Updates in tickborne illness in North Carolina

Nothing Compares
NORTH CAROLINA

July Communicable Disease Webinar
July 20, 2017
Alexis M. Barbarin, PhD

Overview

1. What is the role of DHHS Communicable Disease Branch?
2. Tick biology
3. What ticks and tickborne illnesses are present in NC?
4. Current state of tickborne illness in NC
5. Understanding case definitions (Activity)
6. Recent retrospective analysis of RMSF

Who are the DHHS Vector-borne staff?

Carl Williams, DVM
State Public Health Veterinarian

Mr. Michael Doyle, MS
State PH Entomologist

Alexis M. Barbarin, PhD
State PH Entomologist

Ronna Chan, PhD
Zika Pregnancy Registry

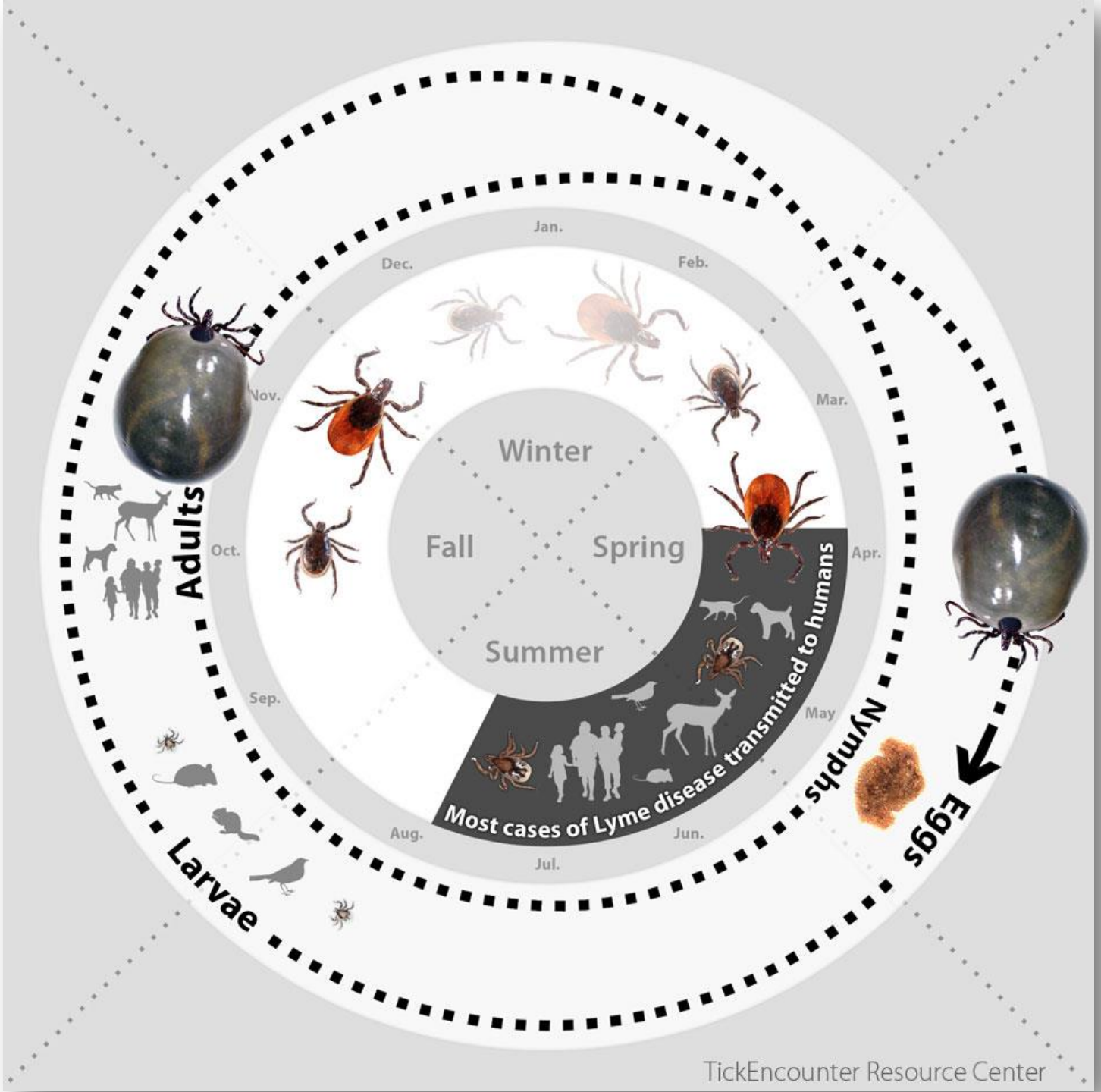
Autumn Locklear, MSPH
Epidemiologist

Coming August 7
Vector-borne Nurse Consultant

What is our role in the Communicable Disease Branch?

- Human disease surveillance of vector-borne diseases (NC EDSS).
- Assist with properly classifying cases.
- Provide guidance according to CDC and CSTE guidelines.
- Provide guidance on where/when to conduct entomological surveillance.
- Report vector-borne illnesses to CDC.

Tick Biology


Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Winter
Spring
Summer
Fall
Most cases of Lyme disease transmitted to humans
Adults
Larvae
Nymphs
Eggs
TickEncounter Resource Center

How tick borne illness is acquired

https://www.youtube.com/watch?v=c_Jn_HdoU3Y

Reportable tickborne illnesses in North Carolina

Anaplasmosis

- **Pathogen:** *Anaplasma phagocytophilum*
- **Vector:** Black legged ticks – *Ixodes scapularis*
- Acute, **febrile illness** resembling RMSF, but without the rash.

Female

Male

Ehrlichiosis

- **Pathogen:** *Ehrlichia chaffeensis & E. ewingii*
- **Vector:** Lone star tick – *Amblyomma americanum*
- **Febrile illness**, which includes chills, headache, myalgia, and arthralgia.

Female

Male

Reportable tickborne illnesses in North Carolina

Spotted fever group rickettsiosis (RMSF*)

- **Pathogen:** *Rickettsia rickettsii*, R. parkeri, & R. amblyommii*
- **Vectors**
  - American dog tick – *Dermacentor variabilis*
  - Lone Star tick – *Amblyomma americanum*
  - Gulf Coast tick – *Amblyomma maculatum*
- **Febrile illness** accompanied by rash, headache, myalgia, nausea and vomiting.

Female

Male

D. variabilis

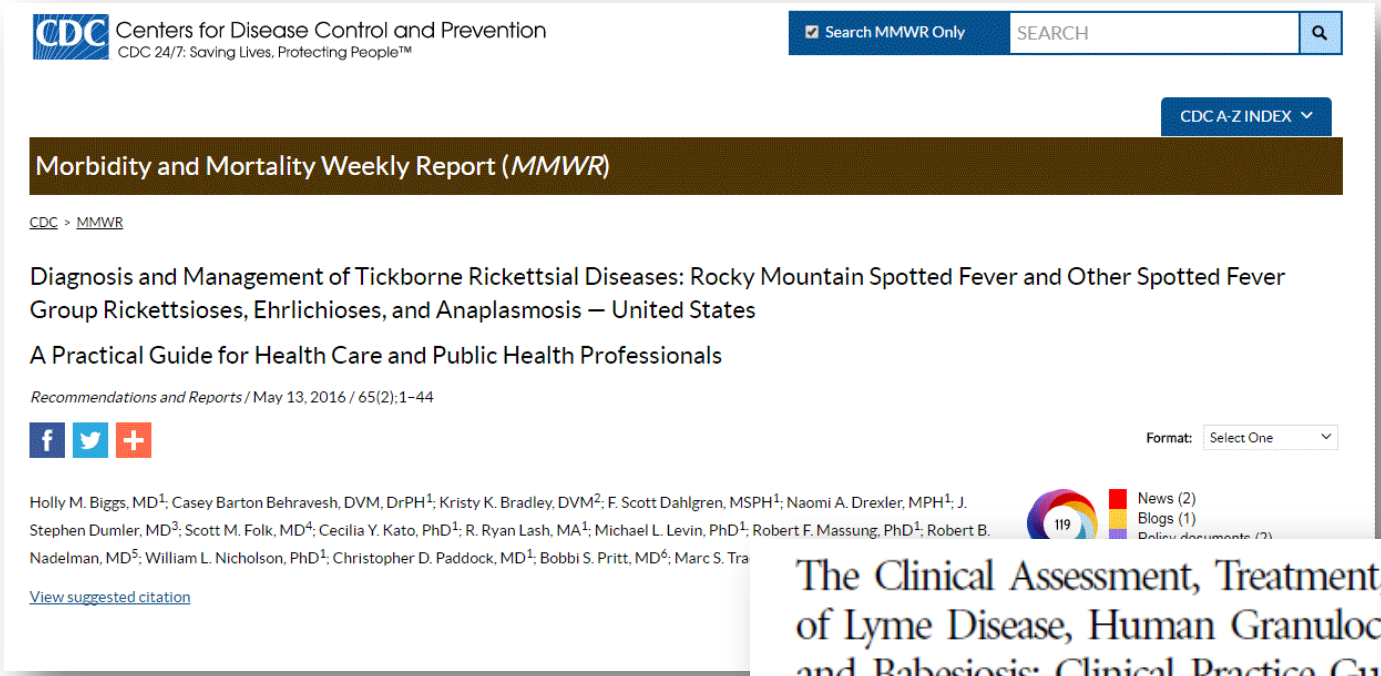
Female

Male

A. maculatum

Reportable tickborne illnesses in North Carolina

SFGR, Ehrlichiosis, and Anaplasmosis Treatment:



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Search MMWR Only | SEARCH

CDC A-Z INDEX

Morbidity and Mortality Weekly Report (*MMWR*)

CDC > MMWR

Diagnosis and Management of Tickborne Rickettsial Diseases: Rocky Mountain Spotted Fever and Other Spotted Fever Group Rickettsioses, Ehrlichioses, and Anaplasmosis — United States

A Practical Guide for Health Care and Public Health Professionals

Recommendations and Reports / May 13, 2016 / 65(2);1–44

Format: Select One

Holly M. Biggs, MD[1]; Casey Barton Behravesh, DVM, DrPH[1]; Kristy K. Bradley, DVM[2]; F. Scott Dahlgren, MSPH[1]; Naomi A. Drexler, MPH[1]; J. Stephen Dumler, MD[3]; Scott M. Folk, MD[4]; Cecilia Y. Kato, PhD[1]; R. Ryan Lash, MA[1]; Michael L. Levin, PhD[1]; Robert F. Massung, PhD[1]; Robert B. Nadelman, MD[5]; William L. Nicholson, PhD[1]; Christopher D. Paddock, MD[1]; Bobbi S. Pritt, MD[6]; Marc S. Tra

119 News (2) Blogs (1)

View suggested citation

The Clinical Assessment, Treatment, and Prevention of Lyme Disease, Human Granulocytic Anaplasmosis, and Babesiosis: Clinical Practice Guidelines by the Infectious Diseases Society of America

Gary P. Wormser,[1] Raymond J. Dattwyler,[2] Eugene D. Shapiro,[5,6] John J. Halperin,[3,4] Allen C. Steere,[3] Mark S. Klempner,[10] Peter J. Krause,[8] Johan S. Bakken,[11] Franc Strle,[13] Gerold Stanek,[14] Linda Bockenstedt,[7] Durland Fish,[6] J. Stephen Dumler,[12] and Robert B. Nadelman[1]

Divisions of [1]Infectious Diseases and [2]Allergy, Immunology, and Rheumatology, Department of Medicine, New York Medical College, Valhalla, and [3]New York University School of Medicine, New York, New York; [4]Atlantic Neuroscience Institute, Summit, New Jersey; Departments of [5]Pediatrics and [6]Epidemiology and Public Health and [7]Section of Rheumatology, Department of Medicine, Yale University School of Medicine, New Haven, and [8]Department of Pediatrics, University of Connecticut School of Medicine and Connecticut Children's Medical Center, Hartford; [9]Division of Rheumatology, Allergy, and Immunology, Massachusetts General Hospital, Harvard Medical School, and [10]Boston University School of Medicine and Boston Medical Center, Boston, Massachusetts; [11]Section of Infectious Diseases, St. Luke's Hospital, Duluth, Minnesota; [12]Division of Medical Microbiology, Department of Pathology, The Johns Hopkins Medical Institutions, Baltimore, Maryland; [13]Department of Infectious Diseases, University Medical Center, Ljubljana, Slovenia; and [14]Medical University of Vienna, Vienna, Austria

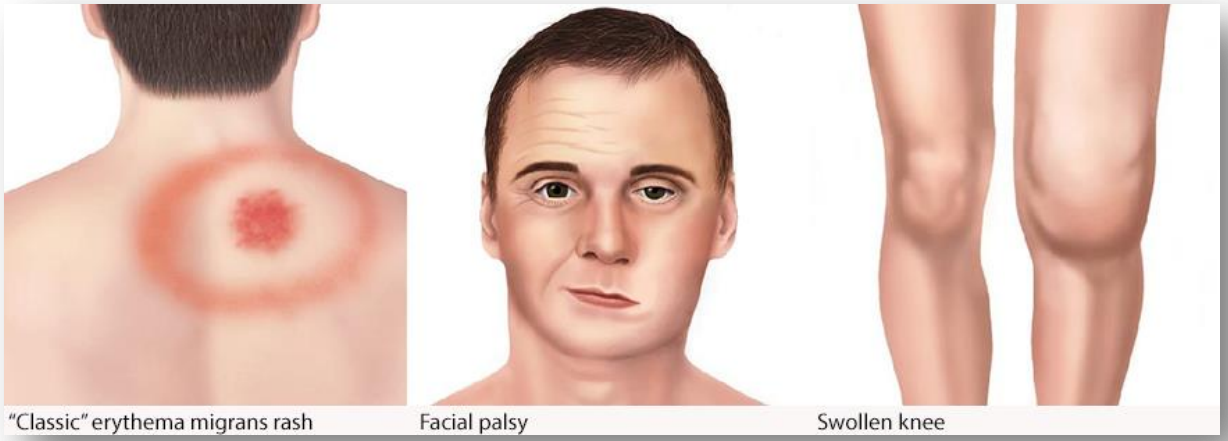
https://academic.oup.com/cid/article/43/9/1089/422463/The-Clinical-Assessment-Treatment-and-Prevention

https://www.cdc.gov/mmwr/volumes/65/rr/rr6502a1.htm

Reportable tickborne illnesses in North Carolina

Lyme disease

- **Pathogen:** *Borrelia burgdorferi*
- **Vector:** Black legged tick – *Ixodes scapularis*



https://www.cdc.gov/lyme/signs_symptoms/

Reportable tickborne illnesses in North Carolina

Lyme disease

- **Pathogen:** *Borrelia burgdorferi*
- **Vector:** Black legged tick – *Ixodes scapularis*

Clinical Manifestations	Symptoms	Early (3-30 days)	Late Clinical Manifestations (30 days or more)
Dermatological	EM rash	✓	
Neurological	Lymphocytic meningitis; cranial neuritis, particularly facial palsy (may be bilateral); radiculoneuropathy; or, rarely, encephalomyelitis.		✓
Musculoskeletal	Recurrent, brief attacks (weeks or months) of objective joint swelling in one or a few joints.		✓
Cardiovascular	Second to third-degree atrioventricular conduction defects.		✓

Reportable tickborne illnesses in North Carolina

Lyme disease Treatment:

The Clinical Assessment, Treatment, and Prevention of Lyme Disease, Human Granulocytic Anaplasmosis, and Babesiosis: Clinical Practice Guidelines by the Infectious Diseases Society of America

