

# NC Tickborne Disease Surveillance

Carl Williams

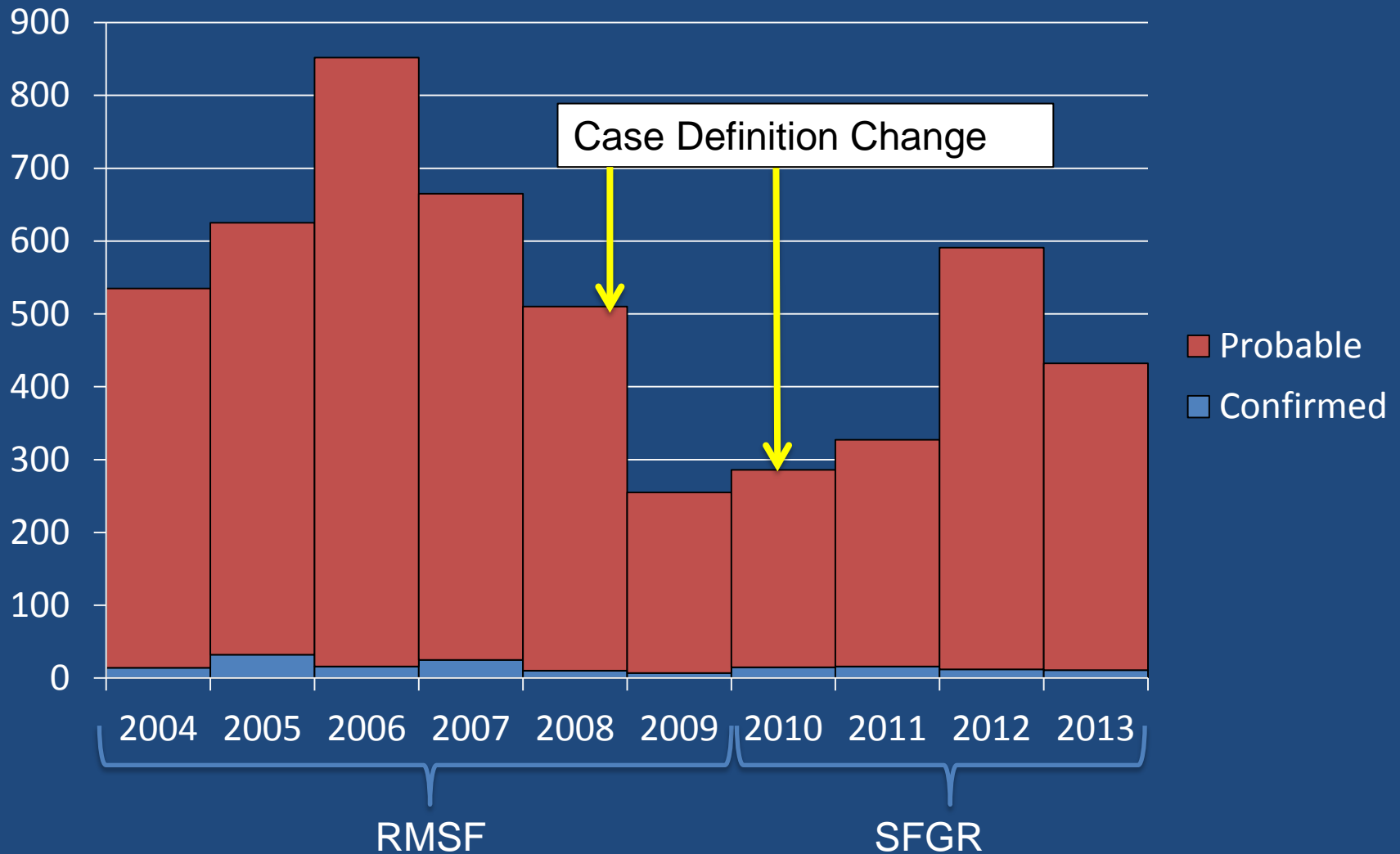
NC Div. of Public Health

All data provisional; final reported  
case counts subject to change

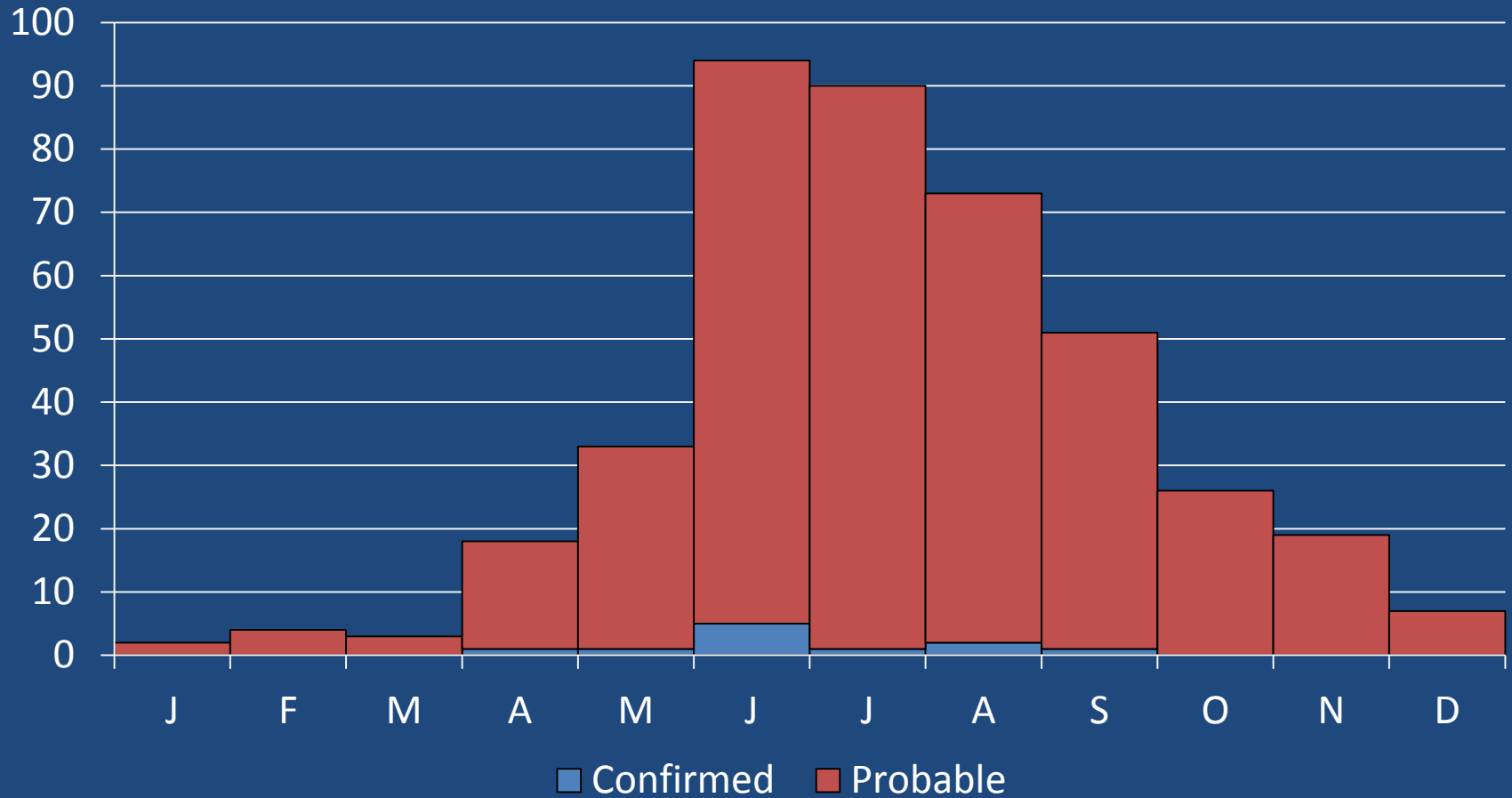
# Objectives / Overview

- Review NC surveillance data
- Clinical vs. Surveillance criteria
  - When to treat?
  - What is importance of laboratory testing?
- What do we need for better surveillance?

# *Rickettsia* spp. Cases by Year, NC



# C & P RMSF Cases by Month Illness Onset, NC, 2013 (n=420)



# RMSF Event Investigation Details

Year	Total Events Created for Investigation	Events Created by Electronic Lab Report	% of Total Events Created by ELR	% of Total Events Resulting in C / P Case Classification
2013	1532	1184	77%	27% (420/1532)
2009	1116	261	23%	23% (255/1116)

Data extracted from NC EDSS “TATP – Source of Event CD” and “event line list – deidentified” reports on 6 FEB 2014

# Rocky Mountain Spotted Fever

- Tick-borne intracellular bacteria *Rickettsia rickettsii*
- Infects endothelial cells, causes vasculitis
  - Non-specific symptoms
  - multi-system organ failure
- No “classic” presentation
- Rapidly fatal
  - Median time to death 8 days
  - >20% case fatality rate in untreated cases

