Ecology, Epidemiology, and Prevention of Lyme Disease in the United States





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Centers for Disease Control and Prevention

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The Essentials

- **Lyme disease is a multisystem vector-borne zoonosis caused by the spirochete *Borrelia burgdorferi***
- **Small mammals and birds are reservoirs**
- **Lyme disease is transmitted in North America by 2 species of black-legged ticks**
  - *Ixodes scapularis*
  - *Ixodes pacificus*

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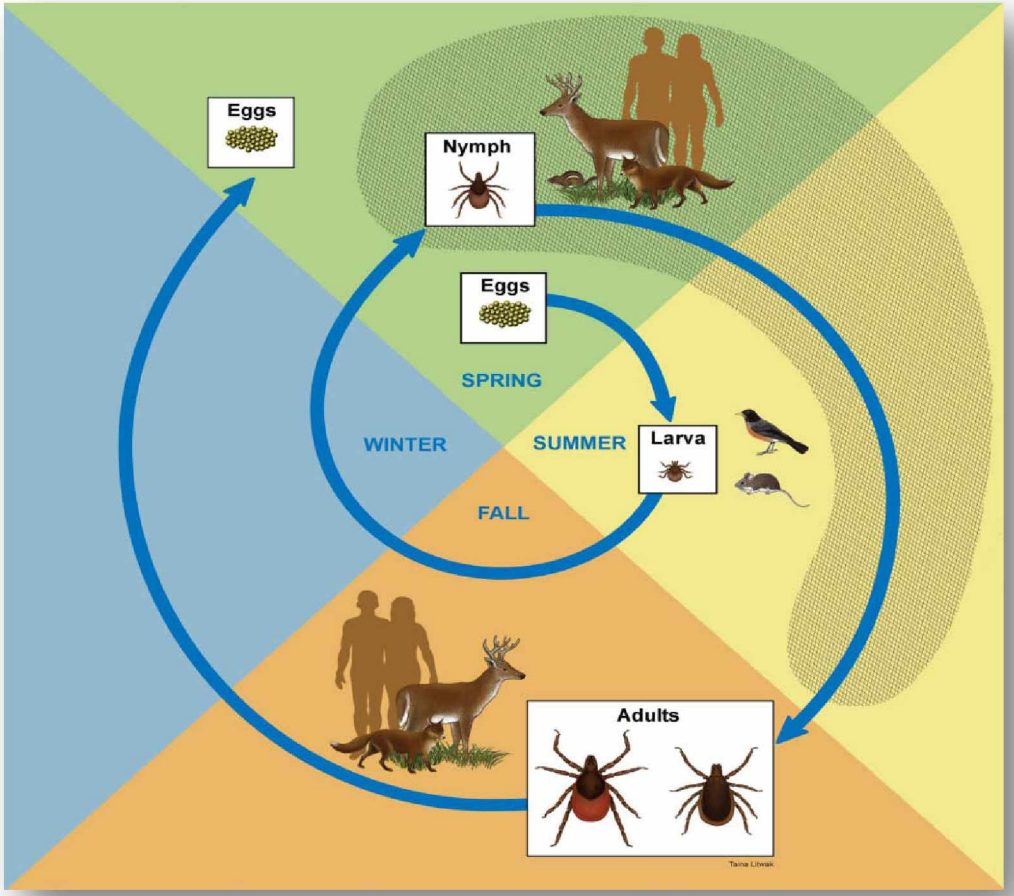
From Ticks to Humans: Transmission of *B. burgdorferi*



- Nymphs are most active in late spring and early summer
- Nymphs play a major role in transmission to humans

- Deer are immune to infection by *B. burgdorferi,* but support tick populations

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National Surveillance for Lyme Disease

- **Lyme disease became nationally notifiable in 1991**
- **Confirmed case definition for surveillance purposes**
  - Erythema migrans with exposure in an endemic area, OR
  - Erythema migrans with laboratory evidence but no exposure, OR
  - Noncutaneous manifestation (e.g., arthritis, carditis, neuritis) with laboratory evidence of infection
- **Probable case definition added in 2008 to capture patients with a broader array of clinical features**

Bacon, RM et al. Surveillance for Lyme disease – United States, 1992-2006. MMWR Surv Summ 2008;57 (SS10):1-9 Available at: www.cdc.gov/osels/ph_surveillance/nndss/casedef/lyme_disease_Current .htm

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Surveillance Challenges and Caveats

- **Verifying cases can be time-consuming**
- **Current magnitude of underreporting is unknown**
  - Estimates of "10 fold" underreporting are obsolete
- **Cases are reported according to county of residence, not county of exposure**

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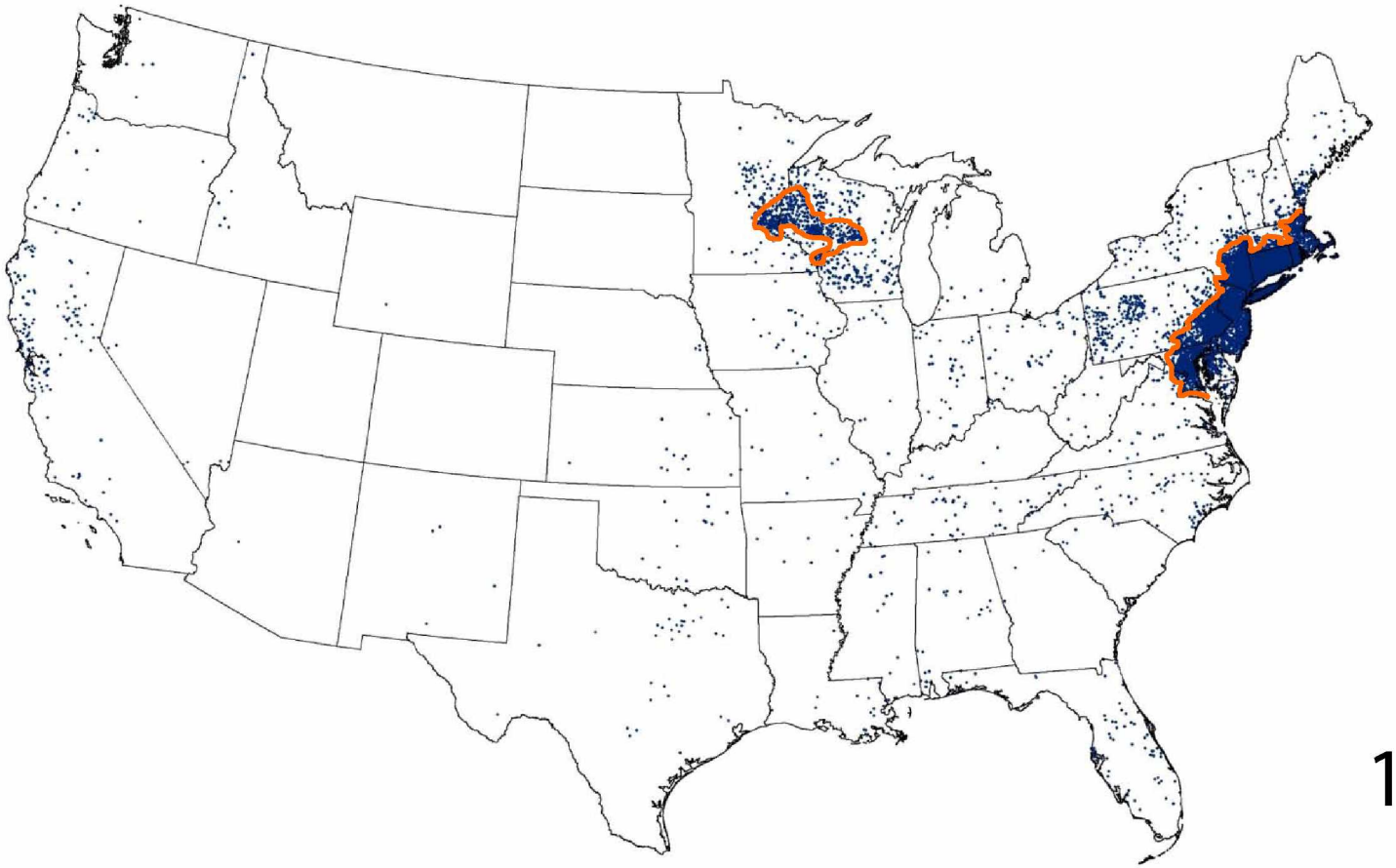
In the United States Lyme Disease is Regional, but Spreading



1998

1 dot per case placed randomly in county of patient residence; may not reflect county of exposure