Gary P. Wormser,[1] Raymond J. Dattwyler,[2] Eugene D. Shapiro,[3,4] John J. Halperin,[3,4] Allen C. Steere,[3] Mark S. Klempner,[10] Peter J. Krause,[5] Johan S. Bakken,[11] Franc Strle,[13] Gerold Stanek,[14] Linda Bockenstedt,[7] Durland Fish,[6] J. Stephen Dumler,[12] and Robert B. Nadelman[1]

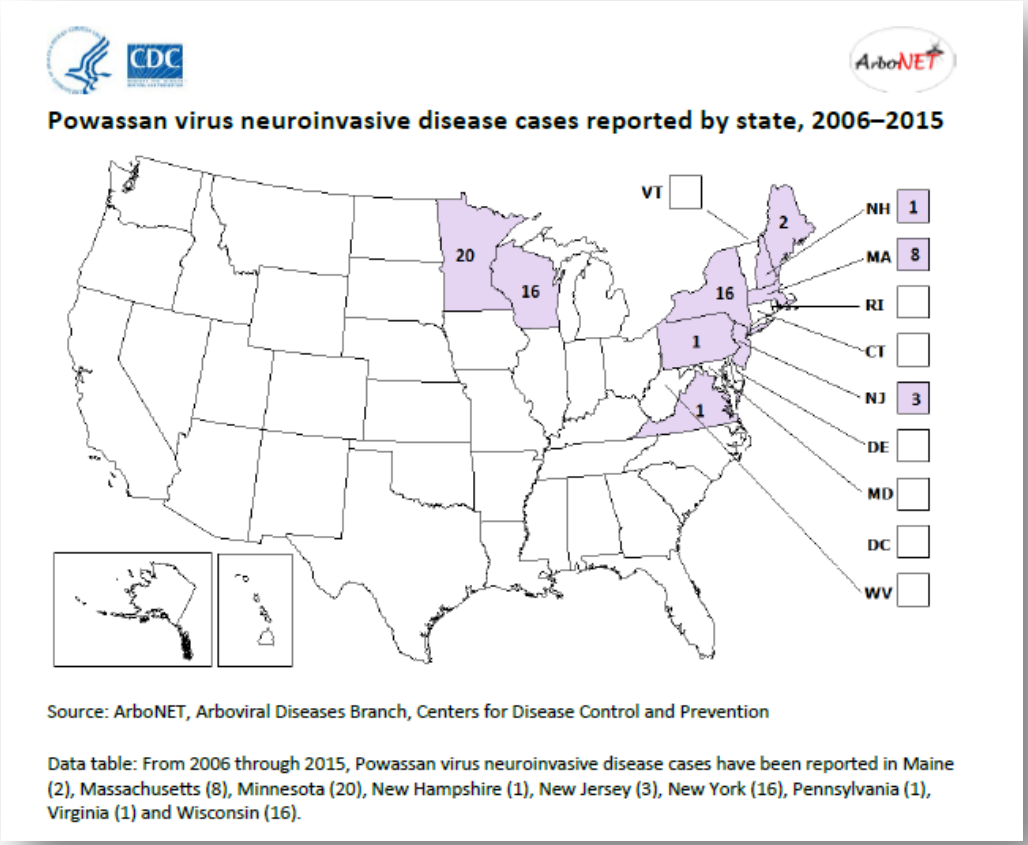
Divisions of [1]Infectious Diseases and [7]Allergy, Immunology, and Rheumatology, Department of Medicine, New York Medical College, Valhalla, and [2]New York University School of Medicine, New York, New York; [4]Atlantic Neuroscience Institute, Summit, New Jersey; Departments of [5]Pediatrics and [6]Epidemiology and Public Health and [7]Section of Rheumatology, Department of Medicine, Yale University School of Medicine, New Haven, and [8]Department of Pediatrics, University of Connecticut School of Medicine and Connecticut Children's Medical Center, Hartford; [9]Division of Rheumatology, Allergy, and Immunology, Massachusetts General Hospital, Harvard Medical School, and [10]Boston University School of Medicine and Boston Medical Center, Boston, Massachusetts; [11]Section of Infectious Diseases, St. Luke's Hospital, Duluth, Minnesota; [12]Division of Medical Microbiology, Department of Pathology, The Johns Hopkins Medical Institutions, Baltimore, Maryland; [13]Department of Infectious Diseases, University Medical Center, Ljubljana, Slovenia; and [14]Medical University of Vienna, Vienna, Austria

https://academic.oup.com/cid/article/43/9/1089/422463/The-Clinical-Assessment-Treatment-and-Prevention

Novel/Rare Tickborne viruses

Arboviral Encephalitis – Other

- Powassan Virus
- Bourbon Virus
- Heartland Virus



Illnesses that are NOT reportable in North Carolina

STARI (Southern tick associated rash illness)

- **Pathogen**: None identified to date
- **Vector:** Lone Star tick – *Amblyomma americanum*
- **Symptoms:** Skin lesion (rash) that looks like an Lyme disease EM rash, fatigue, headache, fever, and myalgia.
- No diagnostic blood tests.
- No evidence that antibiotic treatment is necessary or beneficial.

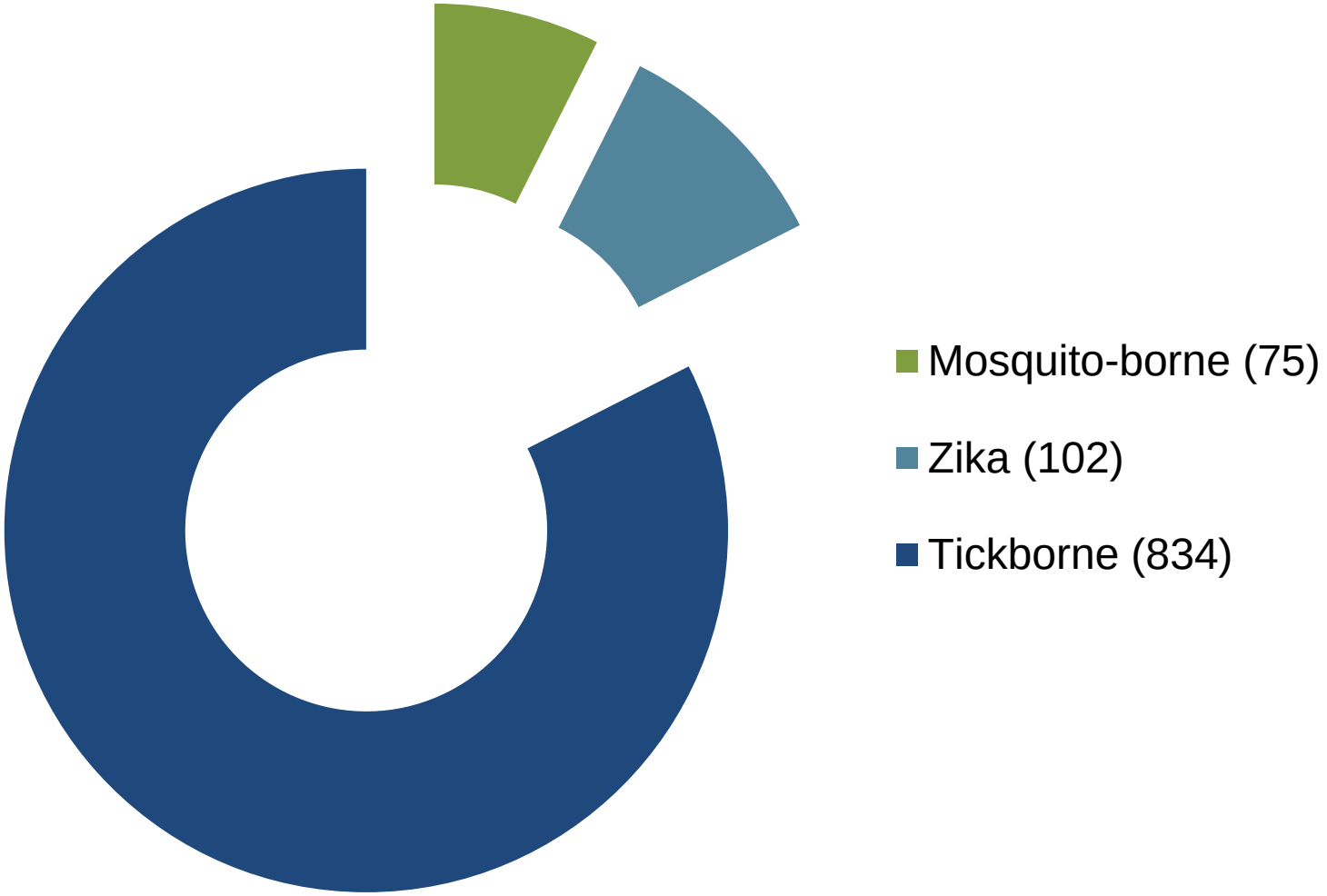
Illnesses that are NOT reportable in North Carolina

α-gal allergy

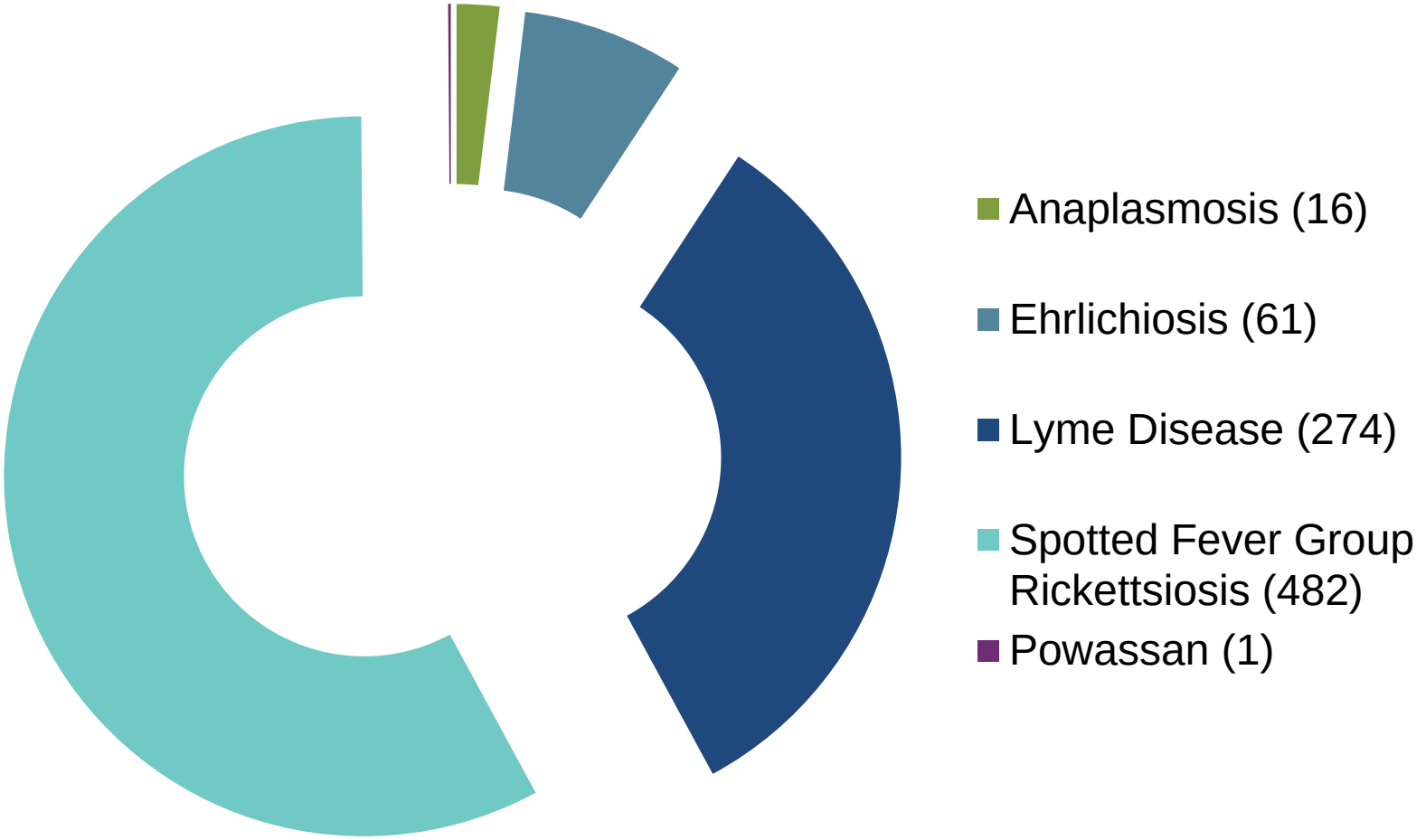
- **Pathogen:** None. It's a carbohydrate present in red meat
- **Vector:** Lone Star tick – *Amblyomma americanum*
- **Symptoms:** Onset delayed (2-8 hours following mammalian meat consumption), severe itching, hives, angioedema, GI upset, respiratory distress, and anaphylaxis.

