



NC DEPARTMENT OF **HEALTH AND HUMAN SERVICES**

ROY COOPER • Governor

MANDY COHEN, MD, MPH • Secretary

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Division of Public Health

Developed by the North Carolina Division of Public Health, Communicable Disease Branch

Ehrlichiosis Surveillance from 2014—2019

Background

Ehrlichiosis is a general name to describe several bacterial infections caused by *Ehrlichia spp.* including *E. chaffeensis*, *E. ewingii*, or *E. muris eauclairensis*. Ehrlichiae are transmitted to humans through the bite of an infected tick. In North Carolina, the most common vector of ehrlichiosis is the lone star tick, *Amblyomma americanum*. Like other tickborne illnesses, Ehrlichiosis can be prevented; it is a serious illness that can be fatal if not promptly treated.

Symptomology

Symptoms of ehrlichiosis typically appear within 1-2 weeks following a tick bite. While there are a number of symptoms, the combination of symptoms can vary from person to person. Symptoms may include fever, headache, fatigue, chills, malaise, muscle aches, nausea, vomiting, diarrhea, confusion, conjunctivitis (red eyes), and a rash. Rashes can be present in up to 60% of children and fewer than 30% of adults.

Epidemiology

National

Incidence varies considerably by geographic area. Ehrlichiosis is most frequently reported in the southeastern and south-central US. In 2018, four states accounted for 50% of all reported cases of Ehrlichiosis: Missouri, Arkansas, New York, and Virginia.¹ The number of reported ehrlichiosis cases has increased since it was added to the National Notifiable Conditions list in 1998; the case fatality rate continues to hover around 1% annually. The national average incidence of ehrlichiosis in 2015 was 0.42 cases per 100,000.²

North Carolina

The number of reported confirmed and probable cases of ehrlichiosis has gradually increased from 2015 to 2019. The highest incidence of ehrlichiosis typically occurs during the months of June and July. The 5-year average incidence rate of ehrlichiosis in North Carolina from 2014-2018 was 0.66 confirmed and probable cases per 100,000 residents, which is marginally higher than the national average. The incidence rate of ehrlichiosis in North Carolina in 2019 was 1.52 cases per 100,000 (based on 2018 population data).

Diagnosis

Diagnosis of ehrlichiosis is often difficult because symptoms vary from patient to patient and are non-specific, making it difficult to distinguish from other illnesses. Serological and Polymerase Chain Reaction (PCR) tests can be used to confirm clinical diagnosis. However, serological tests are often negative during the acute phase of illness; healthcare providers should use their judgement, and can treat patients empirically based on the symptoms above.

Prevention

Reducing exposure to ticks is the best defense against ehrlichiosis. There are a number of methods that can be used to prevent tickborne illness:

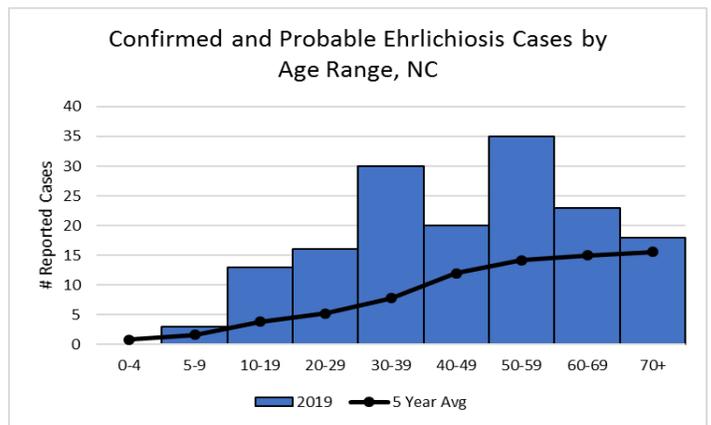
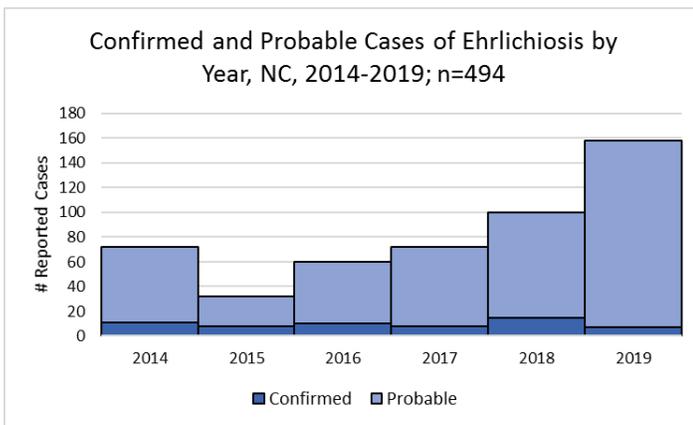
- Wear permethrin treated clothing (0.5%) when exploring the outdoors.
- Use Environmental Protection Agency (EPA) registered insect repellents containing DEET or picaridin to deter ticks.
- Avoid contact with ticks by avoiding wooded and brushy areas with high grasses and leaf litter; instead, walk in the center of trails.
- Check clothing and skin for ticks you may have encountered while outdoors; shower soon after returning indoors.

Case Demographics (Confirmed and Probable)

Gender	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
Male	55	66%	87	55%
Female	29	34%	71	45%

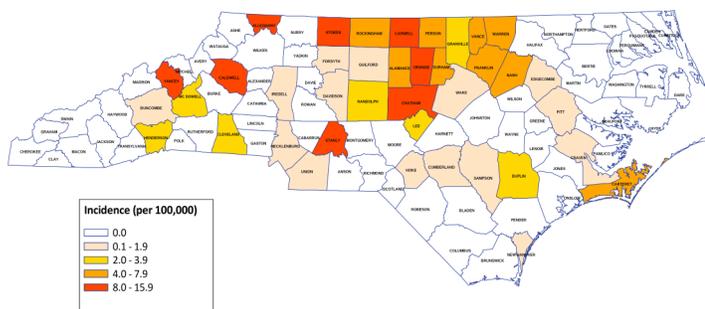
Race	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
White	45	59%	68	43%
Black or African American	11	15%	14	9%
Native Hawaiian or Pac. Islander	0	0%	0	0%
Amer. Indian or Alaskan	<1	< 1%	0	0%
Asian	<1	1%	1	<1%
Other	1	2%	2	1%
Unknown	19	23%	73	46%

Hispanic Ethnicity	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
Yes	2	3%	10	6%
No	42	56%	113	72%
Unknown	31	41%	35	22%



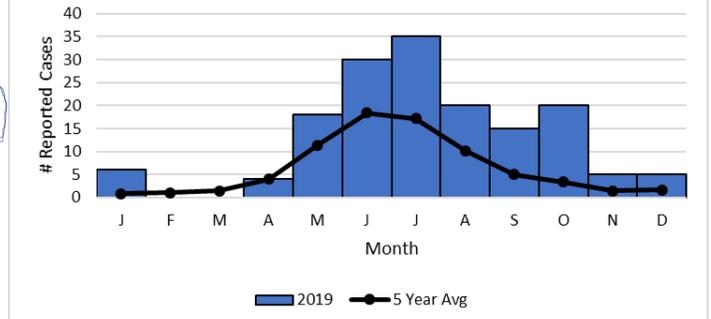
Geographic Distribution

Confirmed and Probable Incidence of Ehrlichiosis Cases by County of Residence, NC, 2019



Cases by Age

Confirmed and Probable Ehrlichiosis Cases by Month of Illness Onset, NC



¹Data are based on a national surveillance data found at: <https://www.cdc.gov/ehrlichiosis/stats/index.html>

