

# One Health: An Integrated Approach to Lyme Disease Management in Wisconsin

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Wisconsin Department of Health Services

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Protecting and promoting the health and safety of the people of Wisconsin

# Overview



Courtesy of CDC

- Lyme disease and other tickborne infections associated with *I. scapularis* in Wisconsin.
- Tick vectors, reservoirs, and hosts.
- Lyme and other tickborne diseases data and statistics.
- Lyme disease characteristics.
- Diagnosis and treatment.
- Control and prevention.

# Tickborne Diseases in Wisconsin

- **Anaplasmosis** - caused by the bacteria *Anaplasma phagocytophilum*.
- **Babesiosis** - typically *Babesia microti* parasite.
- **Ehrlichiosis** - bacteria *Ehrlichia chaffeensis* and *E. muris*-like.
- **Lyme disease** - bacteria *Borrelia burgdorferi*.
- **Powassan virus** - tickborne virus in the arbovirus group.

# Surveillance in WI, 2002-2012

Tickborne Infections Total (confirmed and probable)	Total Cases (%)	
	2012 n= 2,552	2002-2011 n= 21,099
• Powassan	2 (0.78)	11 (0.05)
• <b>Lyme disease</b>	<b>1,906 (75)**</b>	<b>18,189 (86)</b>
• Anaplasmosis/Ehrlichiosis	586 (23)	2,665 (13)
• Babesiosis	44 (1.7)	204 (0.97)
• Spotted fever rickettsiosis (SPF)*	14 (0.55)	30 (0.14)

\*Mostly acquired during travel to another endemic state.

\*\*Change in reporting requirement in June 2012

# Ticks

- Ticks are found in woods, bushes, high grass, and leaf litter.
- Active outdoors in warm weather and need moisture to survive.
- They can detect heat and carbon dioxide from nearby host.
- Attach to host when there is physical contact.
- In US, there are 80 species (850 species worldwide).
- 12 species are of public health or veterinary concerns, only one is of concern in WI.
- *Ixodes* sp. commonly known as the “blacklegged” or “deer” tick, is an important vector for most of the tickborne diseases in Wisconsin.



# *I. scapularis* (Blacklegged or Deer Tick)

Adult female deer tick

Adult male deer tick

Nymph

Larva



One Inch

*Dermacentor variabilis*, commonly known as American dog or wood tick.



Smaller than a American dog/wood tick, adult female and nymph can transmit infection through a bite for a blood meal.

# “Wood” Ticks



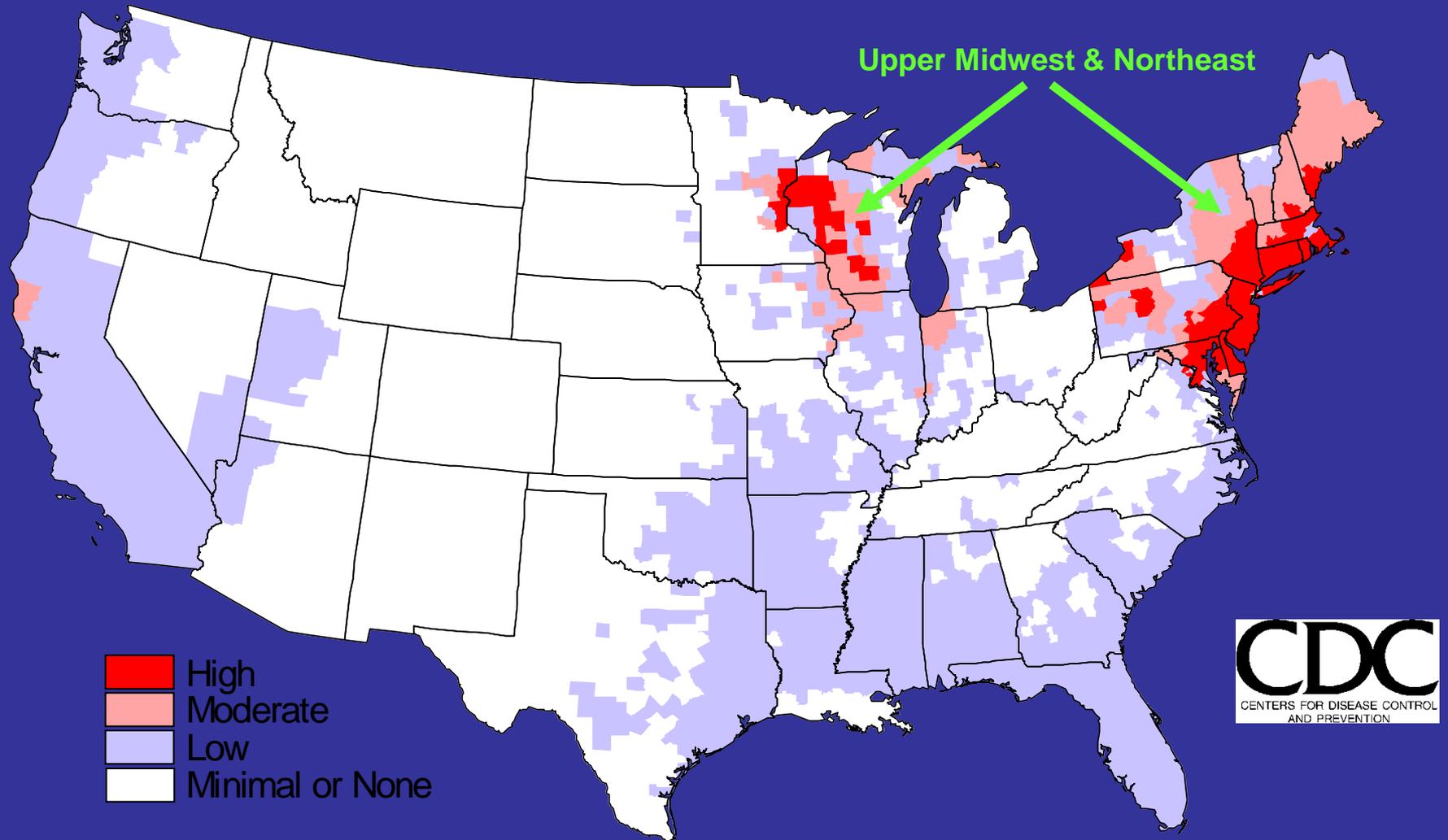
## *Dermacentor variabilis*

- Commonly known as “wood” ticks, American dog ticks.
- Most common ticks found in eastern and central United States.
- They do not transmit Lyme disease, anaplasmosis, ehrlichiosis, and Powassan virus.
- Can transmit spotted fever group, but limited tick testing have not identified this pathogen in Wisconsin.