Current state of tickborne illness in North Carolina

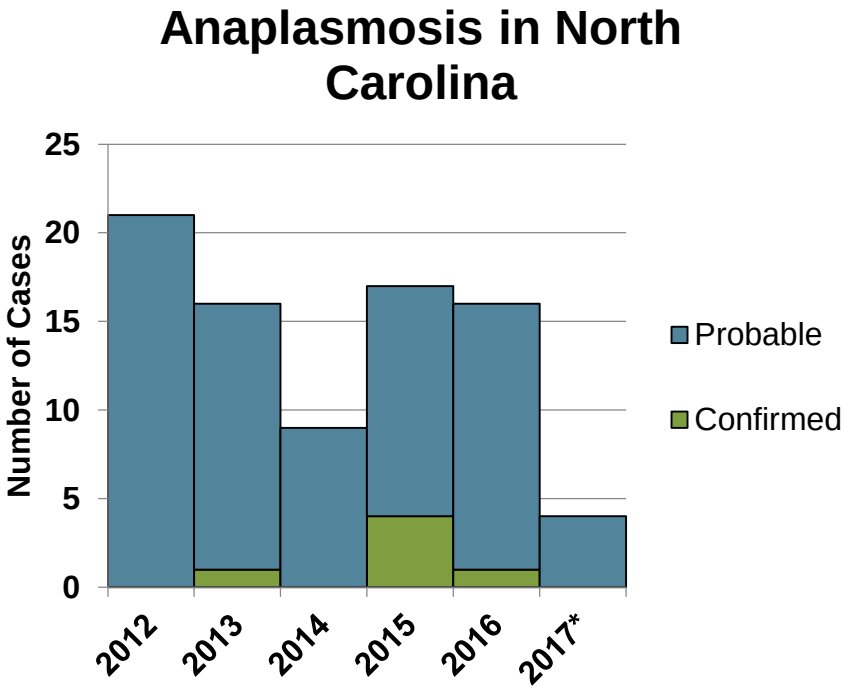
Vector-borne diseases reported in 2016

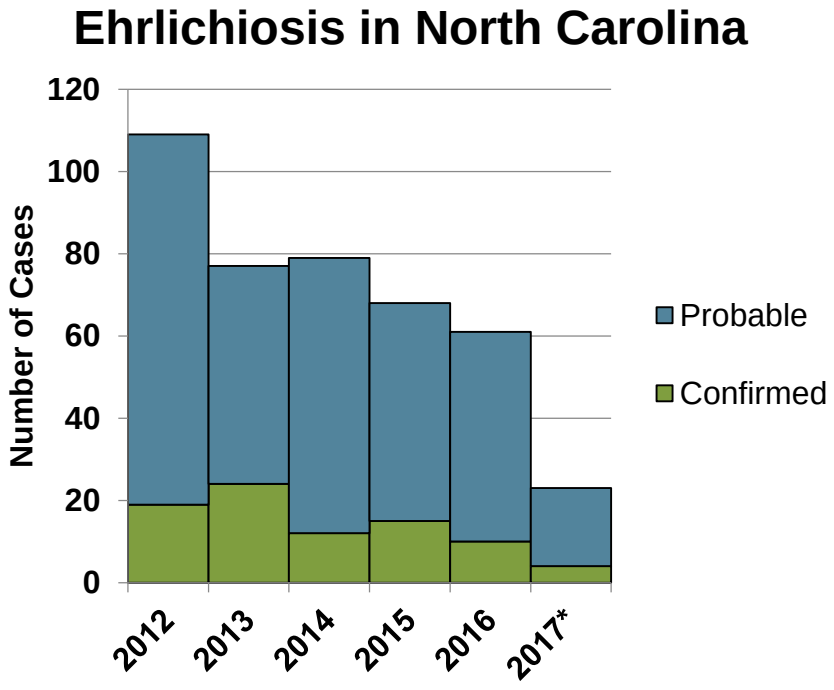


Tickborne diseases reported in 2016



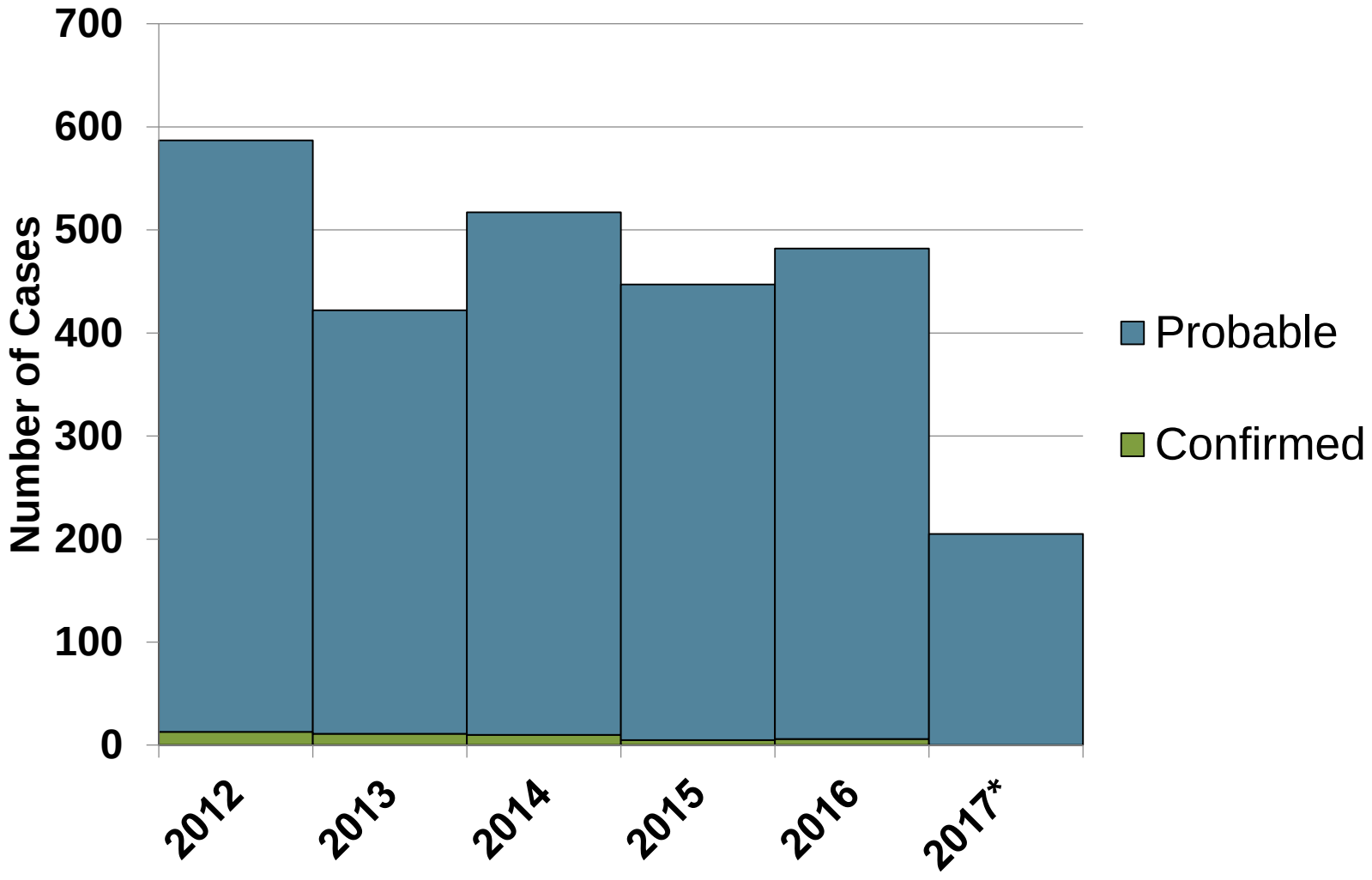
Anaplasmosis and Ehrlichiosis disease burden in North Carolina is minor.





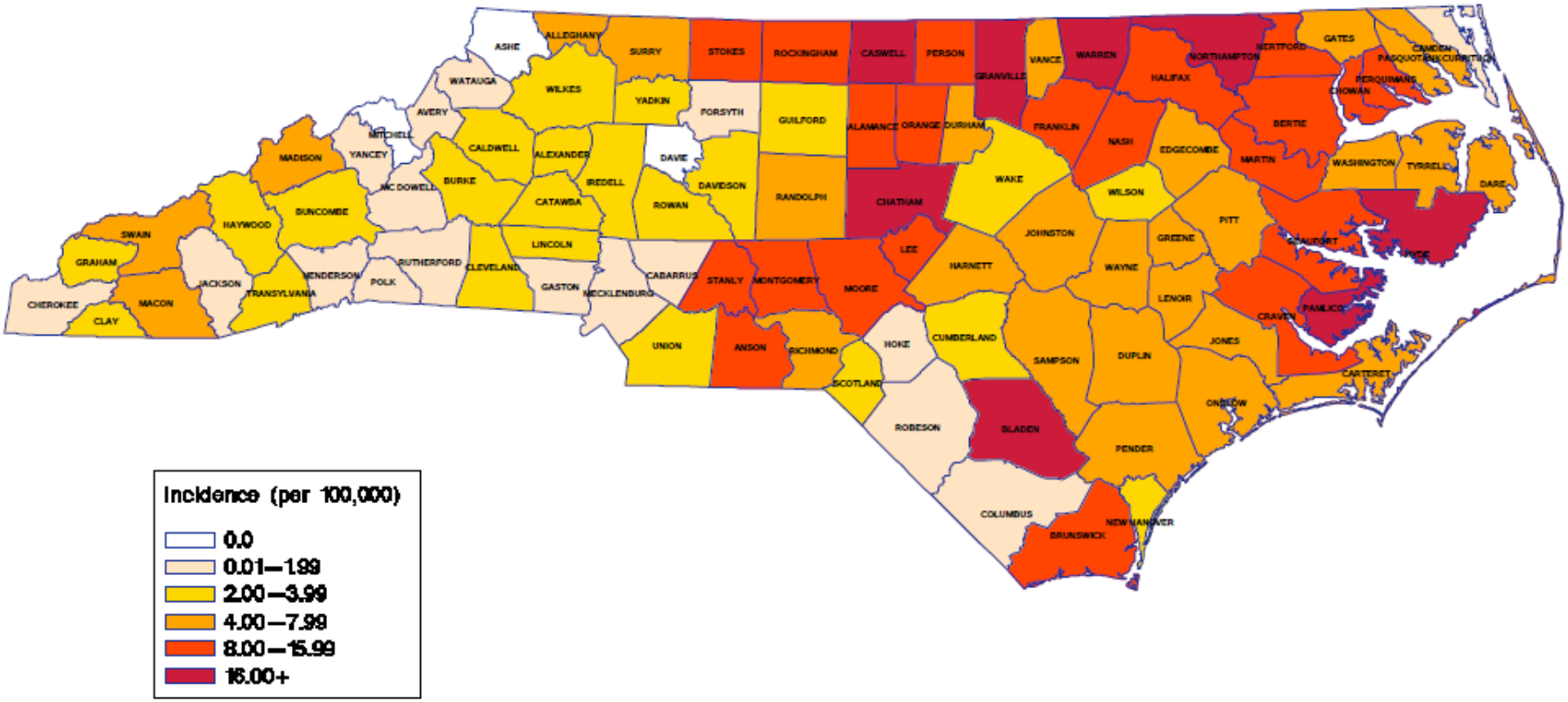
** Note 2017 data are preliminary, as of June 30, 2017.*

Rickettsiosis accounts for the majority of tickborne disease burden in North Carolina.

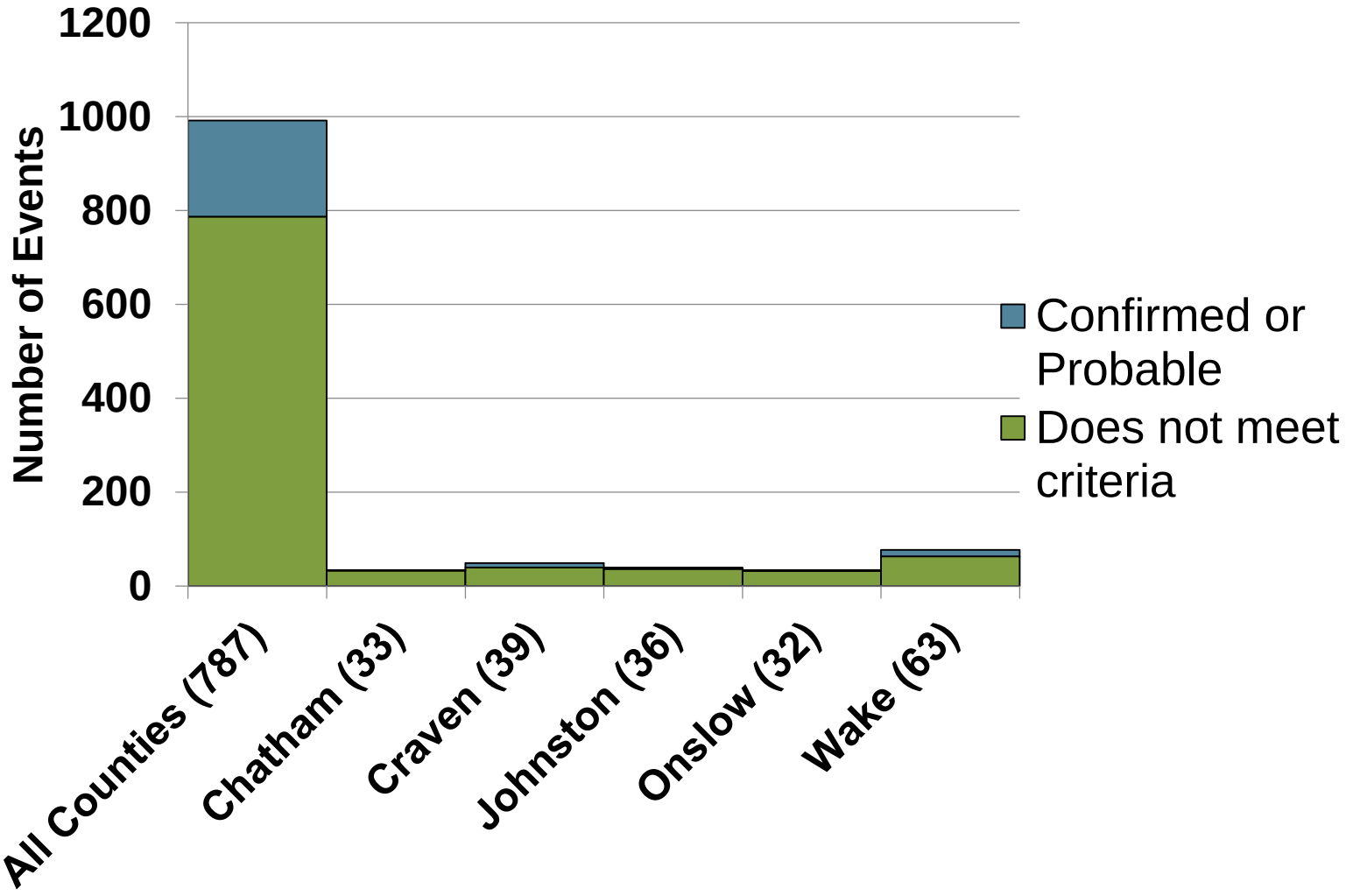


** Note 2017 data are preliminary, as of June 30, 2017.*

Average Annual Incidence of Confirmed and Probable SFGR in North Carolina (2011-15); N=2310

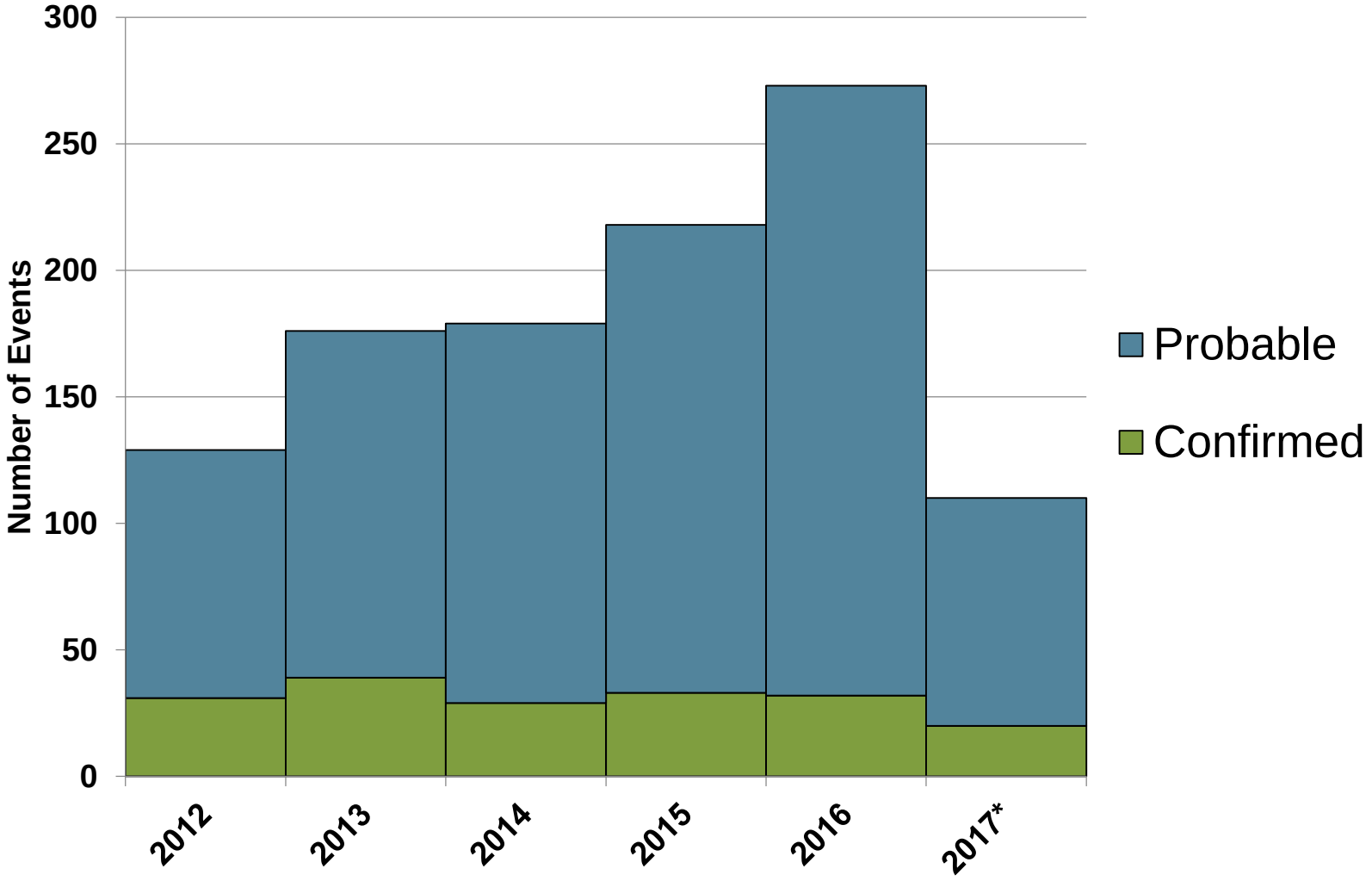


Thank you for your hard work!