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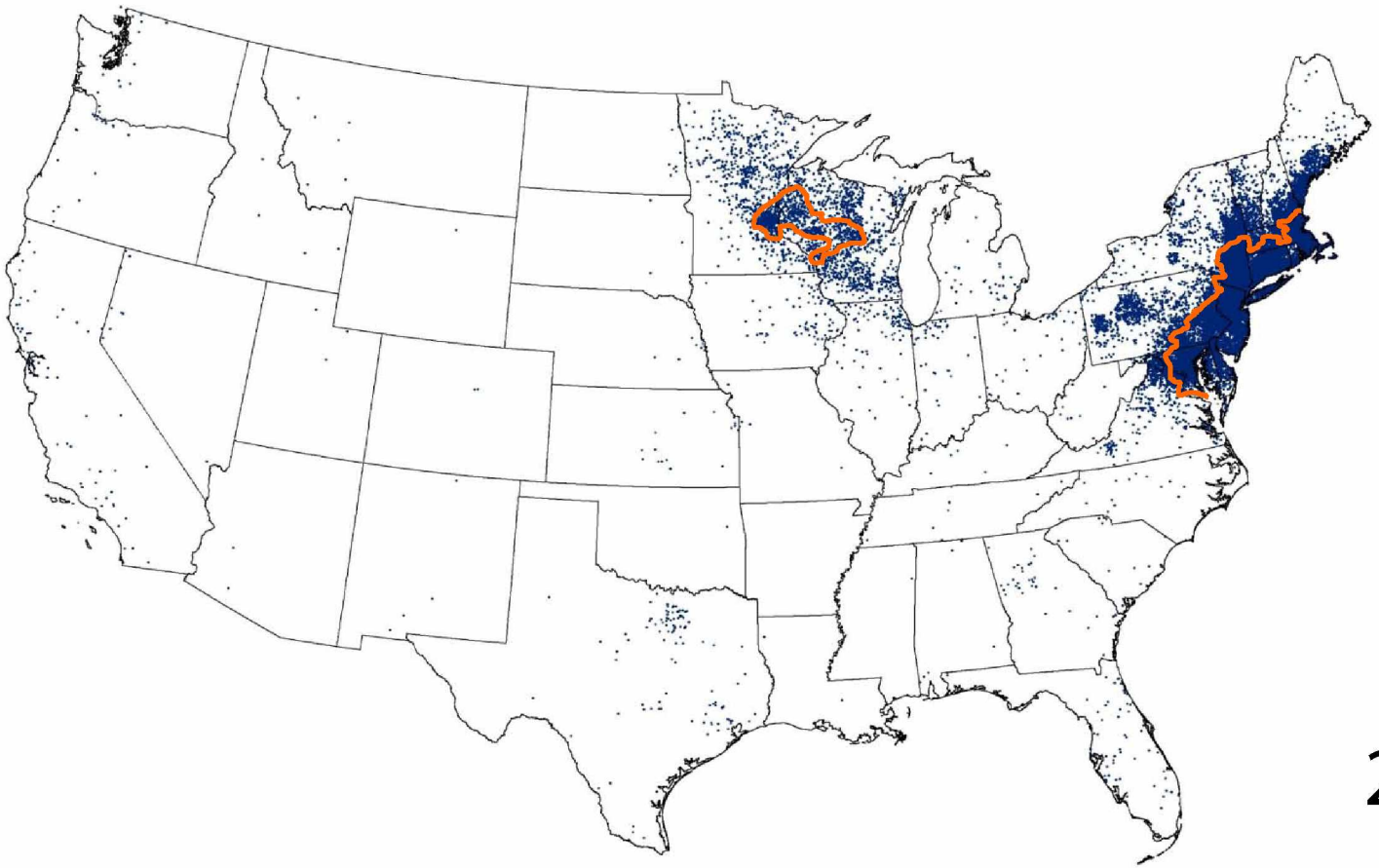
In the United States Lyme Disease is Regional, but Spreading



2008

1 dot per case placed randomly in county of patient residence; may not reflect county of exposure

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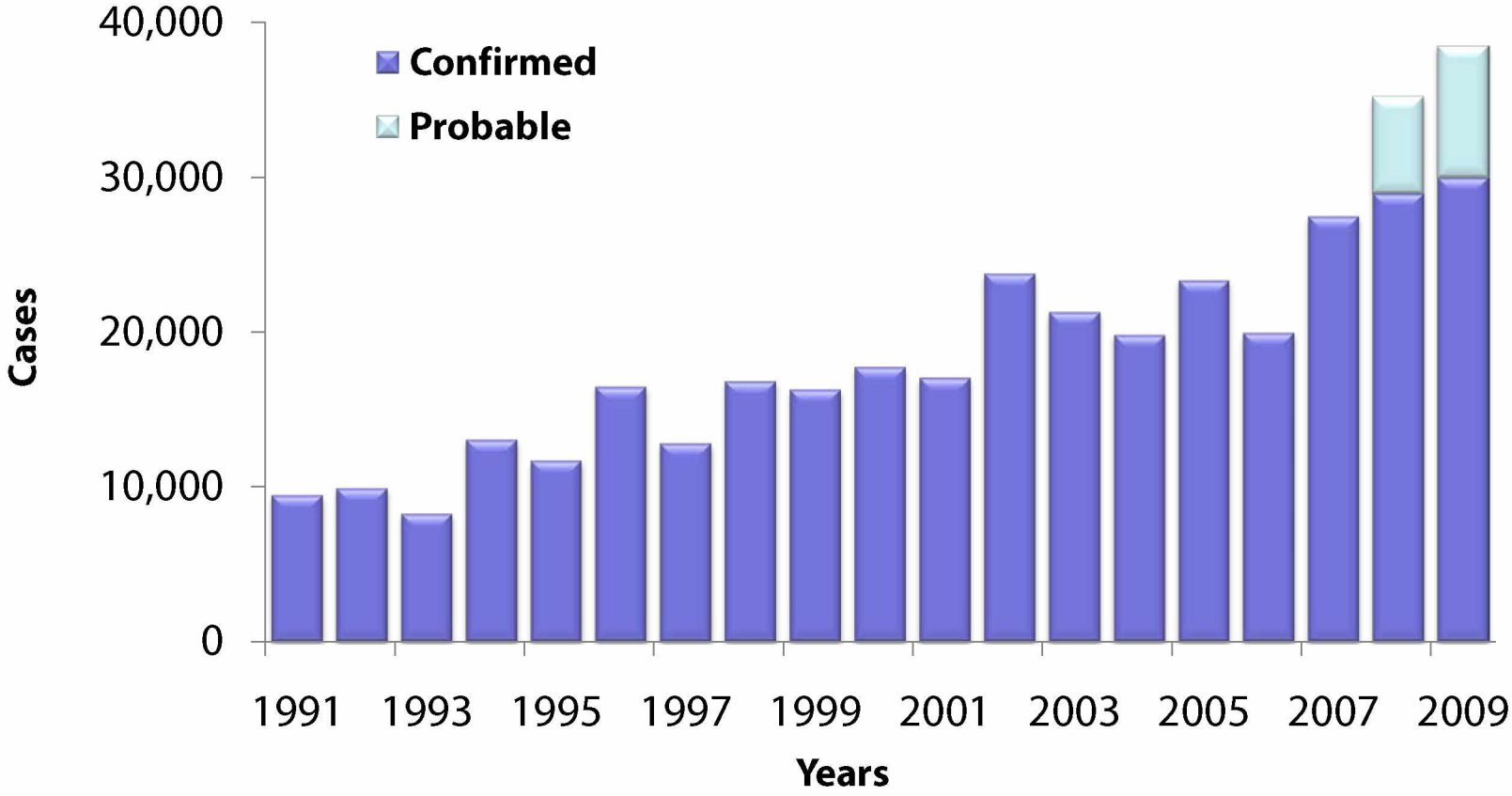
Reported Lyme Disease Cases
United States, 1991–2009



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Top 7 Notifiable Diseases
United States, 2009

Rank	Disease	U.S.
1	Chlamydia	1,244,180
2	Gonorrhea	301,174
3	Salmonellosis	49,192
4	Syphillis	44,828
5	Novel influenza A	43,696
6	Lyme disease	38,468
7	AIDS	36,870

Rank	Disease	New England
1	Chlamydia	39,246
2	Lyme disease	9,205
3	Gonorrhea	5,470
4	Salmonellosis	2,244
5	Varicella	1,729
6	Giardiasis	1,660

New England = CT, ME, MA, NH, RI, VT

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Lyme Disease: Current Challenges

- **Clinical diagnosis and treatment**
- **Laboratory diagnostics**
- **Public health practice**
- **Prevention**
  - Personal protection in the absence of vaccine
  - Environmental management for tick control
  - Community-based interventions

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Personal Protection in the Absence of Vaccine

- ❑ Avoid tick habitat
- ❑ Wear protective clothing
- ❑ Use insect repellents
- ❑ Check for ticks daily
- ❑ Bathe promptly after exposure

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Studies of Selected Personal Protective Measures

Use of insect repellents		Check for ticks		Reference
Effect	P value	Effect	P value	
OR 0.6	NS	OR 0.5	0.02	2009 Connally
OR 0.8	0.05	OR 1.0	NS	2008 Vázquez
OR 0.7	0.02	OR 0.6	0.001	2001 Smith G
OR 1.2	NS	OR 1.2	NS	
OR 1.0	NS	OR 0.5	NS	1998 Orloski
–	NS	–	NS	1996 Klein
OR 1.5	NS	OR 0.8	NS	1995 Ley
RR 0.5	NS	RR 1.1	NS	1988 Smith P[1]
RR 0.7	NS	RR 0.8	NS	

[1] Risk presented as inverse

OR, Odds ratio
RR, Relative risk
NS, Not significant

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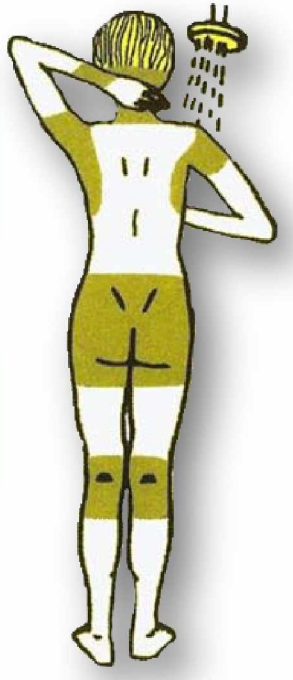
Bathing as Primary Prevention

- **Prospective case control study of 364 Connecticut patients with Lyme disease diagnosed 2005–2007**

Behavior	Adjusted OR (95% CI)
Wearing repellent while in yard	0.59 (0.35–1.03)
Checking for ticks within 36 hrs	0.55 (0.32–0.94)
Bathing within 2 hrs	0.42 (0.23–0.78)



CI, Confidence interval
OR, Odds ratio
Connally, NP et al. Am J Prev Med 2009;37:201-206

