

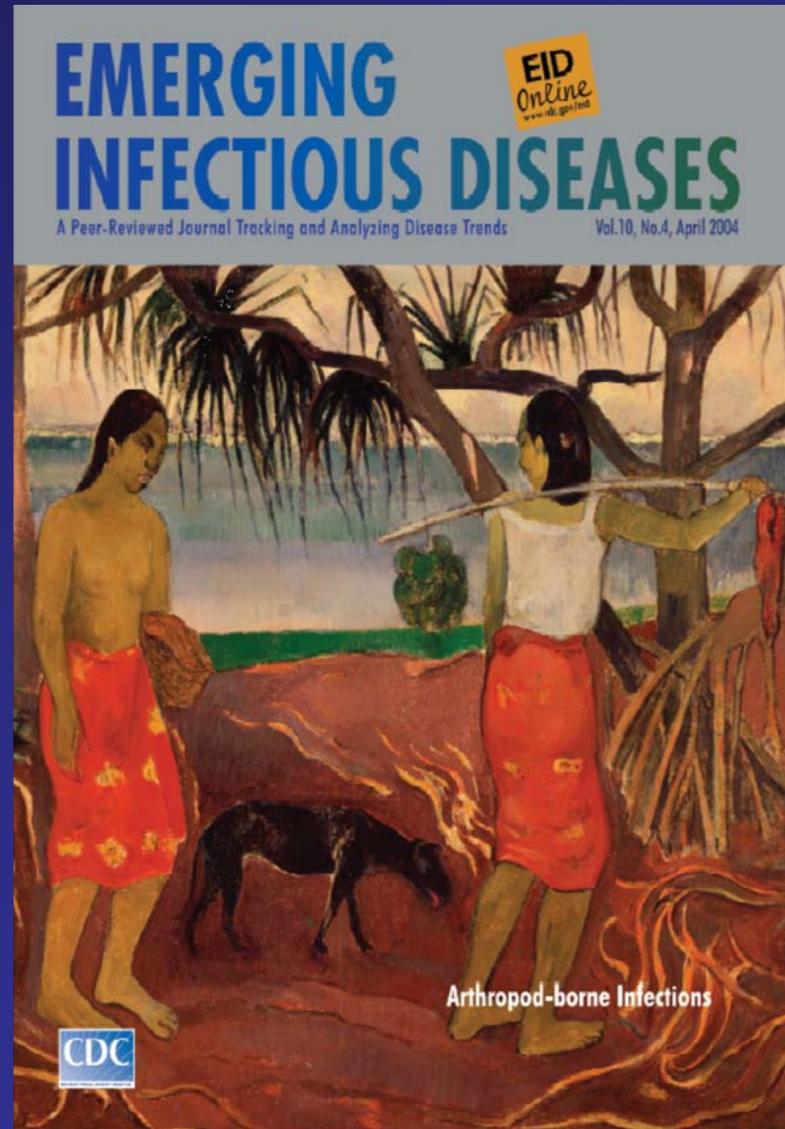
Tick-borne Diseases

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Tick-borne Diseases

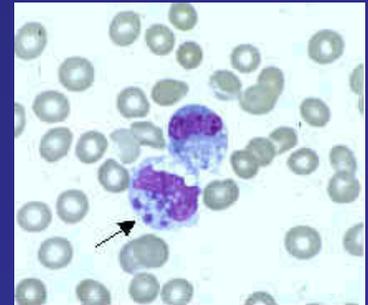
- Ehrlichiosis*
 - Human Monocytic Ehrlichiosis (HME)
 - Human Granulocytic Ehrlichiosis (HGE)
- Rocky Mountain Spotted Fever (RMSF)*
- Lyme Disease*
- Southern Tick-Associated rash illness (STARI)
- Babesiosis
- Tularemia*

