Tickborne Diseases in Wisconsin

Diep (Zip) Hoang Johnson
Wisconsin Division of Public Health
608-267-0249
08/01/11

Overview

- Reporting in WI
- Disease characteristics
- Laboratory testing, results, and interpretations
- Epidemiology and Statistics

Why Are Tickborne Infections Reportable?

Surveillance-

- Define demographic, geographic, and seasonal distribution
- Monitor disease trends in a more consistent and unified manner with the same case definition for reporting
- Identify areas where tickborne diseases may be emerging and risk exposures to WI residents
- Evaluate where to target education, prevention, and control measures
- Define disease characteristics and sequelae
- Determine if the current diagnosis/treatment process is effective
- Data available for future funding and research

Reporting in WI

- WI Reporting- hard copy or electronic reporting (ELR)
- WI Electronic Disease Surveillance System (WEDSS)
- All positive laboratory results should be reported
- Tickborne diseases- require lab results and compatible signs/symptoms to determine case status (confirmed, probable, suspect, not a case)
- All patient with EM rash (with or without lab results) should be reported because this is a confirmed Lyme disease case in WI
- All clinical information should be reported by providers using specific disease case report form or entered directly into WEDSS as all the fields requesting information have been programmed into WEDSS

Surveillance in WI, 2002-2010

Tickborne Infections	Total Cases(%) 2010 (*n= 4,102*)	2002-2010 (*n= 16,996*)
• Powassan virus	4 (0.1)	7 (0.04)
• Lyme disease	3,499 (85)	14,876 (88)
• Anaplasmosis/Ehrlichiosis	546 (13)	1,968 (12)
• Babesiosis	28 (0.7)	125 (0.7)
• Spotted Fever Rickettsiosis (SPF)*	7 (0.2)	20 (0.1)

* Travel related infections

“Tastefully Simple” WEDSS

http://www.dhs.wisconsin.gov/wiphin/WEDSS.htm

The 5-step method for providers:

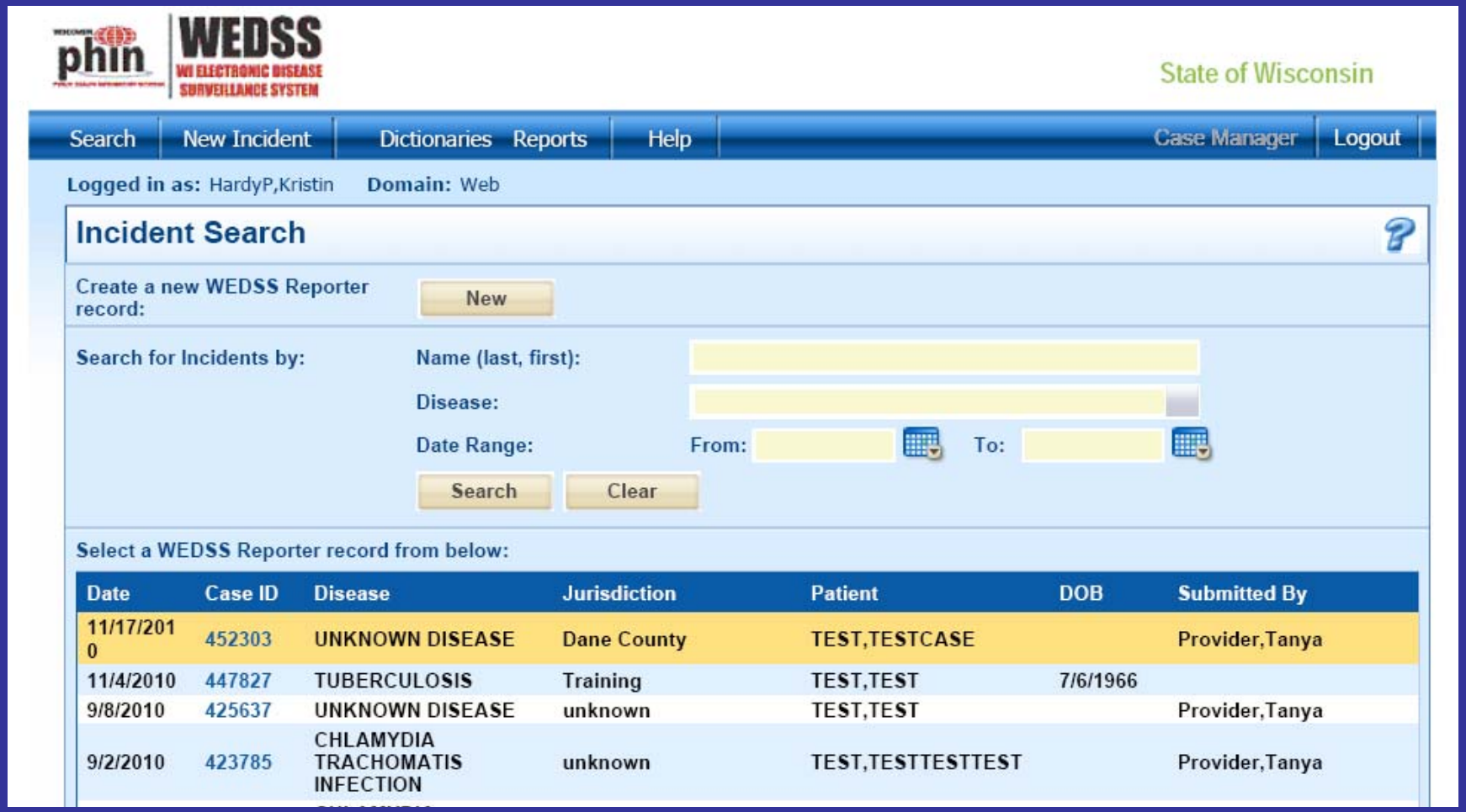
- Request WI user ID and password through the WI Access Management System (WAMS)

  https://on.wisconsin.gov/WAMS/SelfRegController
- Reply to email received
- Register in the HAN (Health Alert Network) using WAMS ID/password

  ttps://www.han.wisc.edu/mod_regs/index.jsp?jhan_curr_mod=regs
- Contact WEDSS help desk by email to notify dhswedss@wisconsin.gov
- Follow WEDSS instructions email- include WEDSS access, account, temporary password

  https://wedss.wisconsin.gov/webvcmr

WEDSS-Search Screen in Provider's Portal



Provider's Web Report

phin | WEDSS WI ELECTRONIC DISEASE SURVEILLANCE SYSTEM

State of Wisconsin

Search | New Incident | Dictionaries | Reports | Help | Case Manager | Logout

Logged in as: Domain: Web

Disease Incident

Patient: , Incident ID: Process Status:

DOB: Disease: LYME DISEASE Resolution Status:

Patient | Supplemental | Lyme-LabClinical | Lyme-Risk | Lyme-Intervntn

* Disease Being Reported: LYME DISEASE

* Last Name
* First Name
Middle Name
Name Suffix
Ethnicity
Future Client No.
DOB (MM/DD/YYYY)
Age
Months
Days
Primary Language
Address Number & Street
Apartment/Unit Number
Race
Add / Update
City
State: WI
Zip
Census Tract
County of Residence
Country of Residence
Country of Birth
Date of Arrival (MM/DD/YYYY)
Home Telephone
Cellular Phone / Pager
Work/School Telephone
Work/School Location
Work/School Contact
Gender
Pregnant? Yes No Unknown
Estimated Delivery Date
Marital Status
Medical Record Number
Patient's Parent/Guardian Name
Occupation Setting
Describe/Specify
Occupation
Describe/Specify
Occupation Location
Request New Report Source
* Submitter Name: ICP, NAME
* Reporting Source

Next | Cancel | Save

Provider's Web Report

This information is on the Case Investigation tab of the LHD's view

Disease Incident

Patient: test,user
Incident ID:
Process Status:
DOB:
Disease: LYME DISEASE
Resolution Status:

Patient | Supplemental | Lyme-Lab/Clinical | Lyme-Risk | Lyme-Intervntn

Incident Information

Date of Onset (MM/DD/YYYY)

Asymptomatic:

Date of Diagnosis (MM/DD/YYYY)

Date of Death (MM/DD/YYYY)

Patient Died of this illness:

Yes No

Patient hospitalized:

Yes No

Inpatient Outpatient

Date Admitted (MM/DD/YYYY)

Date Discharged(MM/DD/YYYY)

Remarks

Risk Factors/Suspected Exposure Type

Mark all that apply:

Type of Diagnostic Specimen

Mark all that apply:

Laboratory Information w/Provider & Facility

Show Results Beginning
ID-01

Show All Results For Patient

Accession Number
Order Result Status
Specimen Collected Date
Specimen Received Date
Specimen Source
Specimen Body Site
Test Code
Resulted Test
Test Coding System
Result
Units
Reference Range
Organism Code
Resulted Organism
Organism Coding System
Result Date
Performing Facility ID
Abnormal Flag
Notes
Observation Result Status

Delete
Add

Back Next Save Cancel

Provider's Web Report

Patient | Supplemental | Lyme-LabClinical | Lyme-Risk | Lyme-Intervntn

Lyme case definitions

Lyme - Laboratory Findings

Laboratory evidence of Lyme disease: A qualified laboratory assay is (1) a positive culture for B. burgdorferi, (2) two-tier testing* with IgM immunoblot seropositive result for specimens collected within 30 days of onset date, or (3) positive IgG immunoblot interpreted using established criteria. Additional assays including PCR will be considered on a case by case basis.

*Two tier testing includes an initial screen by enzyme immunosorbent assay (EIA) or indirect immunofluorescence assay (IFA), followed by a Western immunoblot on any equivocal or positive EIA or IFA results.

Lyme EIA/IFA
☐ IgM ☐ IgG ☐ Total

Lyme EIA/IFA collection date

If specimen was not serum, specify

Lyme EIA/IFA result
○ Pos ○ Neg ○ Equivocal
○ Not done

Lyme Western Blot (WB) collection date

If not serum, specify

Lyme WB IgM
○ Pos ○ Neg ○ Equivocal
○ Not done

Indicate positive WB IgM bands, if known. 2 of 3 bands must be positive

☐ 41 kDa (FlaB) ☐ 39 kDa (BmpA)
☐ 21-25 kDa (OspC)

Lyme WB IgG
○ Pos ○ Neg ○ Equivocal
○ Not done

Indicate positive WB IgG bands, if known. 5 of 10 bands must be positive

☐ 93 kDa ☐ 66 kDa
☐ 58 kDa ☐ 45 kDa
☐ 41 kDa ☐ 39 kDa
☐ 30 kDa ☐ 28 kDa
☐ 21 - 25 kDa (OspC) ☐ 18 kDa

Other tests (check all that apply)

Other lyme tests
☐ B. burgdorferi cultured ☐ CSF titer higher than serum titer ☐ Additional assays (including PCR)

Specify additional assay

(Please specify test, collection date, specimen type, and result)

Lyme - Clinical signs and symptoms

Did a physician or other medical professional diagnose patient w/ Lyme disease?
○ Yes ○ No

Symptom onset date

LYME CONFIRMATORY SIGNS AND SYMPTOMS

EM rash (> 5 cm in diameter, physician diagnosed)
○ Yes ○ No ○ Unk

Bells palsy or other cranial neuritis
○ Yes ○ No ○ Unk

Lymphocytic meningitis
○ Yes ○ No ○ Unk

2nd or 3rd degree atrioventricular block
○ Yes ○ No ○ Unk

Arthritis (objective episodes of joint swelling)
○ Yes ○ No ○ Unk

Encephalomyelitis*
○ Yes ○ No ○ Unk

Radiculoneuropathy
○ Yes ○ No ○ Unk

*If encephalomyelitis is checked "Yes", CSF titer must be higher than serum titer.

LYME NON-CONFIRMATORY SIGNS AND SYMPTOMS--check all that apply.

☐ Arthralgias ☐ Bundle branch block
☐ Cognitive impairment ☐ Encephalopathy.
☐ Fatigue. ☐ Fever/Sweats/Chills
☐ Headache ☐ Myalgias (muscle aches)
☐ Myocarditis ☐ Neck pain
☐ Other rash ☐ Palpitations
☐ Paresthesias ☐ Peripheral neuropathy
☐ Visual/auditory impairment

Symptom(s) not listed above

Clinician information

Physician/medical provider name

Clinic Name

Address

Phone number

CDC LYME DATA - STATE USE ONLY

Provider's Web Report

phin | WEDSS WI ELECTRONIC DISEASE SURVEILLANCE SYSTEM

State of Wisconsin

Search | New Incident | Administration | Dictionaries | Reports | Help | Case Manager | Logout

Logged in as: Bloy,Kirstin **Domain:** Web

Disease Incident

Patient: test,test
DOB:
Incident ID:
Disease: LYME DISEASE
Process Status:
Resolution Status:

Patient | Supplemental | Lyme-LabClinical | Lyme-Risk | Lyme-Intervntn

Lyme - Treatment

Antibiotics used for this illness (check all that apply)

- [ ] Doxycycline
- [ ] Penicillin
- [ ] Azithromycin
- [ ] Other (not listed above)
- [ ] Ceftriaxone
- [ ] Amoxicillin
- [ ] Cefuroxime axetil

If other, please specify

Combined duration of antibiotics for this illness

○ <1 month ○ 1-3 months ○ >3 months

Attempts to Contact

Lyme - Health Teaching

Back | Cancel | Submit

The submit button is always on the last tab of the providers view.

Lab Clinical Tab for Local Health Departments (LHDs) and State Users

Search | New Incident | Dictionaries | Reports | Help

Logged in as: HardyP,Kristin Domain: Web

Disease Incident

Patient: testtesttest,testestest
Incident ID:
Process Status:
DOB:
Disease: LYME DISEASE
Resolution Status:

Patient | Supplemental | Lyme-LabClinical | Lyme-Risk | Lyme-Intervntn

Lyme case definitions

Lyme - Laboratory Findings

Laboratory evidence of Lyme disease: A qualified laboratory assay is (1) a positive culture for B. burgdorferi, (2) two-tier testing* with IgM immunoblot seropositive result for specimens collected within 30 days of onset date, or (3) positive IgG immunoblot interpreted using established criteria. Additional assays including PCR will be considered on a case by case basis.

*Two tier testing includes an initial screen by enzyme immunosorbent assay (EIA) or indirect immunofluorescence assay (IFA), followed by a Western immunoblot on any equivocal or positive EIA or IFA results.