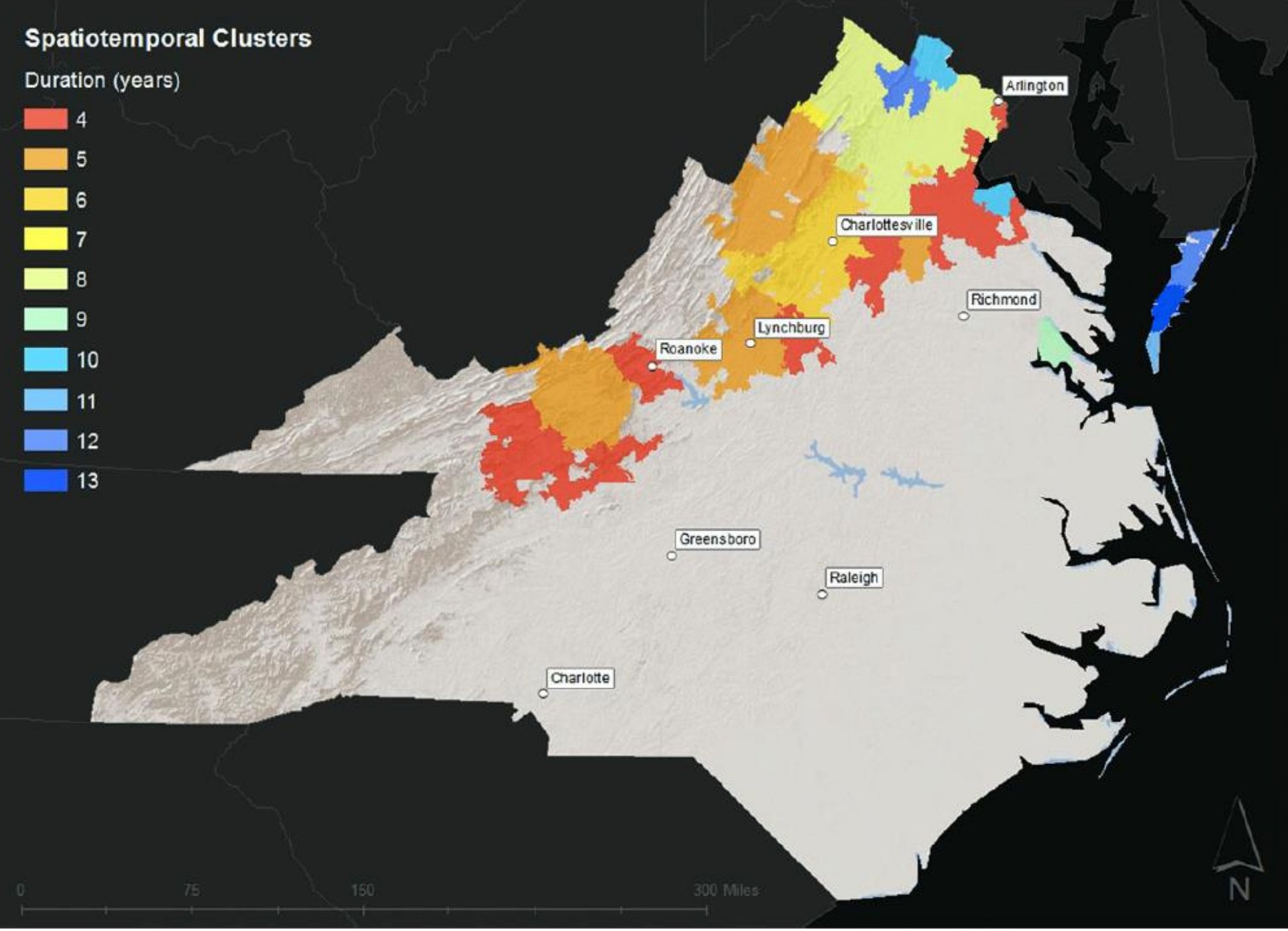


**Note: these numbers are preliminary as of July 19, 2017.*

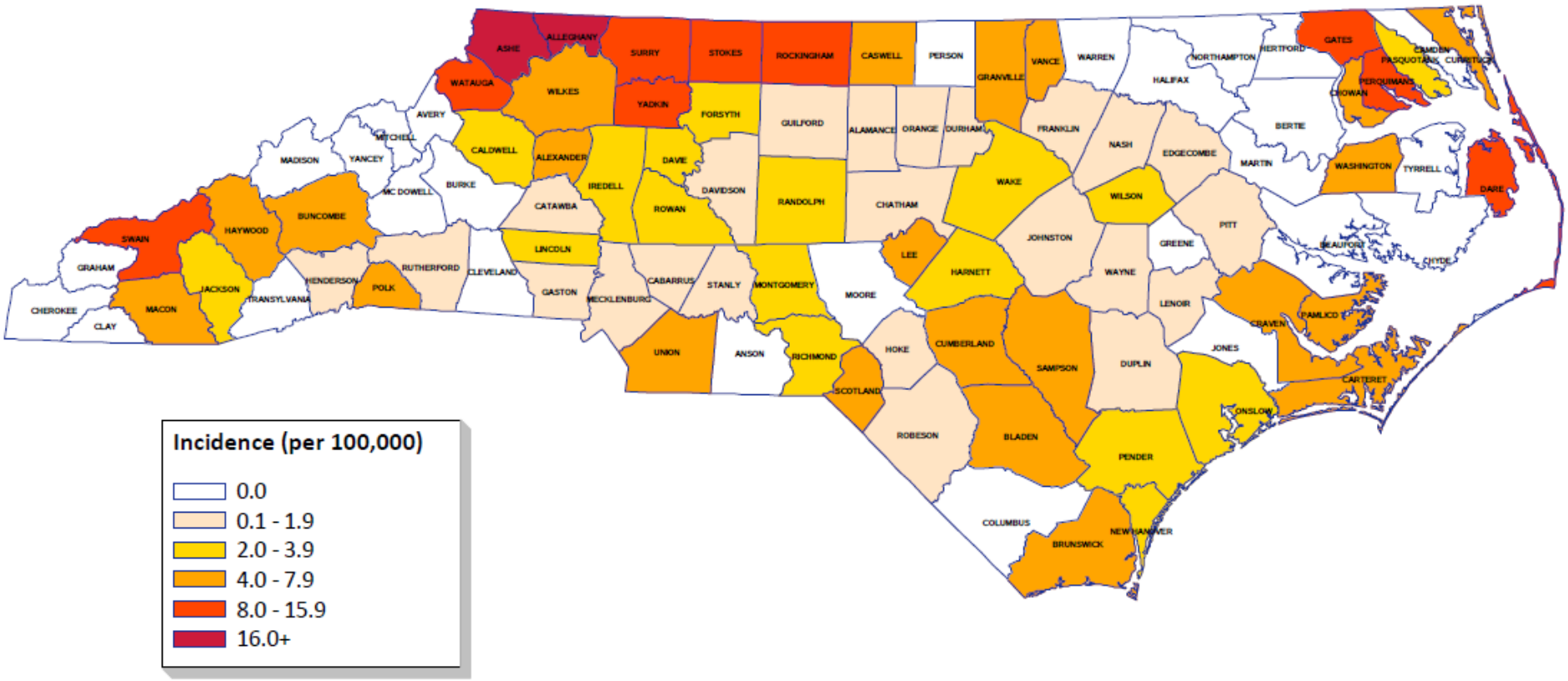
Probable cases of Lyme are increasing; confirmed cases are stable.



** Note 2017 data are preliminary, as of June 30, 2017.*

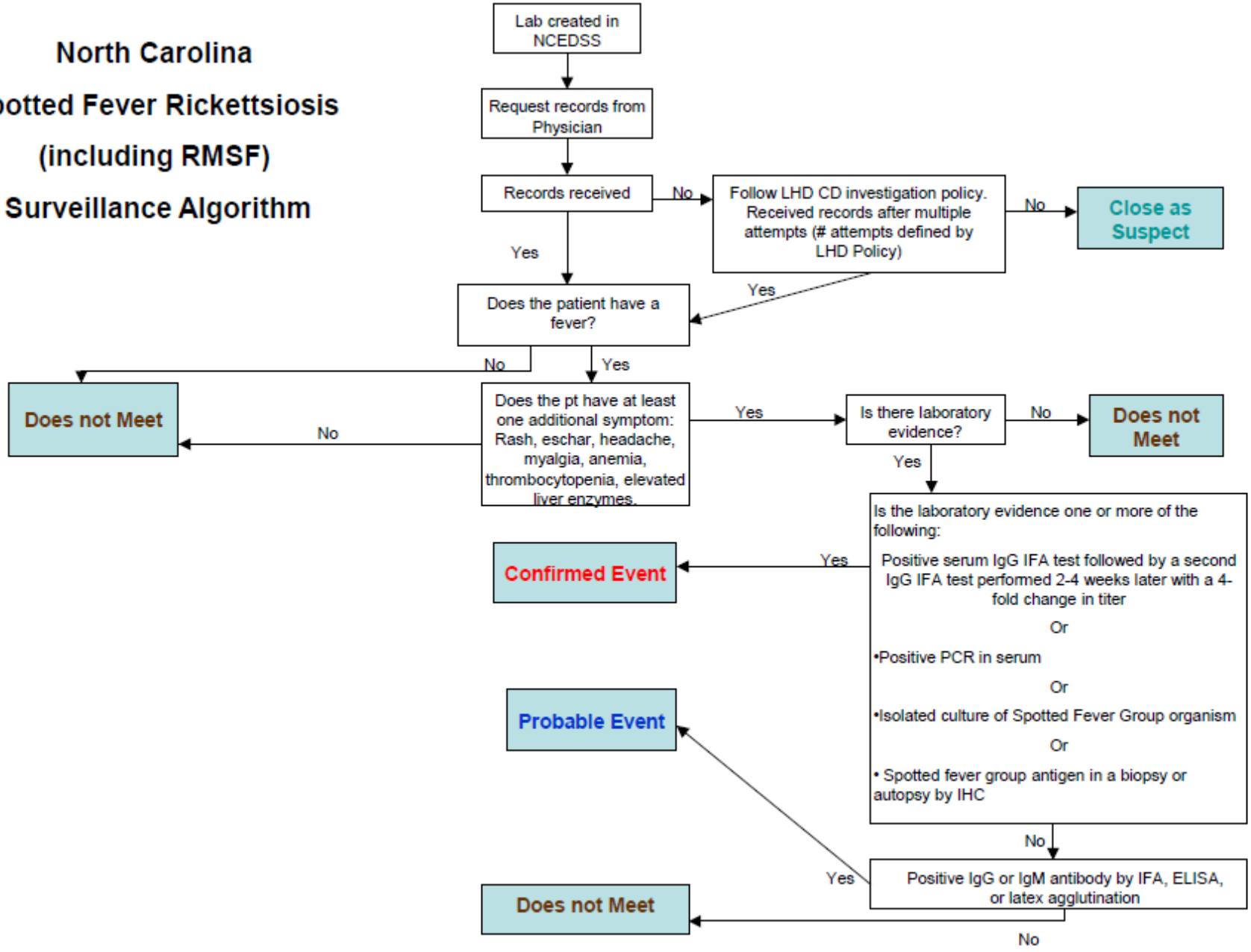

Spatiotemporal Clusters
Duration (years)
4
5
6
7
8
9
10
11
12
13
Arlington
Charlottesville
Richmond
Lynchburg
Roanoke
Greensboro
Raleigh
Charlotte
0
75
150
300 Miles
N