# RMSF: early clinical manifestations (Day 1-4)

- **Day 1-2:** fever, headache, myalgia (*may be responsive to OTC pain/fever meds*)
- **Day 2-4:** May develop respiratory signs (cough, community-acquired pneumonia) and/or gastrointestinal signs (nausea, vomiting, abdominal pain)
- **Day 2-4:** light maculopapular rash \*may\* appear
- **Day 2-4:** Thrombocytopenia, hyponatremia, elevated liver enzymes (AST, ALT) \*may\* occur

# RMSF: late clinical manifestations (Day 5 or later)

- Worsening systemic illness (cough, dyspnea, arrhythmias, hypotension, severe abdominal pain)
- Petechial rash may develop
- Thrombocytopenia, hyponatremia, elevated liver enzymes (AST, ALT) usually present
- Onset of neurologic signs (photophobia, altered mental status, seizures)





# RMSF treatment

- Treat early, based on clinical suspicion and exposure history
  - Do not wait for lab results – may be negative early during the course of infection
  - Use exposure history as a guide- keep in mind tick bite only reported in 60% of cases
- Doxycycline is the drug of choice for adults and children of all ages
  - Improvement often seen in 24-72h
  - Other broad-spectrum antibiotics are not effective
  - Sulfas, fluoroquinolones may cause more severe disease