Lyme EIA/IFA
☐ IgM ☐ IgG ☐ Total

Lyme EIA/IFA collection date

If specimen was not serum, specify

Lyme EIA/IFA result
○ Pos ○ Neg ○ Equivocal
○ Not done

Lyme Western Blot (WB) collection date

If not serum, specify

Lyme WB IgM
○ Pos ○ Neg ○ Equivocal
○ Not done

Indicate positive WB IgM bands, if known. 2 of 3 bands must be positive

☐ 41 kDa (FlaB)
☐ 39 kDa (BmpA)
☐ 21-25 kDa (OspC)

Lyme WB IgG
○ Pos ○ Neg ○ Equivocal
○ Not done

Indicate positive WB IgG bands, if known. 5 of 10 bands must be positive

☐ 93 kDa
☐ 66 kDa
☐ 58 kDa
☐ 45 kDa
☐ 41 kDa
☐ 39 kDa
☐ 30 kDa
☐ 28 kDa
☐ 21 - 25 kDa (OspC)
☐ 18 kDa

Other tests (check all that apply)

Other lyme tests
☐ B. burgdorferi cultured ☐ CSF titer higher than serum titer ☐ Additional assays (including PCR)

Specify additional assay

Lyme - Clinical signs and symptoms

Did a physician diagnose patient w/ Lyme disease?
○ Yes ○ No

Symptom onset date

LYME CONFIRMATORY SIGNS AND SYMPTOMS

EM rash (> 5 cm in diameter)
○ Yes ○ No ○ Unk

Arthritis (objective episodes of joint swelling)
○ Yes ○ No ○ Unk

Bells palsy or other cranial neuritis
○ Yes ○ No ○ Unk

Encephalomyelitis*
○ Yes ○ No ○ Unk

Lymphocytic meningitis
○ Yes ○ No ○ Unk

Radiculoneuropathy
○ Yes ○ No ○ Unk

2nd or 3rd degree atrioventricular block
○ Yes ○ No ○ Unk

*If encephalomyelitis is checked "Yes", CSF titer must be higher than serum titer.

LYME NON-CONFIRMATORY SIGNS AND SYMPTOMS--check all that apply.

☐ Arthralgias
☐ Bundle branch block
☐ Cognitive impairment
☐ Encephalopathy.
☐ Fatigue.
☐ Fever/Sweats/Chills
☐ Headache
☐ Myalgias (muscle aches)
☐ Myocarditis
☐ Neck pain
☐ Other rash
☐ Palpitations
☐ Paresthesias
☐ Peripheral neuropathy
☐ Visual/auditory impairment

Symptom(s) not listed above

Clinician information

Physician/medical provider name

Clinic Name

Address

Phone number

Supplemental Tab in WEDSS' Report (left) Showing in LHD's View (right)

Search | New Incident | Dictionaries | Reports | Help | Case Manager | Logout

Logged in as: HardyP,Kristin Domain: Web

Disease Incident

Patient: testtesttest,testestest
DOB:
Incident ID:
Disease: LYME DISEASE
Process Status:
Resolution Status:

Patient | Supplemental | Lyme-LabClinical | Lyme-Risk | Lyme-Intervntn

Incident Information

Date of Onset (MM/DD/YYYY)

Asymptomatic:

Date of Diagnosis (MM/DD/YYYY)

Date of Death (MM/DD/YYYY)

Patient Died of this illness:

Yes No

Patient hospitalized:

Yes No

Inpatient Outpatient

Date Admitted (MM/DD/YYYY)

Date Discharged(MM/DD/YYYY)

Remarks

Risk Factors/Suspected Exposure Type

Mark all that apply:

- Agricultural Activities
- Child Care
- Child Care - Attends
- Child Care - Contact to Child in Child Care
- Child Care - Worker
- College, Technical School or University
- Contact with Animal(s)
- Contact with Case - Casual
- Contact with Case - Close
- Correctional Facility
- Environmental Exposure
- Public Event
- Recreational Water
- School
- School - Attends
- School - Contact to Faculty or Staff Member
- School - Contact to Student
- School - Faculty or Staff Member
- Sexual Contact
- Shared Conveyance
- Shared Sleeping Quarters
- Shared Structural Enclosure

Type of Diagnostic Specimen

Mark all that apply:

- Blood
- Bone
- Clinical
- CSF
- Internal Body Site
- Joint
- Muscle
- other
- Other Sterile Site
- Pericardial Fluid
- Peritoneal Fluid
- Placenta

- Exterior Household Lead Hazard
- Food and/or Beverage
- Health care worker
- Household Contact
- Interior Household Lead Hazard
- Lead Hazards in Work Activities
- Out of State travel
- Sharing of Food and/or Drinks
- TRAVEL - FOREIGN
- TRAVEL - OUT OF County
- TRAVEL - OUT OF State
- Zoo
- Zoo, Petting
- Serology - IgG
- Serology - IgM
- Stool
- Stool - Negative
- Stool - Pending
- Stool - Positive
- Stool Kit Issued
- Urine

Laboratory Information w/Provider & Facility

Show Results Beginning ID-01

Show All Results For Patient

Accession Number | Order Result Status | Specimen Collected Date | Specimen Received Date

Specimen Source | Specimen Body Site

Test Code | Resulted Test | Test Coding System

Result | Units | Reference Range

Organism Code | Resulted Organism | Organism Coding System

Result Date | Performing Facility ID

Abnormal Flag | Notes

Observation Result Status

Delete

Add

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, an important vector for most of the tickborne diseases in WI

Ixodes scapularis (Blacklegged or Deer Tick)

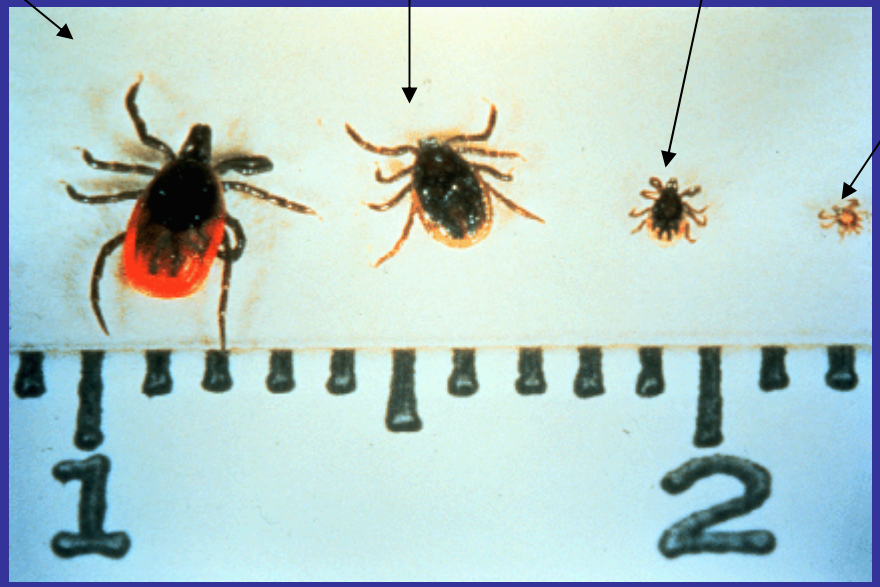
Adult female deer tick

Adult male deer tick

Nymph

Larva

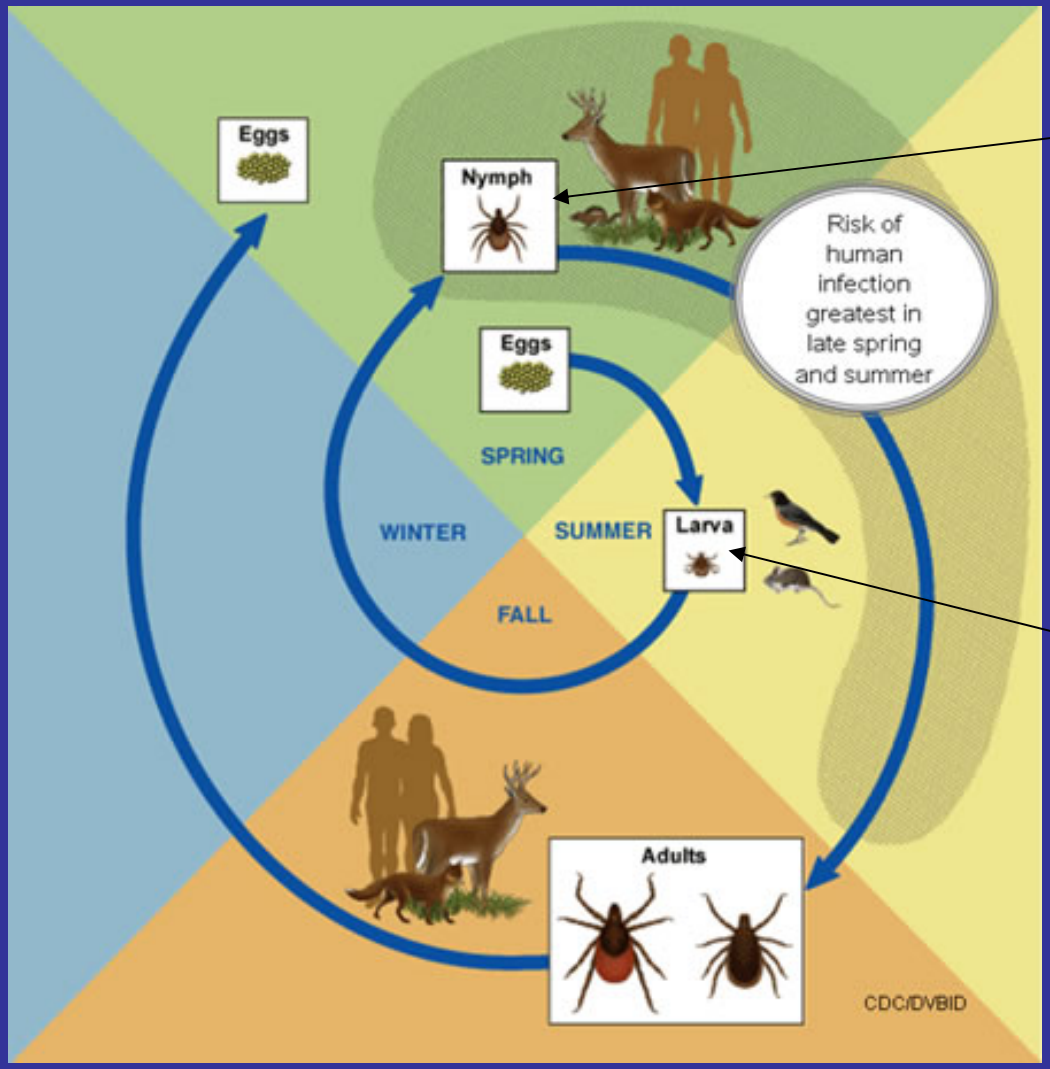
Smaller than a American dog/wood tick, adult female and nymph can transmit infection through a bite for a blood meal



One Inch

Dermacentor variabilis **(American dog or wood tick)**

Life Cycle of Blacklegged Tick



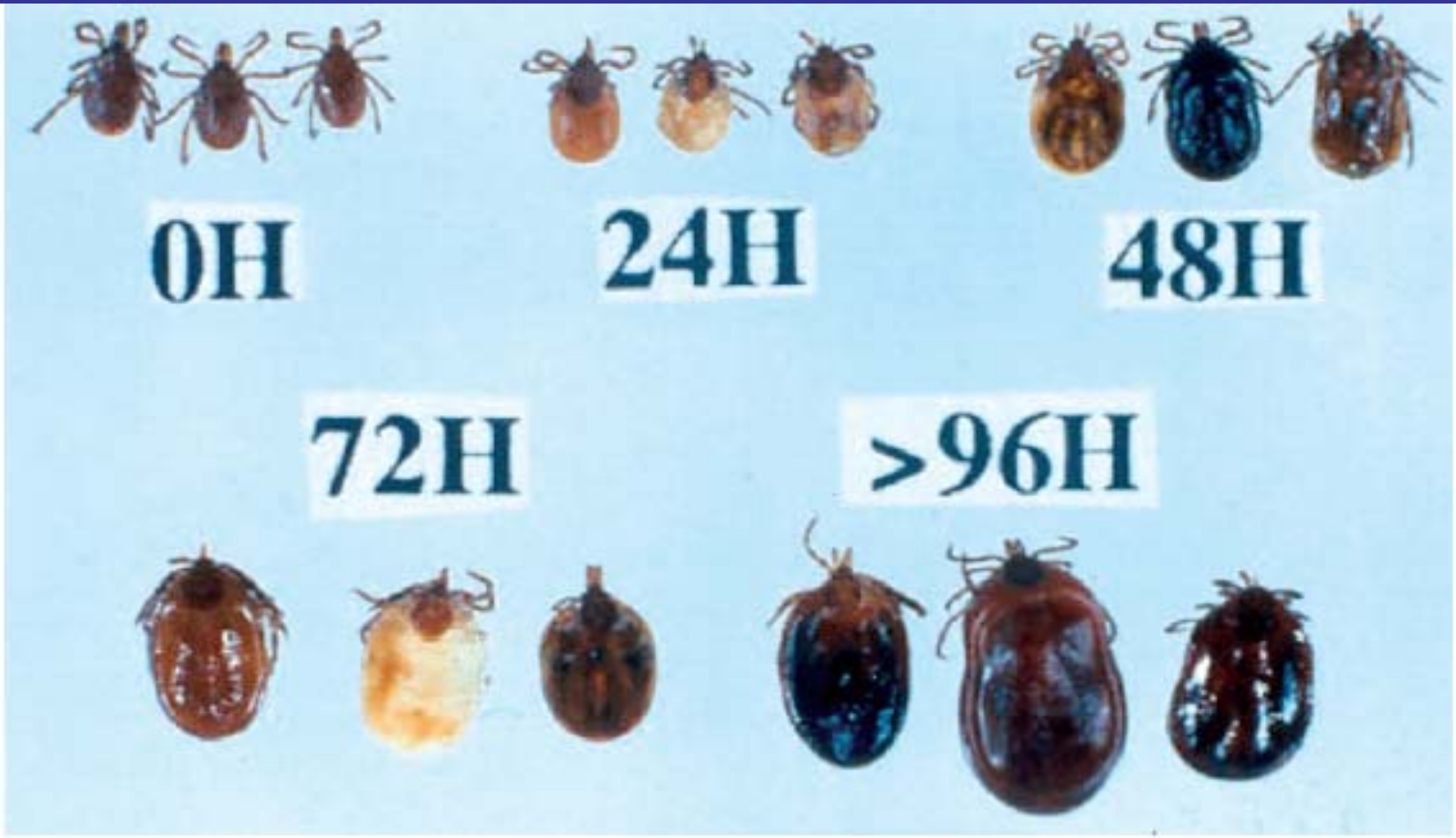
Based on EM case onsets, nymphs account for most transmission