Incidence of Confirmed and Probable Cases Lyme in North Carolina (2016); N=273

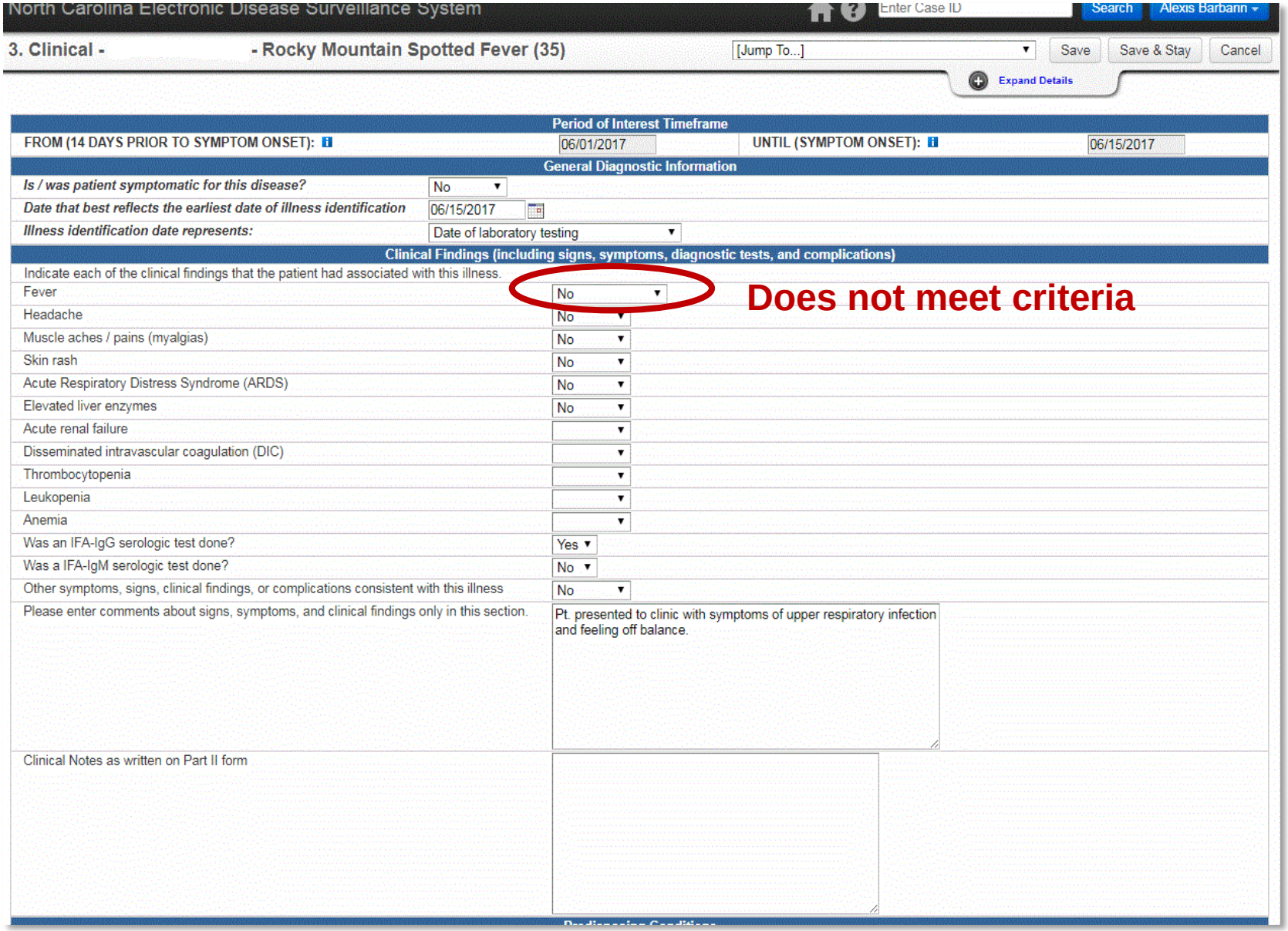


Understanding Case Definitions

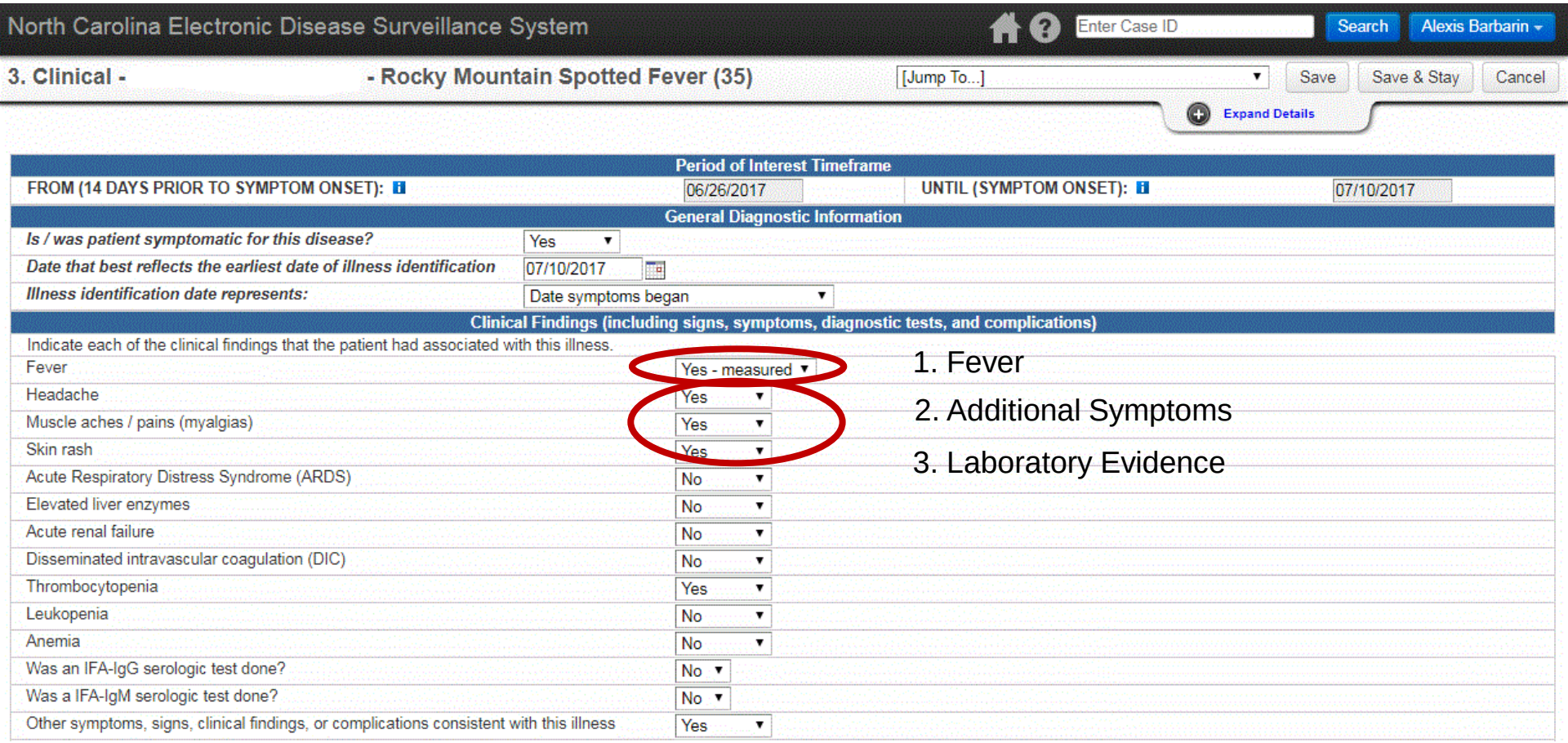
North Carolina Spotted Fever Rickettsiosis (including RMSF) Surveillance Algorithm



RMSF – Does Not Meet Criteria



RMSF – Probable



1. Fever
2. Additional Symptoms
3. Laboratory Evidence

Event Summary

Basic Information

Event ID:	101294434
Disease:	Rocky Mountain Spotted Fever (35)
Person:	Birth Date: Phone:
Type:	Batch
Investigation Status:	Open
Linked Events/Contacts:	0 linked event(s)/contact(s) (View)
Attachments:	0 attachment(s) (Add)
Notifications:	Classification: Probable County of residence: Craven County Event is in workflows [View List]

Notes (Add/Edit | Show My Notes)

Edit Event Properties | Copy Event

Event Data | Lab Results | Concerns | Persons | Tasks | Event Properties | Event History

Labs

Lab No.	Specimen Date	Specimen Number	Specimen Type	Result	Result Status	Result Value	Test	Last Update
1	07/11/2017	19382432230			Final Results	1:512	R rickettsi IgG Titr Ser IF...	07/15/2017
1	07/11/2017	19382432230		Positive	Final Results		R rickettsi IgG Ser QI EIA ...	07/15/2017

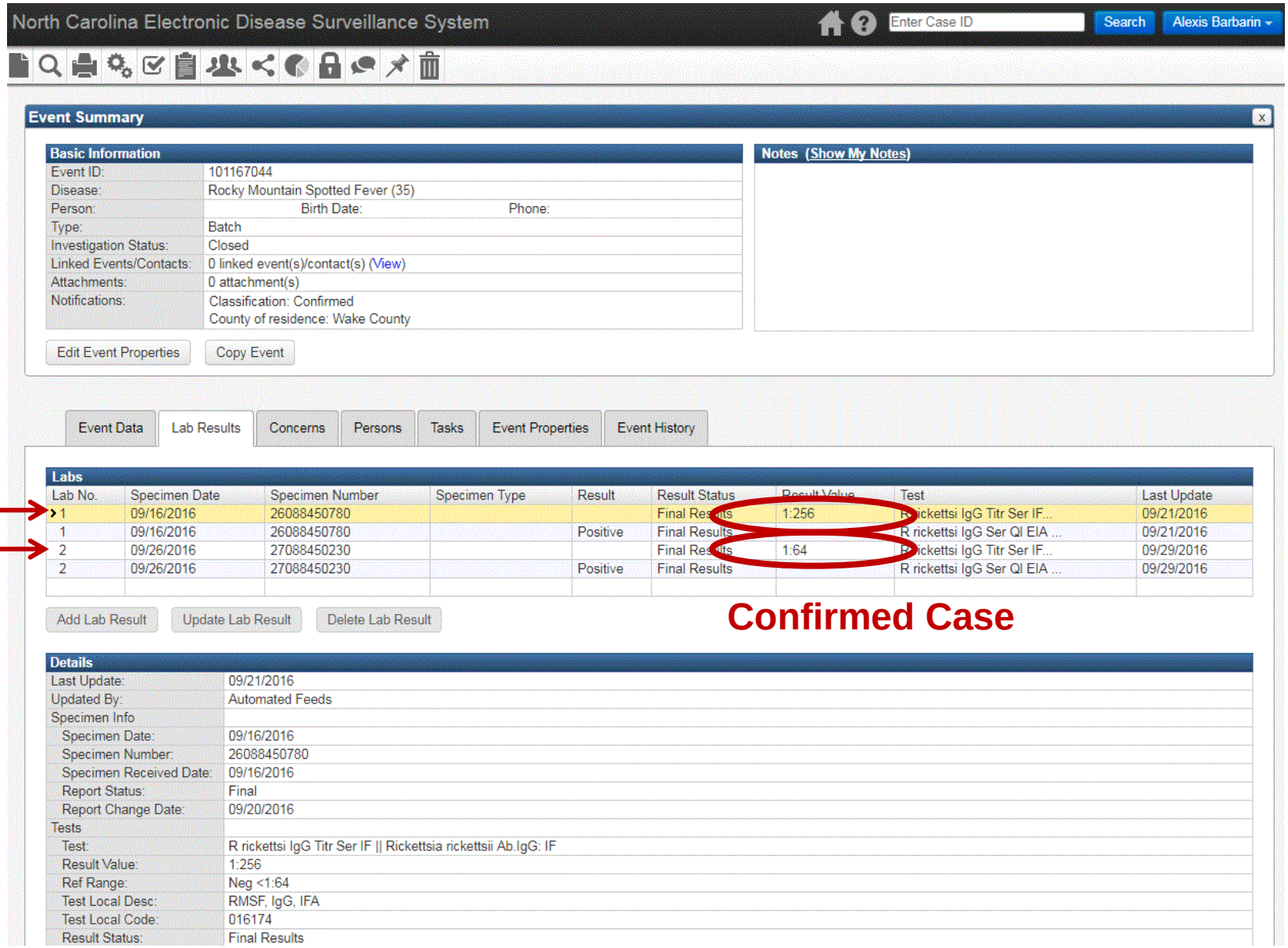
Add Lab Result | Update Lab Result | Delete Lab Result

Probable case

Details

Last Update:	07/15/2017
Updated By:	Automated Feeds
Specimen Info	
Specimen Date:	07/11/2017
Specimen Number:	19382432230
Specimen Received Date:	07/12/2017
Report Status:	Final
Report Change Date:	07/14/2017
Tests	
Test:	R rickettsi IgG Titr Ser IF || Rickettsia rickettsii Ab.IgG: IF
Result Value:	1:512
Ref Range:	Neg <1:64
Test Local Desc:	RMSF, IgG, IFA
Test Local Code:	016174

RMSF – Confirmed Case



Blank Clinical Tabs Make Me Cry

North Carolina Electronic Disease Surveillance System

Enter Case ID | Search | Alexis Barbarin

3. Clinical - - Rocky Mountain Spotted Fever (35)

[Jump To...] | Save | Save & Stay | Cancel

Expand Details

Period of Interest Timeframe

FROM (14 DAYS PRIOR TO SYMPTOM ONSET):	04/21/2017	UNTIL (SYMPTOM ONSET):	05/05/2017

General Diagnostic Information

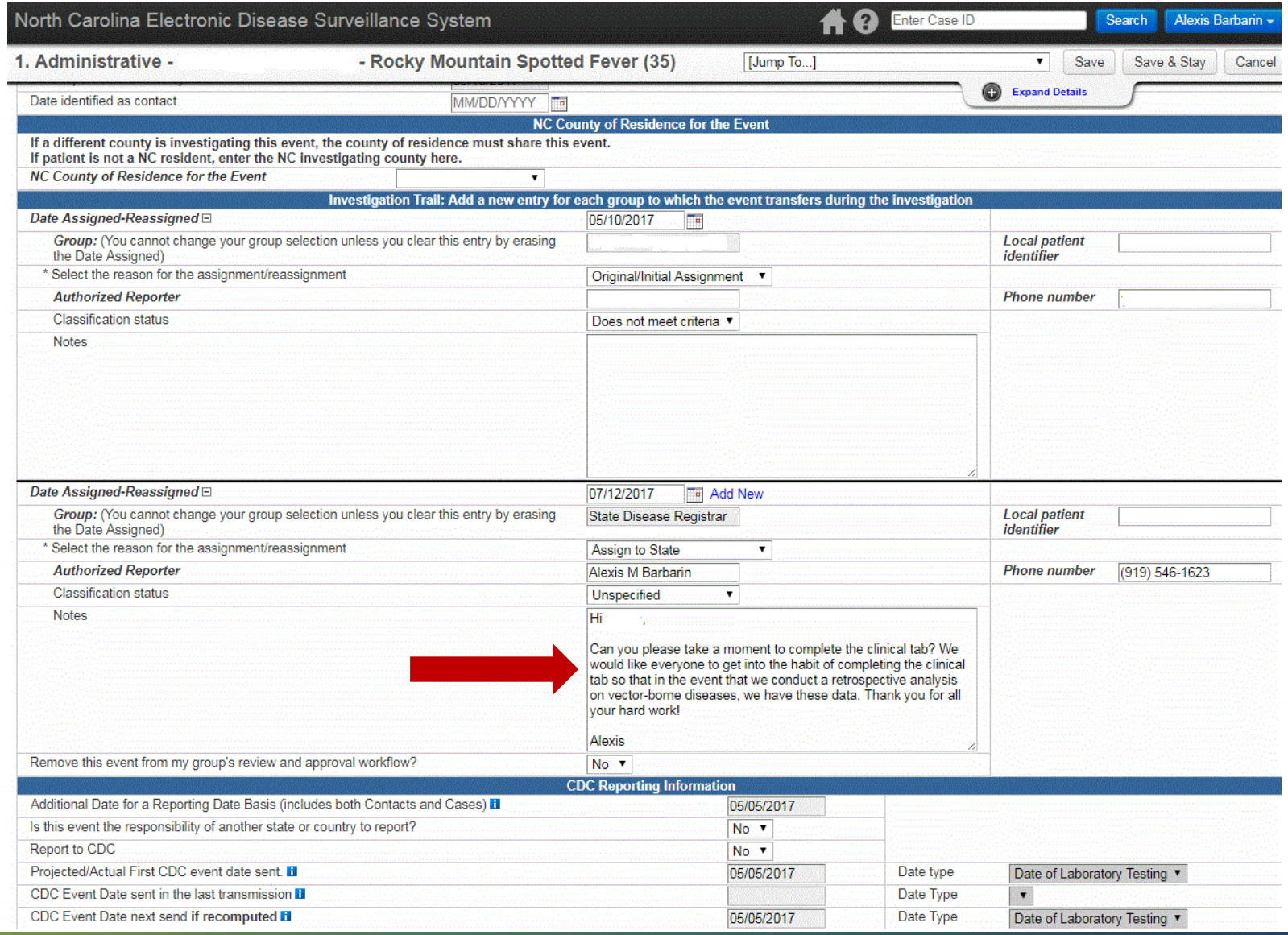
Is / was patient symptomatic for this disease?	No
Date that best reflects the earliest date of illness identification	05/05/2017
Illness identification date represents:	Date of laboratory testing

Clinical Findings (including signs, symptoms, diagnostic tests, and complications)

Indicate each of the clinical findings that the patient had associated with this illness.