# Distribution of *I. scapularis*

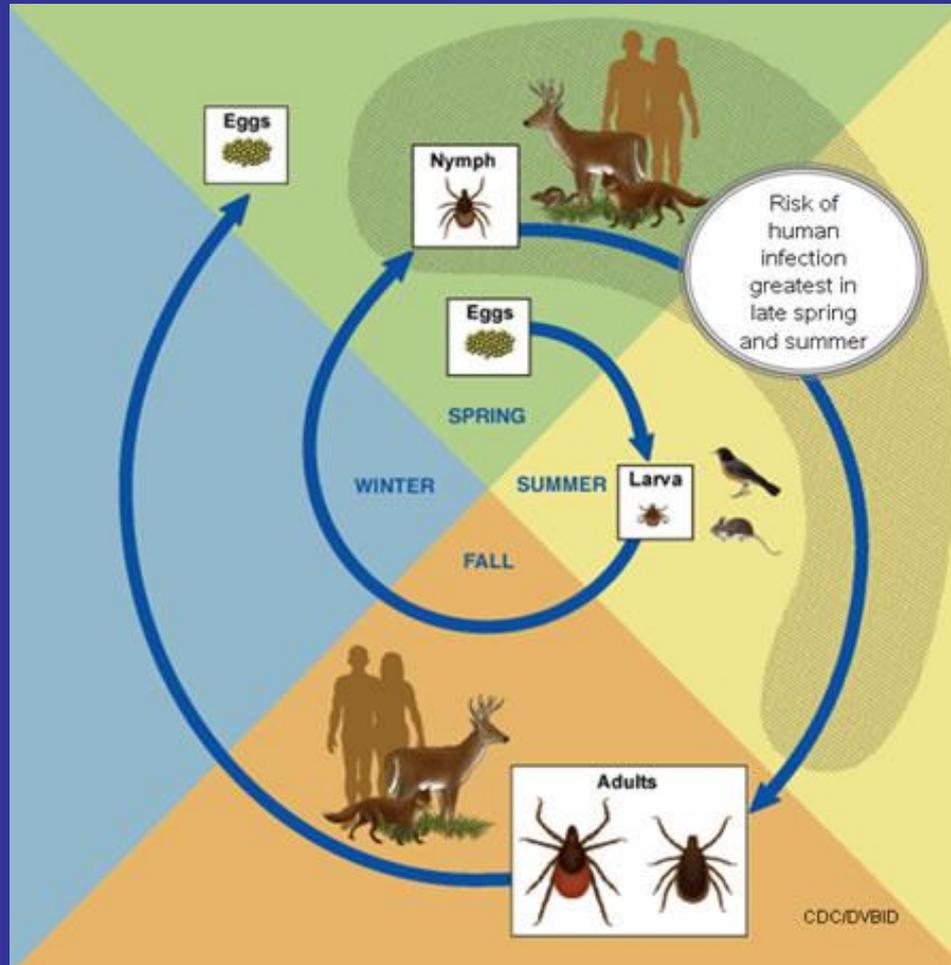
- Found along the east coast of United States.
- Small mammals, primarily white-footed mice (*Peromyscus leucopus*) are the most important reservoir hosts.
- Adult ticks feed on large mammals, primarily the white-tailed deer; therefore, deer can play an important role in the tick-life cycle.
- However, deer blood can inactivate *Borrelia* bacteria and are dead-end host.

# Lyme Disease High Risk Areas



# Life Cycle of Blacklegged Tick

Adult ticks becomes active in October and can remain active in the winter if temperatures are above freezing.



Nymphs feed on variety of hosts. Based on EM case onsets, nymphs account for most human transmission.

Larva activity peak in August when they feed on primarily white-footed mice (small mammals and birds), first chance for picking up the bacteria .

During the 2-year life cycle, total 3 blood meals.

Courtesy of CDC

Stages of blood engorgement in female adult *Ixodes* ticks depicted by the durations of attachment (borrowed from IDSA, Dr. Richard Falco-Fordham University).



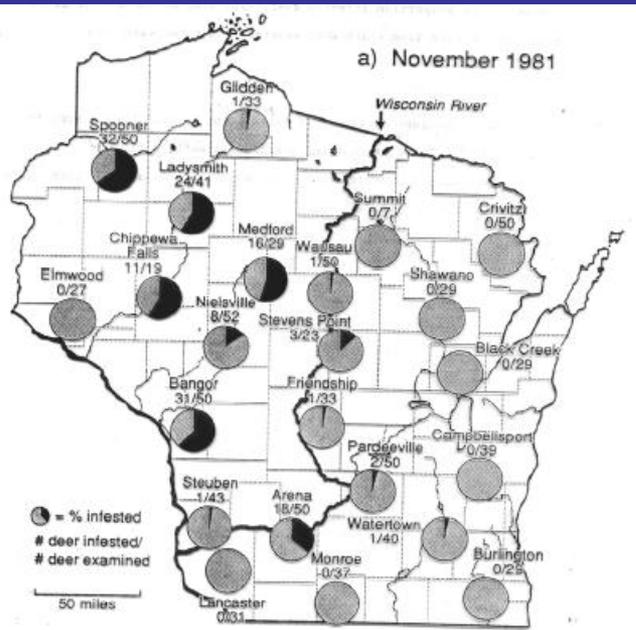
# Ticks Hunting 2008



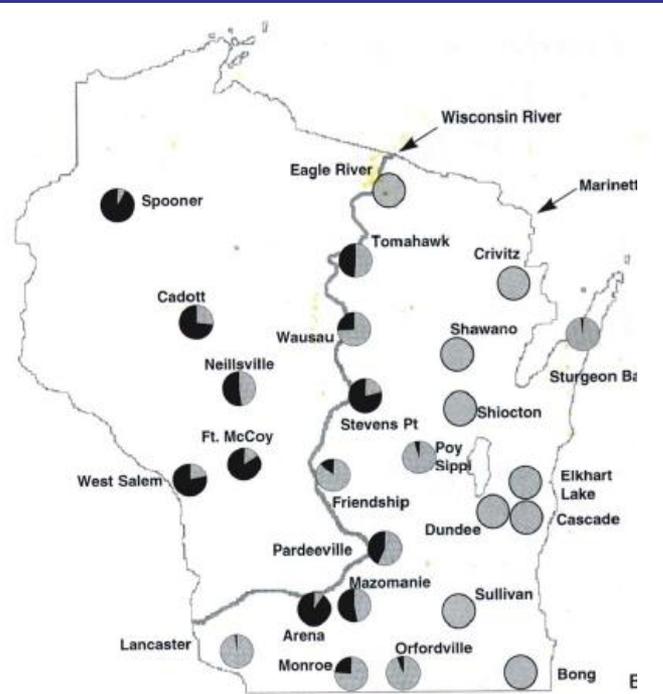
**Diep (Zip) Hoang Johnson from the Wisconsin Division of Public Health checked a hunter-registered deer for ticks.**