Larva do not transmit bacteria

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

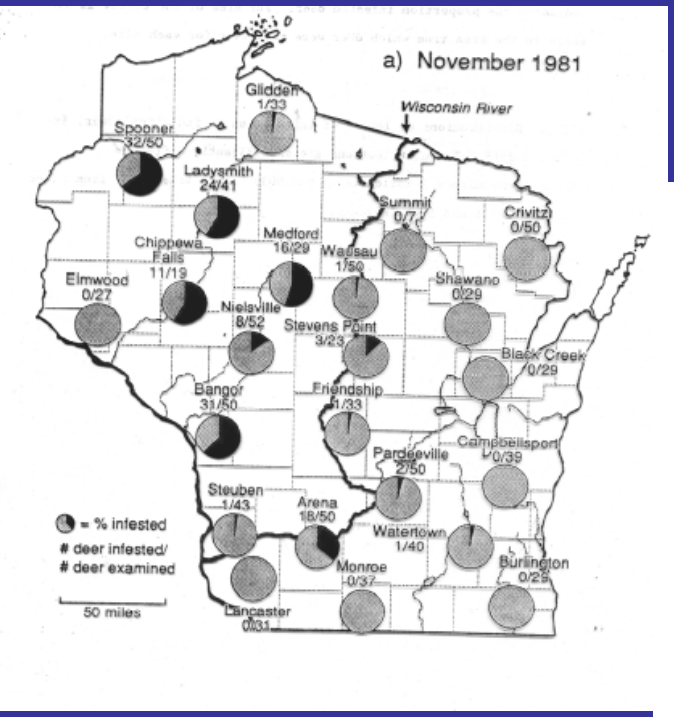
Courtesy of CDC

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

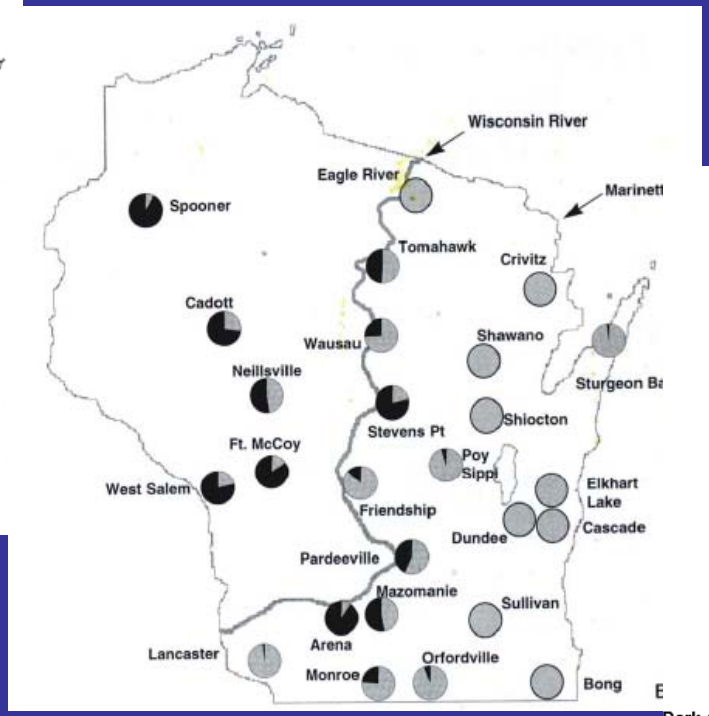


UW-Madison, Entomology- Tick Surveys

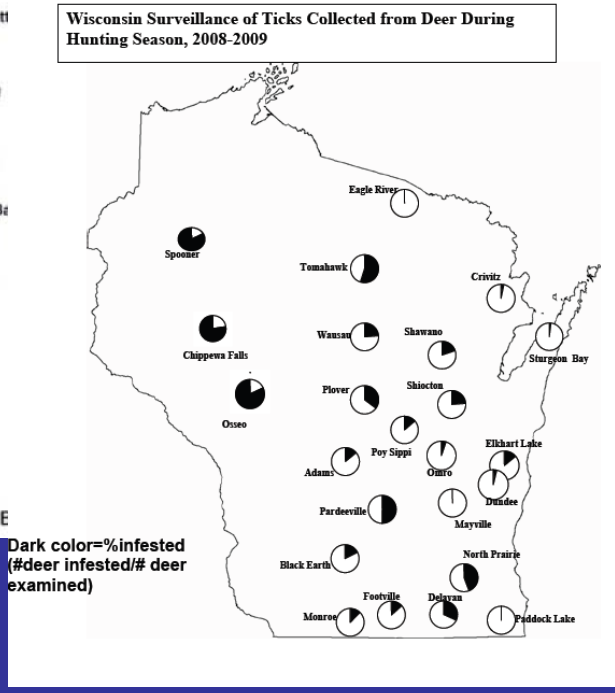
1981



1994



2008-2009



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

Tickborne Diseases

Ixodes scapularis transmit:

- Powassan virus infection (tickborne arbovirus)
- Anaplasmosis (*A. phagocytophilum*)
- Ehrlichiosis (*E. chaffeensis?*, *E. muris* -like)
- Lyme disease

Powassan Virus Infection

Powassan Virus (POWV) Infection

- Rare tickborne arbovirus infection
- Initially isolated in 1958, in Northern Ontario
- First case in US- New Jersey in 1970
- Cases have been reported in northern regions of United States (Maine, Michigan, Minnesota, New York, Vermont, and Wisconsin)
- Reservoir- small mammals
- Vector- *Ixodes scapularis*

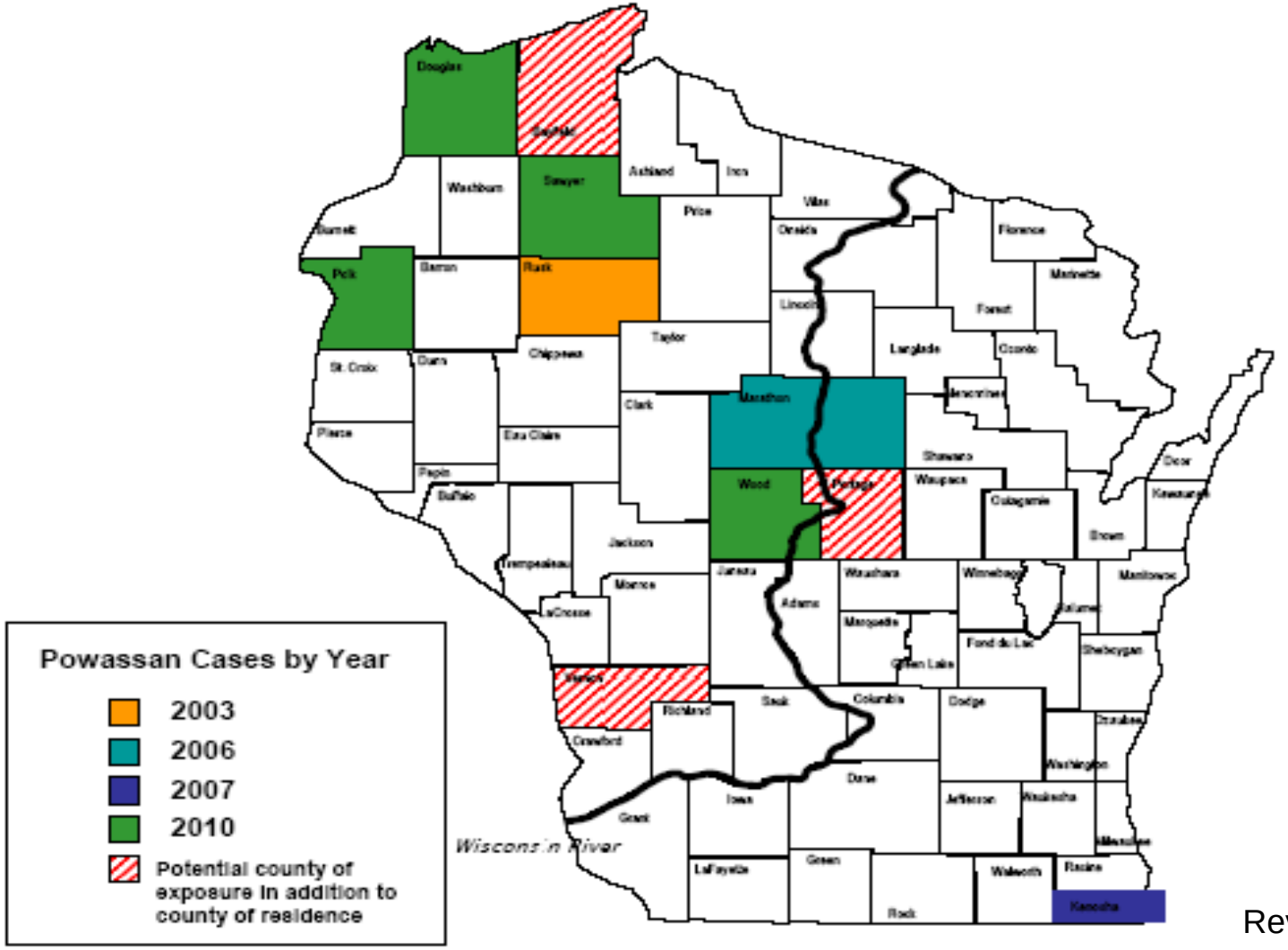
Powassan- Clinical Diagnosis

- Incubation period is usually >/= 1 week (range from 8-34 days)
- Acute onset of fever, muscle weakness, confusion, headache, nausea, vomiting, and stiff neck
- Severe signs and symptoms- respiratory distress, tremors, seizures, gait unbalance, confusion, paralysis, and coma
- Neuroinvasive disease- most of the cases reported menigoencephalitis leading to long-term neurologic sequelae
- 10%-15% cases are fatal
- Supportive treatment only and no vaccine available

Powassan virus (POWV) Testing

- There is no commercial test available for Powassan virus
- CDC will perform testing for Powassan upon state's request if symptoms are consistent with an arbovirus-like illness
- All commercial positive results for arbovirus agents need to be confirmed at WI State Laboratory of Hygiene (WSLH) and CDC
- POWV IgM and IgG testing can be performed on serum or CSF using MAC-ELISA and plaque-reduction neutralization test (PRNT) at CDC
- Physician should consider requesting POW testing if commercial tests resulted in non-specific reactivity to an arbovirus agent or a negative result and patient continues to exhibit signs and symptoms consistent with an arbovirus infection

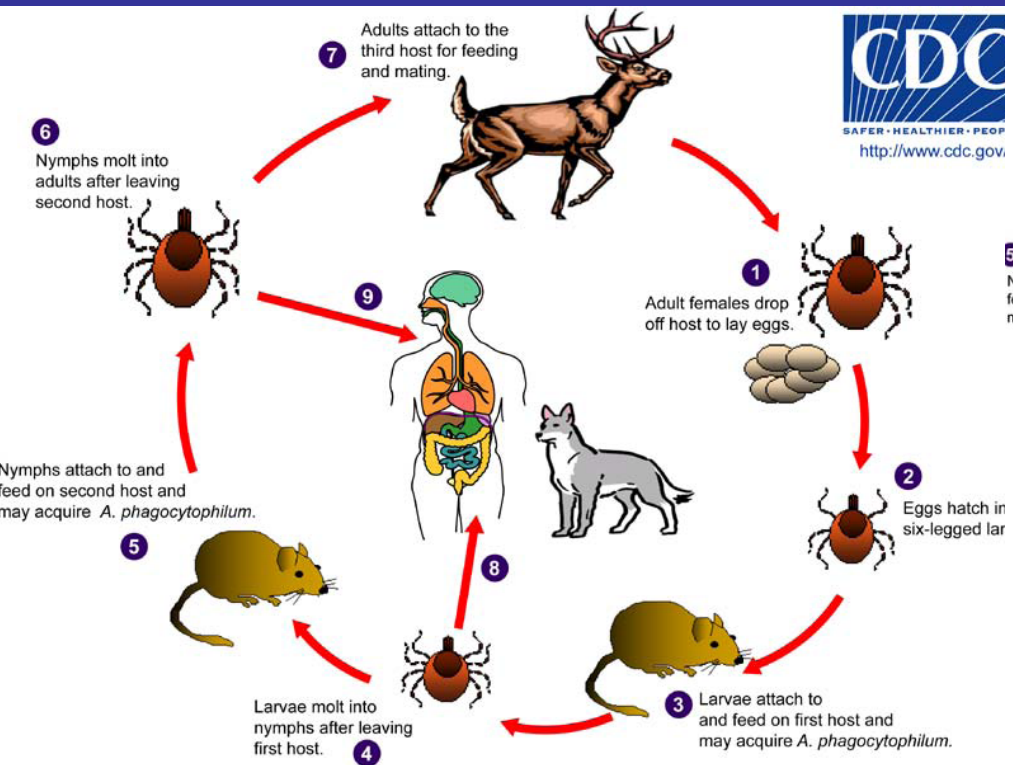
County of Residence and Potential Exposure for Powassan Cases, WI, 2003-2010