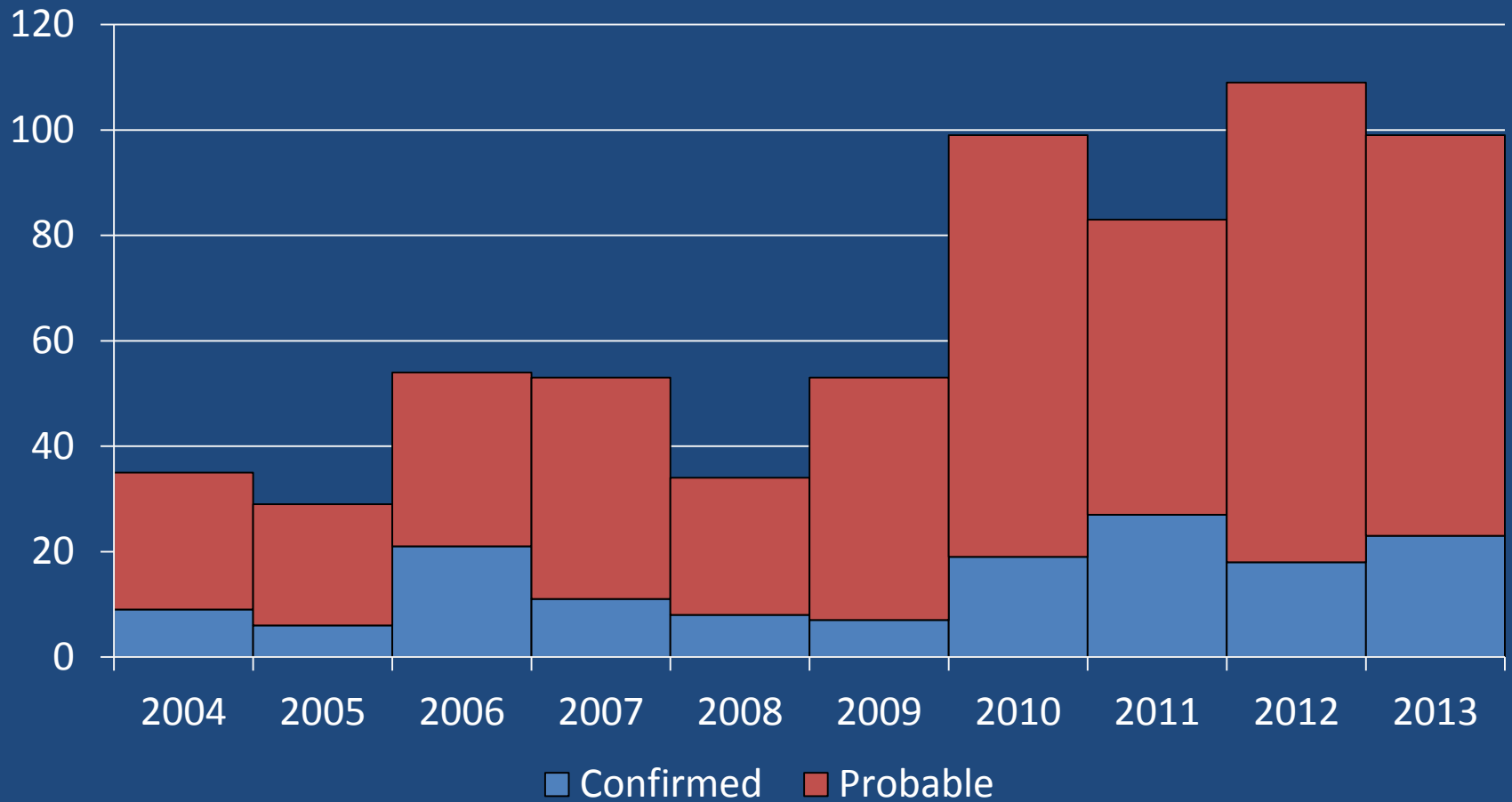
# Testing for RMSF

- Testing is used for surveillance and public health (magnitude of cases, confirm risks)
- No early diagnostic test can definitively rule RMSF in or out
- Do not base treatment decisions on (or wait for) test results

