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

Ehrlichiosis Surveillance from 2015—2020

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 less 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 of confirmed and probable cases in 2019 was 0.65 cases per 100,000.[2]

North Carolina
The number of reported confirmed and probable cases of ehrlichiosis has gradually increased between 2015 and 2020. 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 between 2015—2019 was 0.65 confirmed and probable cases per 100,000 residents, which is comparable to the national average. The incidence rate of ehrlichiosis in North Carolina in 2020 was 1.00 cases per 100,000 (based on 2019 population data). The decline in Ehrlichiosis cases in 2020 may be linked to the large number of events that were closed as "suspect." Suspected events occur when a patient has a positive laboratory test, but no accompanying clinical data can be gathered.

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 to 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:
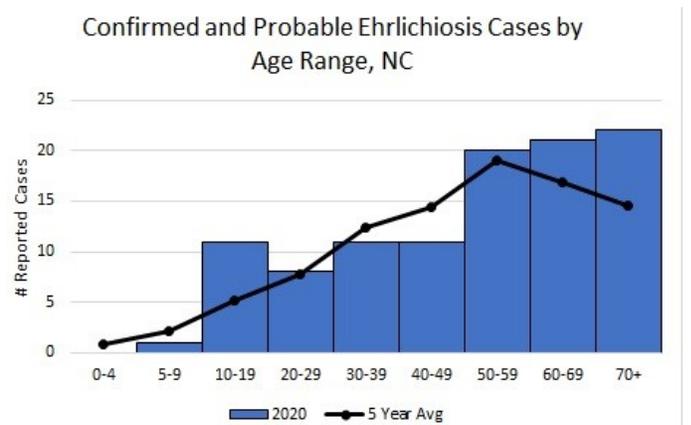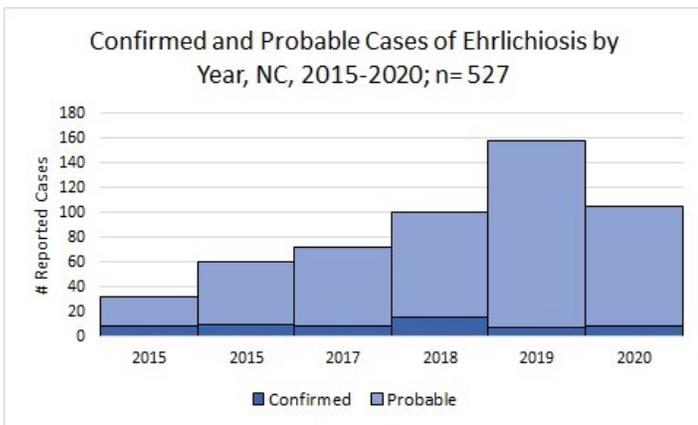- Wear permethrin treated clothing (0.5%) when exploring the outdoors.
- Use Environmental Protection Agency (EPA) registered insect repellents containing DEET or picaridin to deter ticks.
- Avoid contact with ticks by avoiding wooded and brushy areas with high grasses and leaf litter and walking in 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 (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
Male	*63*	*61.9%*	49	*46.6%*
Female	39	*38.1%*	56	*53.4%*

Race	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
White	56.4	60.6%	74	70.5%
Black or African American	10.8	11.6%	12	11.4%
Native Hawaiian or Pac. Islander	0	0%	0	0%
Amer. Indian or Alaskan	0	0.0%	0	0.0%
Asian	2	2.1%	1	<1%
Other	3	3.2%	5	4.7%
Unknown	20.8	22.3%	13	12.4%

Hispanic Ethnicity	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
Yes	4	4.70%	4	3.8%
No	57	61.50%	79	75.2%
Unknown	31	33.80%	22	21.0%

Confirmed and Probable Cases of Ehrlichiosis by Year, NC, 2015-2020; n= 527

Confirmed and Probable Ehrlichiosis Cases by Age Range, NC

Geographic Distribution

Cases by Age

Confirmed and Probable Incidence of Ehrlichiosis Cases by County of Residence, NC, 2020

Incidence (per 100,000)
- 0.0
- 0.1 - 1.9
- 2.0 - 3.9
- 4.0 - 7.9
- 8.0 - 15.9
- 16.0+

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

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

[2]Data are based on a national surveillance data found at: https://wonder.cdc.gov/nndss/static/2019/annual/2019-table2f.html

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

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

Lyme Disease Surveillance Summary from 2015—2020

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.