# UW-Madison, Entomology- Tick Surveys

1981

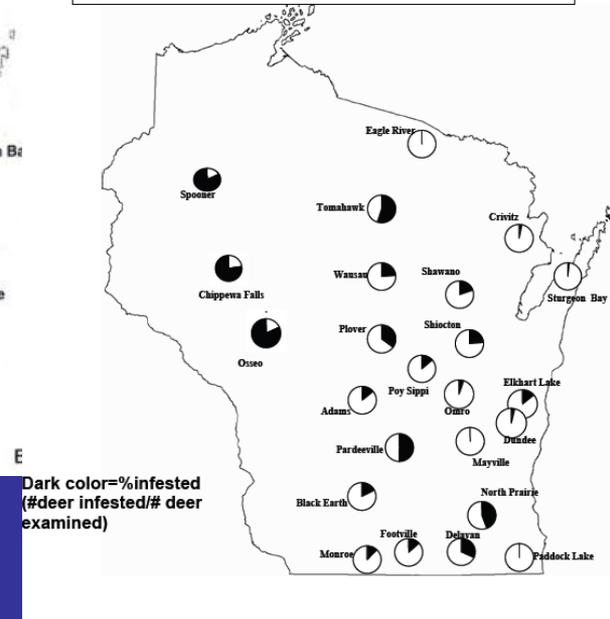


1994



2008-2009

Wisconsin Surveillance of Ticks Collected from Deer During Hunting Season, 2008-2009