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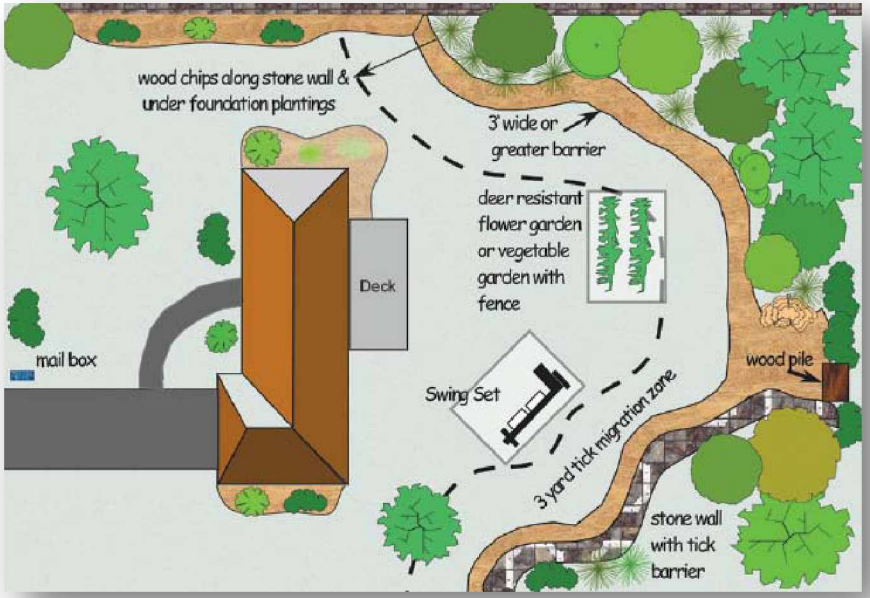
Environmental Management for Tick Control

Landscaping to create "tick-safe zones"

- Clear brush and leaf litter
- 3-foot barrier of wood chips can reduce questing ticks in lawn by 50%
- Use deer-resistant plantings
- Install deer fencing



Stafford III, KC and Kitron U. In: J. Grey. Lyme Borreliosis: Biology, Epidemiology, and Control. CABI Publishing, New York, NY, 2002, pp 301-334

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Chemical Tick Control

- **A single, springtime application of pesticide can reduce questing tick populations by 68–100%**

Stafford III, KC. Tick Management Handbook (Bulletin 1010) 2007.
Connecticut Agricultural Experiment Station, New Haven, CT
http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/b1010.pdf

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Community-based Interventions

- USDA "4-poster" stations treat deer with topical pesticide and reduce tick carriage
- Obstacles include concerns about pesticides and the spread of chronic wasting disease

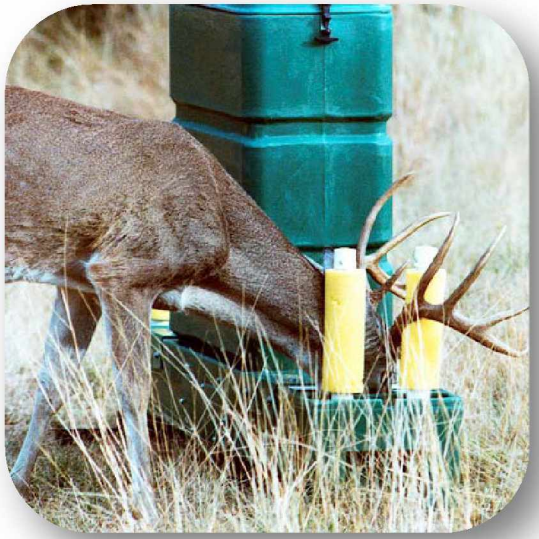

Photo credit by Scott Bauer, ARS

Stafford III, KC. Tick Management Handbook (Bulletin 1010) 2007.
Connecticut Agricultural Experiment Station, New Haven, CT
http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/b1010.pdf
USDA, US Department of Agriculture

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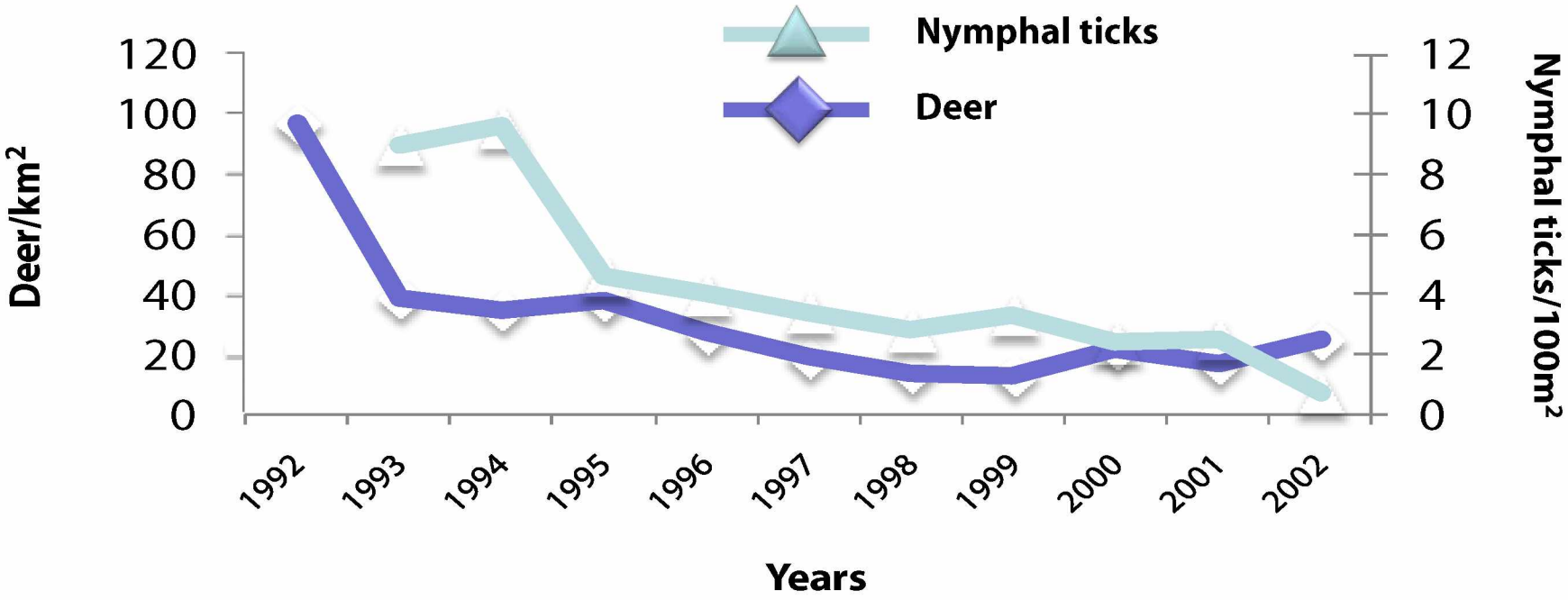
Sharp, Community-wide Reductions in Deer Populations May Decrease Lyme Disease Cases

Bridgeport, Connecticut



Stafford III, KC et al. J Med Entomol 2003;40:642-652

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Summary

- Lyme disease is an important public health problem
- The number of cases continues to grow
- An array of prevention interventions are available
- Currently, there is no single, widely-accepted prevention method

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CDC Lyme Disease Prevention Strategies

Education, education, education

- Assure that current prevention options are widely known and adopted
- Use fewer but better targeted messages

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CDC Lyme Disease Prevention Strategies

- **Improve current, and develop and validate new prevention methods**
  - Placebo-controlled trial of 1,600 households is under way to validate benefits of pesticide applications
  - Natural products from plant extracts
  - Rodent-targeted vaccines
  - Deer-based interventions

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Clinical Manifestations and Treatment of Lyme Disease





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Division of Rheumatology, Allergy and Immunology

Massachusetts General Hospital

Harvard Medical School

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Overv

- **How it all began**
- **Clinical manifestations**
  - Active infection
  - Postinfectious syndromes
- **Treatment**
  - What, when, and how long?
- **What's ahead**

view

Lyme, Connecticut

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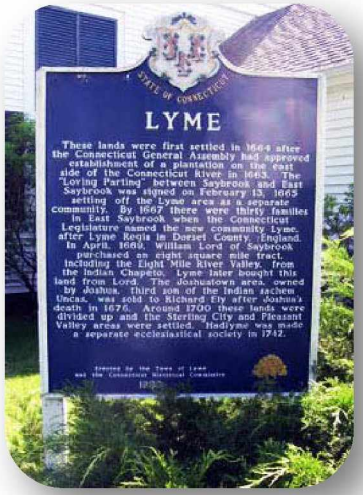
How it All Began

- **October 1975: Two mothers contacted health officials about arthritis cases in their communities (Lyme and Old Lyme, CT)**
- **January 1977: First description of "Lyme arthritis"**
  - Patients had an arthropod-transmitted illness
  - 1/4 of the children or their parents recalled an expanding skin lesion before the onset of arthritis

LYME ARTHRITIS

AN EPIDEMIC OF OLIGOARTICULAR ARTHRITIS IN CHILDREN AND ADULTS IN THREE CONNECTICUT COMMUNITIES

ALLEN C. STEERE, STEPHEN E. MALAWISTA, DAVID R. SNYDMAN, ROBERT E. SHOPE, WARREN A. ANDIMAN, MARTIN R. ROSS, and FRANCIS M. STEELE



Edlow JA. Bull's eye. Unraveling the medical mystery of Lyme disease. 2003. Yale University Press, New Haven, CT
Steere, A et al. Arthritis and Rheum 1977;20:7-17

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Clinical Manifestations of Lyme Disease