*Reportable in VA



Ehrlichiosis

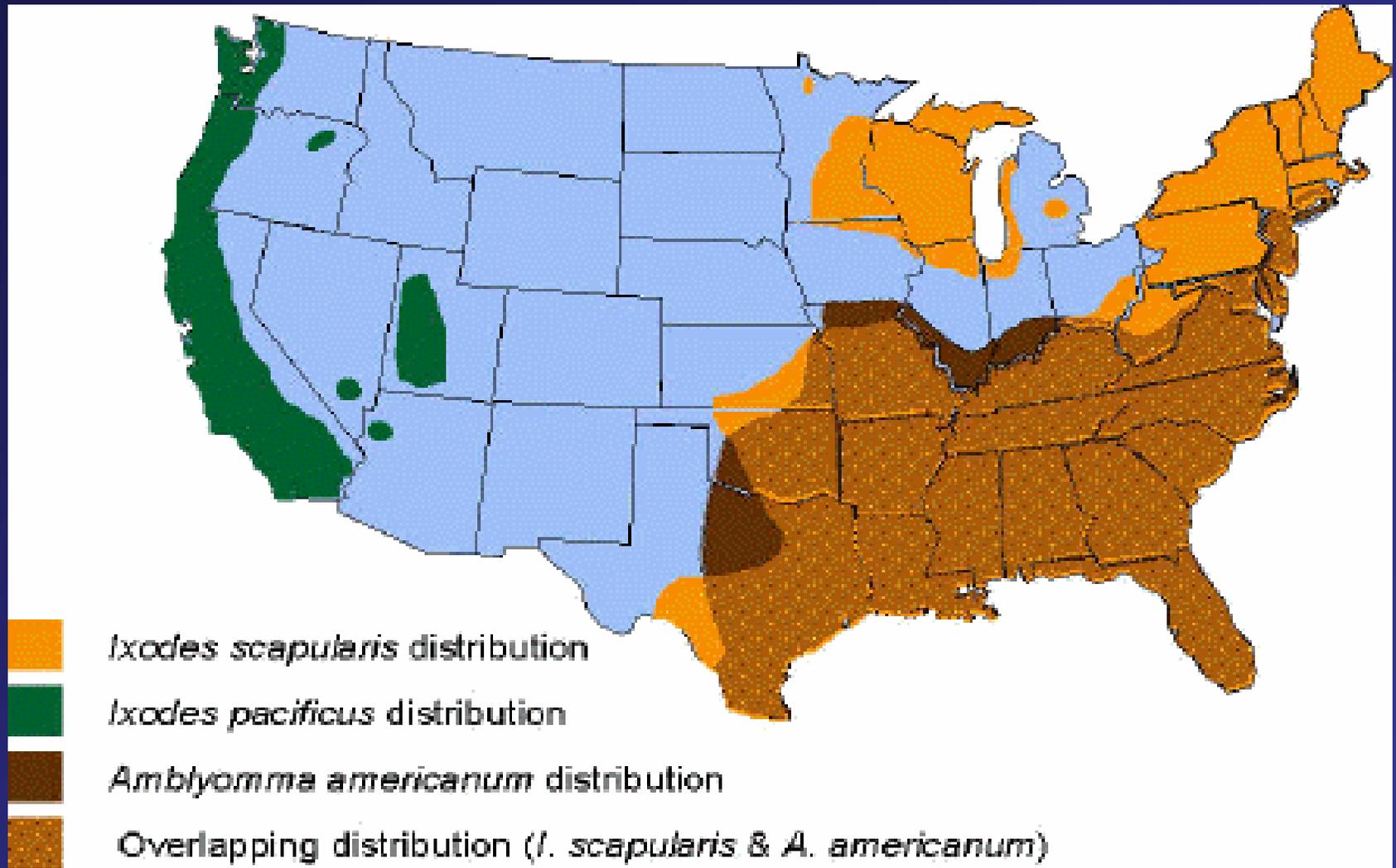
- Obligate intracellular, gram-negative cocci
- Two different bacteria causing similar syndromes
 - Human Monocytic Ehrlichiosis (HME)
 - Caused by *Ehrlichia chaffeensis*
 - Most frequently infects monocytes and macrophages
 - Human Granulocytic Ehrlichiosis (HGE)
 - Caused by *Anaplasma phagocytophila* (formerly *E. phagocytophila*)
 - Most frequently infects granulocytes (neutrophils and rarely eosinophils)



Ehrlichiosis - US Epidemiology

- 80-90% of all ehrlichiosis cases occur between April and September
- HME cases most frequently reported in Southeastern and Midwestern states
- Most HGE cases occur in states with high incidence of Lyme Disease
- Increased age – risk factor for disease
- Case-fatality rate: 2 - 3%

Areas where human ehrlichiosis may occur based on approximate distribution of vector tick species