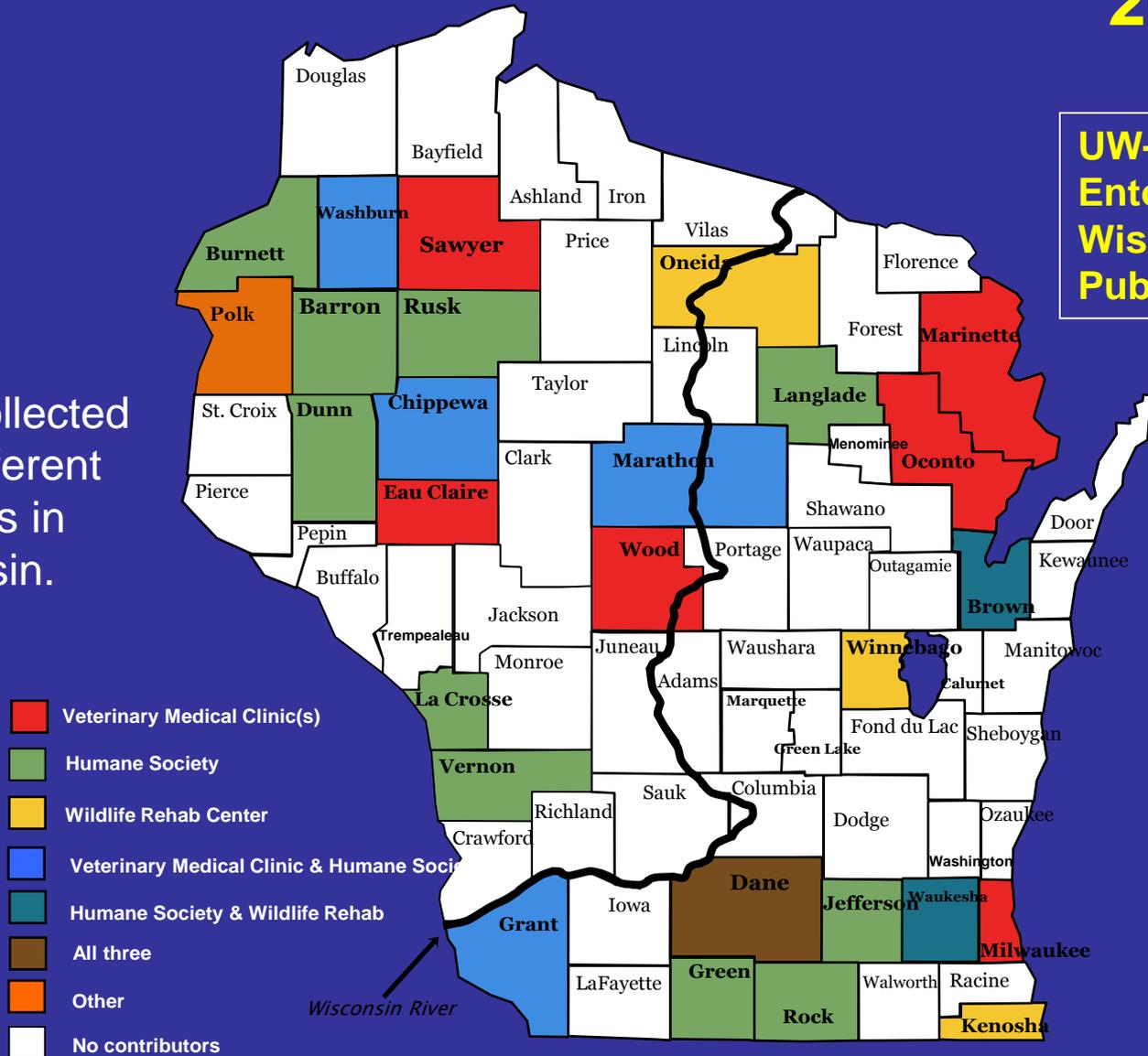


Dark color of the pie= % deer infested with *Ixodes* ticks

# Wisconsin Tick Surveillance of Small Mammals, 2011-2012

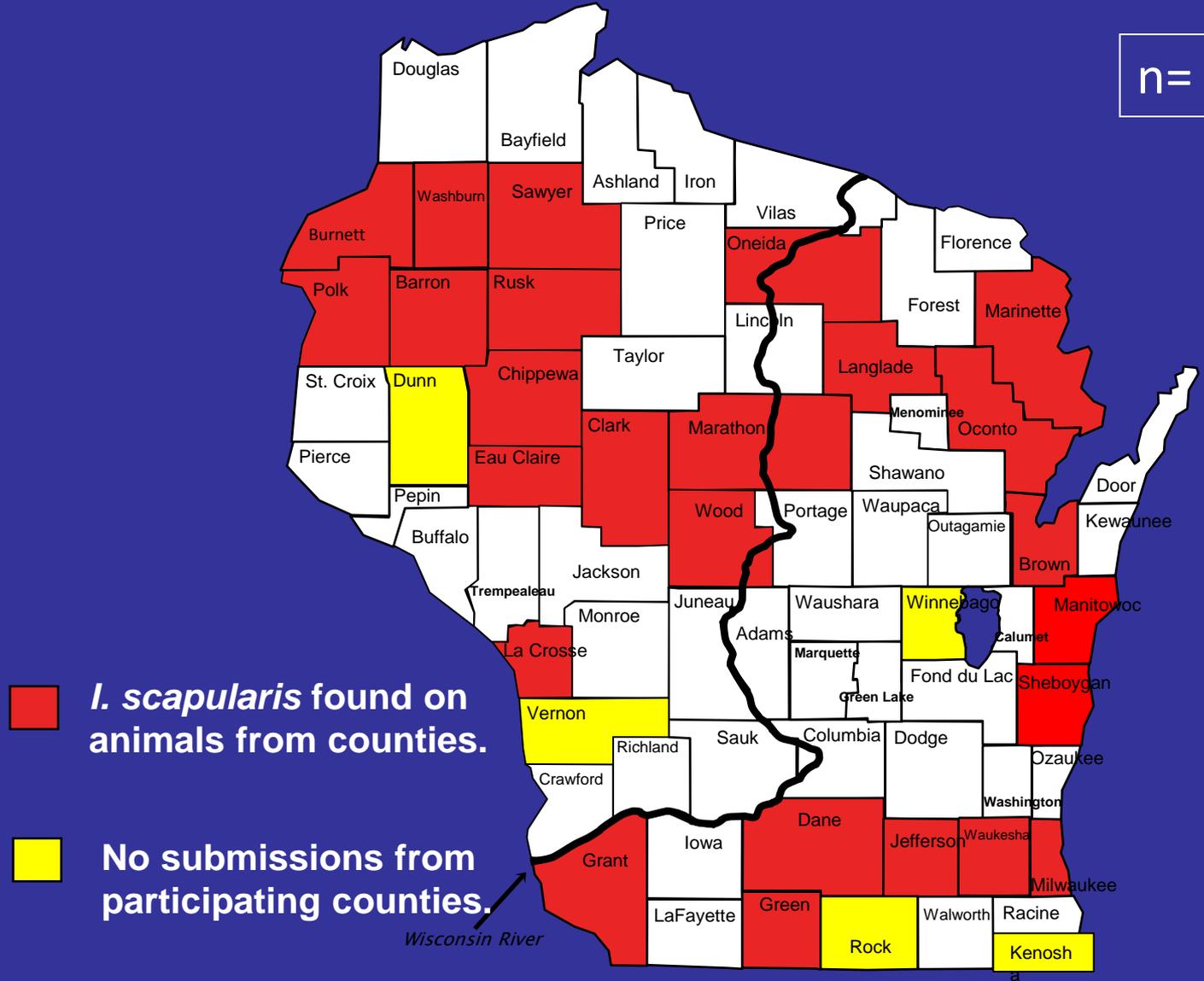
UW-Madison, Dept. Entomology and Wisconsin Division of Public Health.

Ticks collected from different agencies in Wisconsin.



# Ticks Found On Animal Species, 2011-2012

n= 853

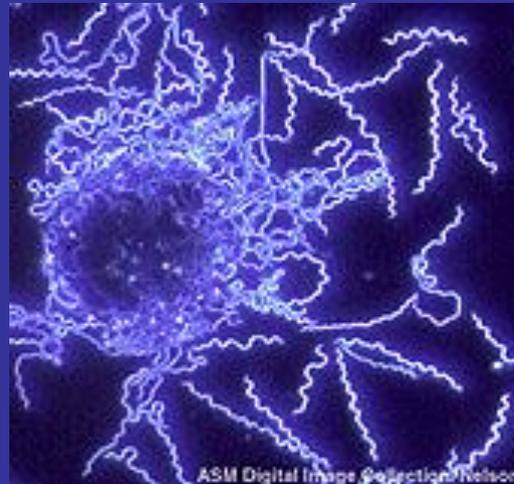


# Tick Infectivity

Tick surveillance in Wisconsin performed by the UW-Madison, Department of Entomology:

- Average state infectivity rate for *Borrelia* in nymphs is 22% (20-24%). Adult tick infectivity rate is twice that of the nymphs.
- Other tickborne diseases infectivity rate is much lower than *Borrelia* sp.
- Co-infectivity rate for tickborne diseases are unknown.