²Data are based on a national surveillance data found at: https://www.cdc.gov/mmwr/volumes/64/wr/mm6453a1.htm?s_cid=mm6453a1_w

³View NC Disease Statistics here: <https://public.tableau.com/profile/nc.cdb#!/vizhome/NCD3NorthCarolinaDiseaseDataDashboard/DiseaseMapsandTrends>



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Lyme Disease Surveillance Summary from 2014—2019

Background

Lyme disease is a bacterial infection caused by *Borrelia burgdorferi*, and is transmitted to humans and animals through the bite of infected *Ixodes scapularis* (blacklegged) ticks. Symptoms of Lyme disease include fever, headache, fatigue, and a characteristic bull's-eye rash called erythema migrans (EM). If left untreated, infection can spread to the joints, heart, and nervous system. Diagnosis is based on the presence of symptoms, clinical findings (like an EM rash), exposure to ticks, and serological testing. Most cases of Lyme disease are effectively treated with antibiotics. The best way to mitigate Lyme disease is prevention.

Symptomology

Early signs of Lyme disease include fever, chills, headache, fatigue, muscle and joint aches, swollen lymph nodes, and EM rash. It is important to note that an EM rash only occurs in 70-80% of patients, and can take up to 30 days to appear. Untreated Lyme disease can cause a variety of symptoms including severe headaches and neck stiffness, additional EM rashes, arthritis with severe joint pain and swelling, particularly in the knees and other large joints, facial palsy and heart conditions associated with Lyme carditis.

Epidemiology

National

Reported cases of Lyme disease are centered in the Northeast and upper Midwest of the United States, with 96% of cases reported from 14 states: Connecticut, Delaware, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia and Wisconsin. The average incidence rate of Lyme disease between 2013-2016 was 8.1 cases per 100,000 residents, with incidence rates of the highest states reaching >50 cases per 100,000.* The national incidence rate in 2018 was 7.2 cases per 100,000 residents.

North Carolina

In North Carolina, the reported number of confirmed and probable cases of Lyme disease has increased over the past five years. The highest incidence of Lyme disease in 2019 is clustered to the northwestern portion of the state, particularly in Ashe, Alleghany, Surry, Stokes, Watauga, and Yancey counties.** The 5-year average incidence rate of Lyme disease in North Carolina from 2014-2018 was 2.41 confirmed and probable cases per 100,000 residents. The incidence of Lyme disease in 2019 was 3.30 cases per 100,000 residents (using 2018 population data).

Diagnosis

Lyme disease can be physician diagnosed based on the symptoms outlined above, a history of tick exposure and serological testing. Serological blood tests are effective when used correctly and performed with validated methods. Lab tests are not recommended for patients who do not have symptoms of typical Lyme disease to avoid both misdiagnosis and the treatment of Lyme disease when the true cause of illness may be something else.

Prevention

Reducing exposure to ticks is the best defense against Lyme disease. There are a number of methods that can be used to prevent tickborne illness:

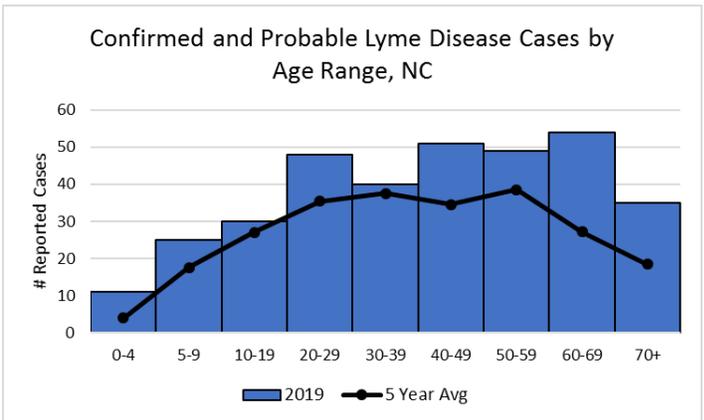
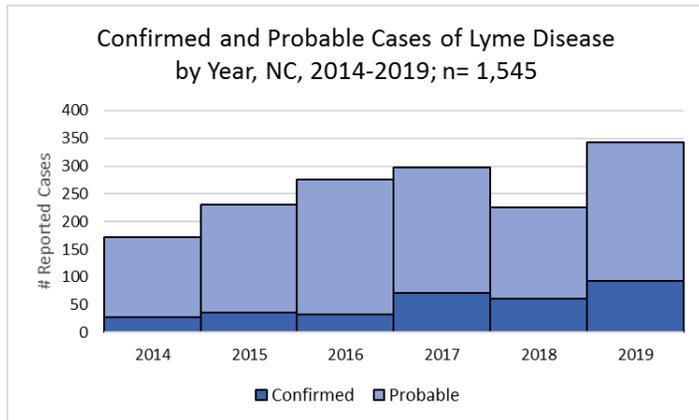
- Wear permethrin treated clothing (0.5%) when exploring the outdoors.
- Use Environmental Protection Agency (EPA) registered insect repellents containing DEET or picaridin to deter ticks.
- Avoid ticks in wooded/brushy areas with high grasses and leaf litter by walking in the center of trails.
- Check clothing and skin for ticks you may have encountered while outdoors; shower soon after returning indoors.

Case Demographics (Confirmed and Probable)

Gender	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
Male	114	48%	173	50%
Female	126	52%	170	50%

Race	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
White	119	53%	170	50%
Black or African American	8	4%	16	5%
Asian or Pac. Islander	1	< 1%	1	< 1%
American Indian or Alaskan	0	< 1%	0	0%
Other	2	< 1%	2	< 1%
Unknown	92	41%	154	44%

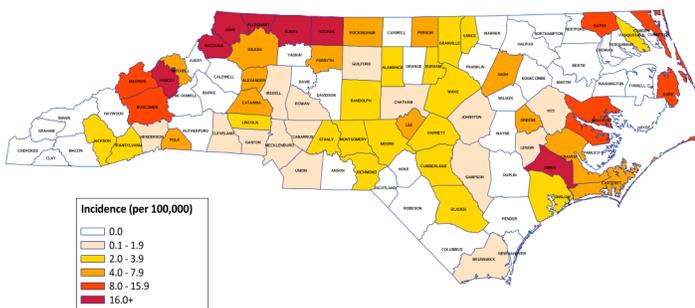
Hispanic Ethnicity	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
Yes	5	2%	7	2%
No	119	51%	162	47%
Unknown	109	47%	174	51%



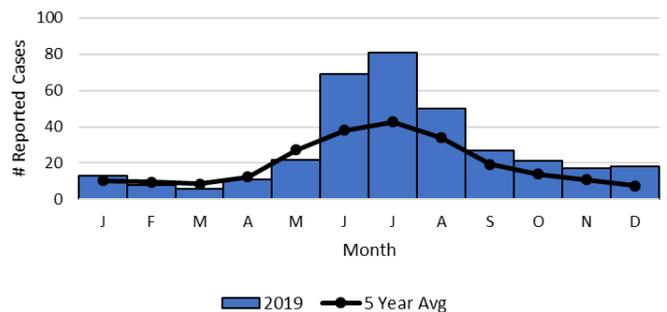
Geographic Distribution

Cases by Age

Confirmed and Probable Incidence of Lyme Disease Cases by County of Residence, NC, 2019



Confirmed and Probable Lyme diseases cases by Month of Illness Onset, NC



*These data are based on a national surveillance data found at: https://www.cdc.gov/mmwr/volumes/64/wr/mm6453a1.htm?s_cid=mm6453a1_w

** CDC Case Definition for Lyme Disease: <https://wwwn.cdc.gov/nndss/conditions/lyme-disease/case-definition/2017/>

View NC Disease Statistics here: <https://public.tableau.com/profile/nc.cdb#!/vizhome/NCD3NorthCarolinaDiseaseDataDashboard/DiseaseMapsandTrends>