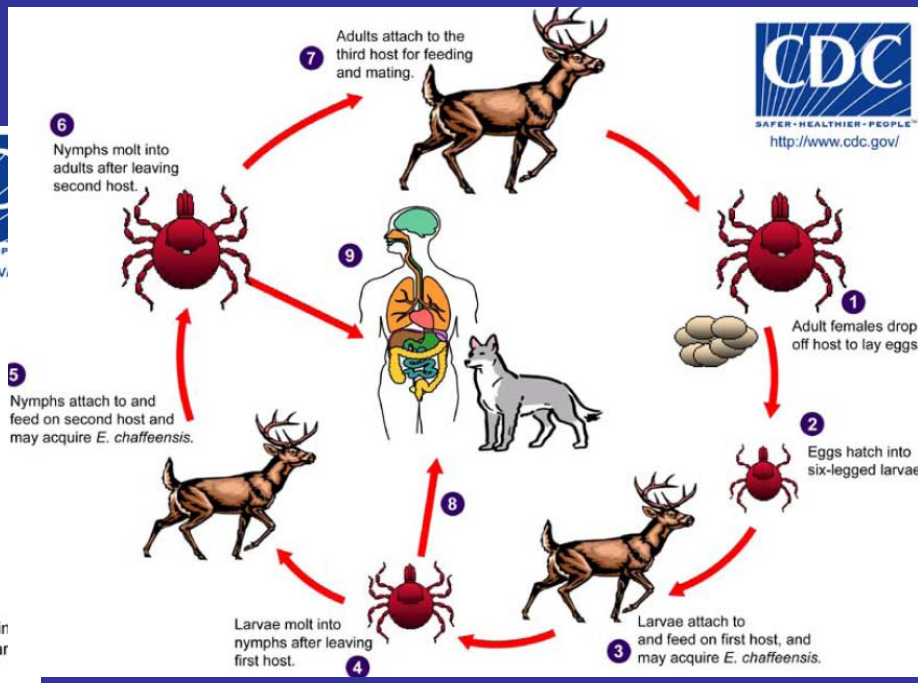
Revised 3/4/11

Lifecycles

Anaplasmosis



Ehrlichiosis



Anaplasmosis/Ehrlichiosis

- Prior to 2008, anaplasmosis and ehrlichiosis infections were referred to as human granulocytic ehrlichiosis (HGE) and human monocytic ehrlichiosis (HME), respectively

- As of April 2008, human anaplasmosis and ehrlichiosis are now classified as:
  - Anaplasmosis caused by the *A. phagocytophilum* bacteria
  - Ehrlichiosis caused by *E. chaffeensis, E. ewingii, and* new species *E. muris*-like (EML*)*
  - Anaplasmosis/Ehrlichiosis undetermined (species unknown)

- *A. phagocytophilum* is the second most common tickborne pathogen in WI
- Increase in probable cases of *E. chaffeensis* (*Amblyoma* tick vector not traditionally seen in WI)
- In 2009, identified a cluster of novel *E. muris*-like cases

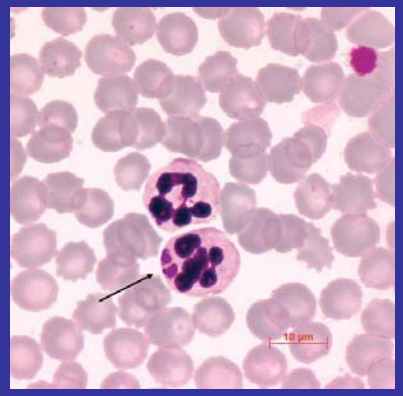
Anaplasmosis/Ehrlichiosis Clinical Manifestation

- Fever, headache, fatigue, muscle aches, and shaking chills
- Less common symptoms: nausea, vomiting, diarrhea, cough, joint pain, confusion, and occasional rash (maculopapular, petechial, erythroderma)
- Symptoms usually appear 5-10 days after a tick bite
- Treatment is effective with tetracycline antibiotics
- If suspected, treatment should be initiated as soon as possible and not delayed because of pending test results

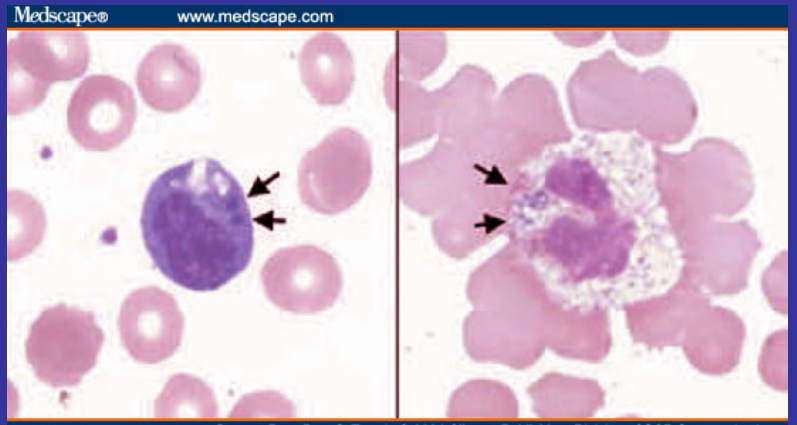
Anaplasmosis/Ehrlichiosis Testing

- Laboratory findings: anemia, leukopenia, thrombocytopenia, and elevated liver enzymes

- Diagnostic testing- important to test for both agents
  - serology for IgM/IgG antibodies (IFA, ELISA)
  - smear for morulae
  - Isolation
  - PCR (test of choice)



Anaplasma phagocytophilum **granulocyte morulae**



Ehrlichia chaffeensis **monocyte morulae from Medscape**

Serology Testing

IFA test for IgG and IgM to specific *Ehrlichia* or *Anaplasma* species

- Most commonly used among commercial labs
- Serology test can have cross-reactivity between agents
- IFA result is reported in titers (positive >=1:64) IgM or IgG antibody
- IgM is not used independently because of false positive and titer can last a long time; IgG is more dependable antibody
- Single sample (serum collected within first week of illness) is considered as probable, a second sample collected 2-4 weeks later to confirm
- Confirmed lab results- 4-fold change in titers between acute/convalescent sample

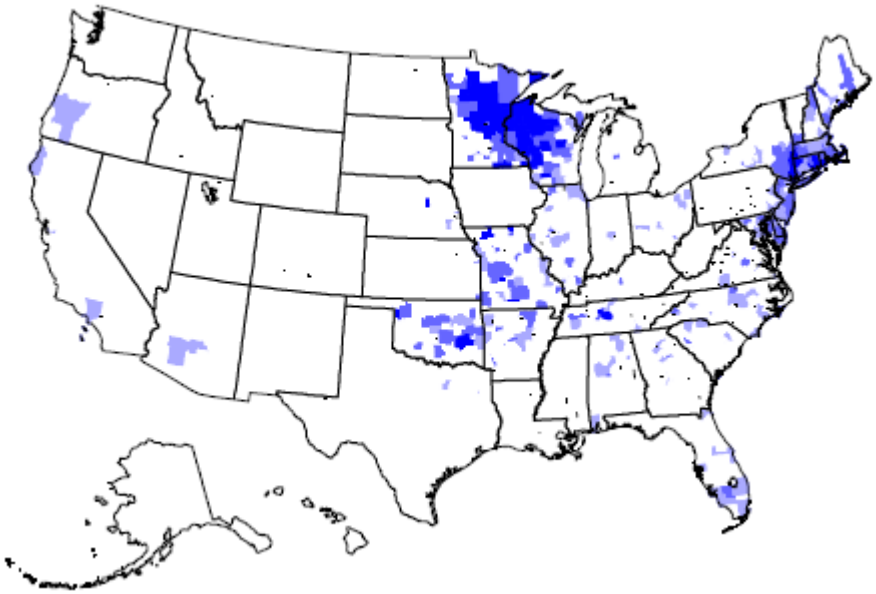
PCR Testing

PCR is the test of choice

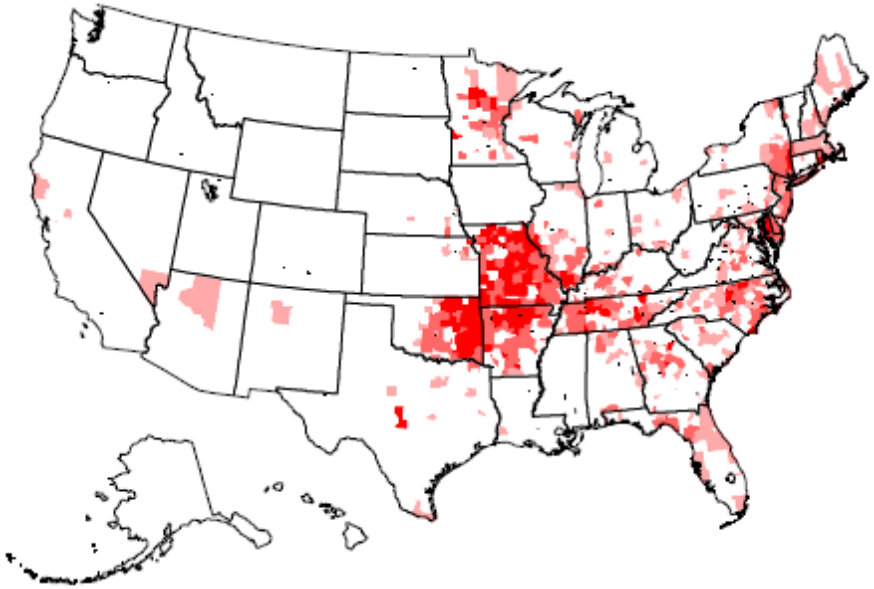
- Result is considered as confirmed (more specific, no cross-reactivity)
- Sample should be collected before treatment (EDTA blood sample)
- PCR multiplex is the only test that can identify the new *E. muris-like* species and can also detect *A. phagocytophilum*, *E. chaffeensis,* and *E. ewingii* at the same time by identifying melting point curves
- A negative result is not as meaningful, follow-up with serology if patient is ill with tickborne symptoms

Incidence of Human Anaplasmosis and Ehrlichiosis, US, 2000-2007§

Anaplasmosis



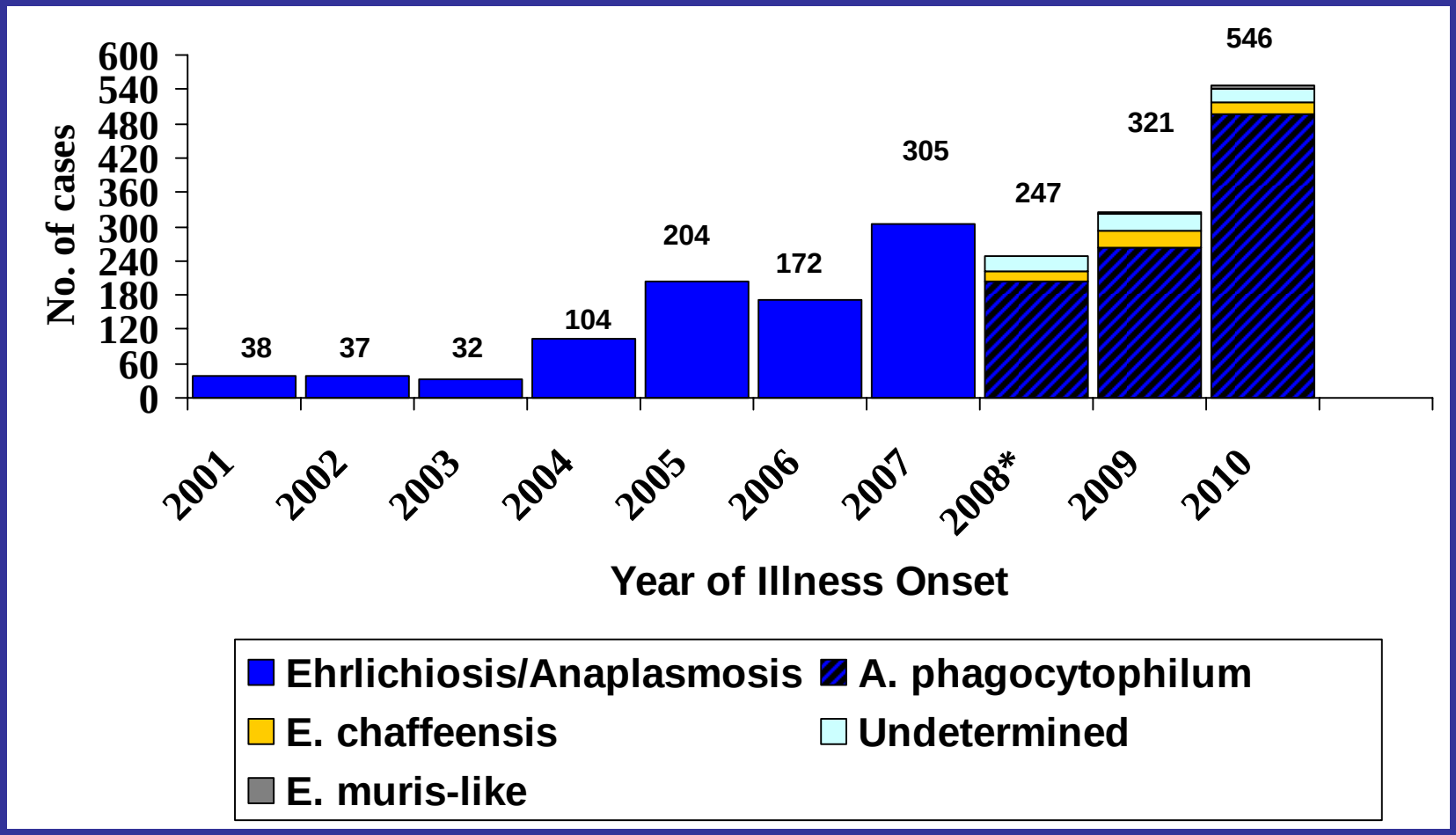
Ehrlichiosis



Anaplasmosis	0	0-3	3-15	15+
Ehrlichiosis	0	0-3	3-15	15+

§ NNDSS 2000-2007, Incidence per million per year, courtesy of CDC

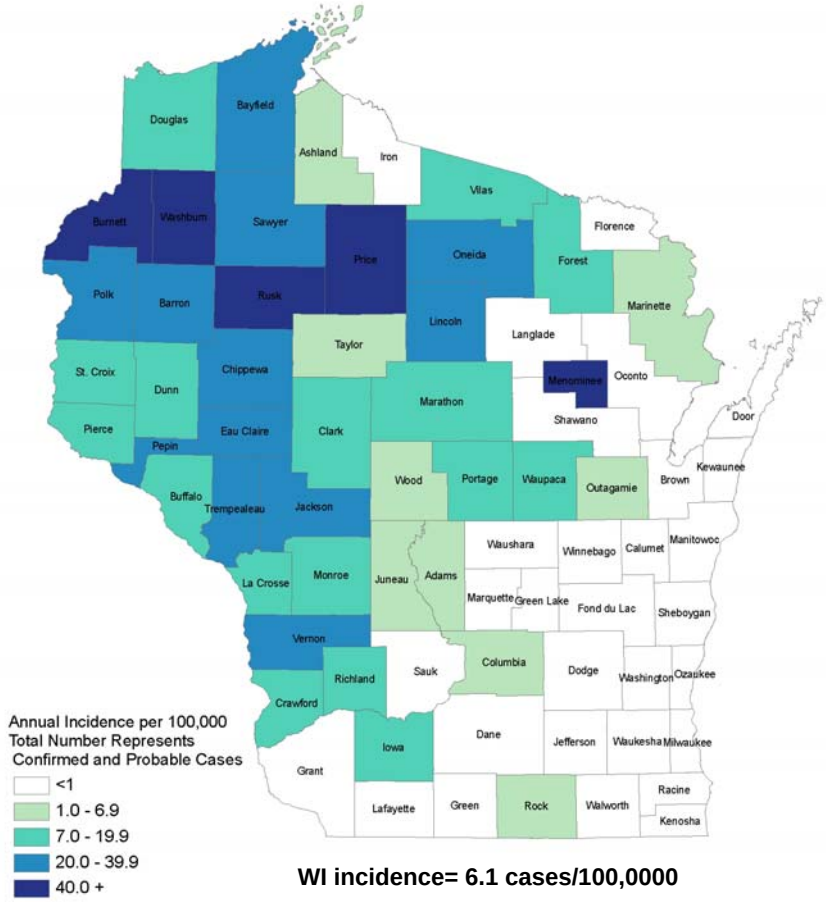
Total Cases of Ehrlichiosis/Anaplasmosis Infections Wisconsin, 2001-2010