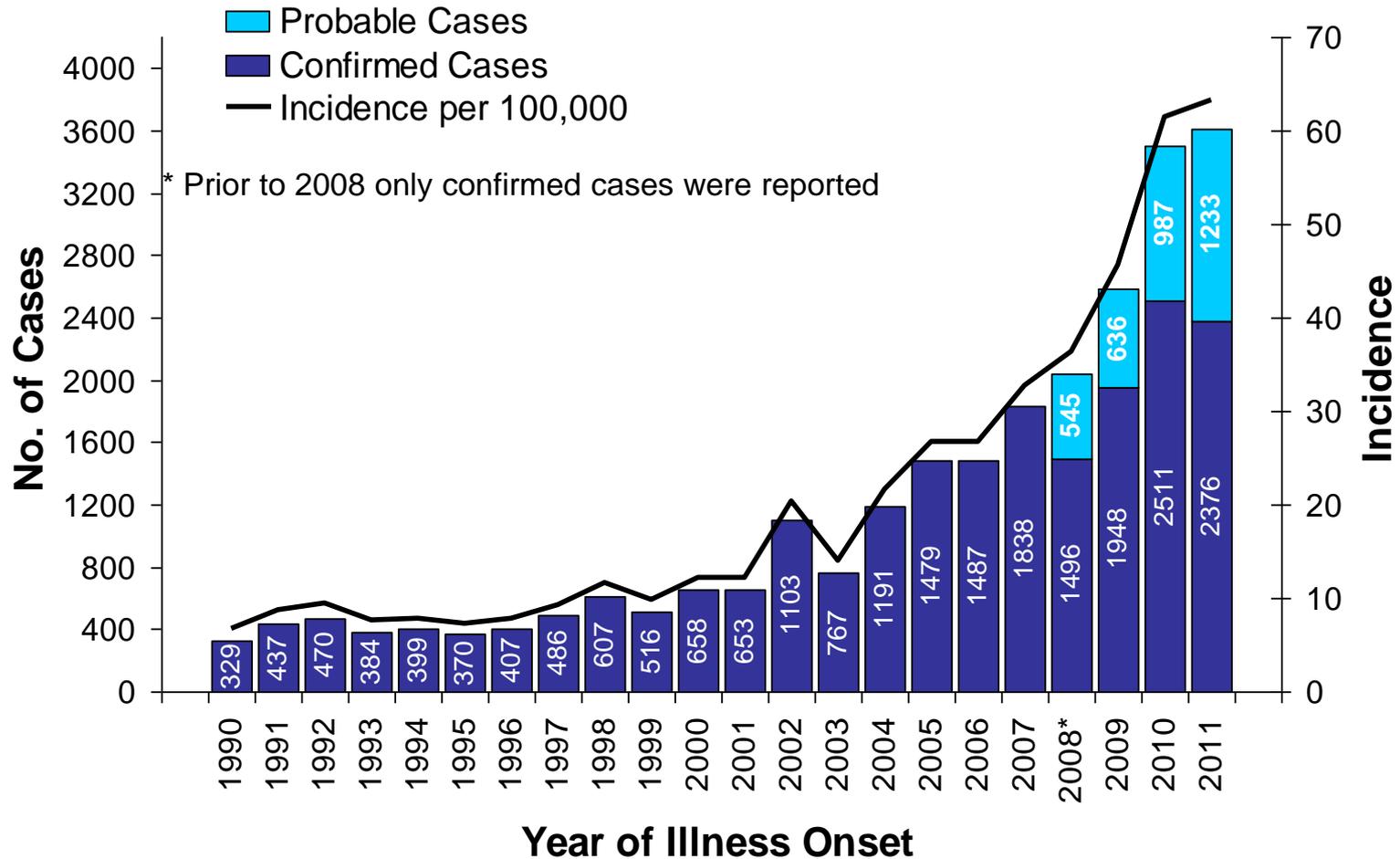
# Lyme Disease



**Bacteria- *Borrelia burgdorferi***

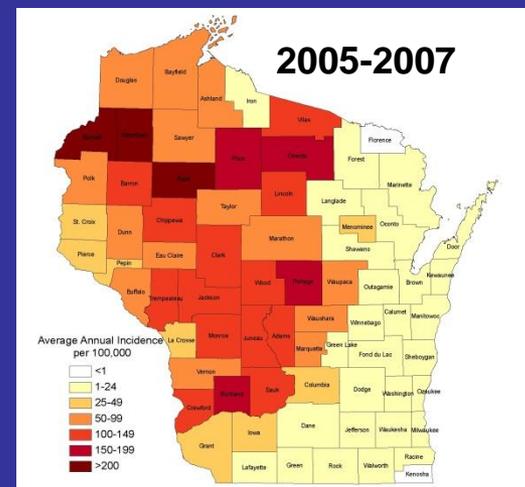
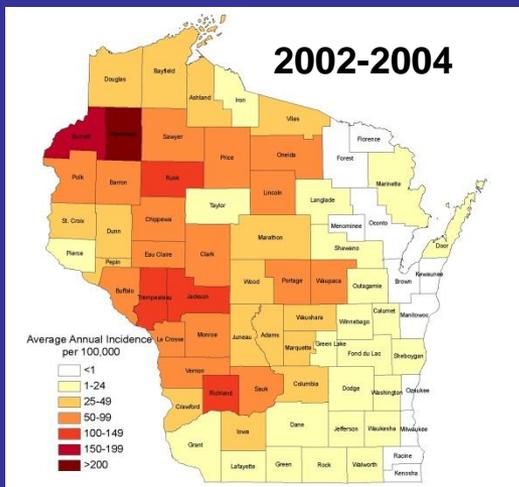
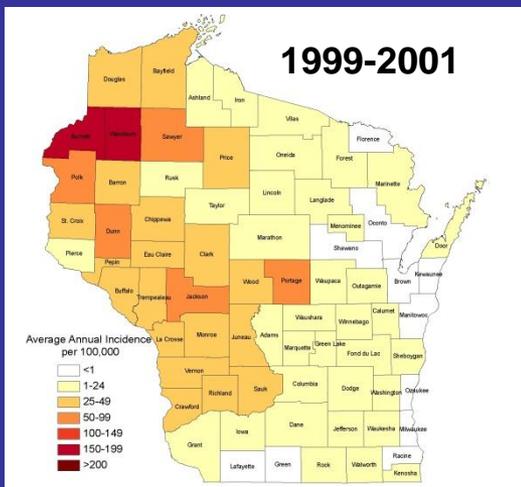
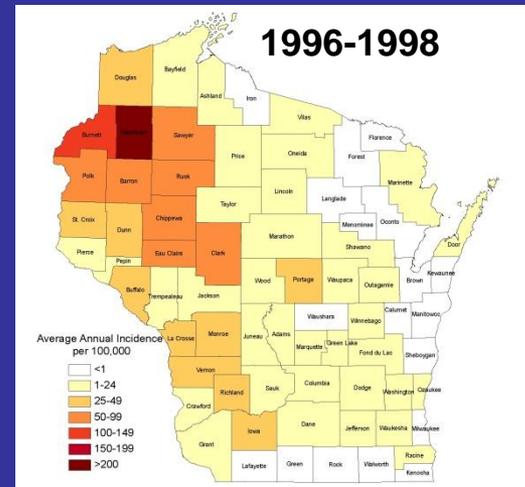
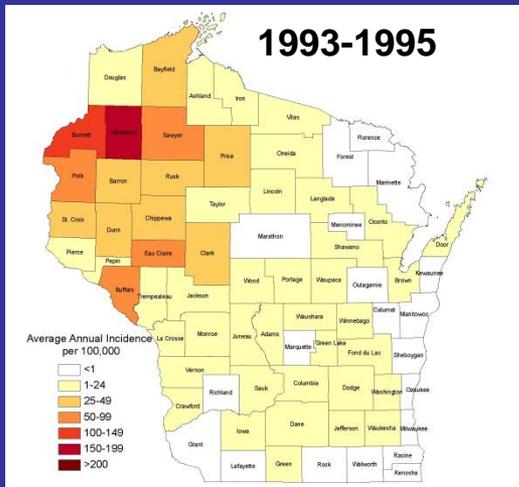
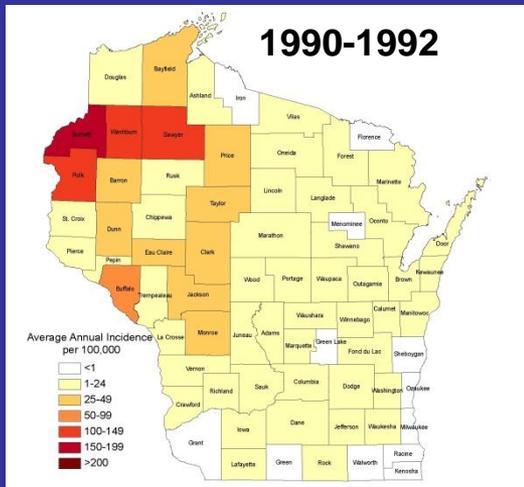
# Reported Lyme Disease, WI, 1990-2011