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 15 states designated as high incidence states: Connecticut, Delaware, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, and Wisconsin. The reported average incidence rate of Lyme disease between 2013—2016 was 8.1 **confirmed** cases per 100,000 residents, with incidence rates of the highest states reaching >50 cases per 100,000.[1] The reported national incidence rate in 2019 was 7.1 **confirmed** cases per 100,000 residents.[2]

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 2020 is largely clustered to the northwestern portion of the state, particularly in Ashe, Alleghany, Buncombe, Madison, Mitchell, Surry, Wilkes, and Yancey counties.[3] The 5-year reported average incidence rate of Lyme disease in North Carolina between 2015—2019 was 2.67 **confirmed and probable** cases per 100,000 residents, which is significantly lower than the national average. The estimated incidence of Lyme disease in 2020 was 2.59 **confirmed and probable** cases per 100,000 residents (2019 population data). The decline in Lyme cases in 2020 may be linked to the large number of events that were closed as "suspect." Suspected events occur when a patient has a positive laboratory test, but no accompanying clinical data can be gathered.

Diagnosis

Lyme disease can be physician diagnosed based on the symptoms outlined above, a history of tick exposure and serological testing. Serological tests are effective when used correctly. A positive two-tier test, defined as a positive or equivocal enzyme immunoassay (EIA) or immunofluorescent assay (IFA) followed by a positive Immunoglobulin M[1] (IgM) or Immunoglobulin G[2] (IgG) western immunoblot (WB) can help to determine active infection. Lab tests are not recommended for patients who do not have symptoms of typical Lyme disease.

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 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.
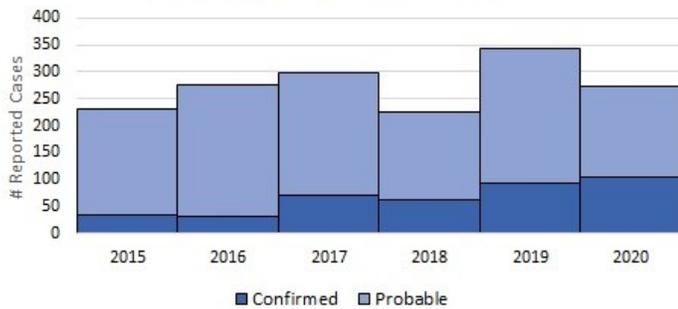
Case Demographics (Confirmed and Probable)

Sex	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
Male	134	48.7%	130	47.8%
Female	141	51.3%	142	52.2%

Race	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
White	133	52.0%	165	60.7%
Black or African Amer.	9	3.5%	5	1.8%
Asian or Pac. Islander	1	0.4%	2	0.7%
Amer. Indian or Alaskan	0	0.0%	0	0.0%
Other	2	0.8%	2	0.7%
Unknown	111	43.4%	98	36.0%

Hispanic Ethnicity	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
Yes	5	2.04%	4	1.5%
No	133	50.19%	153	56.3%
Unknown	127	47.92%	115	42.3%

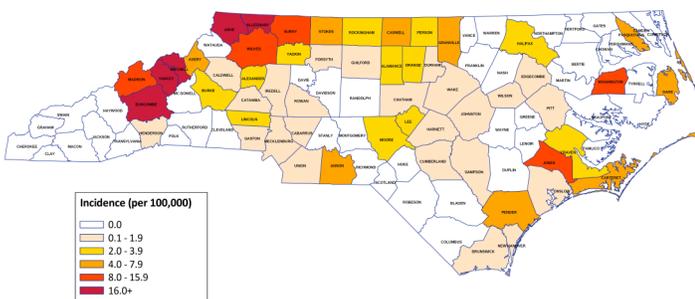Confirmed and Probable Cases of Lyme Disease by Year, NC, 2015-2020; n= 1645

Confirmed and Probable Lyme Disease Cases by Age Range, NC
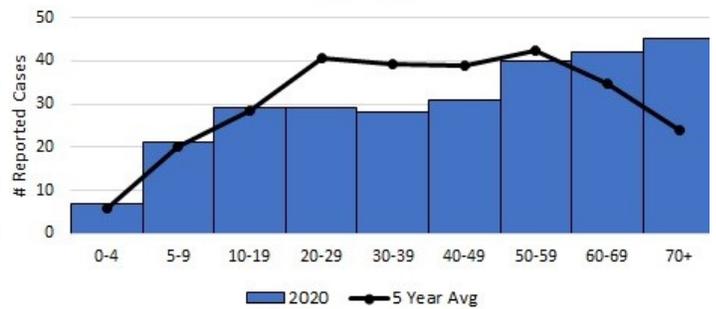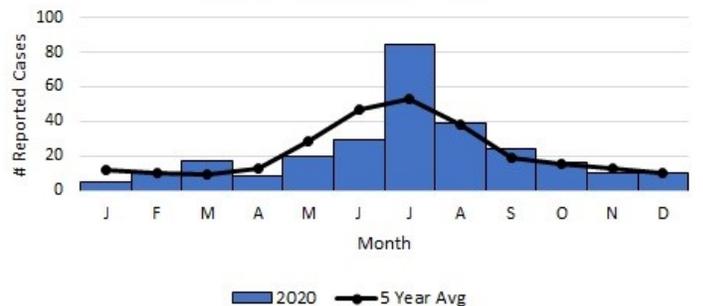
Geographic Distribution