*In 2008, cases were classified using the new CDC case definition

Revised 5/31/2011

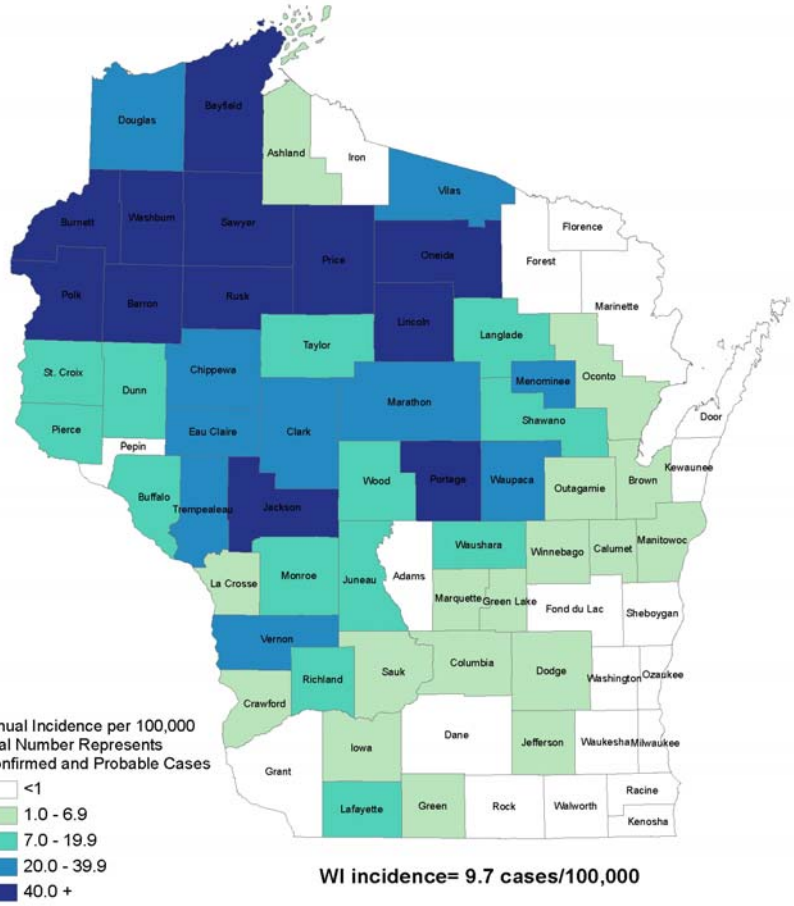
Ehrlichia/Anaplasma Disease Incidence, WI 2009
Cases per 100,000 population



WI incidence= 6.1 cases/100,0000

Revised 11/17/2009
Data Source: Wisconsin Division of Public Health

Ehrlichia/Anaplasma Disease Incidence, WI 2010
Cases per 100,000 population



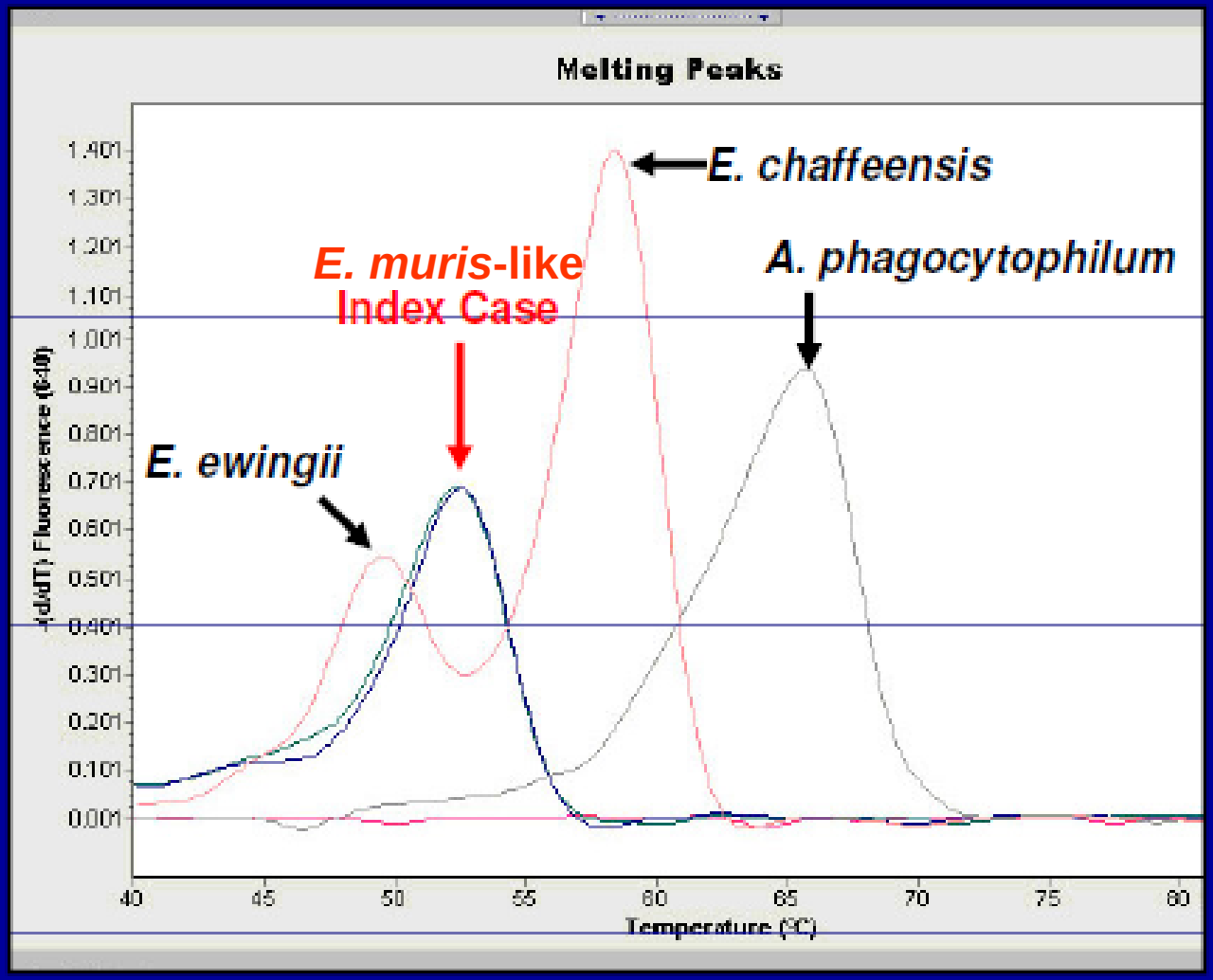
WI incidence= 9.7 cases/100,000

Revised 08/02/2010
Data Source: Wisconsin Division of Public Health

Investigation of Novel *E. muris*-like (EML) Cluster, 2009

- Index case: June 12, 2009
- Male, 51 years
- Clinical presentation: fever, headache, myalgia
- Laboratory findings: lymphopenia, throbocytopenia, and elevated liver enzymes
- Testing performed by Mayo labs- multiplex PCR, differentiated different agents by melting point curves
- CDC confirmation- PCR and sequencing confirmed novel *Ehrlichia* species similar to *E. muris,* referred to as *E. muris*-like
- From 2009-2010, WI have identified 8 confirmed EML cases

Melting Point Curve- PCR (Courtesy of Mayo Labs)

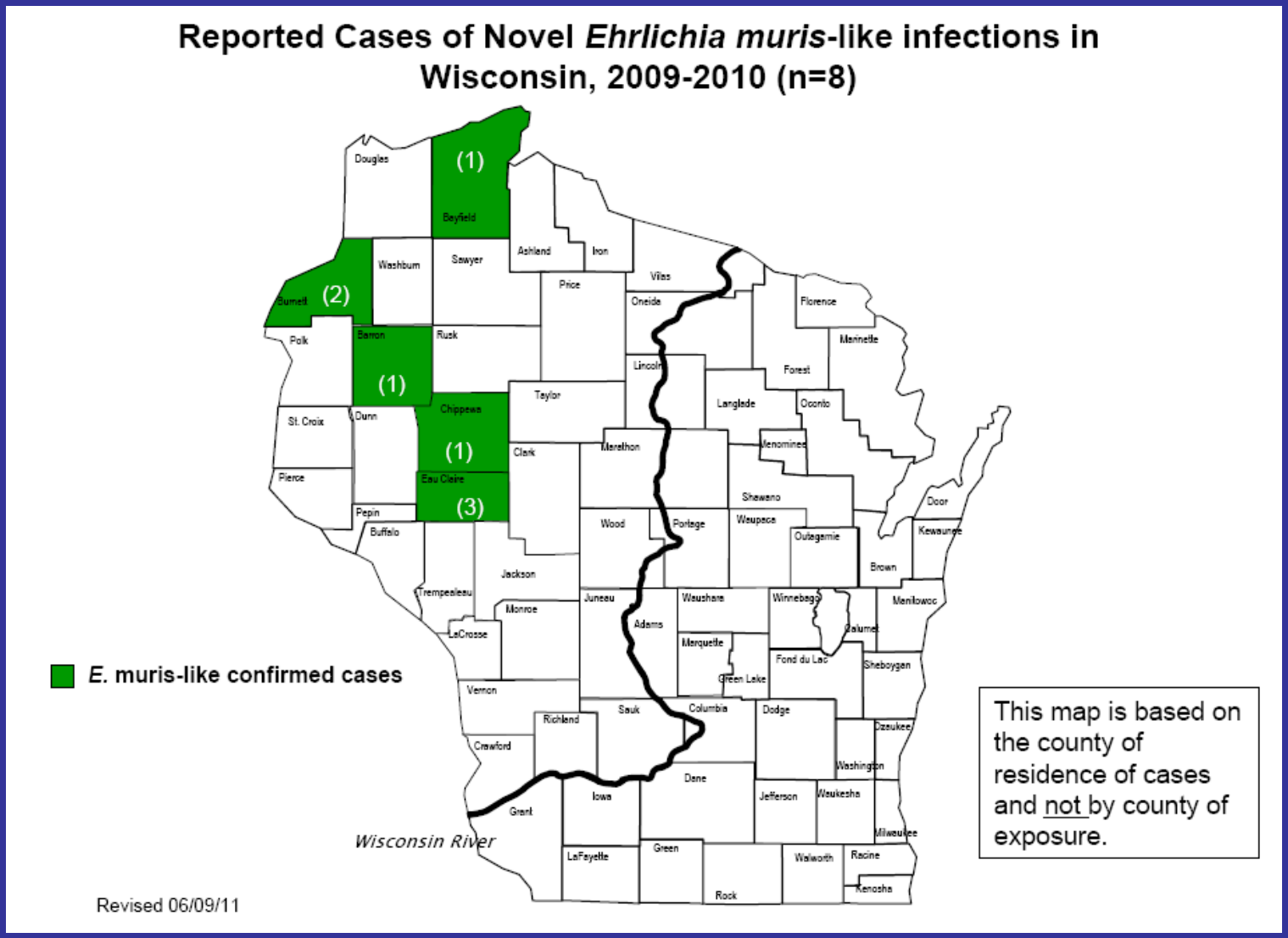


Investigation of *E. muris*-like Cluster (cont.)