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Spotted Fever Group Rickettsiosis Surveillance Summary from 2014—2019

Background

Spotted fever group rickettsioses (SFGR), including Rocky Mountain spotted fever, are a group of bacterial infections caused by *Rickettsia* spp. including *R. rickettsia* and *R. parkeri*. Spotted fevers are transmitted to humans through the bite of an infected tick. In North Carolina the most common vectors of spotted fevers include the American dog tick, *Dermacentor variabilis*, the Rocky Mountain wood tick, *D. andersoni*, and the Lone star tick, *Amblyomma americanum*. The brown dog tick, *Rhipicephalus sanguineus* has been implicated in transmission in other parts of the US. If left untreated, illness can become serious, even leading to death.

Symptomology

Early signs of SFGR are non-specific, including fever and headache. Symptoms may appear 3–12 days following a tick bite. Other signs and symptoms can include nausea, vomiting, stomach pain, muscle pain, lack of appetite, and rash. Rash is a common sign among those infected with *R. rickettsii*, the causative agent of Rocky Mountain spotted fever (RMSF), and usually develops 2-4 days following fever onset. Rashes can look like red splotches or pinpoint dots.

Epidemiology

National

Incidence varies considerably by geographic area. From 2008-2012, 63% of reported SFGR cases originated from five states: Arkansas, Missouri, North Carolina, Oklahoma, and Tennessee¹. Thousands of cases of SFGR occur every year, but it is unknown how many cases are RMSF. Case fatality rates vary annually, but have decreased overall from 28% in 1944 to < 1% in 2001. The national average incidence of SFGR in 2015 was 1.31 cases per 100,000.¹

North Carolina

The number of confirmed and probable cases of spotted fever rickettsiosis has remained stable in North Carolina over the past five years. The highest incidence of SFGR is clustered around central and eastern North Carolina. The 5-year average incidence rate of SFGR in North Carolina from 2014-2018 was 4.85 confirmed and probable cases per 100,000 residents, which is higher than the national average². The incidence of SFGR in North Carolina in 2019 was 6.59 cases per 100,000 residents (using 2018 population data).

Diagnosis

Delay in diagnosis and treatment is the most important factor associated with poor outcomes, and early treatment based on clinical impression is the best way to prevent RMSF progression. Both acute and convalescent serum specimens are needed to confirm the rickettsial infection. Serological tests are often negative during the acute phase of illness, however, physicians may diagnose patients based on the symptoms outlined above. In January 2020, the case definition of SFGR was amended to require an elevated IgG antibody titer of >1:128 within 60 days of illness onset³.

Prevention

Reducing exposure to ticks is the best defense against SFGR. There are a number of methods that can be used to prevent tickborne illness:

- Wear permethrin treated clothing (0.5%) when exploring the outdoors.
- Use EPA registered insect repellents containing DEET or picaridin to deter ticks.
- Avoid ticks in wooded/brushy areas with high grasses and leaf litter by walking in the center of trails.
- Check clothing and skin for ticks you may have encountered while outdoors; shower soon after returning indoors.

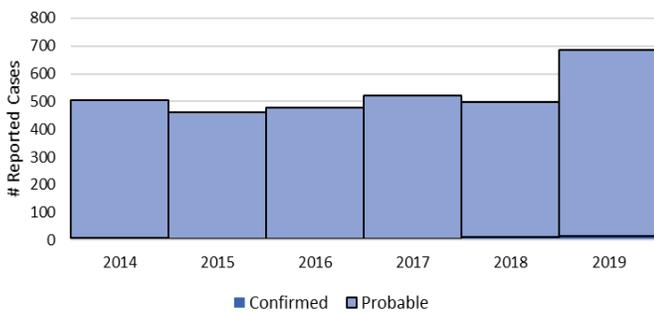
Case Demographics

Gender	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
Male	342	70%	453	66%
Female	150	30%	232	34%