- **Stage 1: Localized infection**
  - Erythema migrans – a slowly expanding skin lesion, sometimes with partial central clearing
  - Often with flu-like symptoms: Headache, stiff neck, myalgias, arthralgias, or fever, but no gastro-intestinal or respiratory symptoms
  - About 1 in 5 patients lack this initial skin lesion, and the illness begins with flu-like symptoms or a later disease manifestation

Steere A. NEJM 2001;345:115-25

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Clinical Manifestations of Lyme Disease

- **Stage 2: Early disseminated infection**
  - Neuroborreliosis: About 15% of untreated patients
  - Most commonly
    - Meningitis
    - Cranial neuropathy
    - Motor or sensory radiculoneuropathy
  - Cardiac involvement: About 5% of untreated patients
    - Atrio-ventricular (AV) nodal block
    - Myopericarditis

Steere A. NEJM 2001;345:115-25

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Clinical Manifestations of Lyme Disease

- **Stage 3: Late persistent infection**
  - Arthritis – 60% of untreated patients
  - Intermittent attacks in one or a few joints, especially the knee, sometimes becoming chronic
  - Late subtle encephalopathy or polyneuropathy, accompanied by abnormal cerebrospinal fluid (CSF) or electromyogram (EMG)
  - Late in the illness, the infection is usually quite localized, and systemic symptoms are minimal, if present at all
  - Even without antibiotics, the immune system seems to win out eventually, and symptoms resolve

Steere A. NEJM 2001;345:115-25
Kruger, H et al. Acta Neuro Scand 1990;82:59-67
Kalish, RA et al. J Infect Dis 2001;183:453-60

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Treatment of Early Lyme Disease
Guidelines of the Infectious Diseases Society of America

- **What**
  - Doxycycline or amoxicillin
  - Cefuroxime or erythromycin
    (in case of allergy to doxycycline or amoxicillin)
  - All taken by mouth
- **How long**
  - 14–21 days

All drugs administered *per os* (by mouth)
Wormser, GP et al. Clin Infect Dis 2006;43:1089-1134

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Treatment of Later Manifestations of Lyme disease
Guidelines of the Infectious Diseases Society of America

- **Early or late neuroborreliosis: 2–4 weeks**
  - Ceftriaxone or cefotaxime, intravenously (IV)
  - Na-penicillin G, IV
- **Heart involvement: 4 weeks**
  - Generally, start with IV therapy
  - When clinical picture improves, complete course with oral therapy
- **Joint involvement: 4–8 weeks**
  - Oral regimens 4–8 weeks
  - Some patients require IV antibiotics for 4 weeks for successful treatment of the infection

IV, Intravenous
Wormser, GP et al. Clin Infect Dis 2006;43:1089-1134

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Then and Now

- **Key clinical challenge today: How to diagnose and treat syndromes that may follow standard courses of antibiotic therapy for Lyme disease**
  - Distinguishing these symptoms from other illnesses
  - Most researchers think that these syndromes result from other factors than active infection
  - Strong feeling on the part of advocacy groups that these persistent symptoms result from persistent infection and require months or years of antibiotics

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Reasons for Persistent Signs or Symptoms after Antibiotic Treatment

- **Neuroborreliosis**
  - Neurologic recovery (e.g., facial palsy) may be incomplete
- **Antibiotic-refractory Lyme arthritis**
  - Proliferative synovitis may persist for months or several years after 1–2 months of oral antibiotics and 1 month of IV antibiotics
  - Autoimmunity may play a role in the course of Lyme disease

IV, Intravenous

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Reasons for Persistent Signs or Symptoms after Antibiotic Treatment

- **Pain, neurocognitive, and/or fatigue symptoms**
  - In a small percentage of cases, these symptoms may begin after recommended courses of antibiotics for Lyme disease.
  - CSF and EMG testing shows normal results
  - The majority of patients now diagnosed with "chronic Lyme disease" have pain and fatigue symptoms, but lack evidence of past or present *B. burgdorferi* infection
    - Sigal LH, et al. Am J Med 1990;88:577-81
    - Steere, A et al. JAMA 1993;269:1812-16
    - Carrington, RM et al. Ann Intern Med 1998;128:354-62
  - Amplification of sensory signals in the brain may be an important mechanism

CSF, Cerebrospinal fluid
EMG, Electromyogram

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Antibiotic Therapy for Persistent Symptoms after Standard Antibiotic Treatment for Lyme Disease

- **Pain, neurocognitive, and/or fatigue symptoms after Lyme disease**
  - Four double-blind, placebo-controlled trials have been conducted
  - No sustained benefit from additional oral or IV antibiotic therapy has been shown
  - Severe adverse reactions have been reported
    - Klempner, MS et al. N Engl J Med 2001;345:85-92
    - Krupp, LB et al. Neurology 2003;60:1923-30
    - Fallon, BA et al. Neurology 2008:992-1003

IV, Intravenous

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Summary

- **Lyme disease**
  - Multisystem infection
  - Typically occurs in stages with different clinical manifestations at each stage
- **Infection can be treated effectively with antibiotics**
  - Effective treatment is tailored to the disease manifestation
  - Early disease can usually be treated effectively with oral antibiotics, but organ system involvement may require intravenous therapy

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Summary

- **Post-infectious syndromes**
  - Incomplete recovery of nerve function
  - Persistent synovitis after apparent killing of spirochete with antibiotics
  - Pain, neurocognitive, and fatigue symptoms
- **Currently, there is no evidence for sustained benefit from further courses of antibiotic therapy, but there is potential for substantial harm because of adverse effects, particularly from IV antibiotics**

IV, Intravenous

What's Ahead?

- Search for evidence of active *B. burgdorferi* after IDSA-recommended courses of antibiotic therapy
- Understand the role of autoimmunity in Lyme disease
- Understand and treat effectively centralized pain syndromes, not just in Lyme disease, but in the many conditions in which this may occur

Laboratory Testing for Lyme Disease





Adriana Marques, MD

Laboratory of Clinical Infectious Diseases

National Institute of Allergy and Infectious Diseases

National Institutes of Health

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Disclosure Statement

I will not discuss off-label use and/or investigational use of drugs/devices.

I am a co-inventor on a patent application for the VOVO LIPS test for Lyme disease, in which one of the antigens is based on the IR6 peptide.

Overview

- Current recommendations for laboratory tests for Lyme disease in the United States
- Facts and challenges
- Progress to improve laboratory testing
- Research needs and what's ahead

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Methods for Laboratory Diagnosis of Lyme Disease

- **Direct: Detection of *causative organism***
  - Culturing *B. burgdorferi* from clinical specimens
  - PCR detection of *B. burgdorferi* DNA from clinical specimens
- **Indirect: Detection of *immune response to the causative organism***
  - Detection of antibodies against *B. burgdorferi*

PCR, Polymerase chain reaction

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Direct Methods:
Detection of Causative Organism

- ***B. burgdorferi* is more easily detected**
  - By culture and/or PCR: Skin and blood samples during the early stages of the disease (erythema migrans, when the diagnosis is mostly clinical)
  - In the synovial fluid of patients with Lyme arthritis
- **For other presentations, it is very difficult to confirm the presence of the bacteria**