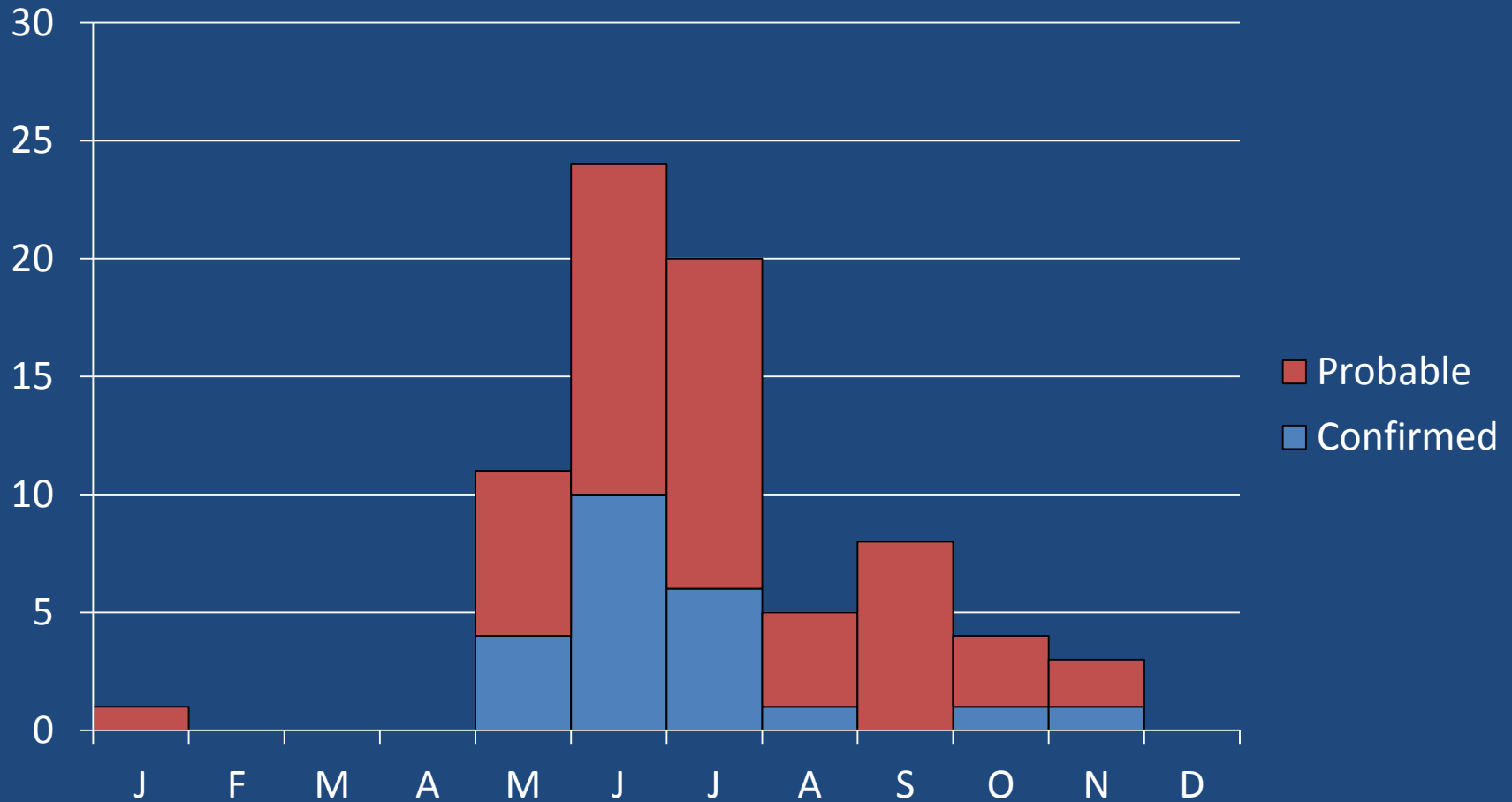
# Testing Methods for RMSF

- PCR or IHC of whole blood, serum, tissue
  - Most accurate for severely ill/fatal cases
  - Unlikely to be positive for mild RMSF or samples taken early (day 1-4 of illness)
- Serology (IFA)
  - Detects antibodies
  - Testing of paired sera (acute, convalescent 2-4 weeks later) recommended
  - Can be difficult to interpret
    - Often negative during acute illness
    - Antibodies from prior infections may persist for years

# HME Cases by Year, NC



# C & P HME Cases by Month Illness Onset, NC, 2013 (n=76)



# HME Event Investigation Details

Year	Total Events Created for Investigation	Events Created by Electronic Lab Report	% of Total Events Created by ELR	% of Total Events Resulting in C / P Case Classification
2013	218	174	80%	35% (76/218)
2009	196	11	6%	27% (53/196)

Data extracted from NC EDSS “TATP – Source of Event CD” and “event line list – deidentified” reports on 6 FEB 2014

# Symptoms of HME

- Fever / chills
- Headache / malaise
- Muscle pain
- Nausea / vomiting / diarrhea
- Confusion
- Rash
  - In up to 60% of children, less than 30% of adults
  - Macular, maculopapular (early) or petechial (late)
- Thrombocytopenia, leukopenia and elevated liver enzymes

# Treatment of HME

- Treat as soon as the disease is suspected
- Adult – Doxycycline 100mg BID until 3 days after fever resolves
- Pediatric – Doxycycline 2.2 mg/kg BID until 3 days after fever resolves
- This treatment regimen has not been proven to cause dental staining, even with repeated use