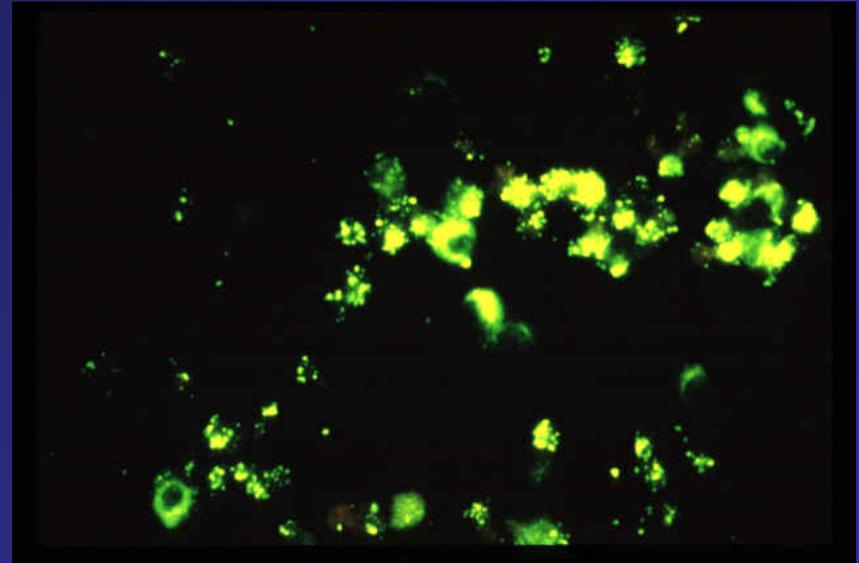


Ehrlichiosis - Symptoms

- Incubation period: Initial symptoms begin 5-10 days
- Symptoms: Include fever, headache, muscle pain, vomiting, malaise
- Rash common in children with HME
- Severe illness can result in prolonged fever, renal failure, meningoencephalitis, coma
- Severity of symptoms may be related to immunostatus of patient
- Clinical laboratory findings include leukopenia, thrombocytopenia, elevated liver enzymes

Ehrlichiosis - Diagnosis

- Diagnosis:
 - Serology: Indirect Immunofluorescence Antibody (IFA)- 4x change in antibody titer between paired serum samples
 - Detection of *E. chaffeensis* OR *A. phagocytophila* DNA by Polymerase Chain Reaction (PCR)
 - Direct Isolation of agent – Cell Culture
 - Immunostaining of *E. chaffeensis* OR *A. phagocytophila* antigen



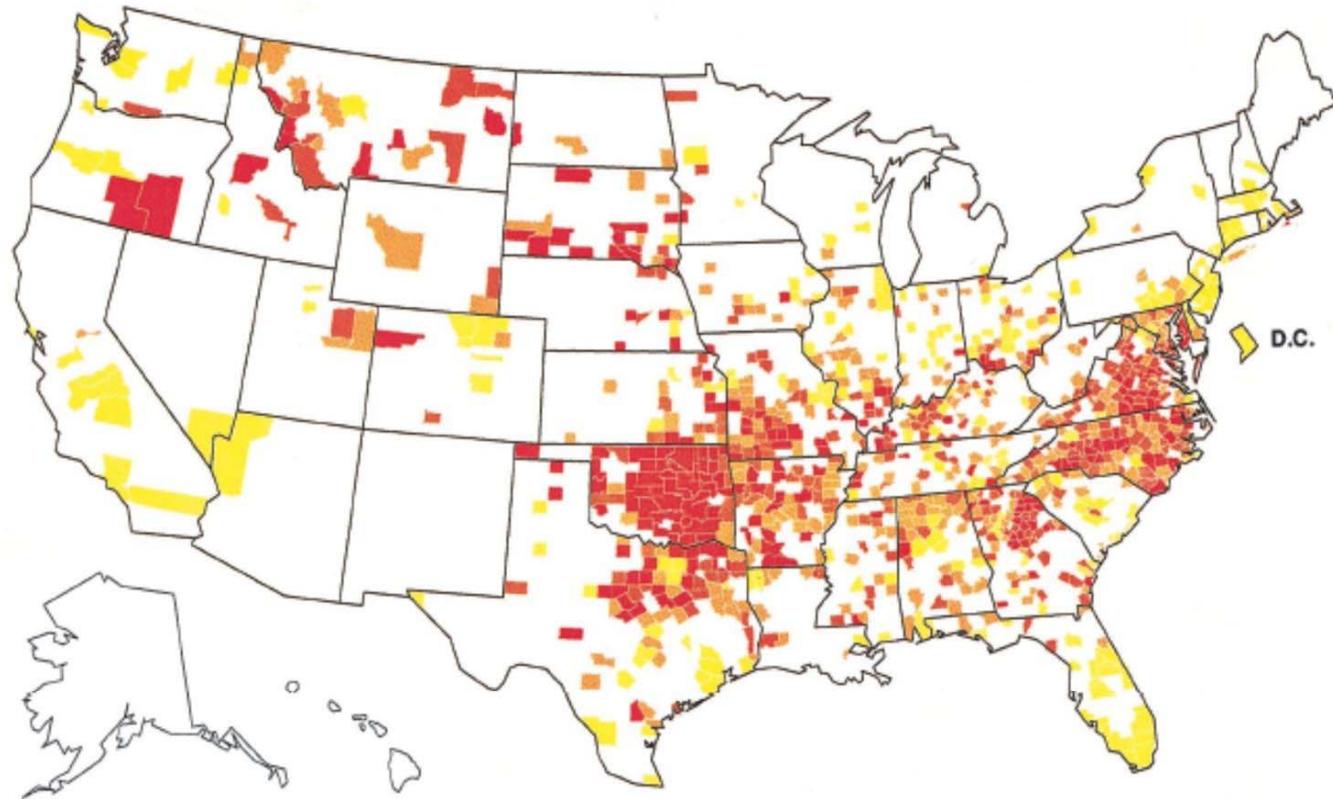
Ehrlichiosis - Treatment

- Should be initiated on suspicion of ehrlichiosis
- Doxycyclines or other tetracyclines
- Failure to respond to tetracyclines argues against diagnosis of Ehrlichiosis