- Obtained all acute and convalescent samples of all reported *Ehrlichia cases* for testing at CDC
- Obtained and reviewed medical records
- Standardized investigation questionnaire to interview patients regarding potential exposures

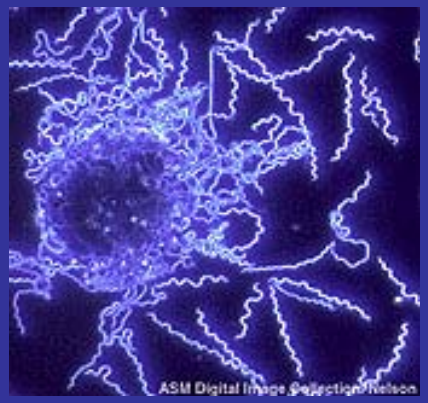
Typical tick friendly habitat surrounding case patients' homes

- All EML patients had exposure to ticks at home and/or in another county in WI
- Many reported seeing deer and wild animals in their backyard



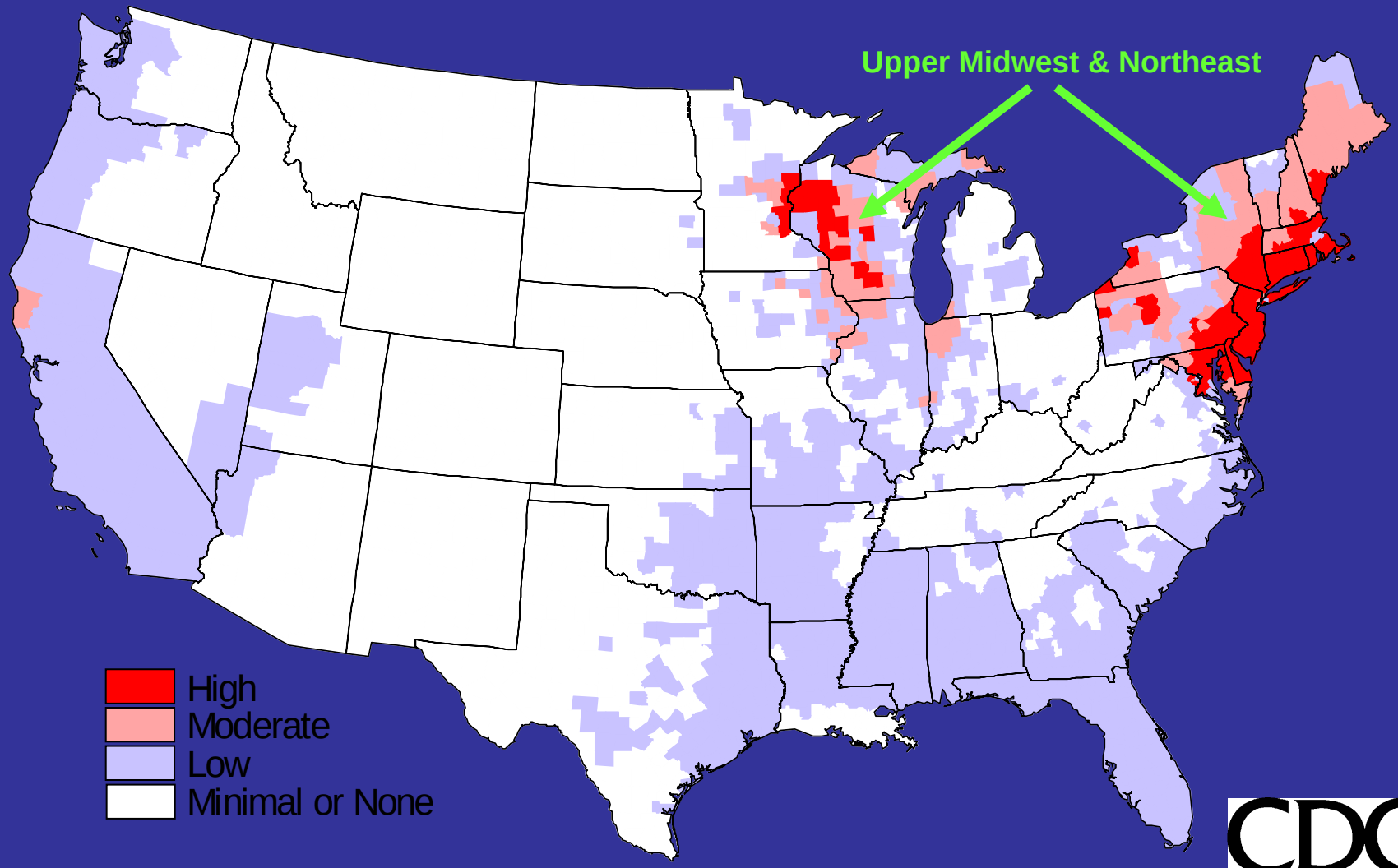
- It is uncertain how widely spread the EML infections are in WI because of the limited testing available
- DPH is currently working with Marshfield labs and WSLH to bring the multiplex PCR testing on board

Lyme disease



Borrelia burgdorferi

Lyme Disease High Risk Areas



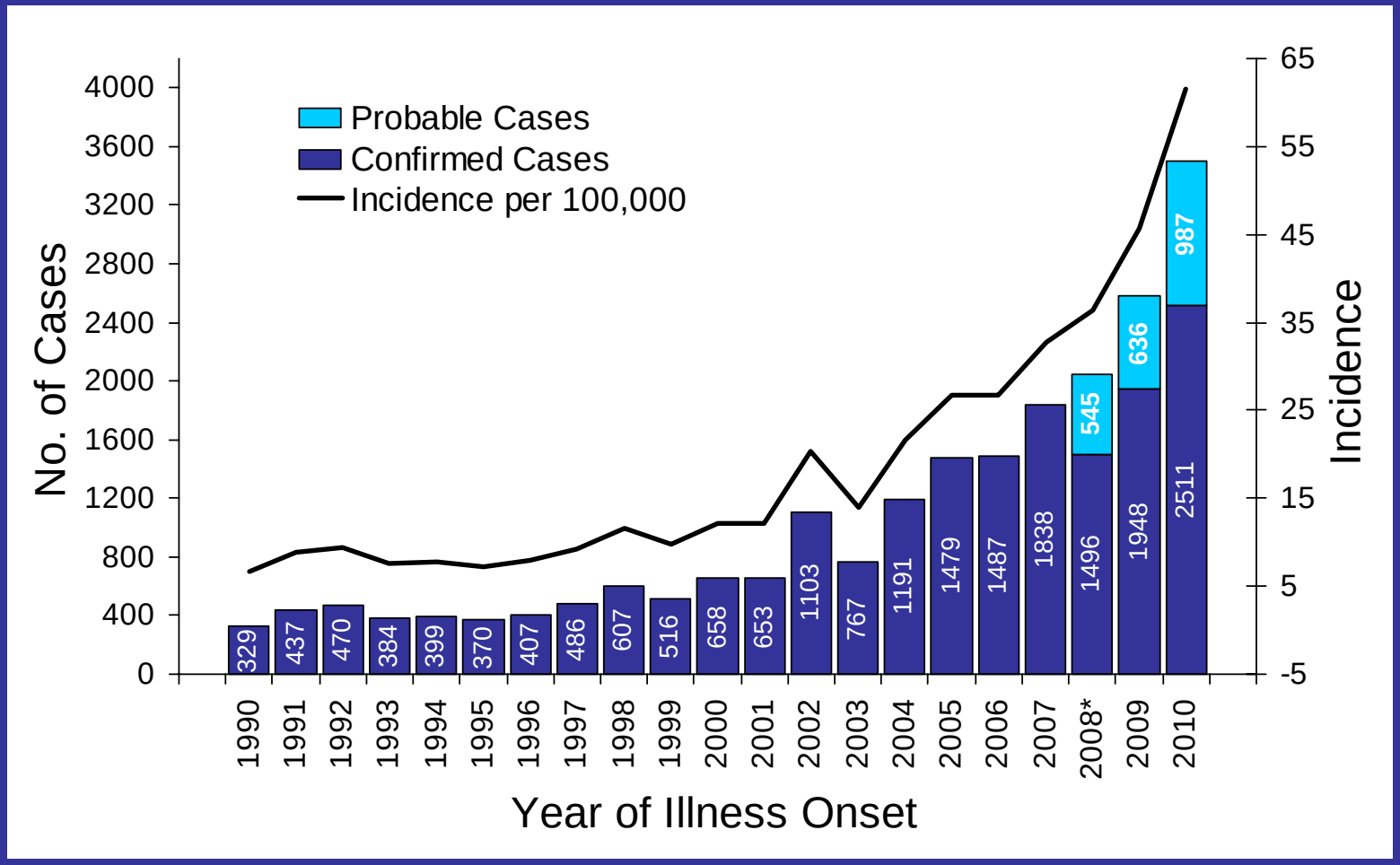
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Top 10 Notifiable Diseases in WI, 2009

Disease	Confirmed case
1. Chlamydia	20,946
2. Gonorrhea	5,212
3. Lyme disease	2,119
4. Hepatitis C	1,823
5. Campylobacteriosis	1,219
6. Mycobacterial (non-tuberculosis)	1,167
7. Salmonellosis	688
8. Cryptosporidiosis	614
9. Streptococcus pneumoniae	590
10. Giardiasis	521

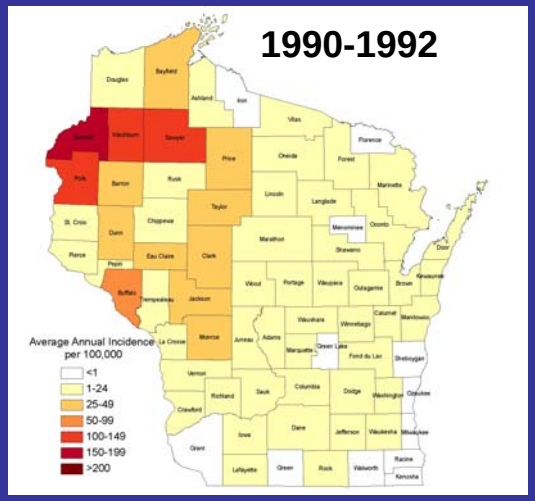
Reported Lyme Disease, WI,1990-2010

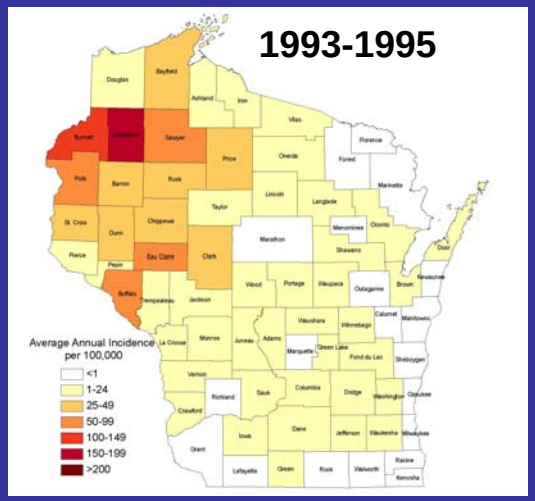
(n=21,704)

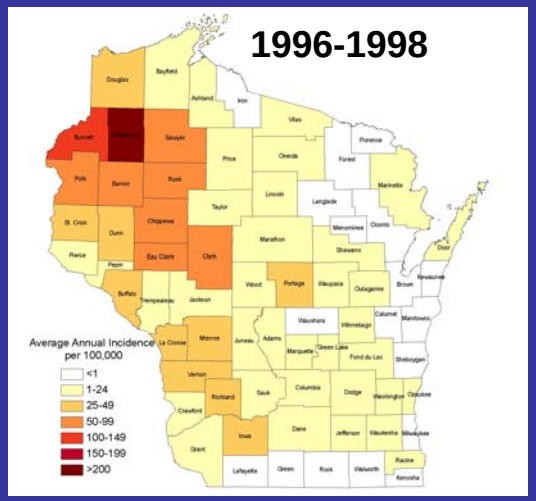


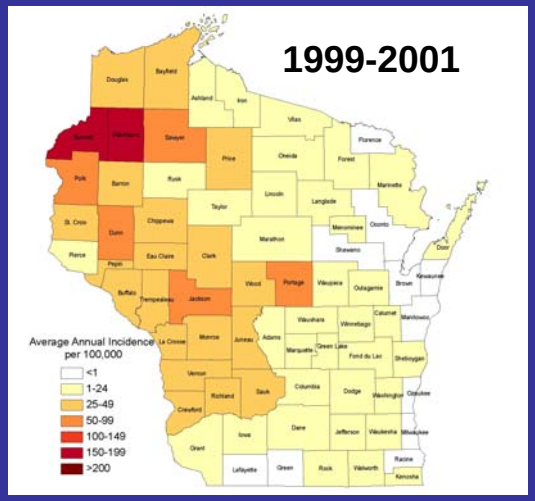
* Previous to 2008 only confirmed cases were reported. Beginning 2008, the total number of cases includes confirmed and probable cases.

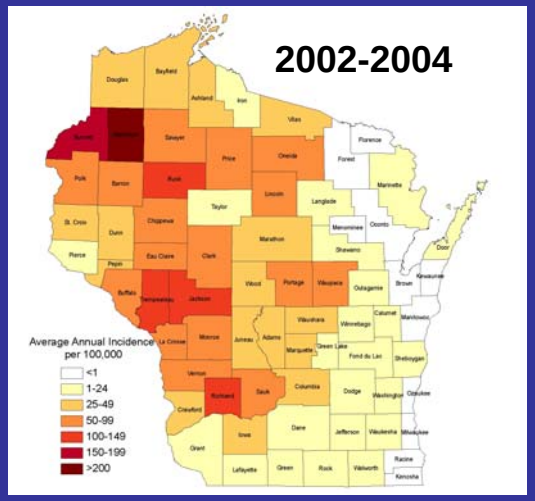
Lyme disease average annual incidence Wisconsin, 1990-2007, by county