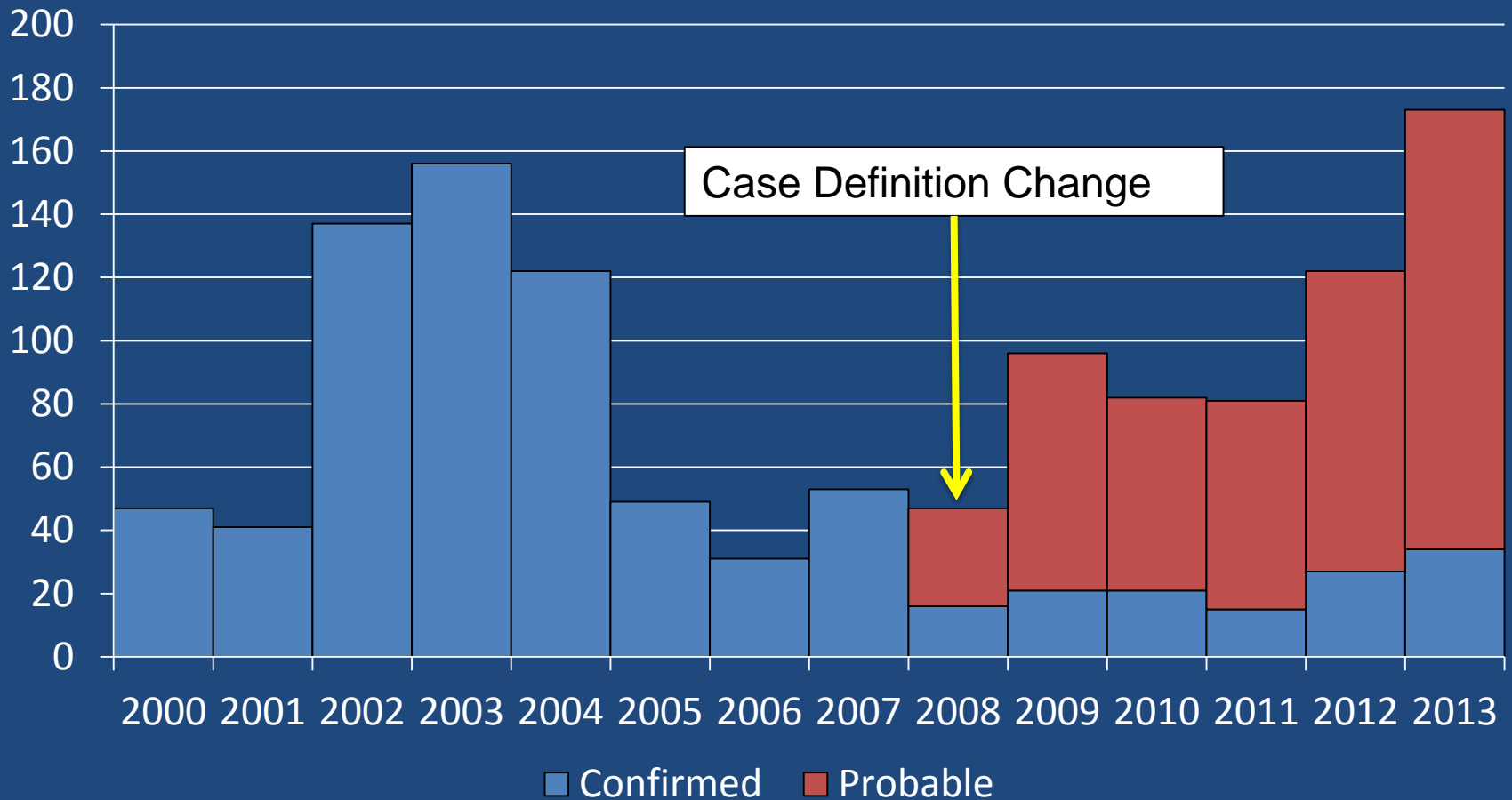
# Testing for HME

- Testing is used for surveillance and public health (magnitude of cases, confirm risks)
- No early diagnostic test can definitively rule ehrlichia in or out
- Do not base treatment decisions on (or wait for) test results