(n=25,313)



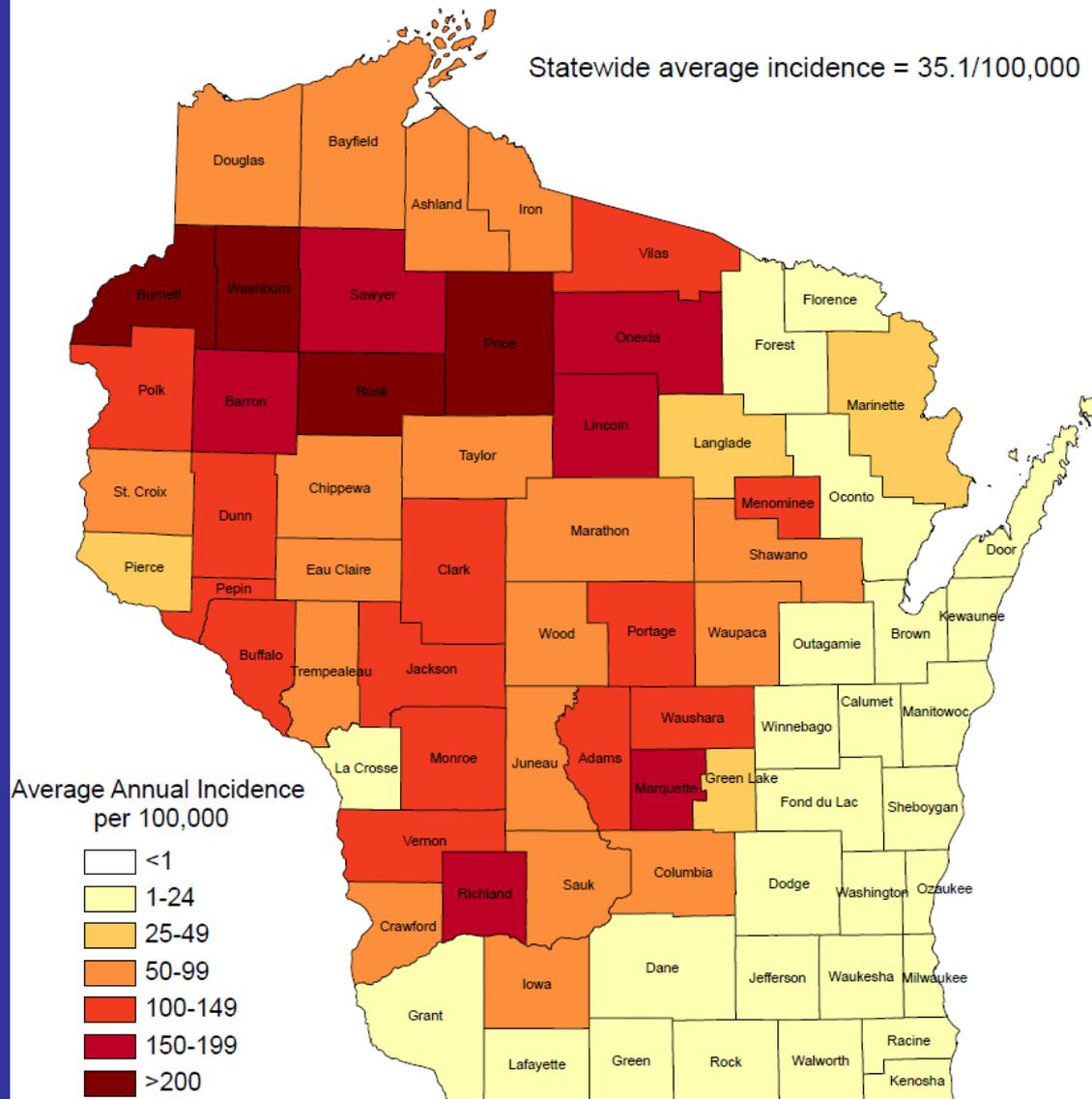
\* Previous to 2008 only confirmed cases were reported. Beginning 2008, the total number of cases includes confirmed and probable cases.

# Lyme Disease Average Annual Incidence Wisconsin, 1990-2007, by County of Residence



# Lyme Disease Average Annual Incidence Wisconsin, 2008-2010

Statewide average incidence = 35.1/100,000



This map is based on the county of residence of confirmed cases.  
Some infections may have been acquired during travel to other areas.