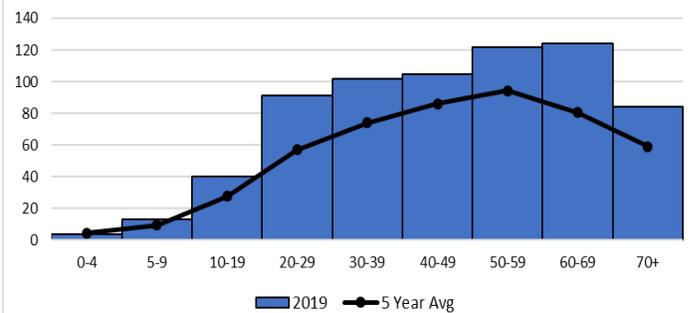
Race	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
White	271	56%	410	62%
Black or African American	32	7%	38	6%
Native Hawaiian or Pacific Islander	1	< 1%	0	0%
Amer. Indian or Alaskan	1	< 1%	0	0%
Asian	1	< 1%	6	< 1%
Other	4	< 1%	19	3%
Unknown	179	37%	192	29%

Hispanic Ethnicity	5 Year Avg (2014-18)		2019	
	No. of Cases	% of total	No. of Cases	% of total
Yes	12	3%	28	4%
No	252	55%	380	57%
Unknown	195	42%	257	39%

Confirmed and Probable Spotted Fever Group Rickettsiosis by Year, NC, 2014-2019; n= 3,150

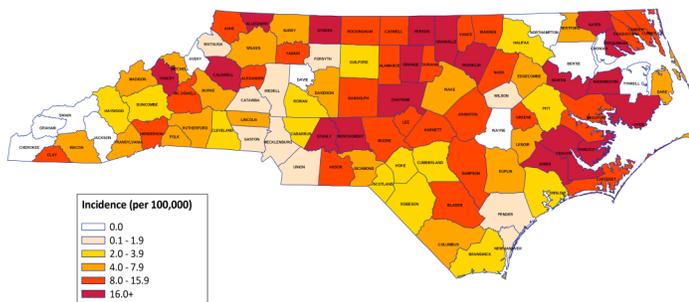


Confirmed and Probable Spotted Fever Group Rickettsiosis by Age Range, NC



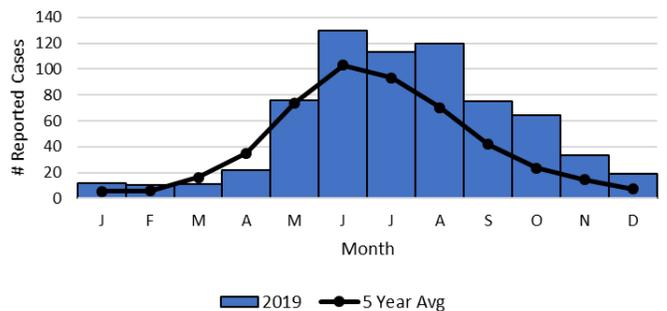
Geographic Distribution

Confirmed and Probable Incidence of Spotted Fever Group Rickettsiosis Cases by County of Residence, NC, 2019



Cases by Age

Confirmed and Probable Spotted Fever Group Rickettsiosis cases by Month of Illness Onset, NC



¹Data are based on a national surveillance data found at: https://www.cdc.gov/mmwr/volumes/64/wr/mm6453a1.htm?s_cid=mm6453a1_w

²View NC Disease Statistics here: <https://public.tableau.com/profile/nc.cdb#!/vizhome/NCD3NorthCarolinaDiseaseDataDashboard/DiseaseMapsandTrends>

³CDC Spotted Fever Group Rickettsiosis Case Definition: <https://www.cdc.gov/nndss/conditions/spotted-fever-rickettsiosis/case-definition/2020/>