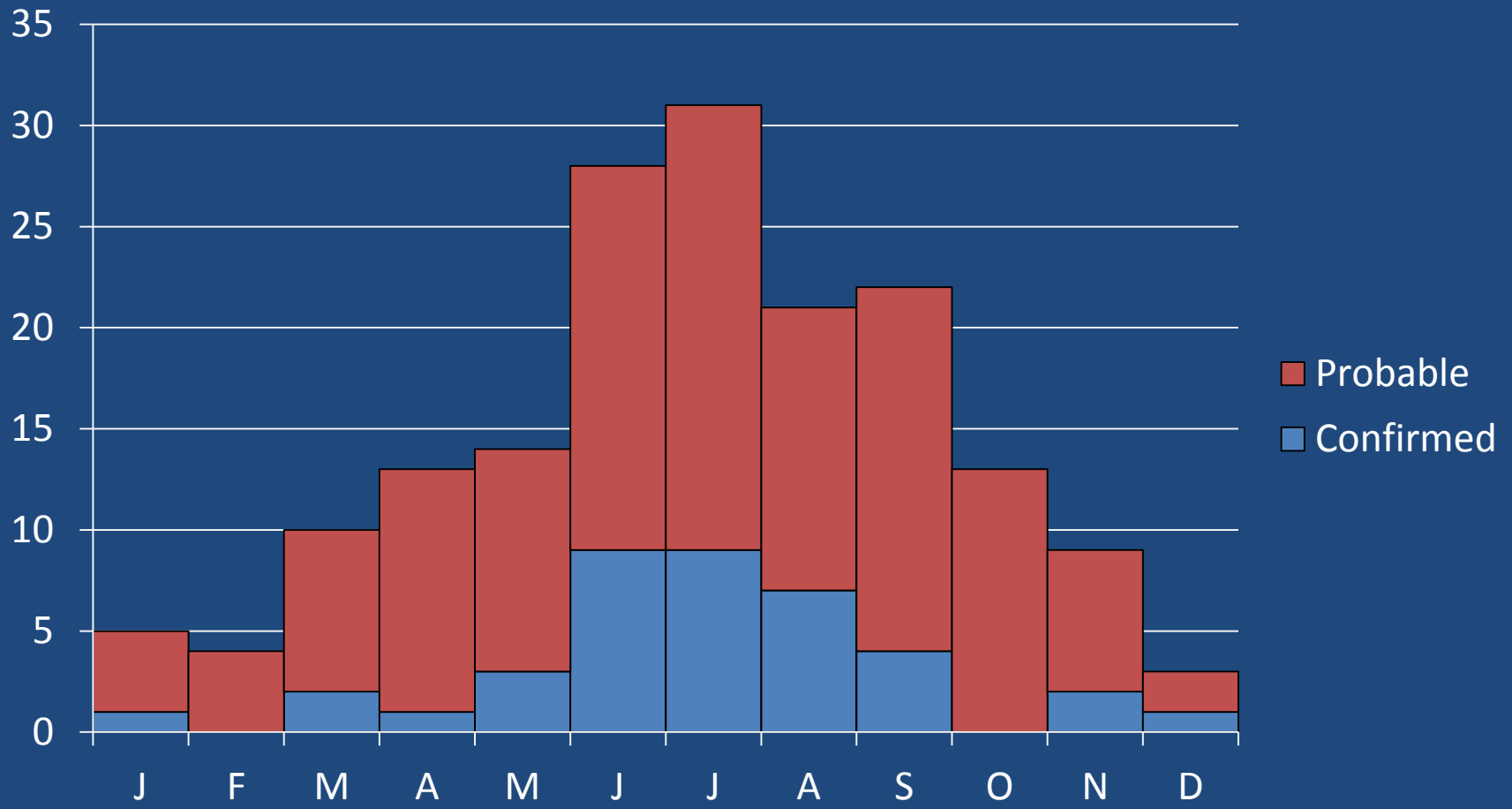
# Serology for HME

- The gold standard serologic test is the indirect immunofluorescence assay (IFA) using species-specific antigen, performed on acute and convalescent sera
  - The first sample should be taken in the first week of symptoms
  - The second sample should be taken 2 to 4 weeks later.
  - Positive samples should demonstrate a significant (four-fold) rise in antibody titers
  - IgM antibodies are less specific than IgG antibodies and more likely to result in a false positive

# LD Cases by Year, NC



# C & P LD Cases by Month Illness Onset, NC, 2013 (n=173)



# LD Event Investigation Details

Year	Total Events Created for Investigation	Events Created by Electronic Lab Report	% of Total Events Created by ELR	% of Total Events Resulting in C / P Case Classification
2013	1172	972	83%	15% (173/1172)
2009	1704	1513	89%	5% (96/1704)

Data extracted from NC EDSS “TATP – Source of Event CD” and “event line list – deidentified” reports on 6 FEB 2014

# Erythema Migrans (EM)

- 70-80% of cases
- ~7-14 days after tick bite
- Expands over days
- Rarely painful
- Distinguish from allergic reaction



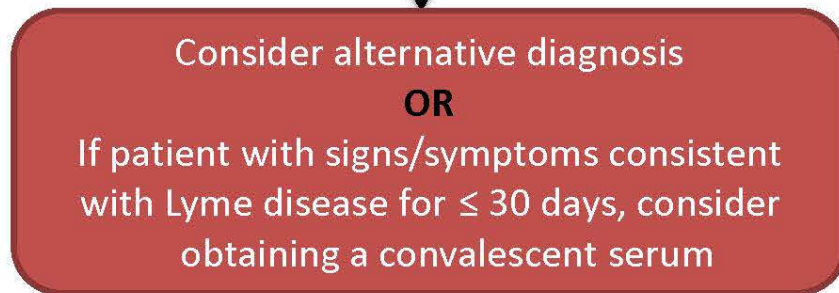
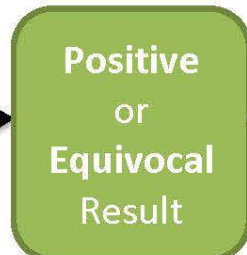
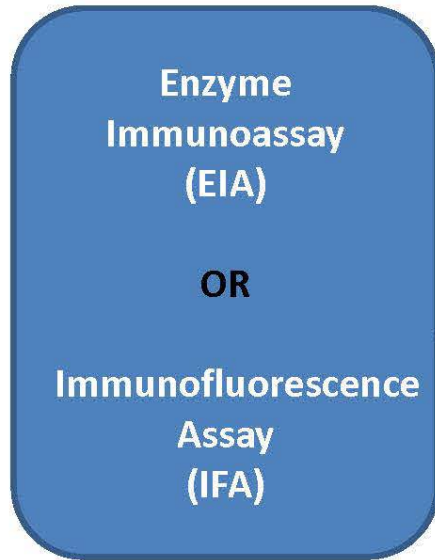
# Disseminated and Late Manifestations

