definition

- Weekly tallies of Lyme disease cases will no longer appear in the Morbidity and Mortality Weekly Report (MMWR).
  - Final totals of reported Lyme disease cases will continue to be reported in the annual final tables in CDC's MMWR each fall, on CDC's Lyme disease statistics webpage, and in the annual Summary of Notifiable Infectious Diseases and Conditions, published in CDC's MMWR each year.

# Case Classifications in MDSS

You can now close a case as either:



2) Probable 3) Confirmed



#### Suspect Cases

- A case of EM where there is no known exposure\* and no laboratory evidence of infection
  - \*Exposure is defined as having been (less than or equal to 30 days before onset of EM) in wooded, brushy, or grassy areas (i.e., potential tick habitats) of Lyme disease vectors in a HIGH INCIDENCE STATE.

#### **Probable Cases**

- Any other case of physician-diagnosed Lyme disease that has laboratory evidence of infection
  - Laboratory evidence plus non-confirmatory ss/sx

#### **Confirmed Cases**

- A case of EM with exposure in a **high** incidence state OR
- A case of EM with laboratory evidence of infection and a known exposure in a **low** incidence state OR
- Any case with at least one late manifestation that has laboratory evidence of infection

#### Review of lab results

#### To meet CDC criteria:

- 2-tier positive IgM Western Immunoblot (WB or IB) test collected within 30 days of onset
- 2-tier positive IgG WB/IB
- 1-tier positive IgG WB/IB
- Positive *B. burgdorferi* culture
   CSF antibody positive for *B. burgdorferi* by EIA or IFA (CSF titer must be higher than serum titer)

#### Does NOT meet CDC criteria:

- Positive ELISA/EIA/IFA only
- IgM WB/IB only
- IgM WB/IB collected >30 days after onset



Please enter information about all laboratory testing performed into MDSS!

#### Updated flow chart...



The updated flow chart can be found here.





#### Updated flow chart...



The updated flow chart can be found here.



The updated flow chart can be found here.



The updated flow chart can be found here.



Let's go over a couple of examples...

# Example 1

- 32 yo male dx with LD on August 10, 2017
- Pt lives in Oakland county
- Ss/sx: EM dx (by PCP!!!), myalgia, fever, and fatigue
- Onset of ss/sx: August 1, 2017
- Additional info.: No hx of tick bite, but went camping in WI on July 20, 2017
- No laboratory tests run, dx was made by PCP based on clinical presentation

Classification?



#### Confirmed

- Lab results do not meet CDC criteria
- EM dx by health care provider
- Exposure to wooded/brushy area <30 days before onset in a HIGH-incidence state

A case of EM with exposure in a high-incidence state

# Example 2

- 45 yo female dx with LD on June 30, 2017
- Lives in Van Buren county, no travel hx
- Additional info.: remembers pulling off an engorged tick after spending multiple days cleaning up brush in yard
- Ss/sx: EM dx (by PCP!!!), myalgia, headache, chills, fatigue
- Onset of ss/sx: June 15, 2017
- Laboratory tests: WB was run-Positive IgM only (collected June 30)

Classification?

#### Suspected

- Lab results do not meet CDC criteria (need 2-tier testing)
- EM was dx by health care provider
- No exposure in a HIGH-incidence state

A case of EM where there is no known exposure and no laboratory evidence of infection

# Example 3



- 12 yo male dx with LD on September 5, 2017
- Lives in Leelanau county, no out-of-state travel hx
- Additional info.: Recently went to North Manitou Island for weekend camping trip with boy scout troop and all of the boys were pulling ticks off of one another while hiking
- Ss/sx: fatigue, neck pain, headache, fever
- Onset of ss/sx: August 20, 2017
- Laboratory tests: Positive EIA, positive WB/IB IgM, negative WB/IB IgG (collected Sept. 5, 2017)

Classification?

#### Probable

- No EM dx by health care provider
- No late manifestations of LD
- Other symptoms not specific to LD were present
- · Lab results meet CDC criteria

Any other case of physician-diagnosed Lyme disease that has laboratory evidence of infection

#### Tick ID and Testing!



Expert tick identification and testing is available from the MDHHS.

- Place the tick in a small vial containing a damp piece of tissue or piece of grass and submit it using the MDHHS test requisition, following guidelines for tick identification and testing found at: www.michigan.gov/lyme.
- This service is free to the public for ticks removed from residents in Michigan.

# **Expedited Tick Testing**

- If you are confident that the tick collected is *lxodes scapularis*, you may send the tick directly to MDHHS Bureau of Laboratories for testing.
  - 3350 North Martin Luther King Jr. Blvd. Lansing, MI 48909
- Alternatively, you may send us an email picture of the tick and we can help you identify it, then it can be sent directly to MDHHS BOL.

- <u>fostere@Michigan.gov</u> or <u>sidgej@Michigan.gov</u>