# Lyme Disease

- Typical symptoms include...
  - Fever
  - Headache
  - Fatigue
  - Characteristic skin rash, erythema migrans, seen in approximately 80% of cases
- If left untreated, infection can spread to joints, the heart, and the nervous system

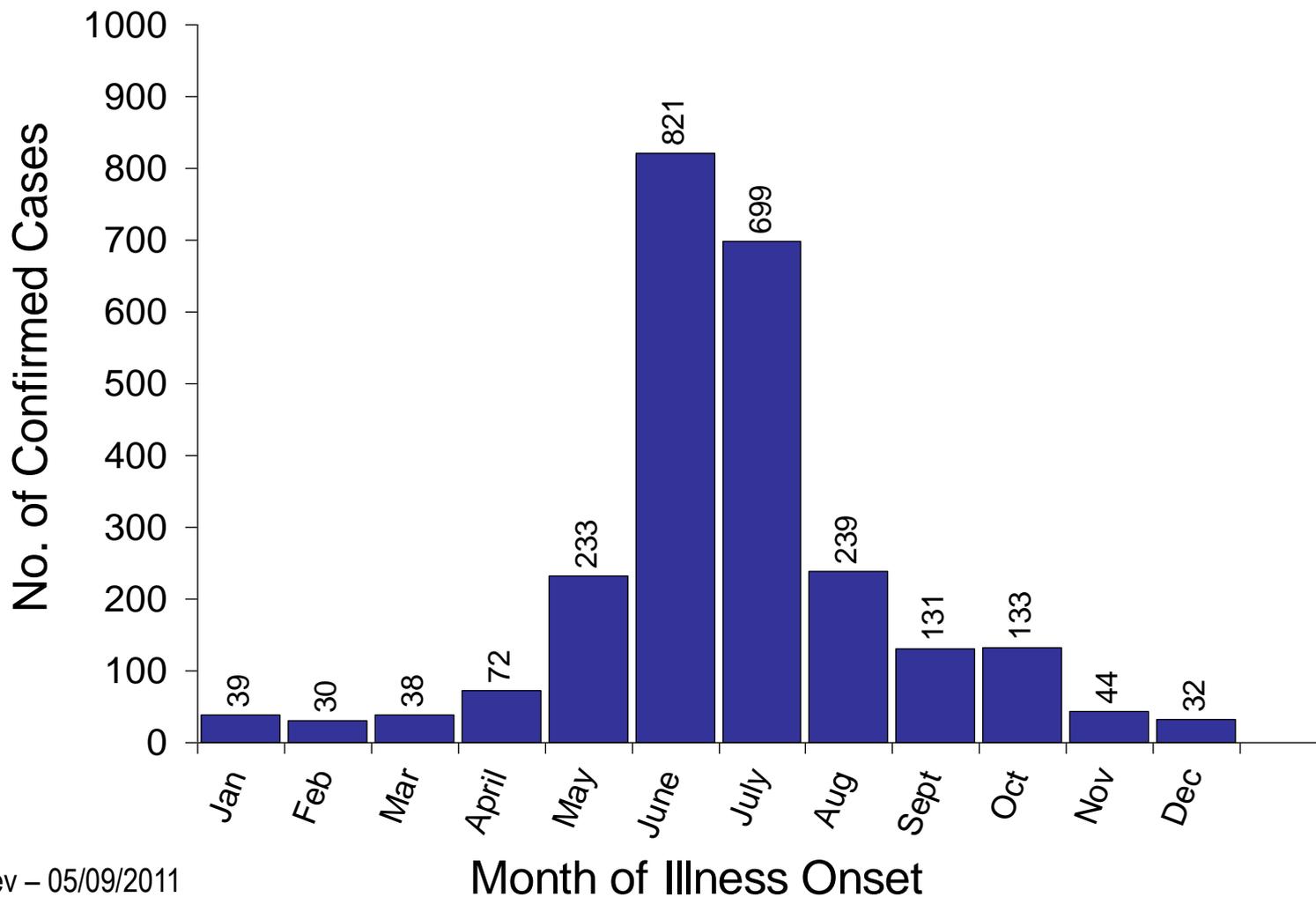


# Early Localized Stage - Erythema Migrans (EM)

- Ticks must be attached for at least 24-48 hours to transmit bacteria
- The EM rash expands in size over time (70% people)
- Occurs within 30 days of tick bite
- Since Lyme disease is endemic in WI, EM rash ( $\geq 5\text{cm}$ ) is considered as a confirmed case with or without laboratory testing and should be reported to health departments.



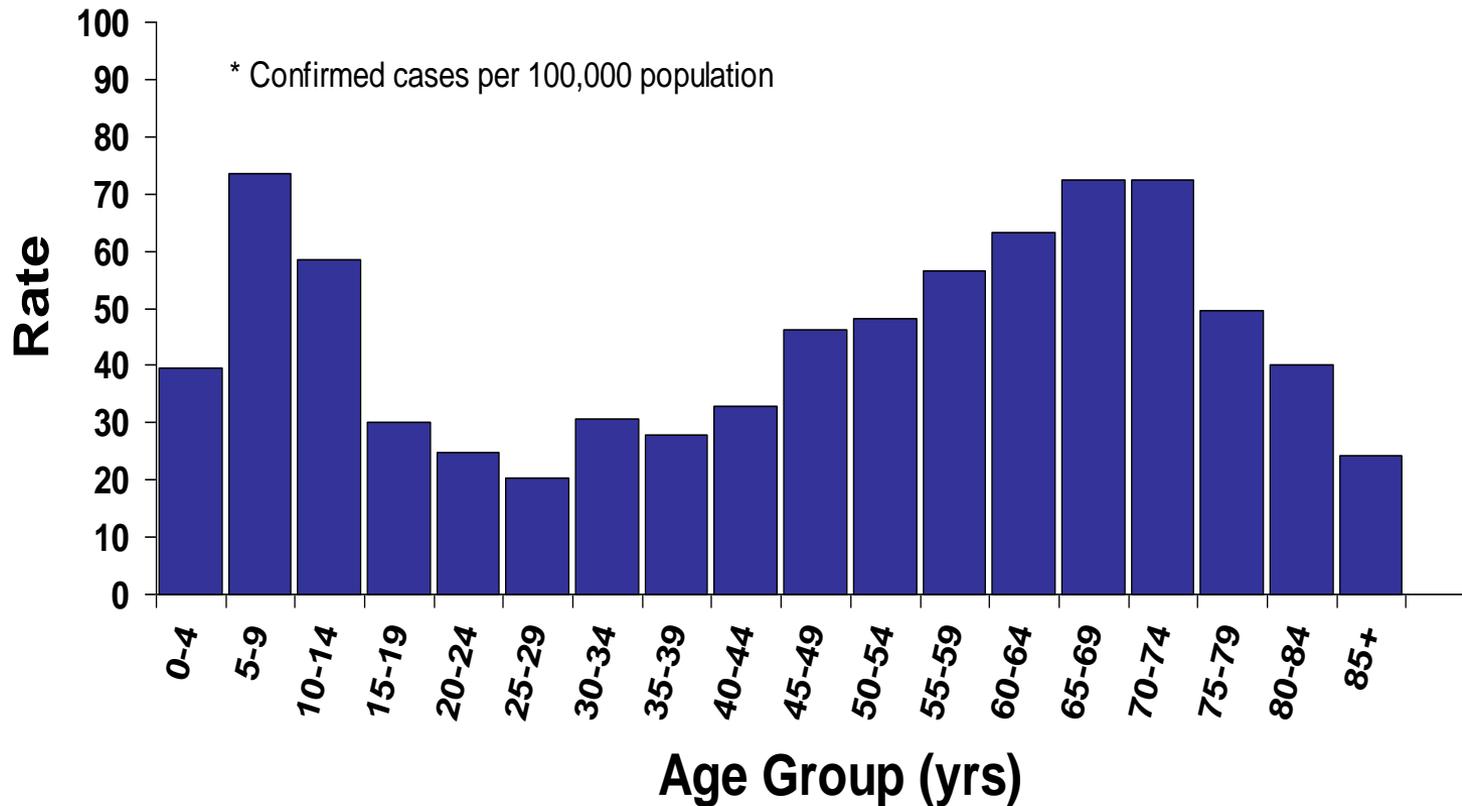
# Confirmed Lyme Disease Cases Reported by Month – WI 2010 (*n*=2,511)