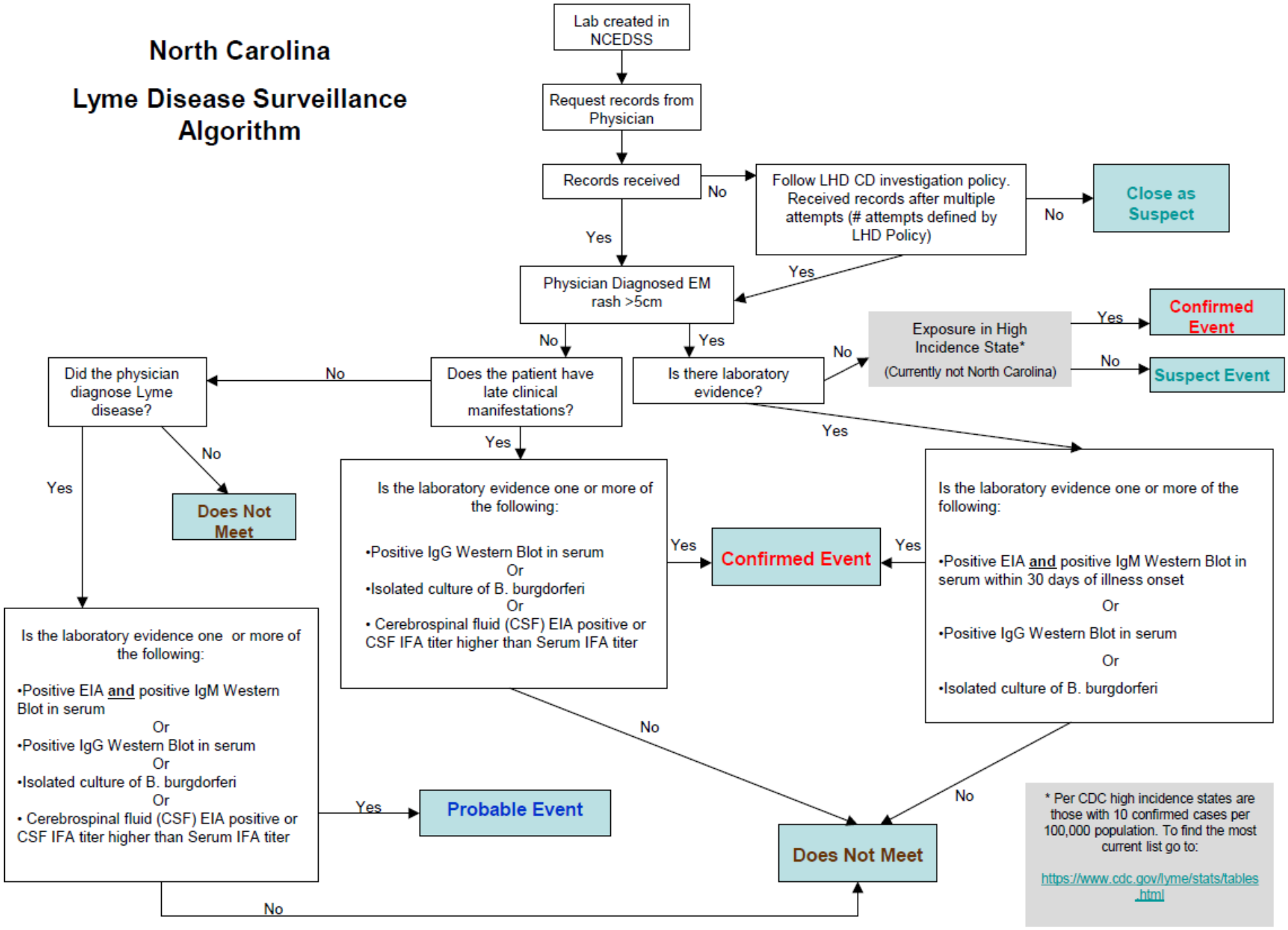
Fever	
Headache	
Muscle aches / pains (myalgias)	
Skin rash	
Acute Respiratory Distress Syndrome (ARDS)	
Elevated liver enzymes	
Acute renal failure	
Disseminated intravascular coagulation (DIC)	
Thrombocytopenia	
Leukopenia	
Anemia	
Was an IFA-IgG serologic test done?	
Was a IFA-IgM serologic test done?	
Other symptoms, signs, clinical findings, or complications consistent with this illness	
Please enter comments about signs, symptoms, and clinical findings only in this section.	