Rocky Mountain Spotted Fever (RMSF) – US Epidemiology

- Caused by *Rickettsia rickettsii*, obligate intracellular bacterium
- Most cases occur in the South Atlantic (NC) and West Central states (AR)
- $X > 90\%$ of patients with RMSF are infected during April – September
- Children at higher risk - 2/3 reported cases occur in patients < 15 years of age
- Case-fatality: 1 - 5%

RMSF -Average annual incidence of Rocky Mountain spotted fever according to county in the United States, 1981–1992



RMSF - Symptoms

- Incubation period:
Symptoms begin 2 to 9 days
- Symptoms: Fever, nausea, vomiting, muscle pain, severe headache, lack of appetite
- Rash: Maculopapular on extremities, 2-5 days
- Petechial exanthem occurs on or after 6th day
- As many as 10-15% of patients may never develop a rash



RMSF-

Diagnosis & Treatment

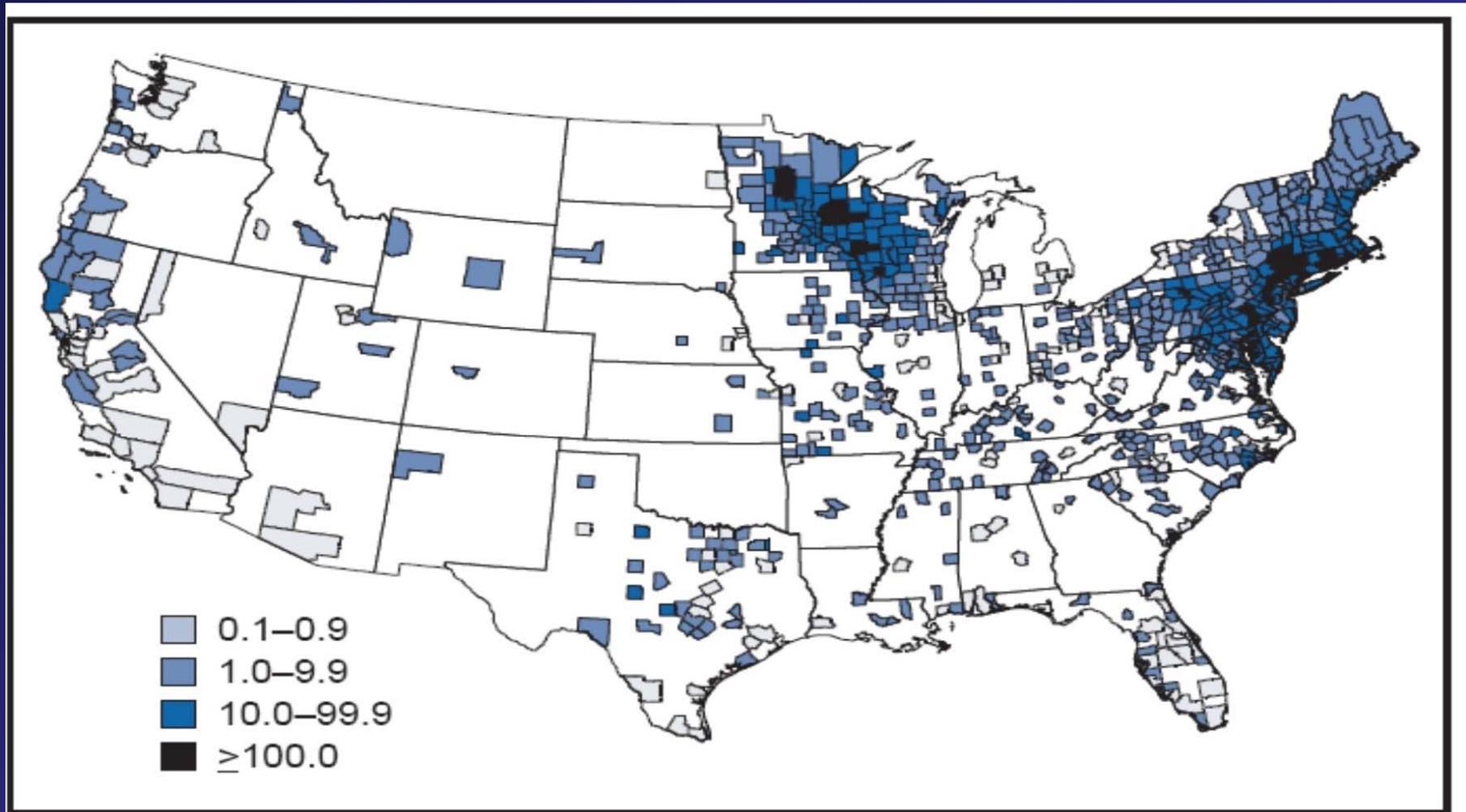
- Diagnosis
 - Serological evidence of significant change in serum antibody titer reactive to *R. rickettsii*
 - Detection of *R. rickettsii* DNA by PCR
 - Direct Isolation of agent – Cell Culture
 - Immunostaining of *R. rickettsii* antigen
- Treatment:
 - Initiated upon suspicion of RMSF
 - Doxycycline
 - Failure to respond to tetracyclines argues against diagnosis of RMSF
 - Chloramphenicol - alternate drug