Rev – 05/09/2011

# Rate\* of Confirmed Lyme Disease

Reported by Age Group – WI 2010 (n=2,511)



Rev – 05/10/2011



# Lyme Disease- Testing Methods

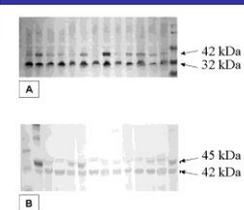
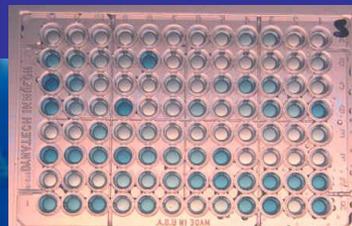
- Serologic assays are the most common tests to detect antibodies to *Borrelia burgdorferi*.
- Diagnostic testing should include 2-step testing on the same sample.

## 1<sup>st</sup> step test:

- Enzyme immunoassay (EIA) tests, or
- Immunofluorescent assays (IFA)

## 2<sup>nd</sup> step test:

- Western Blot test.



# Lyme Disease- Treatment

**CDC follows the Infectious Diseases Society of America (IDSA) guidelines.**

- Antibiotics- very effective if treated early.
  - children  $\geq 8$  yrs and adult= doxycycline 100mg 2x/day for 14 days.
  - children  $< 8$  yrs= amoxicillin 50mg/kg/day in 3 divided doses.
- Usually oral but may be given intravenously in more severe cases.
- Recurrent symptoms may require a second course of antibiotics.
- Long-term intravenous courses (months to years) have not been shown to be beneficial but may cause more complications (gallstones, catheter associated bloodstream infections).

# Prophylaxis to Prevent Lyme Disease

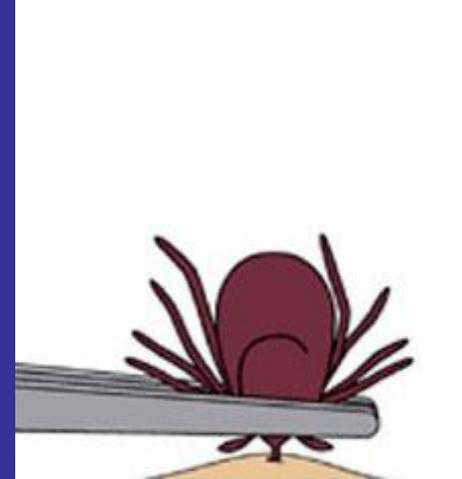
Prophylaxis (follow the Infectious Diseases Society of America guidelines).

- Tick had to be attached for at least 36hrs.
- At least 20% tick infectivity, Wisconsin meets this criteria because the average nymphal tick infectivity rate is about 22% (range from 20-24%).
- Given within 72 hours after tick removal.

**One single dose of doxycycline (200mg) for adults and children  $\geq 8$  yrs.**

# Proper Tick Removal

- Tweezers or a tissue.
- Grasp the tick as close to skin's surface as possible.
- Slowly pull the tick straight out, not at an angle.
- Clean the bite area on the skin with rubbing alcohol or soap and water.
- Take note of the tick bite area, look for rash that is spreading over time and increasing in size.
- See a physician if a rash or tickborne illness-like symptoms develop after tick removal.



Courtesy of CDC

# Tick Prevention and Control

## Integrated tick management:

- Avoidance of tick habitats.
- Personal protection.
- Vector management.
  - decrease reproduction and migration
  - increase mortality.
- Reduction of tick habitats.
- Anti-tick vaccines for reservoir hosts and humans.

# Tick Prevention

## Avoidance of tick habitats.

- When in wooded areas, walk on cleared pathways and trails to reduce the chance of coming in contact with ticks.

## Personal protection.

- Wear protective clothing, long pants and sleeves.
- Tuck shirts into pants and pants into socks or boots to prevent ticks from crawling under clothing and attaching to skin.
- Use repellents per label instructions (20% DEET and other products).
- Permethrin spray for clothing.
- Check for ticks for people and pets after being outdoors.
- Take showers to wash off crawling ticks.
- Use repellent products or acaricides on pets.

# Tick Control (continued)



- Restrict movement of infested hosts into an area to reduce immigration of ticks.
- Reduce the population of rodents habitats near homes by reduce stack wood and food sources.
- Use fences, deer repellents, and plants that will discourage large mammals including deer.
- Eliminate ticks on host by using nesting material, boxes with pesticides, or bait stations with acaracide (ivermectin).
- Wildlife vaccination delivered to hosts as oral bait.



# Resources

- <http://www.dhs.wisconsin.gov/communicable/Tickborne/Index.htm>
- <http://www.cdc.gov/ticks/index.html>
- <http://www.cdc.gov/lyme/>
- <http://cfpub.epa.gov/oppref/insect/>

# Additional Questions

Feel free to contact DPH:

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