Why we need this information



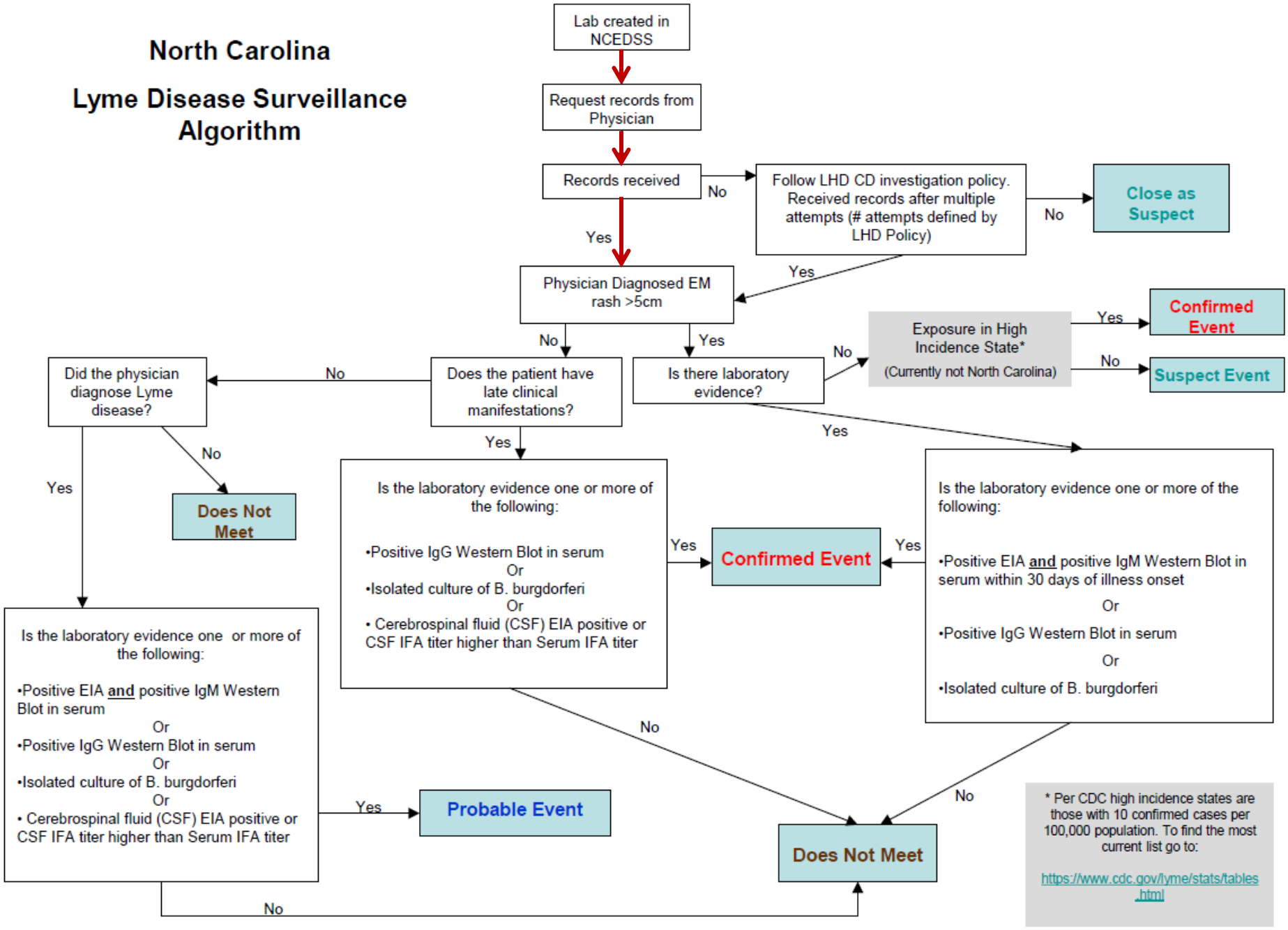
North Carolina

Lyme Disease Surveillance Algorithm

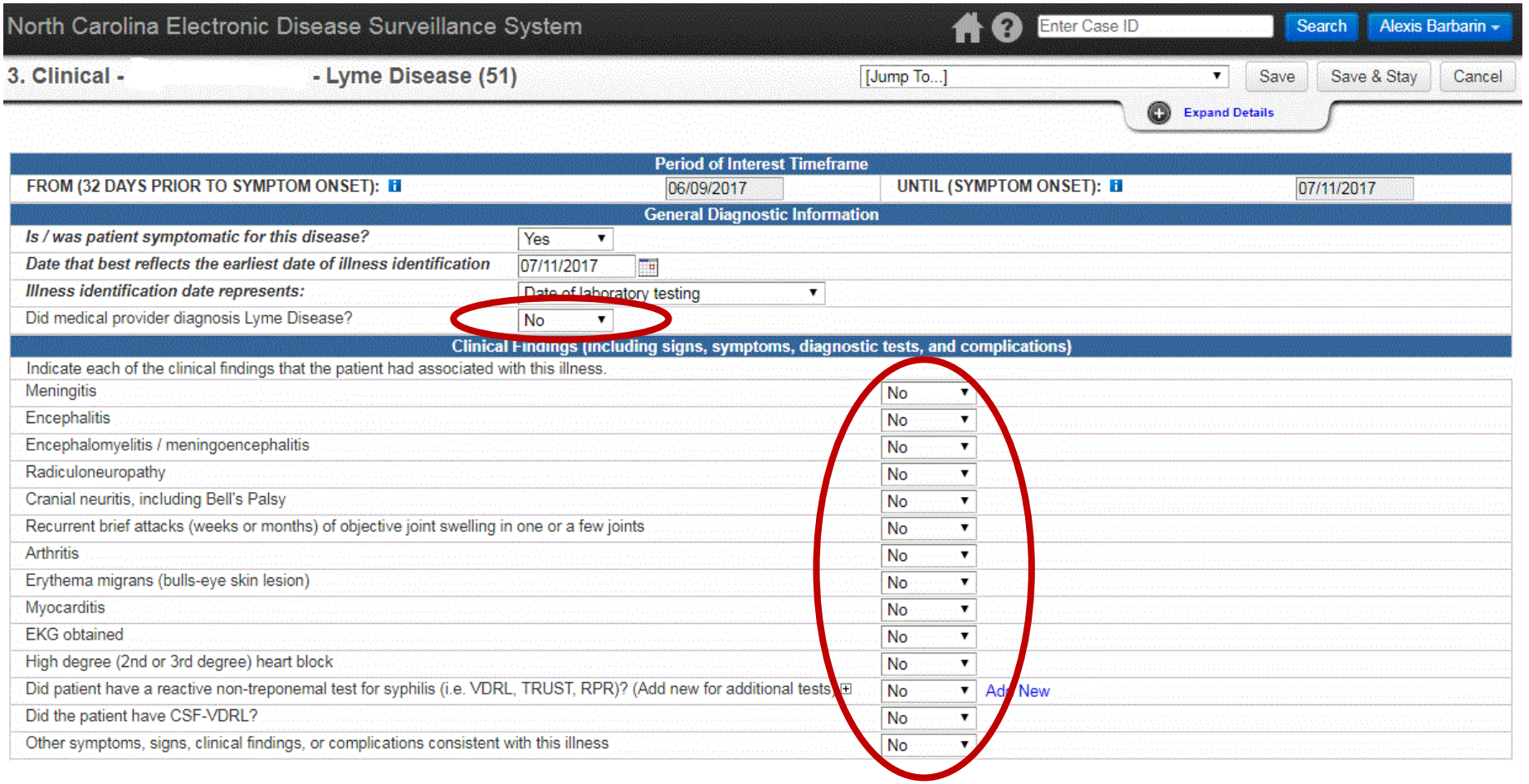


North Carolina

Lyme Disease Surveillance Algorithm

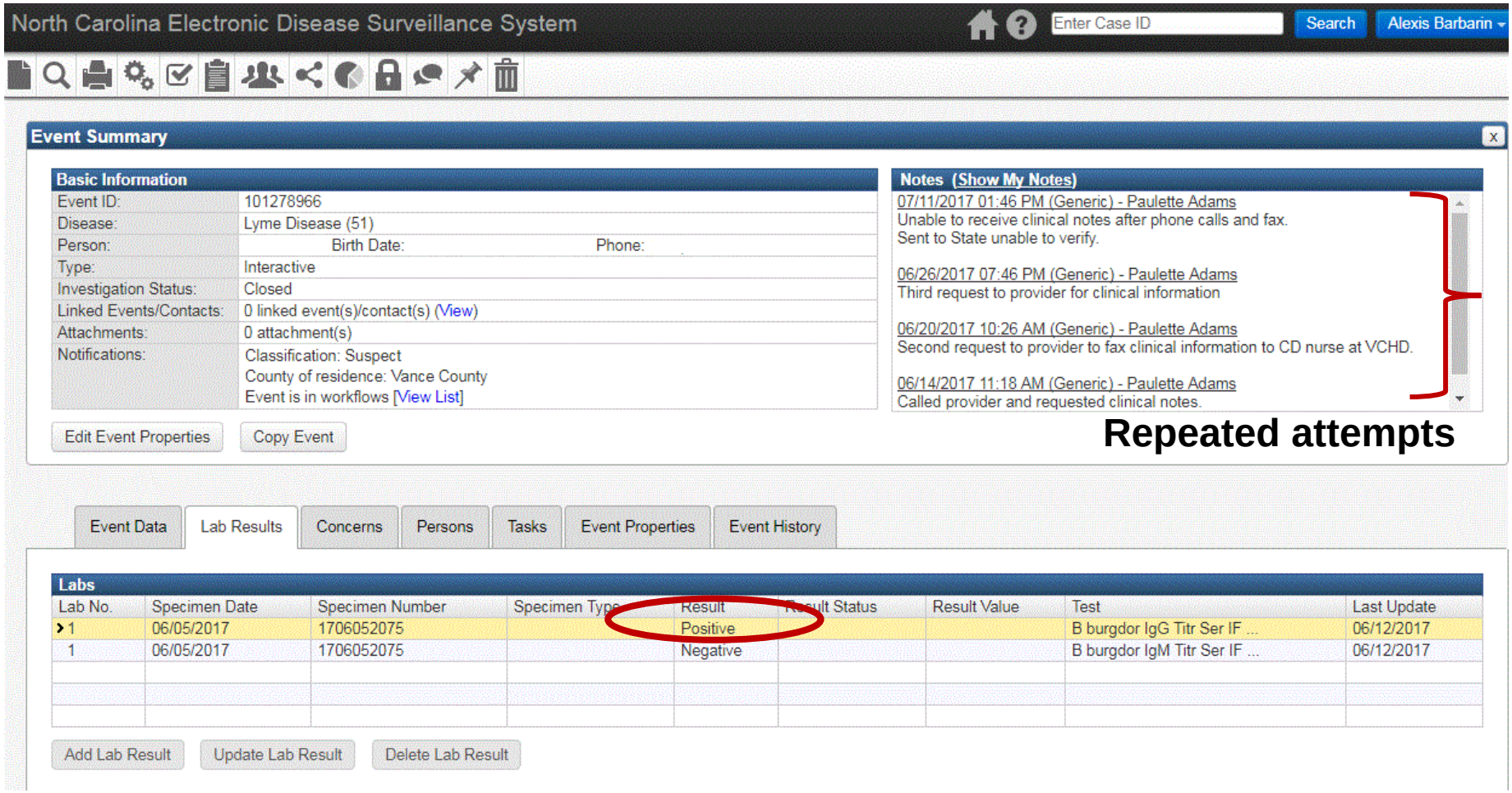


Lyme Disease – Does not meet criteria



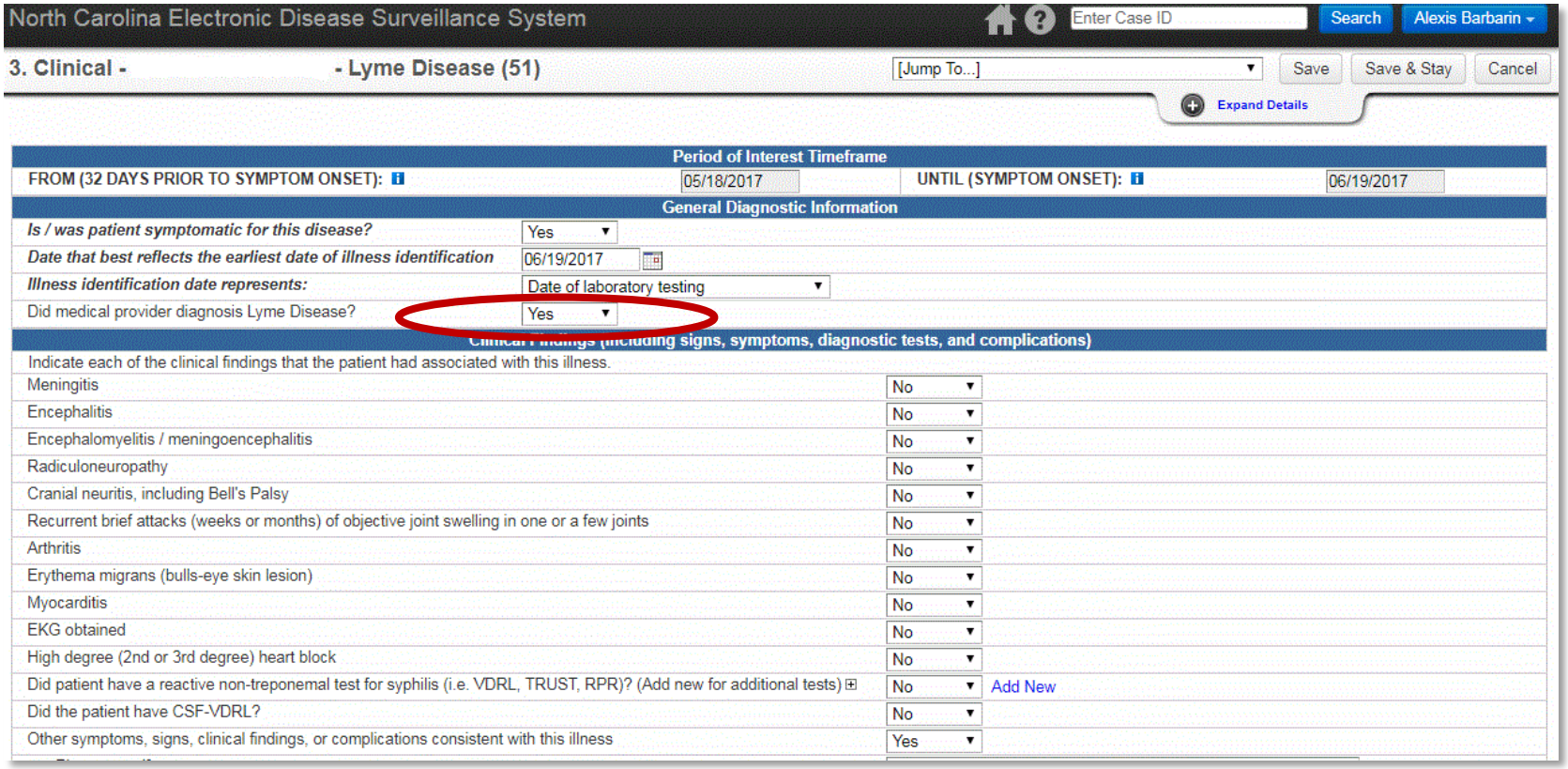
No physician's diagnosis, no clinical = Does not meet criteria

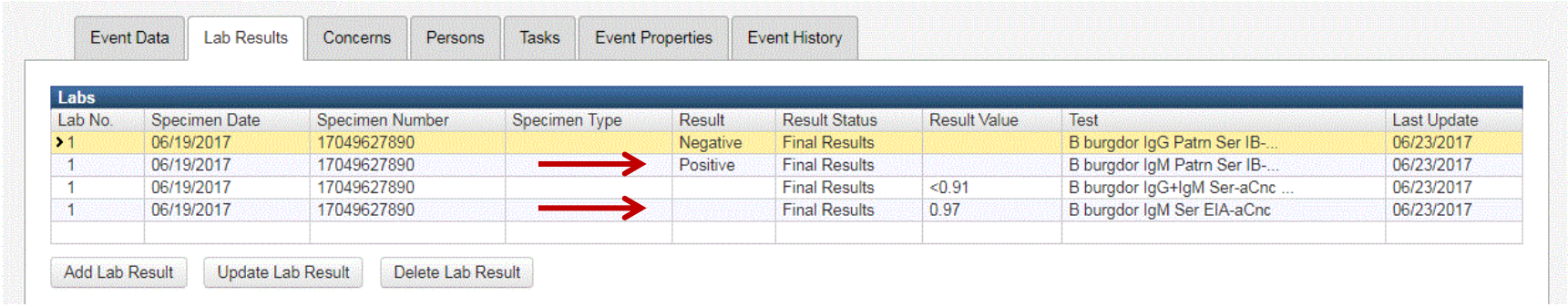
Lyme Disease - Suspect



Suspected case: a case with **no clinical information**, but has laboratory results that would otherwise make the case probable or confirmed.

Lyme Disease – Probable





Probable requires IgG (Pos) or IgM (Pos) and EIA (Equivocal or Pos)

Changes in Lyme disease case definition

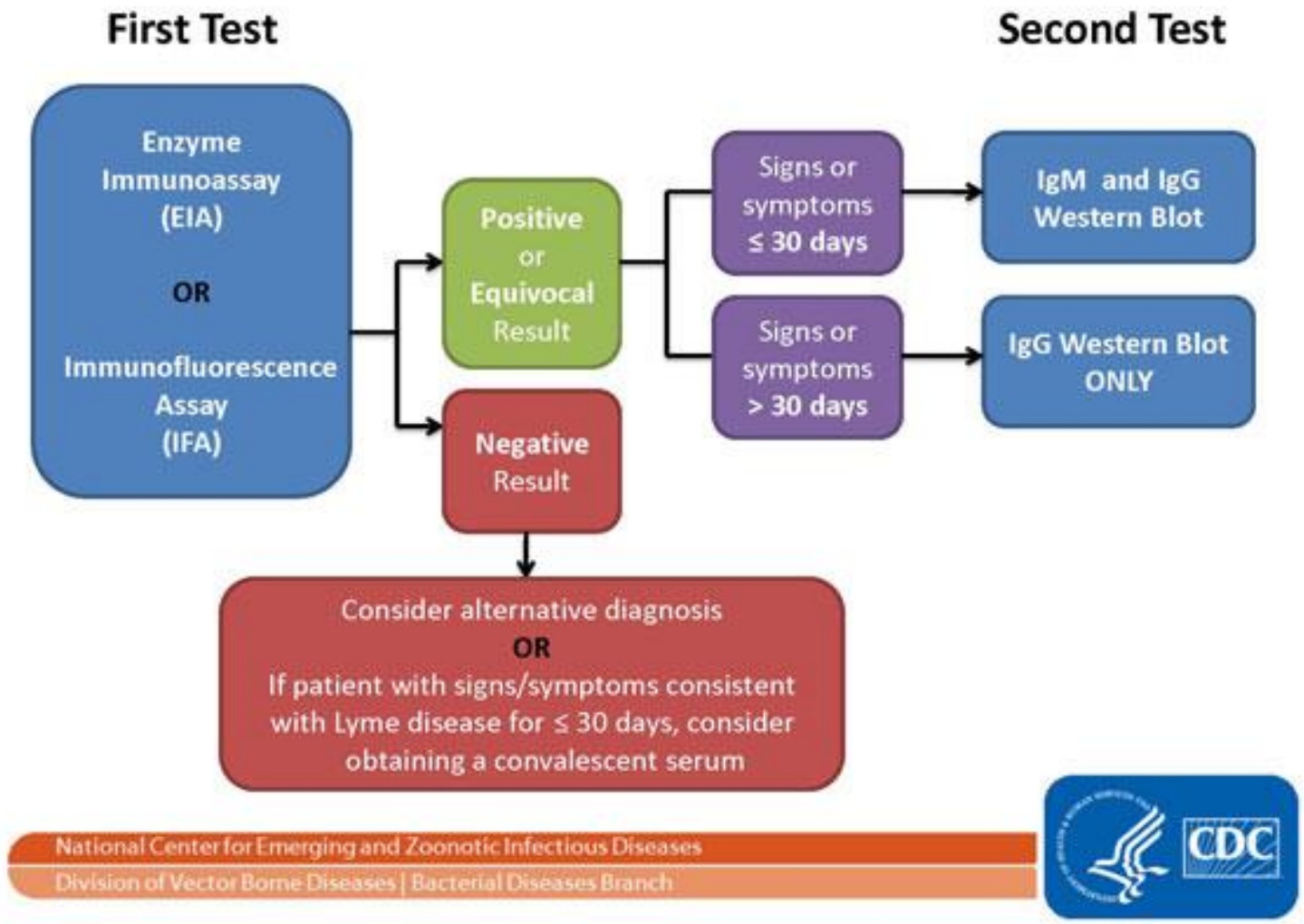
- **January 2017** – CDC amended the previous definition of exposure criteria from “endemic counties” to high and low-incidence states.
  - **High incidence states -** ≥10 confirmed cases of LD per 100,000 residents over the past 3 reporting years
  - **Low incidence states -** <10 confirmed cases per 100,000 residents over the past 3 reporting years

- Cases of Erythema Migrans (EM) alone with exposure to tick habitat in a high-incidence state are classified as **confirmed.**

- All cases of LD with late manifestations or EM in a low-incidence state must be accompanied by lab tests to meet case definition of a confirmed case.

- **As of January 2017, North Carolina is a low-incidence state.**

Two-Tiered Testing for Lyme Disease



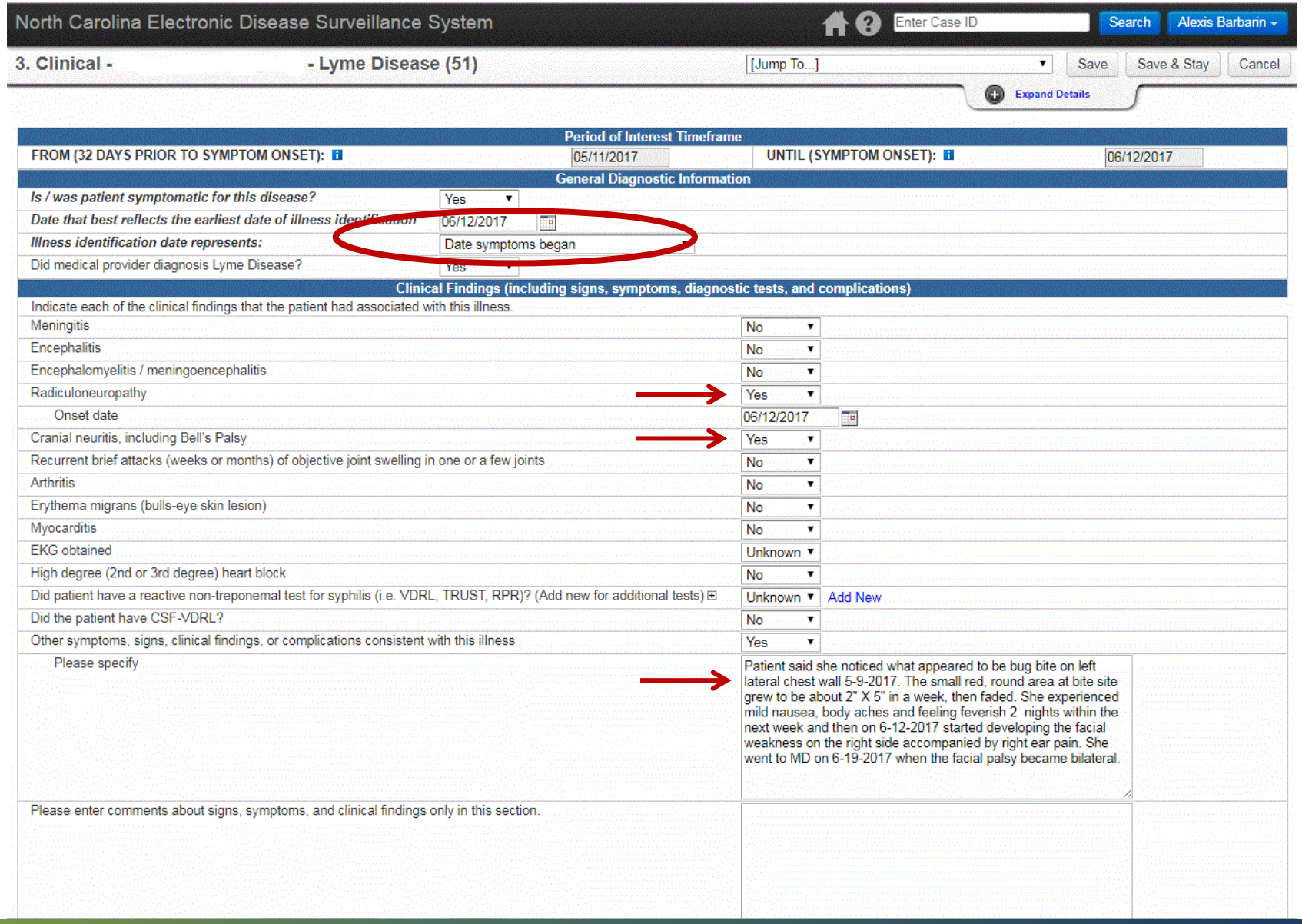
https://www.cdc.gov/lyme/healthcare/clinician_twotier.html

Lyme - Confirmed

- **Several ways to reach a confirmed case:**
  - EM rash >5cm + travel to “high incidence state”
  - EM rash >5cm + lab evidence
  - Late clinical manifestations + lab evidence

- **Lab evidence**
  - **Before 30 days:**
    - +EIA and +IgM Western Blot
    - +IgG Western Blot
    - Isolated culture of *B. burgdorferi*
  - **After 30 days:**
    - IgM no longer valid – patient should have seroconverted
    - +IgG Western Blot
    - Isolate culture of *B. burgdorferi*
    - CSF EIA positive or CSF IFA titer higher than Serum IFA titer

Lyme Disease - Confirmed



North Carolina Electronic Disease Surveillance System

Enter Case ID | Search | Alexis Barbarin

3. Clinical - - Lyme Disease (51)

[Jump To...] | Save | Save & Stay | Cancel

Expand Details

Period of Interest Timeframe

FROM (32 DAYS PRIOR TO SYMPTOM ONSET):	05/11/2017	UNTIL (SYMPTOM ONSET):	06/12/2017

General Diagnostic Information

Is / was patient symptomatic for this disease?	Yes
Date that best reflects the earliest date of illness identification	06/12/2017
Illness identification date represents:	Date symptoms began
Did medical provider diagnosis Lyme Disease?	Yes