Lyme Disease – US Epidemiology

- First recognized among cluster of children believed to have juvenile rheumatoid arthritis in Lyme, CT, 1975
- *Borrelia burgdorferi*: Gram-negative, mobile spirochete
- Risk factors
 - Age < 14 yrs
 - Age > 40 yrs
- Onset typically during the summer months
- Occurs in Northeast, mid-Atlantic, Northcentral, and along Pacific Coast



Incidence of Lyme Disease by County of Residence, U.S. 2002



* Per 100,000 population.

Lyme Disease - Symptoms

- Incubation period: 4 to 7 days (range 3 to 30 days)
- Symptoms:
 - Fever
 - Fatigue
 - Malaise
 - Headache
 - Muscle and joint aches
- Localized Infection: erythema migrans (EM) in 70-90% of cases
- Case-fatality: <1%

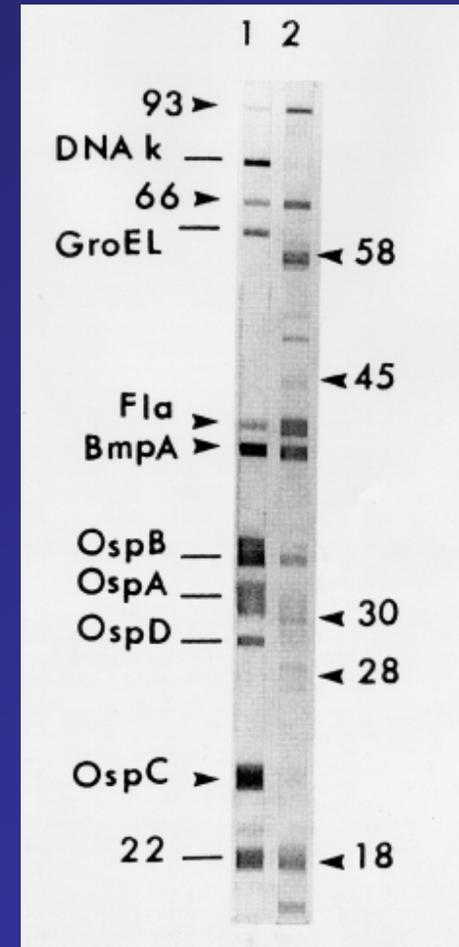


Lyme Disease – Later Stages

- Early disseminated infection – Several weeks to months after onset
 - Neuro: Meningitis, cranial neuropathy (includes facial palsy)
 - Cardio: myocarditis, heart block
 - Arthritis: migratory joint and muscle pains
- Late disseminated infection – Months to years after onset
 - Neuro: Encephalopathy, cognitive disorders
 - Arthritis: Chronic arthritis, prolonged arthritis attacks