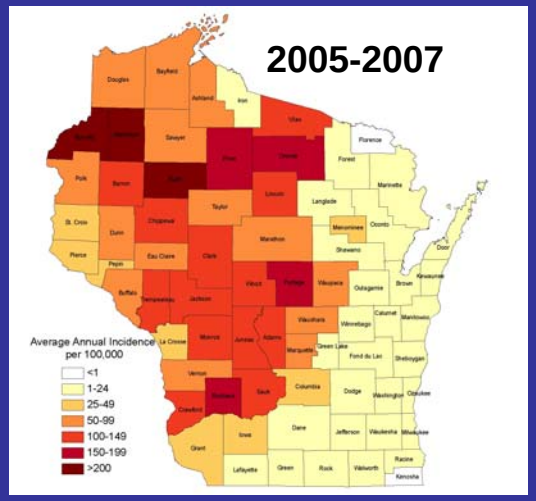




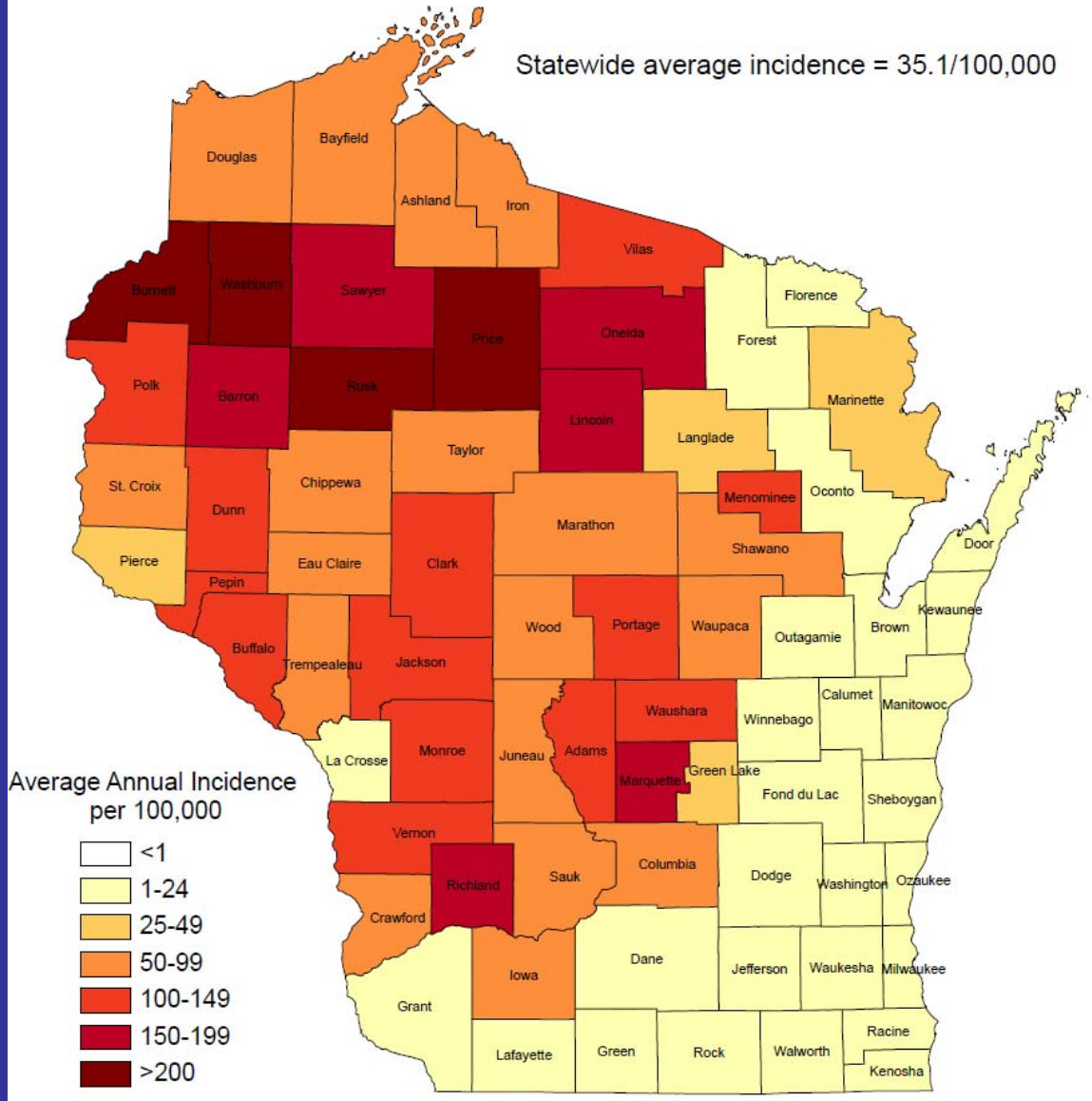








Lyme Disease Average Annual Incidence
Wisconsin, 2008-2010



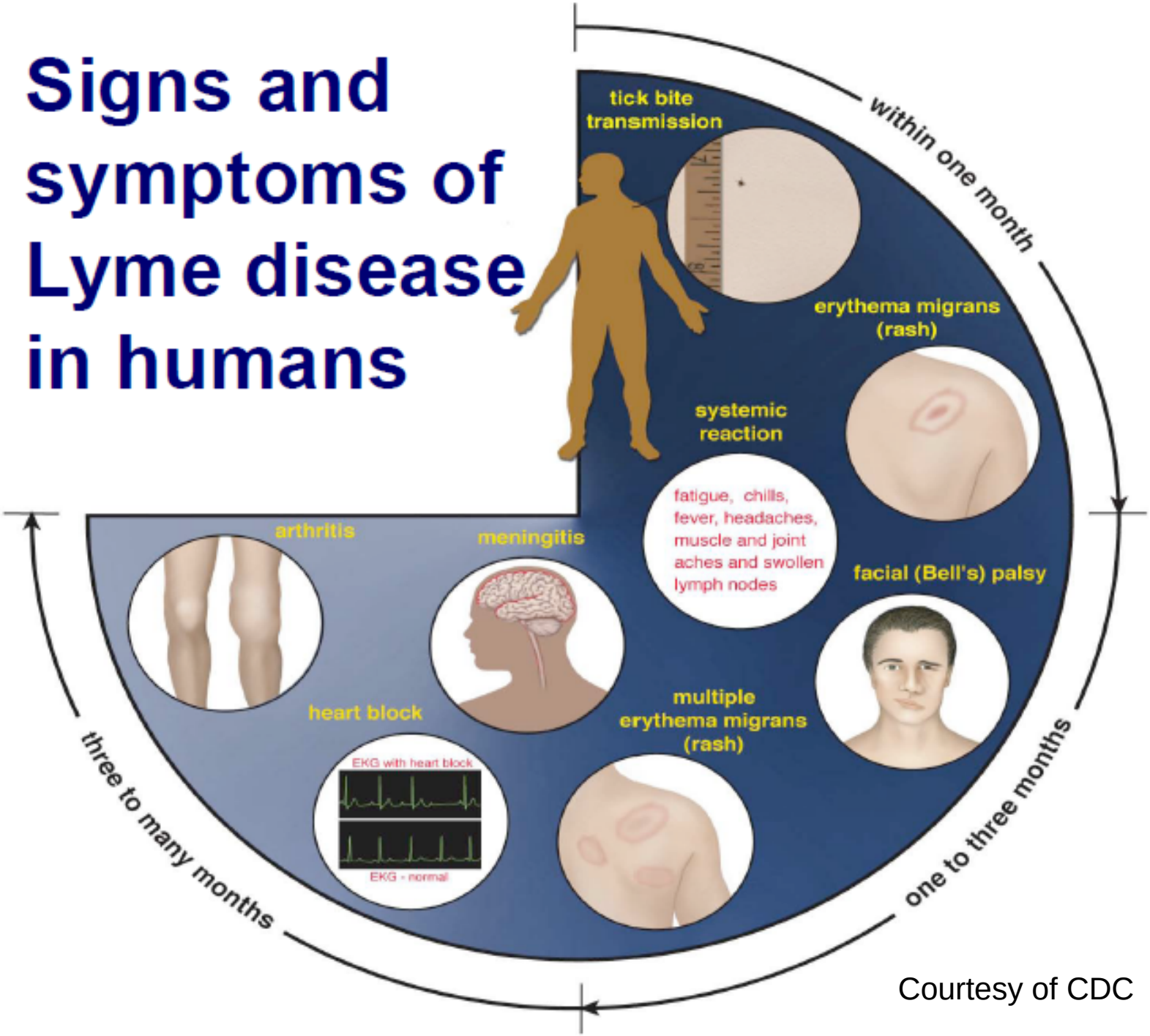
This map is based on the county of residence of confirmed cases.
Some infections may have been acquired during travel to other areas.

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

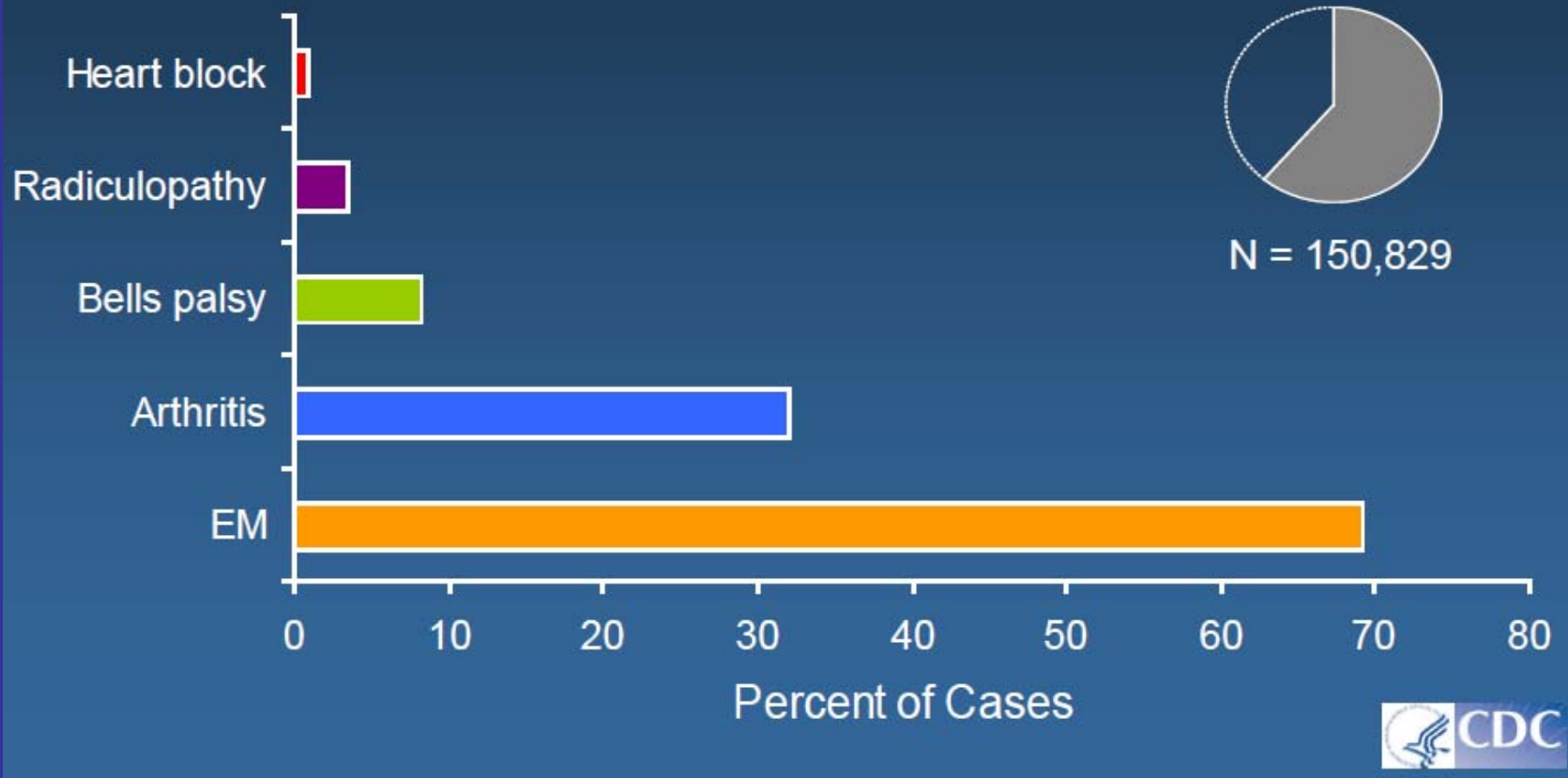
CDC

Signs and symptoms of Lyme disease in humans



Courtesy of CDC

Clinical features of Lyme disease cases reported to CDC, United States, 1992-2006



Early Localized Stage - Erythema Migrans (EM)

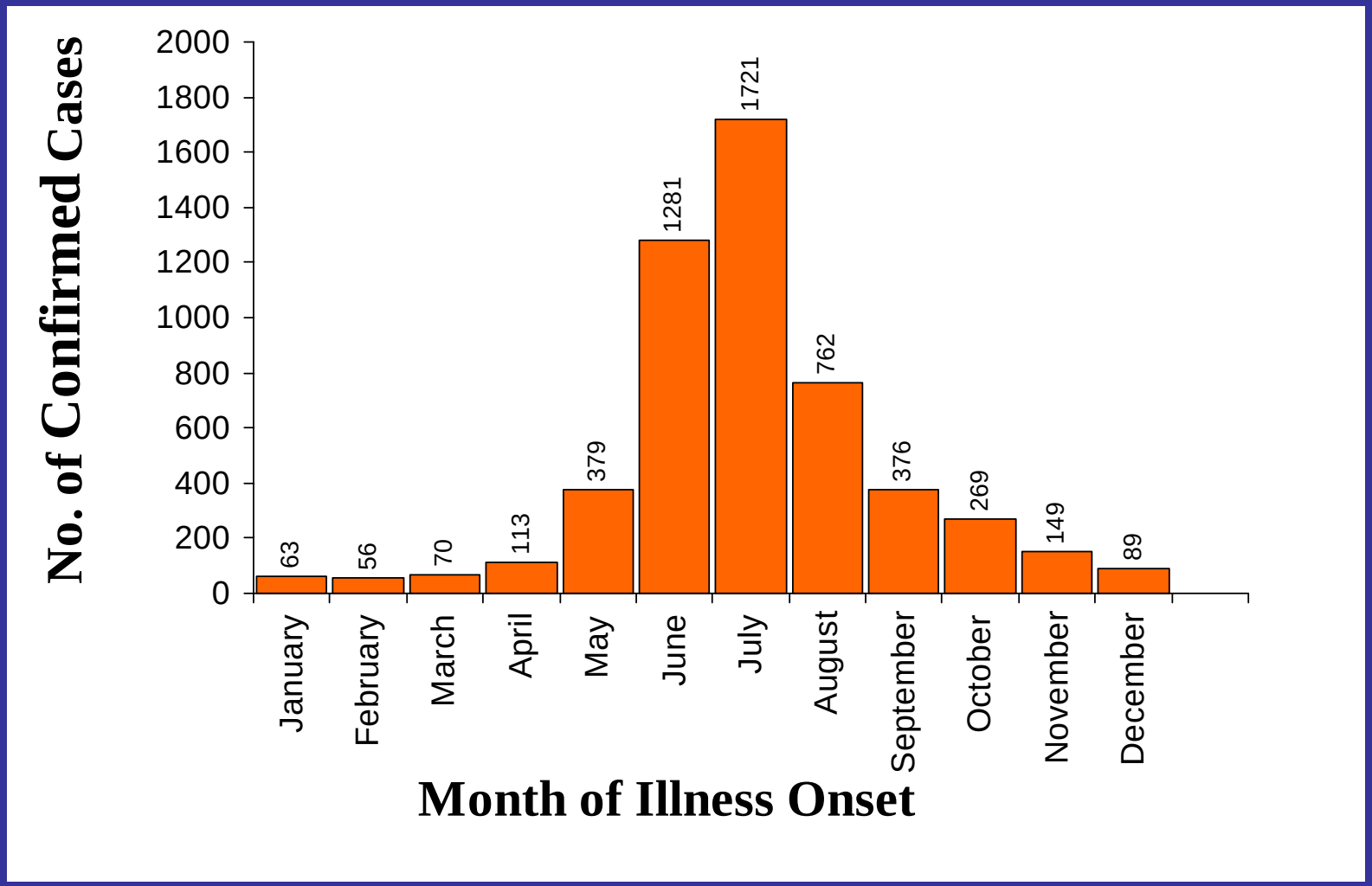
- Ticks must be attached for at least 24-48 hours to transmit bacteria