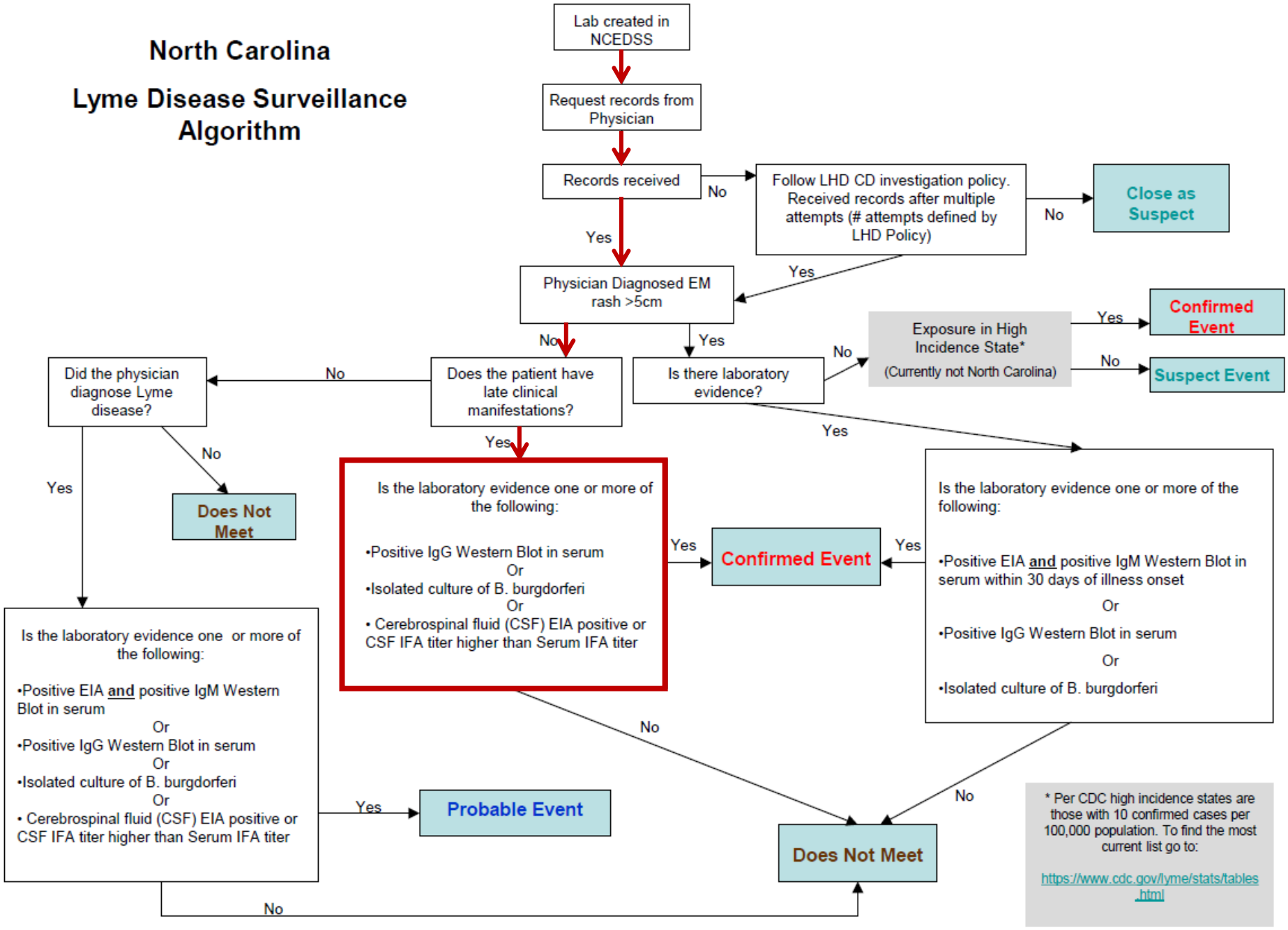
Clinical Findings (including signs, symptoms, diagnostic tests, and complications)

Indicate each of the clinical findings that the patient had associated with this illness.

Meningitis	No
Encephalitis	No
Encephalomyelitis / meningoencephalitis	No
Radiculoneuropathy	Yes
Onset date	06/12/2017
Cranial neuritis, including Bell's Palsy	Yes
Recurrent brief attacks (weeks or months) of objective joint swelling in one or a few joints	No
Arthritis	No
Erythema migrans (bulls-eye skin lesion)	No
Myocarditis	No
EKG obtained	Unknown
High degree (2nd or 3rd degree) heart block	No
Did patient have a reactive non-treponemal test for syphilis (i.e. VDRL, TRUST, RPR)? (Add new for additional tests)	Unknown Add New
Did the patient have CSF-VDRL?	No
Other symptoms, signs, clinical findings, or complications consistent with this illness	Yes
Please specify	Patient said she noticed what appeared to be bug bite on left lateral chest wall 5-9-2017. The small red, round area at bite site grew to be about 2" X 5" in a week, then faded. She experienced mild nausea, body aches and feeling feverish 2 nights within the next week and then on 6-12-2017 started developing the facial weakness on the right side accompanied by right ear pain. She went to MD on 6-19-2017 when the facial palsy became bilateral.
Please enter comments about signs, symptoms, and clinical findings only in this section.	

North Carolina

Lyme Disease Surveillance Algorithm



Event Summary

Basic Information

Event ID:	101285984
Disease:	Lyme Disease (51)
Person:	
Type:	Batch
Investigation Status:	Open
Linked Events/Contacts:	0 linked event(s)/contact(s) (View)
Attachments:	1 attachment(s) (Add) (View)
Notifications:	Classification: Unspecified County of residence: Union County Event is in workflows [View List]

Notes (Add/Edit | Show My Notes)

06/27/2017 04:04 PM (Generic) - Ashley Burts
Mom interviewed. Records attached.

Edit Event Properties | Copy Event

Event Data | Lab Results | Concerns | Persons | Tasks | Event Properties | Event History

Labs

Lab No.	Specimen Date	Specimen Number	Specimen Type	Result	Result Status	Result Value	Test	Last Update
> 1	06/22/2017	17307613360		Positive	Final Results		B burgdor IgG Patrn Ser IB-...	06/27/2017
1	06/22/2017	17307613360		Positive	Final Results		B burgdor IgM Patrn Ser IB-...	06/27/2017
1	06/22/2017	17307613360			Final Results	2.60	B burgdor IgG+IgM Ser-aCnc ...	06/27/2017
1	06/22/2017	17307613360			Final Results	2.45	B burgdor IgM Ser EIA-aCnc	06/27/2017

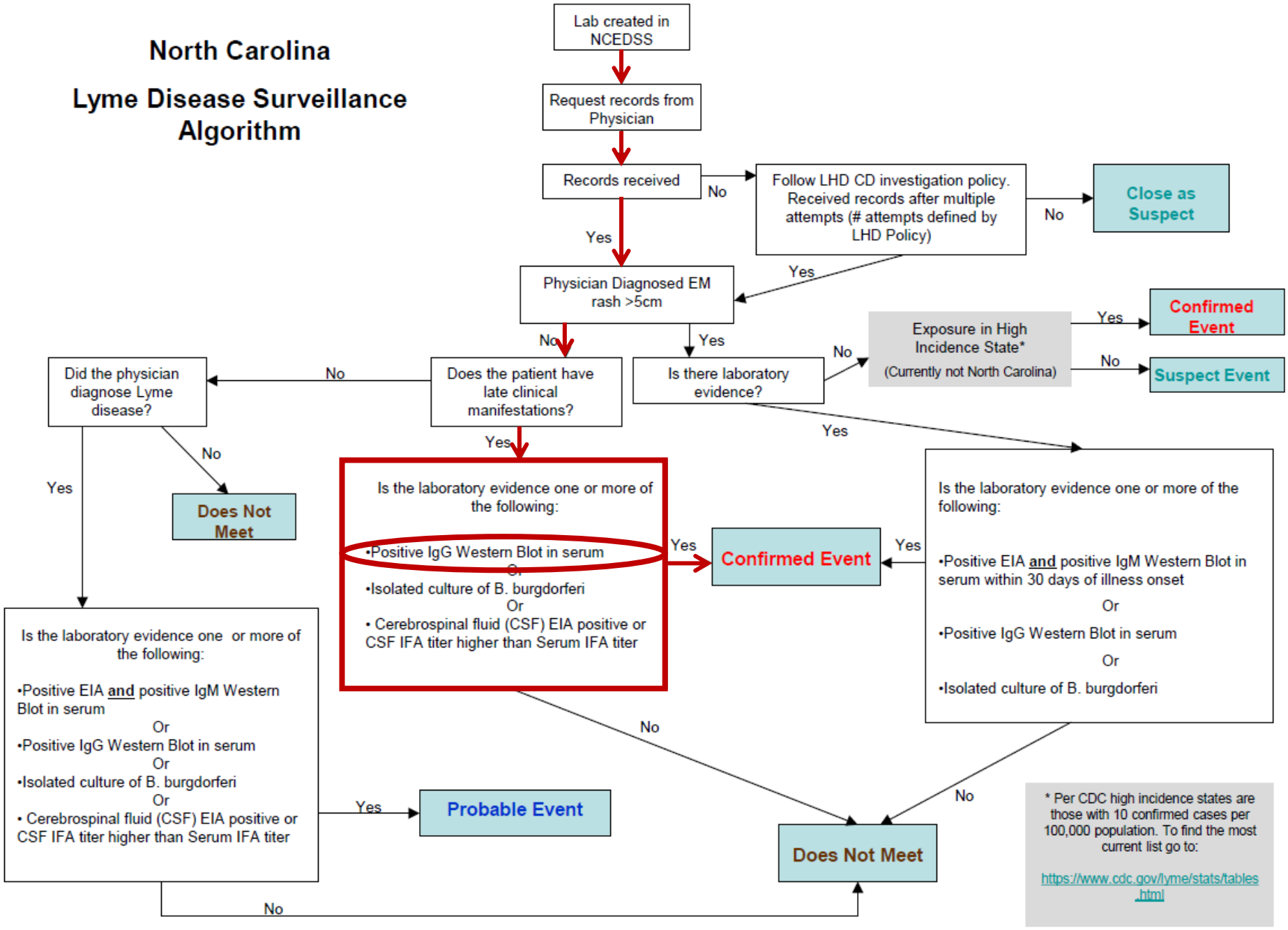
Add Lab Result | Update Lab Result | Delete Lab Result

Details

Last Update:	06/27/2017
Updated By:	Automated Feeds
Specimen Info	
Specimen Date:	06/22/2017
Specimen Number:	17307613360
Specimen Received Date:	06/22/2017
Report Status:	Final
Report Change Date:	06/26/2017
Tests	
Test:	B burgdor IgG Patrn Ser IB-Imp || Borrelia burgdorferi Ab.IgG band pattern: IB
Result:	Positive
Ref Range:	Positive: 5 of the following

North Carolina

Lyme Disease Surveillance Algorithm



A retrospective analysis of RMSF in North Carolina 2008-2016

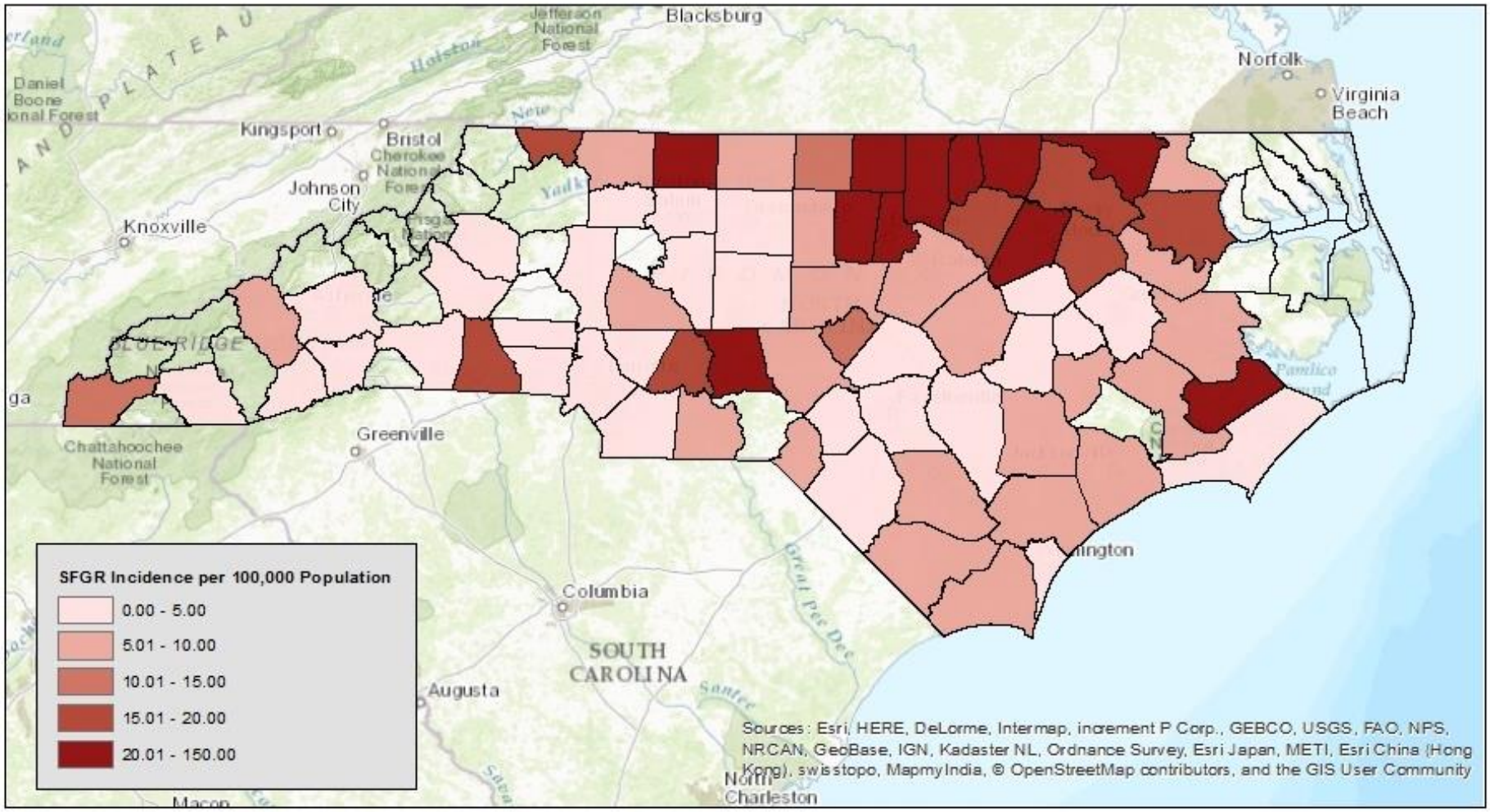
Surveillance summary of SFGR 2008-2016

Kelsey Sumner, UNC

- Which risk factors indicate whether a probable case of SFGR is actually a confirmed case?
- Which risk factors are associated with hospitalization?

- Starting data set: N=3881
- Actual data set: N=619

Spotted Fever Group Rickettsiosis Incidence
2008 to 2016
N=619



Questions?

Alexis M. Barbarin, PhD
Public Health Entomologist
Alexis.Barbarin@dhhs.nc.gov
(919) 546-1623

Michael Doyle, MS
Public Health Entomologist
Michael.doyle@dhhs.nc.gov
(919) 546-1637

Carl Williams, DVM
State Public Health Veterinarian
Carl.Williams@dhhs.nc.gov
(919) 546-1660

Autumn Locklear, MPH
Zika Screening Coordinator
Autumn.Locklear@dhhs.nc.gov
(919) 546-1614

Ronna Chan, PhD.
Zika Registry Coordinator
Ronna.Chan@dhhs.nc.gov
(919) 546-1638