Lyme Disease - Diagnosis

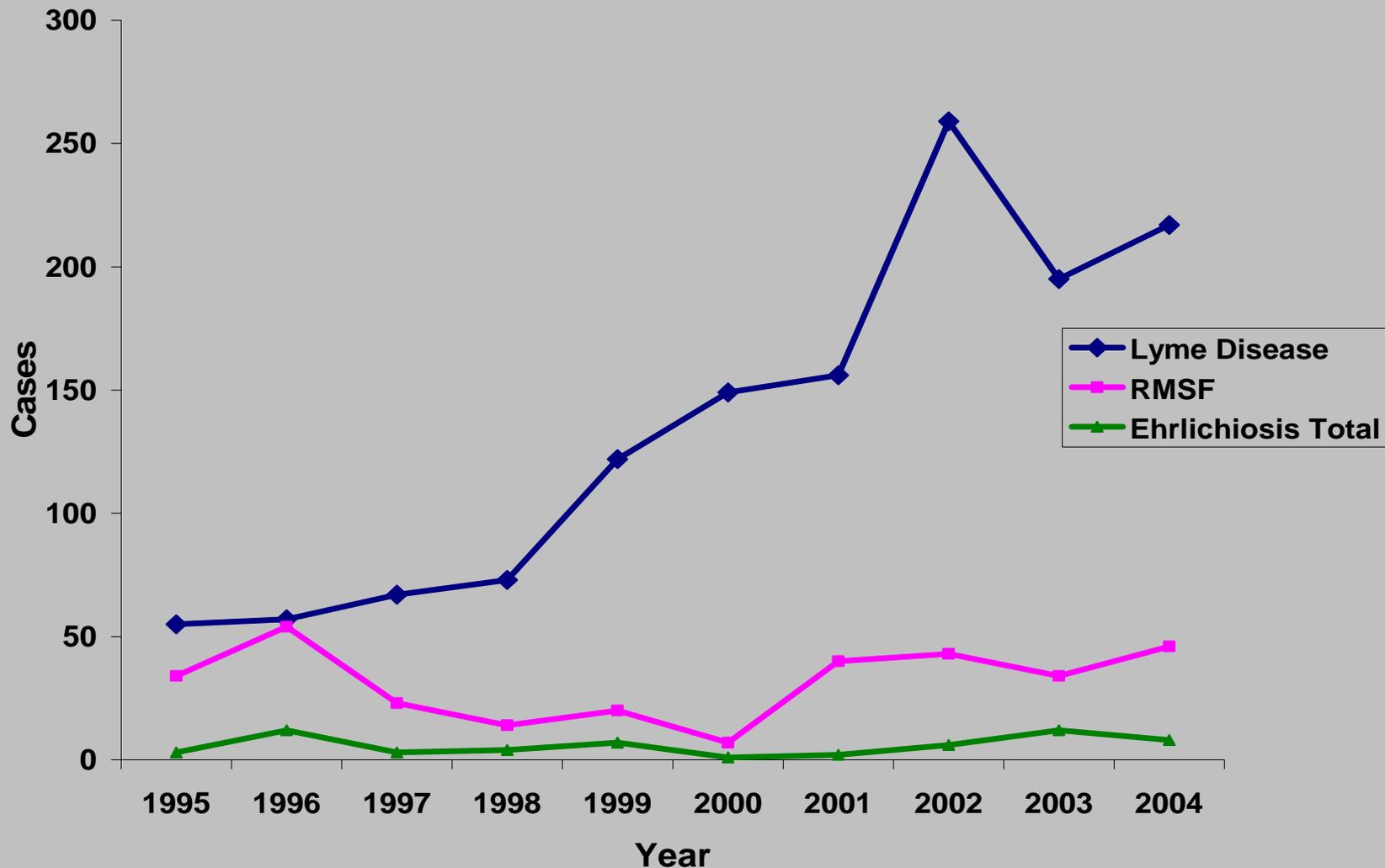
- In absence of EM, diagnosis can be difficult
- Antibodies usually detected 3-4 weeks after infection with ELISA or IFA
- Two-stage serological testing recommended:
 - If Negative: No further testing
 - If Positive or Equivocal- Western immunoblot to demonstrate antibody reaction to several *B. burgdorferi* antigens
- If patient with suspected early LD has negative serology, evidence of infection best obtained by testing paired acute- and convalescent-phase serum samples



Lyme Disease - Treatment

- Treatment: Appropriate to treat patients early based on clinical findings
- Several antibiotics including doxycycline, amoxicillin, penicillin, ceftriaxone, cefotaxime, or cefuroxime axetil
- Intravenous antibiotics for central nervous system involvement and recurrent arthritis
- Complications
 - Treatment-resistant Lyme arthritis associated with HLA-DRB1*0401, 0101 and other related alleles
 - Overtreatment: patients that have no evidence of Lyme disease are treated, report more adverse drug reactions