- The EM rash expands in size over time

- Occurs within 30 days of tick bite (70% people)

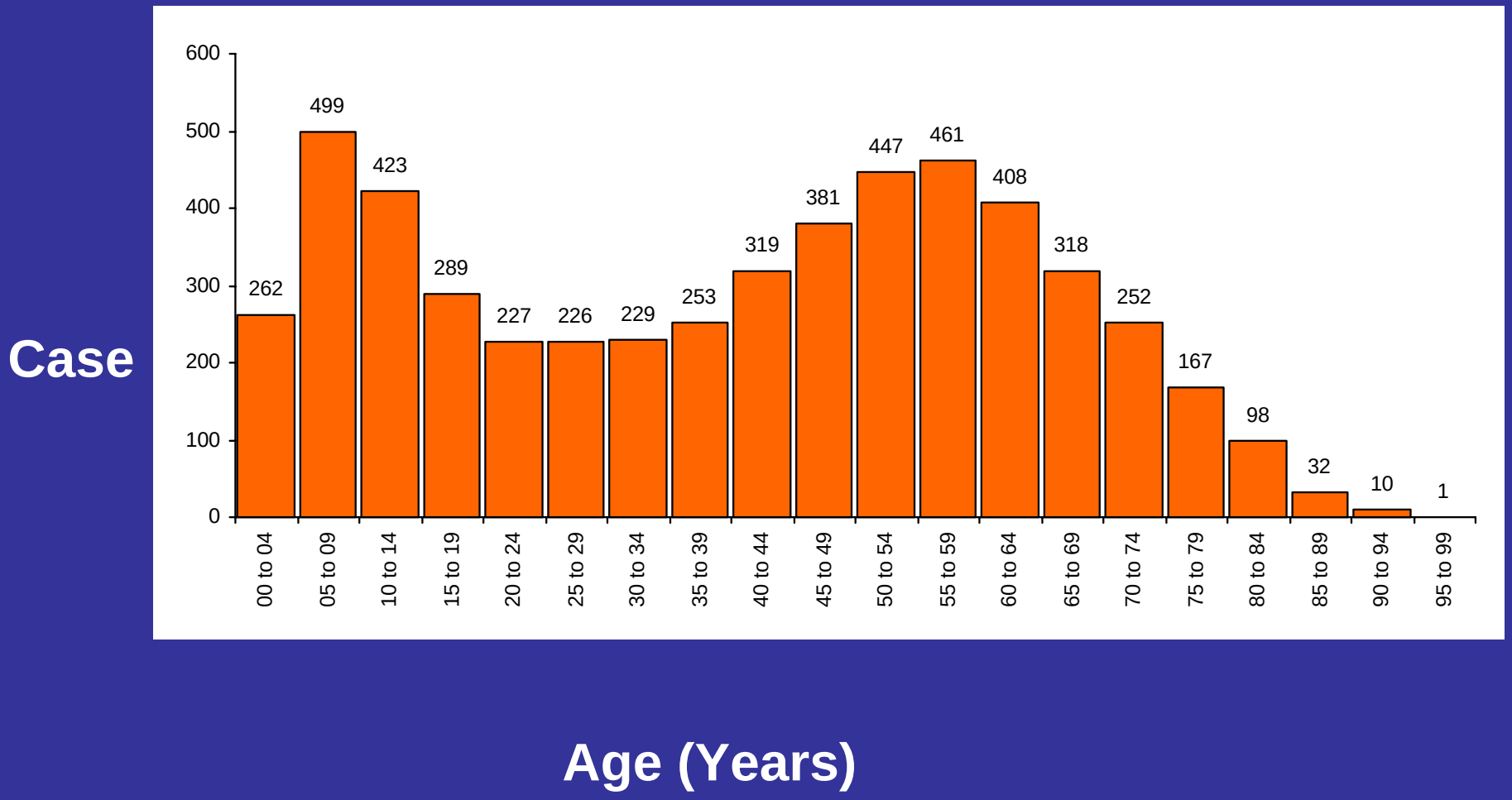
- Since Lyme disease is endemic in WI, EM rash (>/=5cm) is considered as a confirmed case with or without lab testing and should be reported to health departments

Confirmed Lyme Disease Cases by Month, 2007-2009, WI (n=5,302)

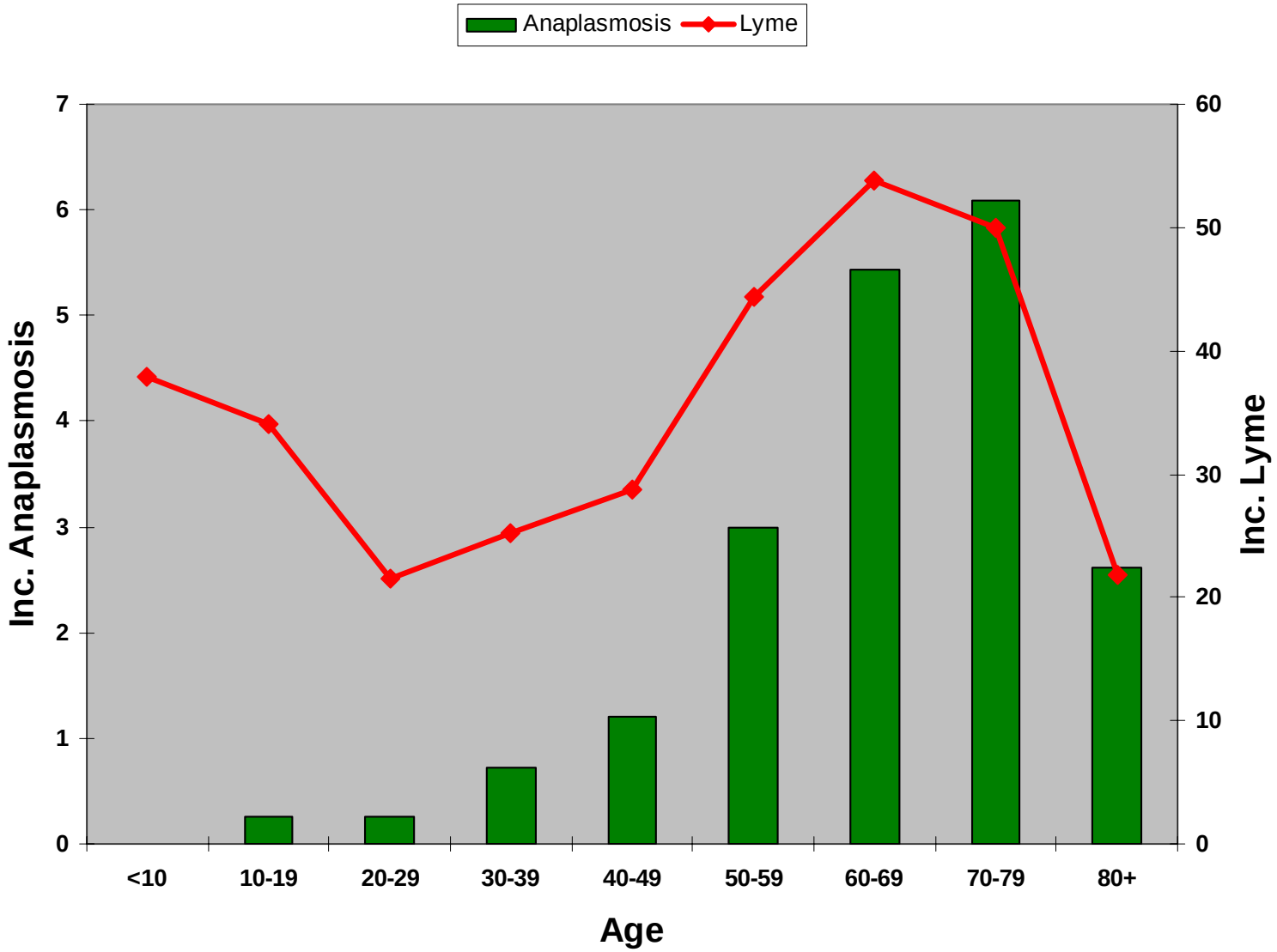


Date revised: 01/04/2011

Lyme Disease by Age, 2007-2009, WI (n=5,302)



Age-Specific Incidence of Reported Anaplasmosis, Wisconsin, 2009 (confirmed cases per 100,000 population)

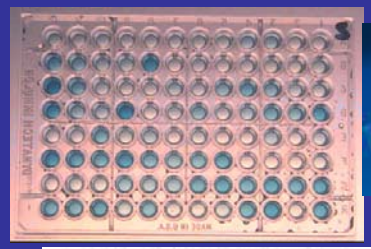


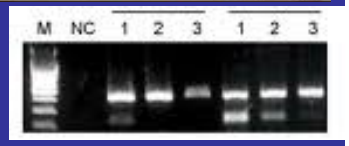
Lyme Disease- Testing Methods

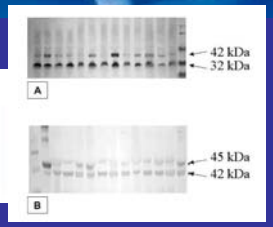
Most common serologic assays to detect antibodies include:

- Enzyme immunoassay (EIA) tests
- Immunofluorescent assays (IFA)
- Western Blot test

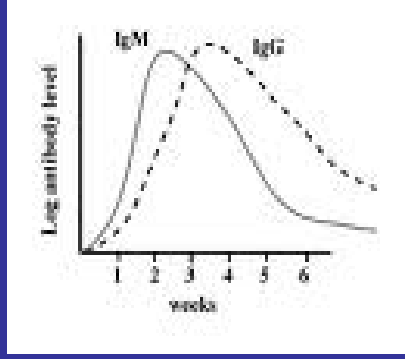
- Culture- detects growth of organism to confirm active infection
- PCR- molecular method of detecting DNA of organism (synovial fluid)







Lyme Disease- Antibody Response



Both IgM and IgG can persist for years (10-20yrs)

Specific IgM response

- Produce earlier than IgG
- Peaks within the first several weeks
- IgM is less specific than IgG
- Generally highest among patients with early infection

Lyme Disease- Antibody IgG Response

Specific IgG response (more reliable than IgM for Lyme and rickettsial infections)

- Produce a few weeks after IgM
- Peaks months to years
- Generally highest in later stages of infection
- Most active infections should have a positive IgG test result in one month

Lyme Disease- Treatment

- CDC uses the guidelines by the Infectious Diseases Society of America (IDSA)
- Antibiotics- very effective if treated early

  - children>/=8yrs and adult= doxycycline100mg 2x/day for 14days

  - children <8yrs= 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 antibiotic
- Long-term intravenous courses (months to years) have not been shown to be beneficial but may cause more complications (gallstones, catheter associated bloodstream infections,…)

Prevention

- Prophylaxis (follow the IDSA guidelines)
  - 1 single dose of doxycycline (200mg) for adults and children >/=8yrs
  - within 72 hrs after tick removal and tick was attached for at least 36hrs
  - at least 20% tick infectivity
  - WI average nymphal tick infectivity rate is about 22% (range from 20-24%)

- No lasting immunity, can get infected more than once

- No current available vaccine for humans since 2002, on-going research

Recurrent Episodes of Lyme Disease

Study of EM patients

- Uncertain if having one episode provides short-lived immunity
- Repeated episodes of Lyme disease may reflect relapse of a persistent infection or reinfection
- Most recurrent episodes are due to reinfection
- Reinfection may be due to at least 17 different sub-types of *B. burgdorferi* strains in the US
- More difficult to differentiate between reinfection and relapse if no EM is present

Lyme Disease Reinfection

- EM rash at a different site from the original episode of infection; recent tick bite within 30 days from the site of lesion
- EM rash usually has a raised or indented red point within the center of the rash at the site where the tick was removed from the skin
- Usually seasonal during spring or summer in places where nymphs are abundant
- Symptoms appears to be less severe with each episode of reinfection
- Reinfection may occur (>/= 1 year after initial episode)

Lyme Disease Relapse

- Relapses can occur if patient with Lyme disease is left untreated or treatment failure
- Patient with EM rash that has been treated usually does not have relapses
- Relapse rash can reappear anytime usually within a year of the first EM (untreated) episode
- EM rash can appear at the same site as the original episode of infection
- EM rash does not have a raised or indented red point within the center of the rash

Don’t get “Tick-ed”

- Avoid areas that could have ticks (wooded areas)
- Wear protective clothing, long pants and sleeves
- Tuck pants into socks or boots to prevent ticks from crawling under clothing
- Tuck shirts into pants
- Use repellants per label instructions (adults-20-30% DEET, children-10%)
- Permethrin spray for clothing
- Check for ticks after being outdoors
- Tick control- environmental landscape to create tick safe areas, spraying acaricides

References

1. Aguero-Rosenfeld ME, Wang G, Schwartz I, et al. Diagnosis of Lyme borreliosis. Clin Microbiology Rev 2005;18:484-509
2. CDC Lyme disease case definition http://www.cdc.gov/ncphi/disss/nndss/casedef/lyme_disease_2008.htm
3. CDC. Recommendation for test performance and interpretation from the second national conference on serologic diagnosis of Lyme disease. MMWR 1995;44:590-591
4. Brown SL, Hansen SL, and Langone JJ. Role of serology in the diagnosis of Lyme disease. JAMA 1999;286:62-66
5. CDC. Notice to readers: caution regarding testing of Lyme disease. MMWR 2005;54:125-126
6. Nadelman RB and Wormser GP. Reinfection in patients with Lyme disease. CID 2007;45:1032-1038
7. Krause PJ, Foley DT, Burke GS, et al. Reinfection and relapse in early Lyme disease. AM J Trop Med Hyg 2006; 75:1090-1094
8. Kalish RA, McHugh G, Grandquist J, et al. Persistence of immunoglobulin M or immunoglobulin G antibody responses to *Borrelia burgdorferi* 10-20 years after active Lyme disease. CID 2001;33:780-785

Additional Questions

Feel free to contact DPH:

Diep (Zip) Hoang Johnson, Epidemiologist

Phone: (608) 267-0249

E-mail: diep.hoangjohnson@wi.gov