No direct detection methods have been reviewed and approved by the FDA

PCR, Polymerase chain reaction
FDA, Food and Drug Administration

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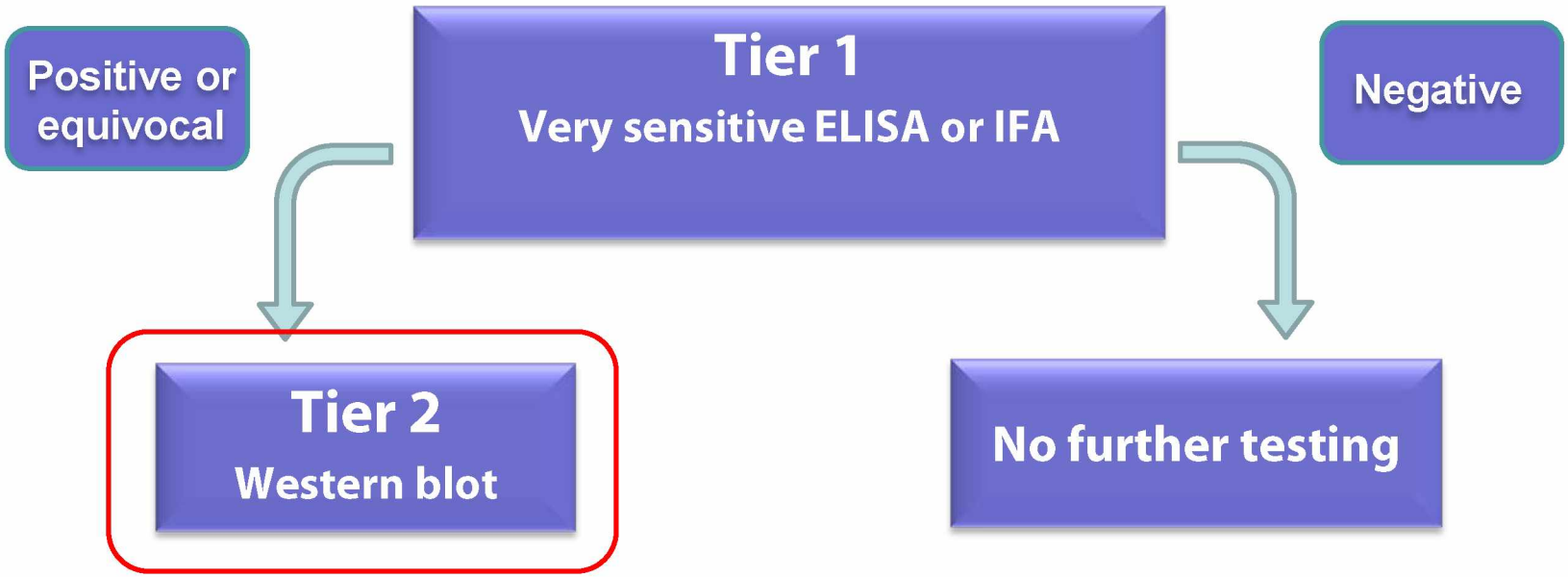
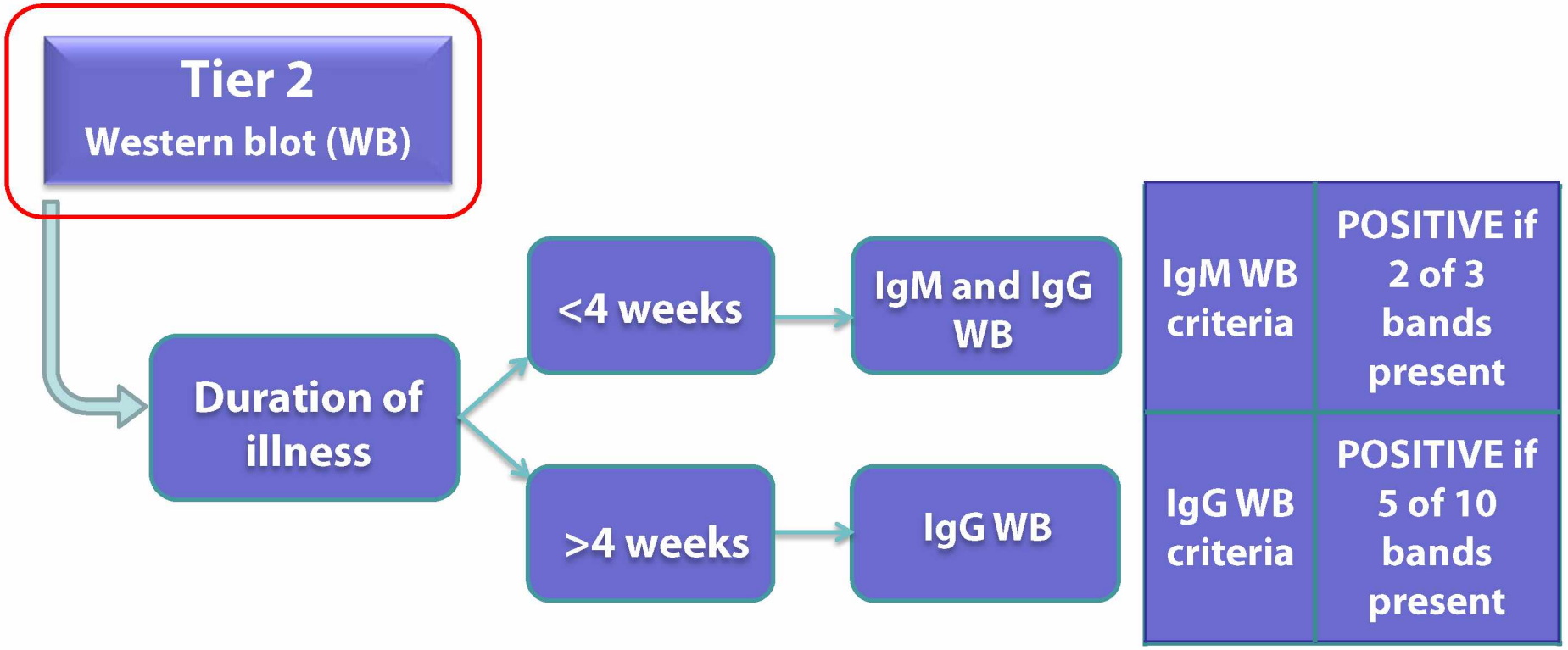
Indirect Methods:
Detection of Immune Response to the Causative Organism

- Serologic assays: Detecting antibodies to *B. burgdorferi*
- Current CDC recommendations: 2-tier algorithm



ELISA, Enzyme-linked immunosorbent assay
IFA, Indirect immunofluorescence assay

Indirect Methods:
Detection of Immune Response to the Causative Organism



ELISA, Enzyme-linked immunosorbent assay
IFA, Indirect immunofluorescence assay

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Facts and Challenges

Facts

- The current algorithm works well when used as recommended
- Serological testing is not required for patients with erythema migrans
  - Patients who present very early in their illness are more likely to have a negative result
  - Less than 50% of the patients with erythema migrans lesions (stage 1) are positive at presentation
- Laboratory tests are most helpful in patients with stage 2 and stage 3 of Lyme disease

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Facts and Challenges

Challenges: Appropriate use of tests

- About 3.4 million Lyme serology tests are performed annually in the United States (compared to 38,000 reported cases in 2009)
- Tests are being used in situations where they are not recommended
  - To rule out Lyme disease in populations with a low probability of having the disease
  - To test patients with suspected erythema migrans
  - To test people bitten by ticks
- Insufficiently validated tests and interpretation criteria are being used

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VlsE: A New Diagnostic Marker

- **VlsE (variable major protein-like sequence, expressed)**
  - An outer surface lipoprotein of *B. burgdorferi*
  - C6 peptide: Derived from its invariable region 6
- **Addition of VlsE to both 1st and 2nd tier tests has improved their performance**
- **C6 ELISA**
  - Shown to be more sensitive for patients with erythema migrans than standard 2-tiered testing, and is more specific than whole cell sonicate ELISA
  - FDA-approved as a 1st tier test; under study as a "stand-alone test"

ELISA, Enzyme-linked immunosorbent assay
FDA, Food and Drug Administration

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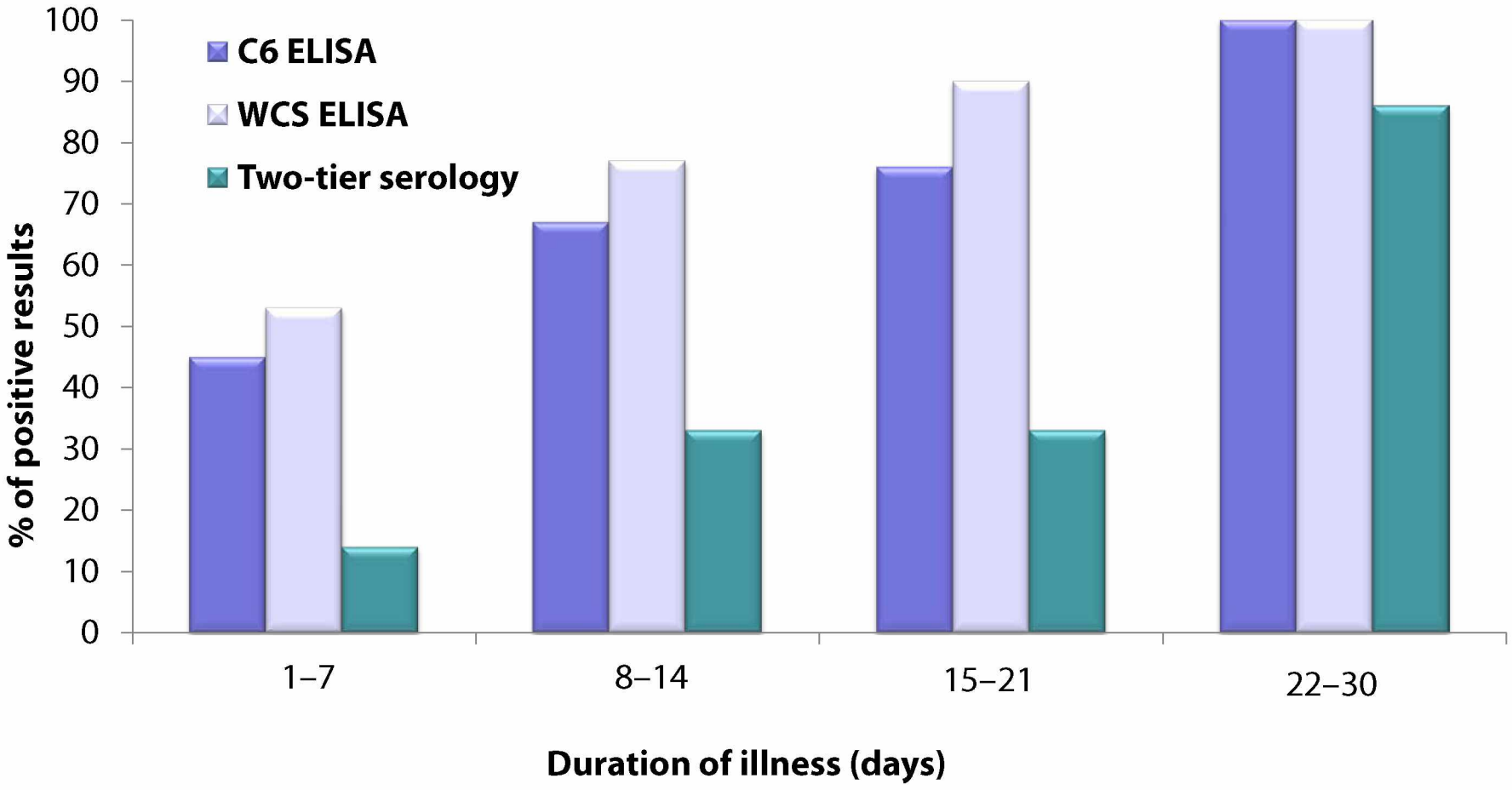
Serological Testing and Duration of Illness
Patients with a Single Erythema Migrans Lesion



Adapted from Wormser, GP et al. Clin Vaccine Immunol 2008;15:1519-22
ELISA, Enzyme-linked immunosorbent assay
WCS, Whole cell sonicate