- Facial palsy
  - Summer months
  - May be bilateral
  - $\pm$  CSF pleocytosis
- Arthritis
  - Intermittent
  - Oligoarticular
- Late-stage neurologic
  - Peripheral neuropathy
  - Encephalopathy



# Two-Tiered Testing for Lyme Disease

## First Test

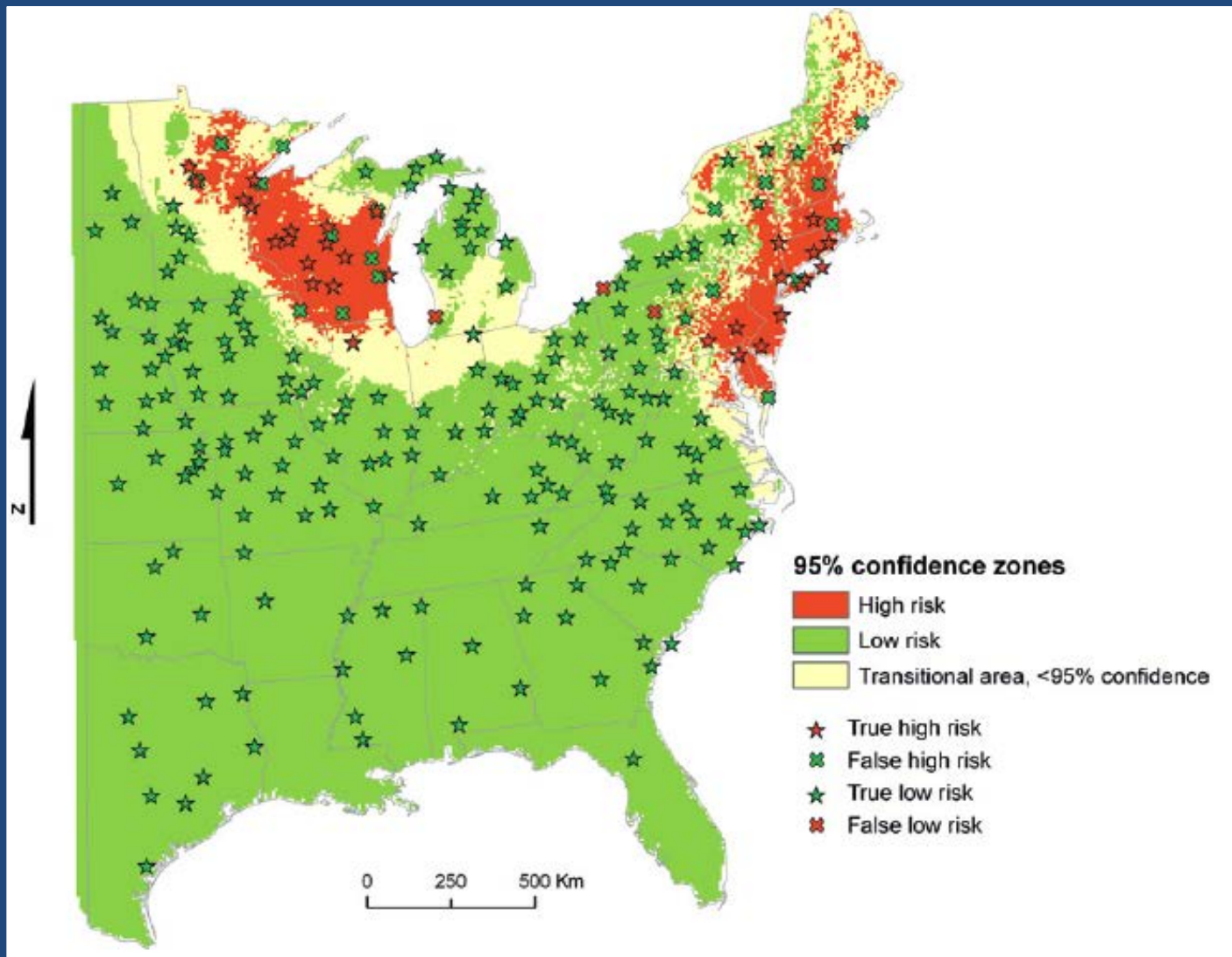


## Second Test





Maria A. Diuk-Wasser, Human Risk of Infection with *Borrelia burgdorferi*, the Lyme Disease Agent, in Eastern United States. *Am. J. Trop. Med. Hyg.*, 86(2), 2012, pp. 320–327