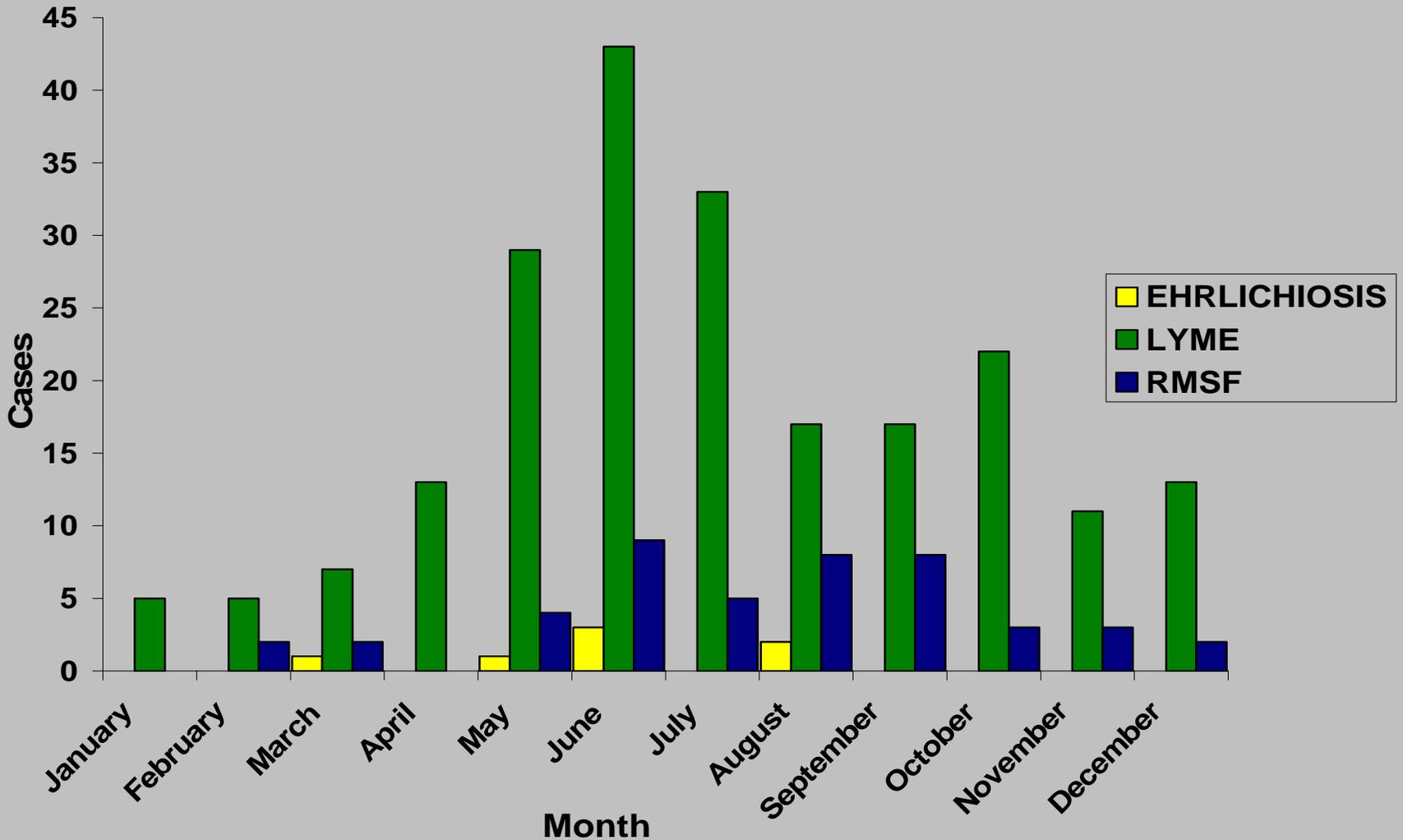
Reported Tick-borne Disease Cases in Virginia, 1995-2004



Tick-borne Diseases in Virginia, Cases by Age and Gender, 2004

	% Male	Median Age (Range) years
Ehrlichiosis (n=8)	71.4	41.0 (14 - 64)
RMSF (n=46)	63.0	43.5 (8 - 75)
Lyme Disease (n=217)	47.0	41.0 (1 - 86)

Seasonal Distribution of Tick-borne Diseases in Virginia, 2004



Tularemia

- Category A Agent
- Gram negative, intra- and extracellular coccobacillus
- Three main types:
 - *Francisella tularensis* biogroup *tularensis* – N. America; most virulent
 - *F. tularensis* biogroup *holartica* – Europe and Asia
 - *F. tularensis* biogroup *novicida* – US but low virulence
- Found in >250 animal species, including mammals and invertebrates
- Natural reservoirs: Rabbits and hares
- Severity of disease depends upon route of transmission



Tularemia - Routes of transmission

- Aerosol droplets
- Animal bites
- Arthropods: ticks, deerfly, various mosquito species
- Contaminated water
- Direct contact with animal product/infected dead animals (skinning rabbits)
- Eating undercooked infected meat
- Inhaling contaminated dust