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Use of Laboratory Tests

- **Current algorithm**
  - Works well when used as recommended
  - Can be improved for patients with early stages of the disease, especially early neurological disease
- **Sensitivity of the test increases with the duration of the infection**
  - Erythema migrans (stage 1): Treatment is indicated, no tests are necessary
  - Stage 2 and 3: Tests are helpful
- **In a patient with low probability of Lyme disease**
  - Negative ELISA test rules out the disease
  - Positive ELISA test is more likely to be a false positive

EM, Erythema migrans
ELISA, Enzyme-linked immunosorbent assay

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Use of Laboratory Tests

- **Current serologic assays do not distinguish between active and inactive infection**
  - Antibodies can persist after successful antibiotic therapy, including IgM antibodies
- **Positive IgM response alone does not distinguish clearly between Lyme disease and other conditions**
  - Positive IgM results for *B. burgdorferi* occur in
    - >50% of parvovirus B19 infections
    - Human granulocytic anaplasmosis, Epstein-Barr virus, and other infections
    - Autoimmune diseases

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What's Ahead

- **Improve direct methods for detecting *B. burgdorferi***
- **Improve current serology diagnostic testing algorithm**
  - Simplicity: A single test or test procedure
  - Objectivity: Quantitative data, independent of who reads the results
  - Greater sensitivity in early disease
  - Independence from disease duration
  - Avoiding using IgM Western blot
  - Decreased cost
- **Develop tests that can help follow response to therapy: Biomarkers for active infection**

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Lyme Disease in Minnesota: Trends and Challenges





Ruth Lynfield, MD
State Epidemiologist and Medical Director
Minnesota Department of Health

MINNESOTA MDH DEPARTMENT OF HEALTH

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Overview

- **Epidemiology of Lyme disease in Minnesota**
- **Challenges**
  - Prevention
  - Laboratory diagnostics
  - Adverse consequences of prolonged courses of antibiotics
  - Legislation
- **Way forward**

http://www.health.state.mn.us/divs/idepc/diseases/lyme/index.html

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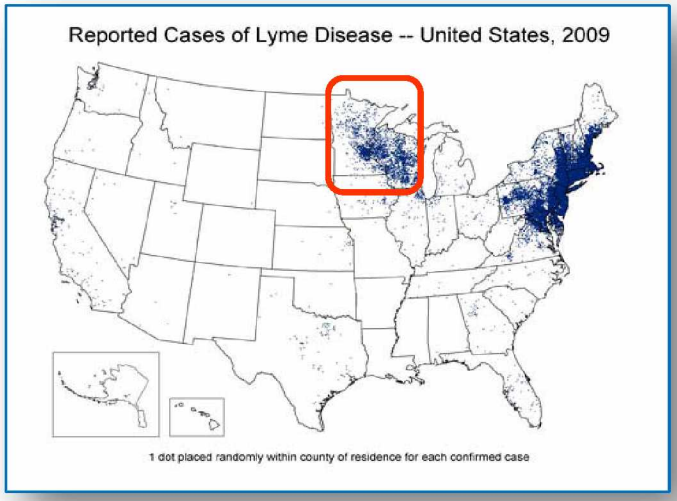
Lyme Disease in Minnesota, 2009

- **Confirmed cases: 1,065, 8th in the US**
- **Incidence: 20.2/100,000 population, 12th in the US**
  - Incidence varies throughout the state
  - Cass county: >100/100,000 population
    - Higher than overall incidence in CT 78/100,000 in 2009

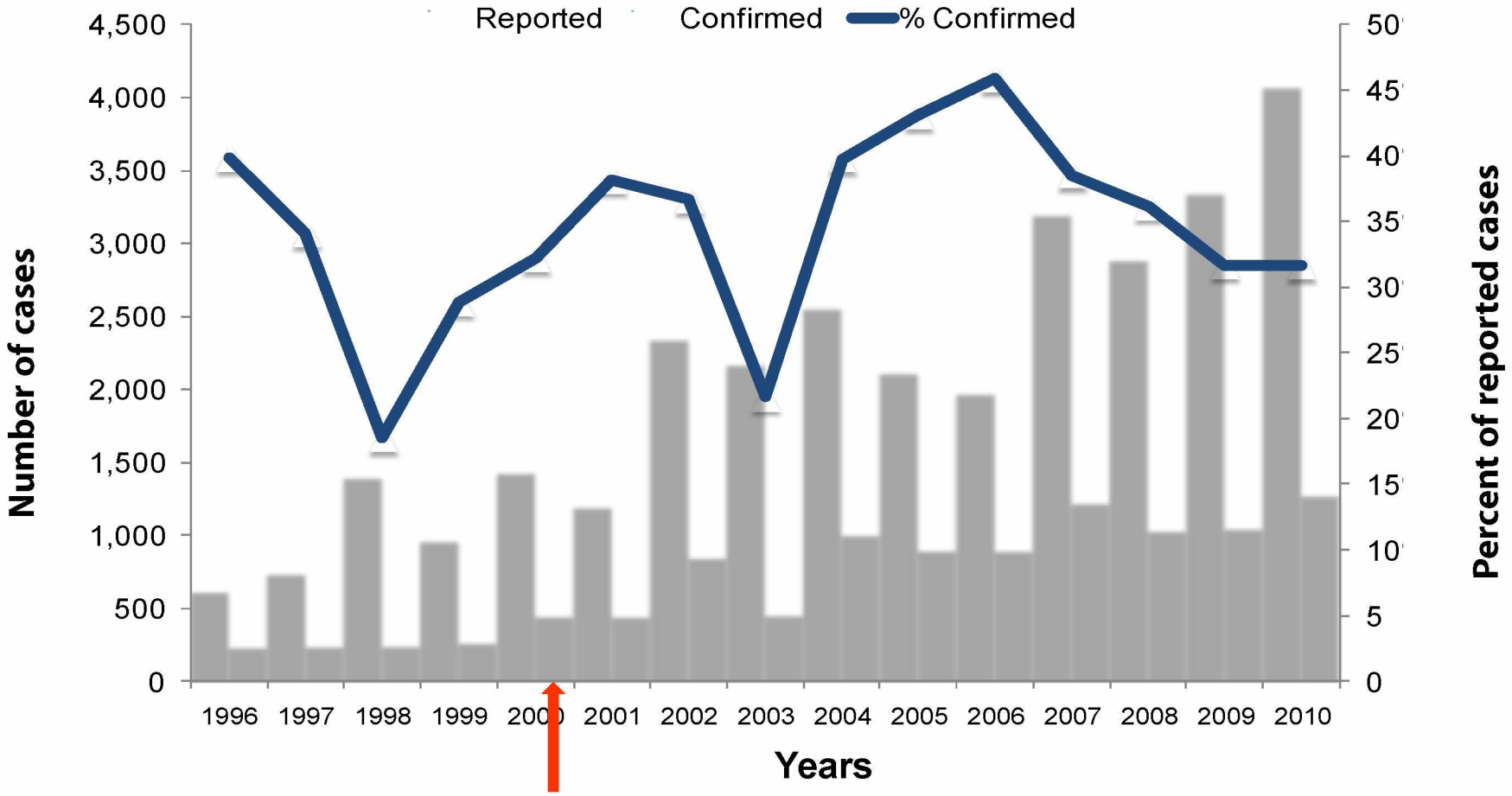


Lyme Disease Cases
United States, 2005–2009

	Minnesota	New England/ Mid-Atlantic	United States
Median age Range	39 years Infant–98 years	43 years Infant–109 years	43 years Infant–109 years
Age distribution	33% <18 years	25% <18 years	25% <18 years
Sex	62% male	56% male	54% male

P Mead, CDC and M Kemperman, Minnesota Department of Health

Reported versus Confirmed Cases of Lyme Disease Minnesota, 1996–2010



Minnesota Department of Health

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Reported versus Confirmed Cases of Lyme Disease Minnesota, 1996–2010

- **Increase in reported cases: Perception**
  - Some may be due to increased awareness among the public and health care providers, increased compliance with reporting requirements, or improved surveillance
- **Increase in reported cases: True increase in Lyme disease**
  - Lyme disease had been endemic and well-known in Minnesota for 15 years prior to this increase
  - No new approaches to testing or reporting occurred during this period
  - Data indicate ticks have spread into areas that border Minnesota's endemic areas