# Lyme Disease Incidence Rate by State, 2012, Confirmed Cases

State	Incidence Rate / 100,000
Pennsylvania	32.5
Maryland	18.9
Virginia	9.8
West Virginia	4.4
North Carolina	0.3
Tennessee	0.0
South Carolina	0.7
Georgia	0.3

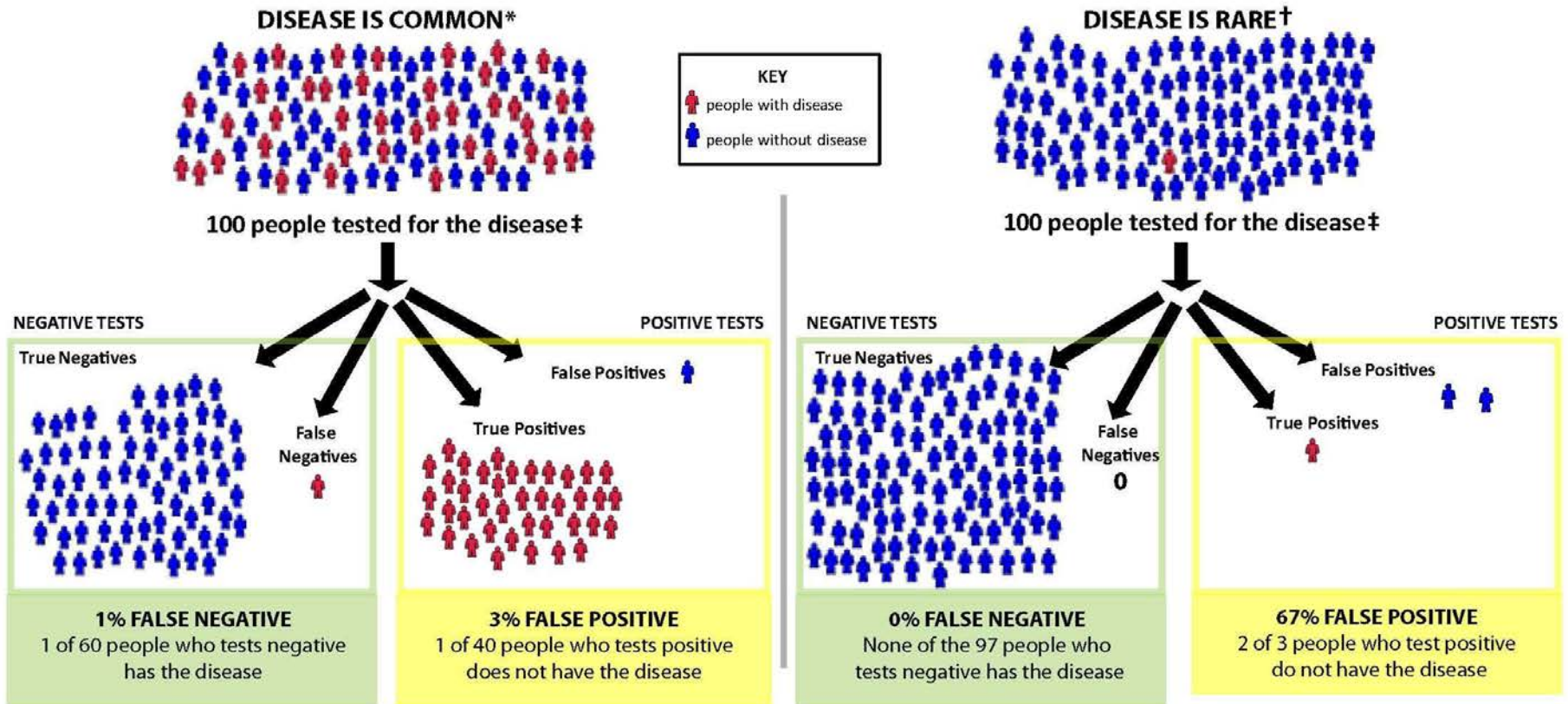
<http://www.cdc.gov/lyme/stats/chartstables/incidencebystate.html>

# Understanding Test Results for Infectious Diseases

Consider the likelihood of disease *before* performing laboratory testing

The likelihood that a patient has a disease depends on many factors:

- Has the patient been in an area where the disease is found?
- Does the patient have signs and symptoms typical of the disease?
- Does the patient have risk factors for contracting or developing the disease?



\* 40 out of 100 patients in this area have the disease.  
† 1 out of 100 patients in this area have the disease.

‡ Test specificity = 98% (high) and test sensitivity = 98% (high)

# STARI or Lyme Disease?

- Southern Tick-Associated Rash Illness (STARI)
  - Rash indistinguishable from Lyme disease EM
  - May be accompanied by fatigue, fever, headache, muscle and joint pains
  - Follows bite of lone star tick, *Amblyomma americanum*
- Cause of STARI is not known



# Questions / Comments

Note:

Surveillance algorithms were sent out to all CD Nurses this spring. Please contact Jodi Reber at [jodi.reber@dhhs.nc.gov](mailto:jodi.reber@dhhs.nc.gov) if you need a copy.