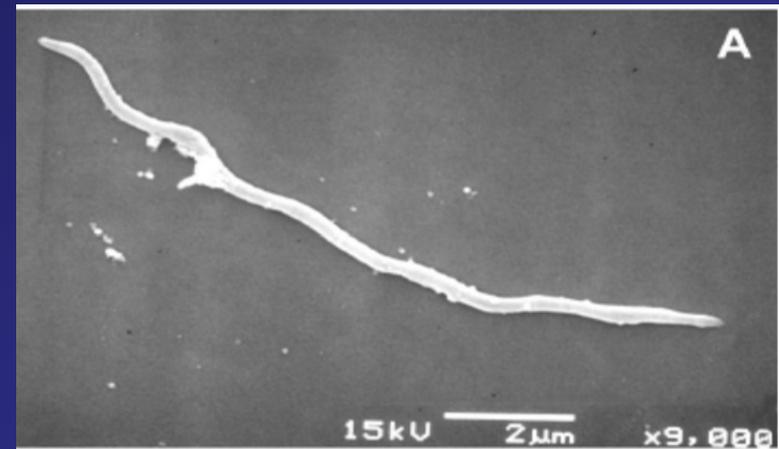
Tularemia

- Incubation period: average 4-5 days, range 1-21 days
- Symptoms: chills, fever, body aches, headache
- Dependent upon route of exposure: ulcers, swollen lymph nodes, conjunctivitis, and sore throat may also develop
- Most acute form is associated with inhalation of bacteria—resulting in pneumonia
- Case-fatality: $x < 2\%$



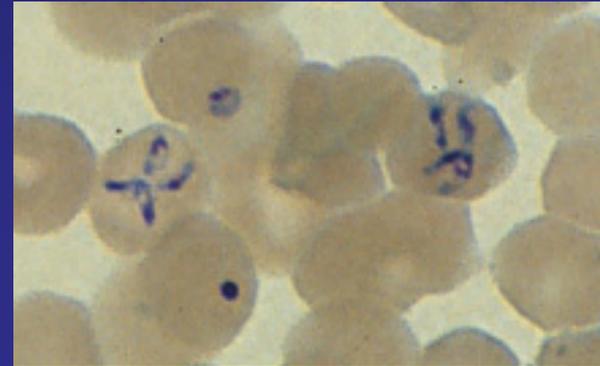
Southern Tick-Associated Rash Illness (STARI)

- *Borrelia lonestari*-spirochete
- Southeastern and South-central states
- Following bite of lone star tick
- Incubation period: ~6 days
- Rash with central clearing; similar to that of Lyme disease
- Other symptoms: fatigue, headache, stiff neck, fever



Babesiosis

- Malaria-like illness caused by protozoa that infect RBCs
 - *Babesia microti* – Eastern and Midwestern USA
 - *B. divergens* – Europe
- Symptoms appear 1- 6 weeks
- Fever, chills, fatigue, sweats, headache, muscle pains
- Complications include acute respiratory failure, congestive heart failure and renal failure
- Severe or fatal cases in the immunosuppressed and those without spleens



Prevention of Tick-borne Diseases

- Avoid tick-infested areas
- Wear light colored clothing
- Tuck pant legs into socks and boots
- Wear long-sleeved shirts that are buttoned at the wrists
- Use DEET
 - $\leq 50\%$ for Adults
 - $\leq 30\%$ for Children under 12
- Use permethrin-based mosquito and tick repellent (on clothing only)



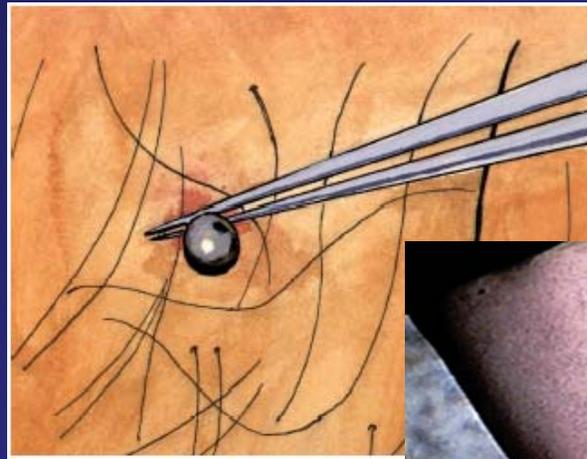
Prevention of Tick-borne Diseases

- When hiking or walking, minimize contact with vegetation
- Walk within the center of mowed trails
- Perform a tick-check on yourself, your children and pets
- Use full-length mirror to check yourself
- Remove, wash and dry clothing
- Sooner you remove the ticks, the better



Prevention of Tick-borne Diseases: Tick Removal

- Use sharp-tipped tweezers or forceps
- Remove tick by grasping it as close to the skin as possibly. Pull it straight out, slowly and steadily.
- After tick is removed, wash your hands with soap and water. Apply antiseptic to bite site.



References and Photo Credits

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More References and Photo Credits

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Next, the Ticks . . .