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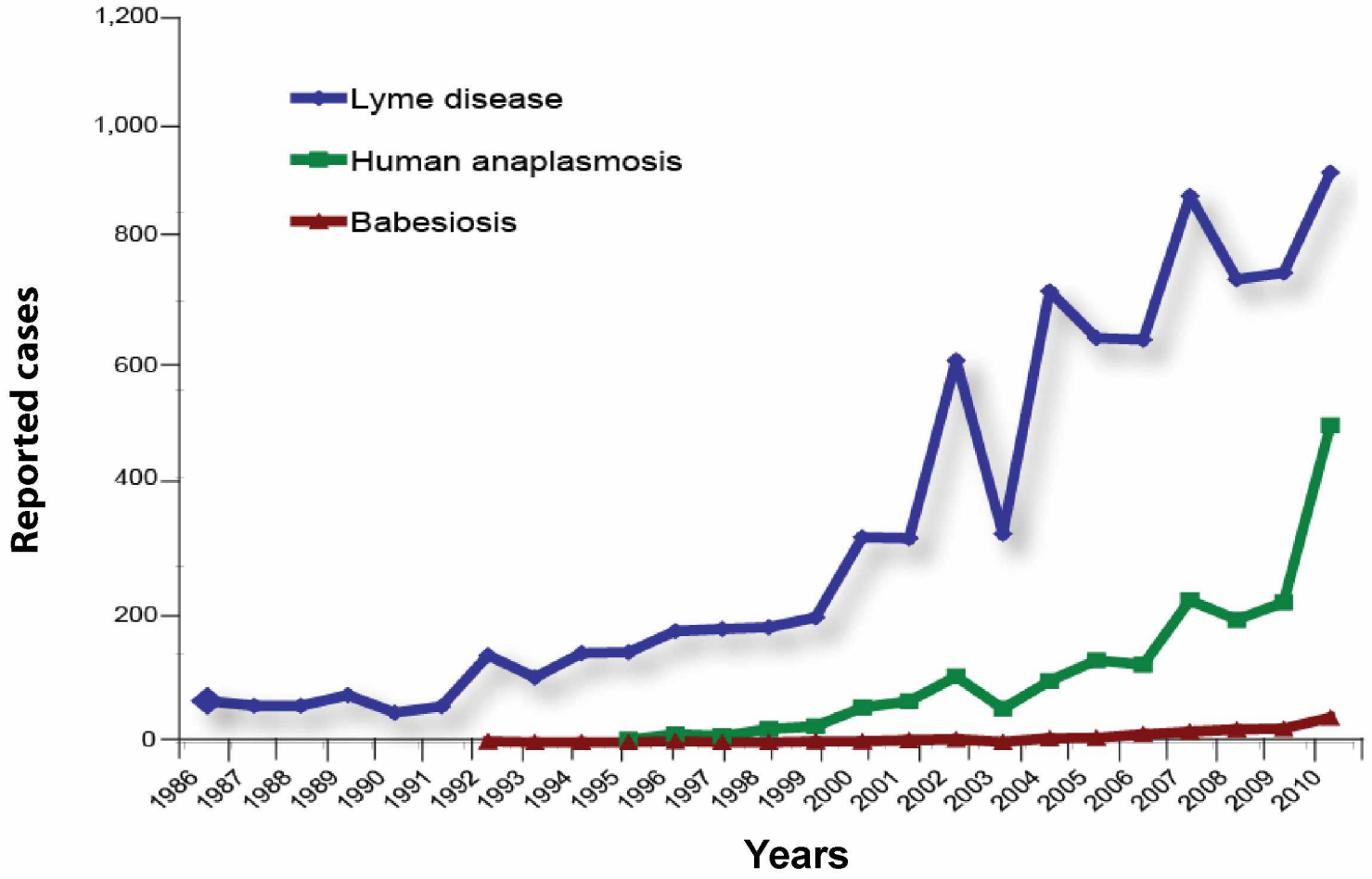
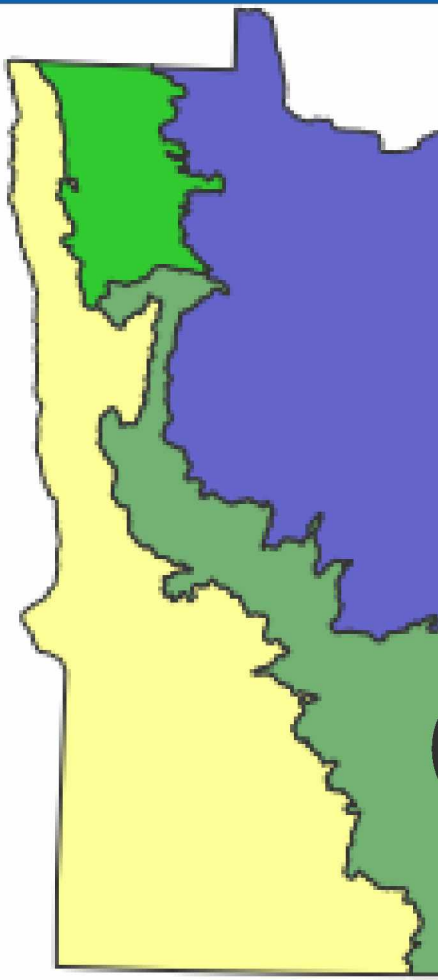
Confirmed Lyme Disease Cases Minnesota, 1986–2010 (N =12,085)



Minneso

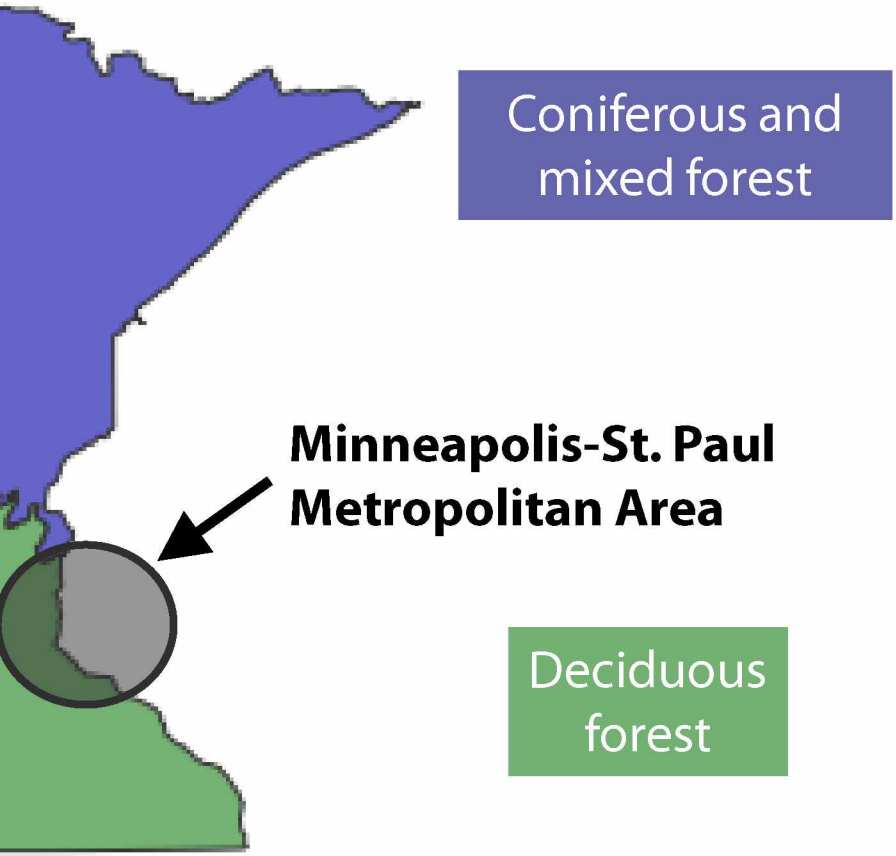
Tallgrass
Aspen Parkland

Prairie
grassland



http://www.dnr.state.mn.us/biomes/index.html

ta Biomes



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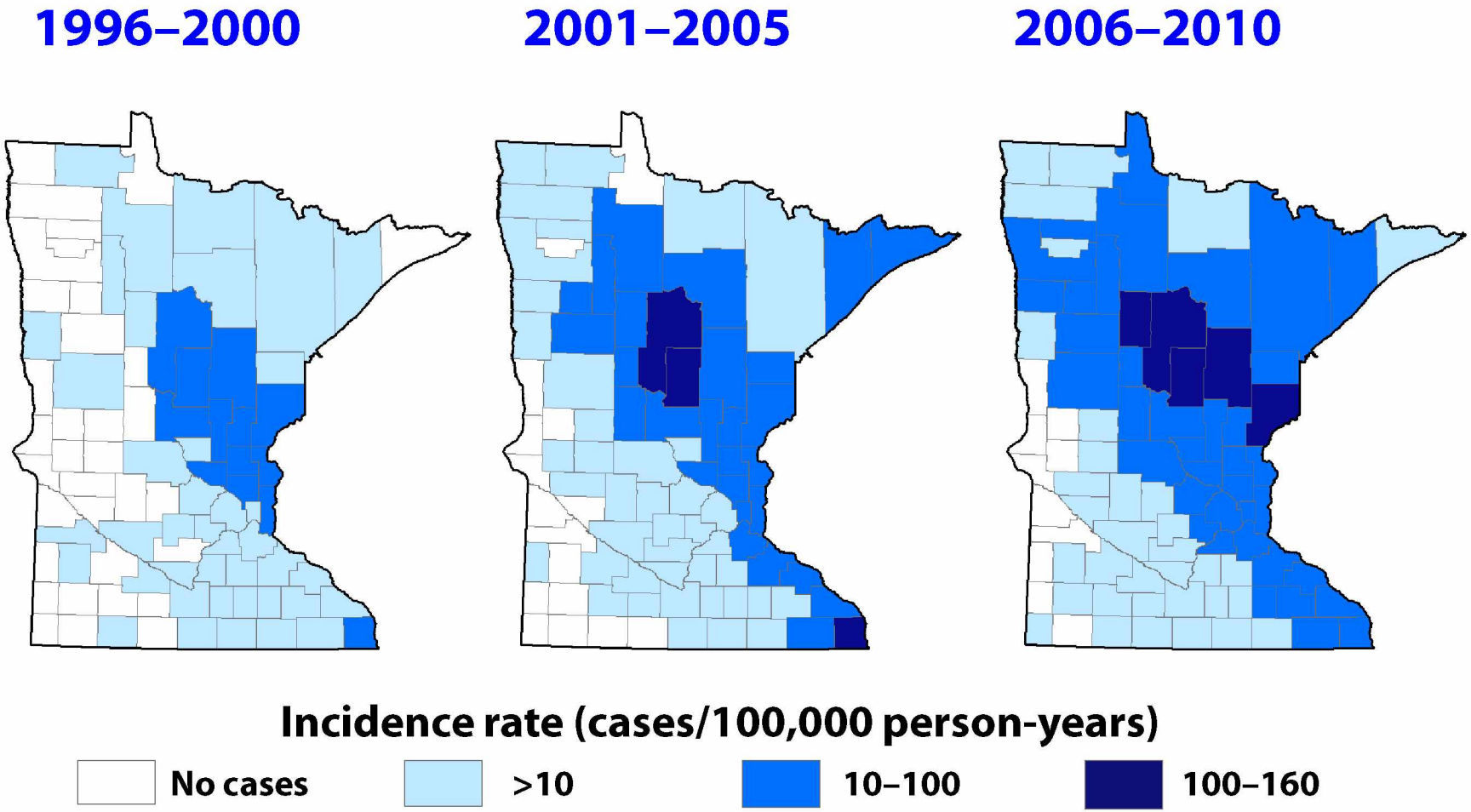
Lyme Disease Cases by County of Residence Minnesota, 1996–2010



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Lyme Disease: Challenges at the State Level

- Prevention
- Laboratory diagnostics
- Adverse consequences of prolonged courses of antibiotics
- Legislation

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Prevention Challenges

Use of Personal Protection Measures in Reported Tick-Borne Disease Cases, Minnesota, 2008

Persons with Lyme disease, human anaplasmosis, and babesiosis who self-reported in the month prior to onset (No = 980)	%
Checked for ticks	73
Wore long pants	72
Used repellent	42
Wore light-colored clothing	39
Checked for ticks and used repellent	37
Avoided the woods	13

R Fischer, MDH 2008 Prevention Survey, unpublished data

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Prevention Challenges
Minnesota Department of Health Strategies

- **Personal protection**
  - Provide information on the MDH website
  - Provide phone consultations
  - Reach out to the community
    - Give talks, especially to high-risk groups (e.g., loggers, foresters)
    - Give lectures to health care providers and others
    - Conduct interviews with the media
- **Environmental tick control**
  - Provide information on the MDH website
    - In May 2009, the tick-borne disease web page had 40,000 hits; 3rd most frequently read MDH site
  - Offer Metropolitan Mosquito Control District consultations to Minneapolis-St. Paul metropolitan area landowners

http://www.health.state.mn.us/divs/idepc/diseases/lyme/index.html
MDH, Minnesota Department of Health

Laboratory Diagnostic Challenges

- **Lyme disease testing for clinical diagnosis**
  - Overuse of Lyme disease tests
    - Testing patients with EM with illness duration of <2–3 weeks (unnecessary and lower sensitivity of antibody test)
  - Lyme disease testing: Misinterpretation
    - A positive IgM and a negative IgG >30 days into an illness is not indicative of Lyme disease

EM, Erythema migrans

Laboratory Diagnostic Challenges
Minnesota Department of Health Strategies

- **Lyme disease testing**
  - Send State Health Advisories electronically through the MDH Health Alert Network to local public health agencies and clinics
  - Provide information on the MDH website
    - When to test patients for Lyme disease
    - How to interpret test results
    - Links to CDC and Infectious Disease Society of America diagnosis/treatment information
- **Give lectures to healthcare providers**
- **Publish an article on Lyme disease in MN Medicine**
  - Kemperman, M et al. Minnesota Medicine. 2008; 91:37-41

http://www.health.state.mn.us/divs/idepc/diseases/lyme/index.html
MDH, Minnesota Department of Health

Adverse Consequences of Prolonged Courses of Antibiotics for Lyme Disease

- **Adverse effects range from mild to severe**
- **Severe adverse effects include**
  - Bloodstream infections in persons with central venous catheters receiving parenteral antibiotic therapy
    - Septic thrombosis and death due to *Candida*
  - Venous thrombosis
  - Severe allergic reactions
  - Cholecystitis
  - *Clostridium difficile* infection

Patel R, et al. Clin Inf Dis 2000;31:1107-9
Fallon BA, et al. Neurology 2008;70:992-1003
Holzbauer S, et al. Clin Inf Dis 2010;51:369-70

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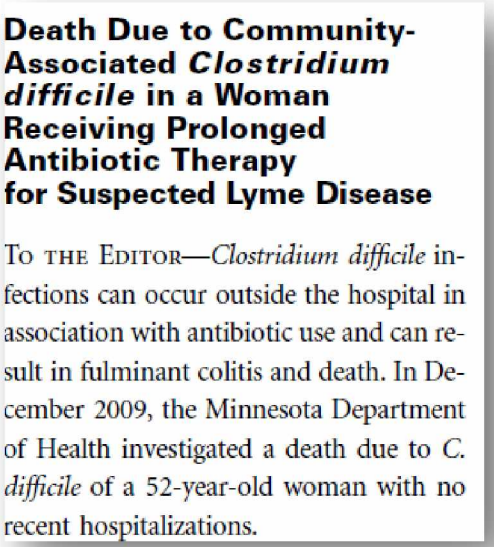
Adverse Consequences of Long-term Use of Antibiotics for Presumed Lyme Disease

Minnesota Experience

- **History and clinical presentation**
  - History of depression
  - Fatigue, insomnia, achy joints, memory loss
- **Laboratory testing for Lyme disease**
  - IFA: Indeterminate
  - IgM Western blot: Positive
  - IgG Western blot: Negative
- **Treatment**
  - Doxycycline, 5 weeks; cefuroxime and telithromycin, 2–4 months
  - Developed diarrhea 5 weeks into course; emergency colectomy
- **Postmortem diagnosis: Fulminant *C. difficile***



Death Due to Community-Associated *Clostridium difficile* in a Woman Receiving Prolonged Antibiotic Therapy for Suspected Lyme Disease

To the Editor—*Clostridium difficile* infections can occur outside the hospital in association with antibiotic use and can result in fulminant colitis and death. In December 2009, the Minnesota Department of Health investigated a death due to *C. difficile* of a 52-year-old woman with no recent hospitalizations.

IFA, Immunofluorescent assay

Holzbauer, S et al. Clin Inf Dis 2010; 51:369-70

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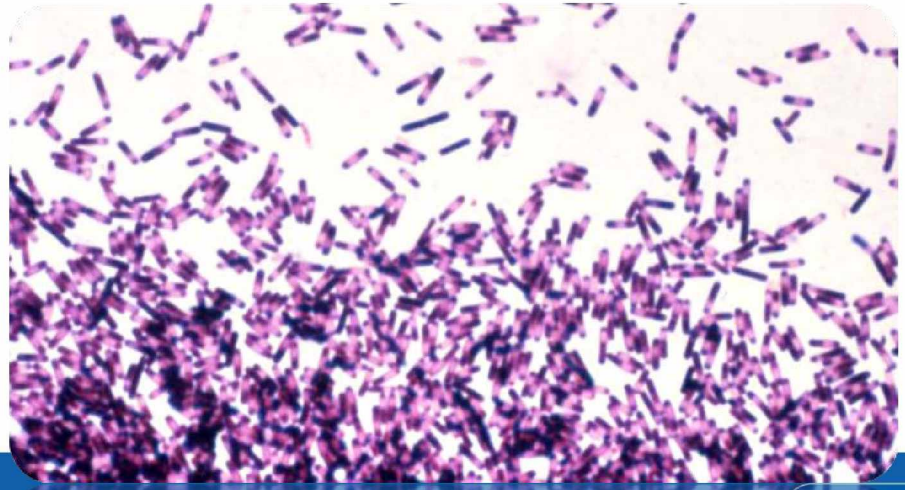
Adverse Consequences of Antibiotics for Presumed Lyme Disease

Minnesota Experience

- **2 nonfatal *C. difficile* cases reported to MDH with onsets in March 2007 and November 2010 in patients given prolonged courses of antibiotics for treatment of presumed Lyme disease**
  - Neither *C. difficile* case was reported to MDH as Lyme disease



MDH, Minnesota Department of Health

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Lyme Disease Legislation at the State Level

- **Many states have passed physician protection and/or health insurance coverage bills for prolonged antibiotic treatment of patients with Lyme disease**

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Lyme Disease Legislation in Minnesota

- **Minnesota: Physician protection bill brought before Health Committees in 2010 (HF2597; SF1631/2584)**

  "Board of Medical Practice limited from bringing a disciplinary action against a physician for prescribing, administering, or dispensing long-term antibiotic therapy for chronic Lyme disease."

- **Prior to bill becoming law, a compromise with the Minnesota Board of Medical Practice was reached**

  http://www.state.mn.us/portal/mn/jsp/home.do?agency=BMP

  "MN Board of Medical Practice voluntarily will engage in a moratorium for a time period not to exceed 5 years, or the time at which double-blind, peer reviewed studies have resolved the issues, whichever is first, on the investigation, disciplining, or issuance of Corrective Action."

Lyme Disease in Minnesota
Summary

- **Incidence of Lyme disease is increasing in Minnesota**
  - Due to expansion of ticks into areas bordering endemic areas
- **Accurate surveillance is important, but is resource intensive**
- **Information about Lyme disease must be made available to the public and health care providers**
  - Prevention
  - Diagnosis
  - Adverse effects associated with prolonged courses of antibiotics
- **Concern about persistent non-specific symptoms that some individuals attribute to active Lyme disease is increasingly becoming a political issue**

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Lyme Disease in the United States

- **Improve understanding of reasons for increase in Lyme disease incidence**
- **Develop and effectively implement available preventative strategies**
- **Improve laboratory diagnostics**
  - Accurate and sensitive diagnostics for early illness
  - Improved laboratory tests for direct detection of the causative agent
  - Biomarkers indicative of active infection that can help follow response to therapy

WAY FORWARD

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Lyme Disease in the United States

- **Improve understanding of prevalence and etiology of persistent symptoms**
  - In individuals following antibiotic treatment for Lyme disease
  - In individuals with no evidence of having had Lyme disease
- **Educate public, health care providers, and legislators**

WAY FORWARD

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Photo credit of Minnesota forest: M Kemperman, Minnesota Department of Health

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