Confirmed and Probable Incidence of Lyme Disease Cases by County of Residence, NC, 2020

Cases by Age

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

[1]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

[2]CDC Lyme Disease Data Tables: https://www.cdc.gov/lyme/stats/tables.html

[3]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

NC DEPARTMENT OF
HEALTH AND
HUMAN SERVICES

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

Spotted Fever Group Rickettsiosis Surveillance Summary from 2015—2020

Background

Spotted fever group rickettsioses (SFGR), including Rocky Mountain spotted fever, are a group of bacterial infections caused by *Rickettsia spp.* including *R. rickettsii* and *R. parkeri, among others*. 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 (may be present or absent). 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. Between 2008-2012, 63% of reported SFGR cases originated from five states: Arkansas, Missouri, North Carolina, Oklahoma, and Tennessee[1]. Thousands of cases of SFGR occur every year, but it is unknown how any 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 **confirmed and probable** SFGR cases in 2019 was 1.59 cases per 100,000.[2]

North Carolina

The number of confirmed and probable cases of spotted fever rickettsiosis decreased significantly in North Carolina in 2020. 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 onset[3], which resulted in a sharp decrease in SFGR cases nationwide. The decline in SFGR cases in 2020 may also be linked to the large number of events that were closed as "suspect." Suspected events occur when a patient has a positive laboratory test, but no accompanying clinical data can be gathered. The 5-year average incidence rate of SFGR in North Carolina between 2015—2019 was 5.15 **confirmed and probable** cases per 100,000 residents, which is higher than the national average[2]. The incidence of **confirmed and probable** SFGR cases in North Carolina in 2020 was 1.81 cases per 100,000 residents (using 2019 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.

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

Sex	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
Male	*360*	*68.2%*	114	*60%*
Female	168	*31.8%*	76	*40%*

Race	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
White	293	56.3%	127	66.8%
Black or African Amer.	31.2	6.0%	13	6.8%
Native Hawaiian or Pacific Islander	0.2	0.0%	0	0.0%
Amer. Indian or Alaskan	1	0.2%	0	0.0%
Asian	2	0.4%	2	1.1%
Other	7.2	1.4%	6	3.2%
Unknown	186	35.7%	42	22.1%

Hispanic Ethnicity	5 Year Avg (2015-19)		2020	
	No. of Cases	*% of total*	No. of Cases	*% of total*
Yes	15	3.0%	5	2.6%
No	277	55.6%	120	63.2%
Unknown	206	41.4%	65	34.2%

Confirmed and Probable Spotted Fever Group Rickettsiosis by Year, NC, 2015-2020; n= 2,834
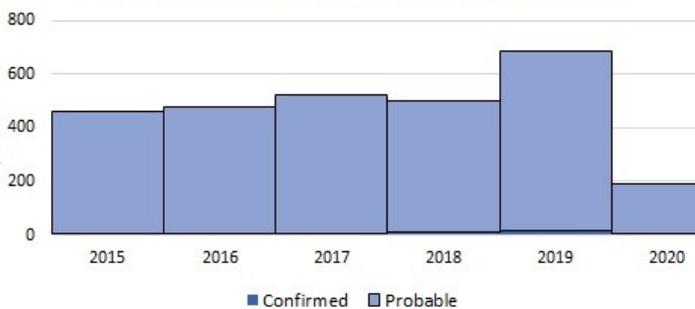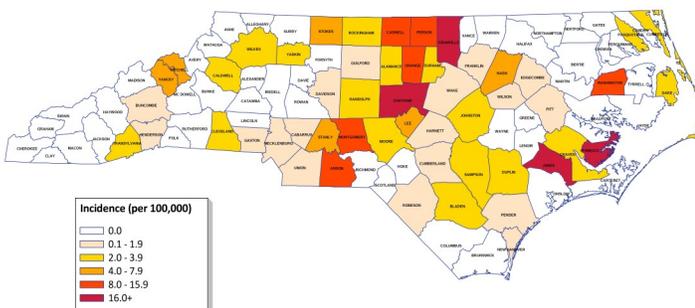

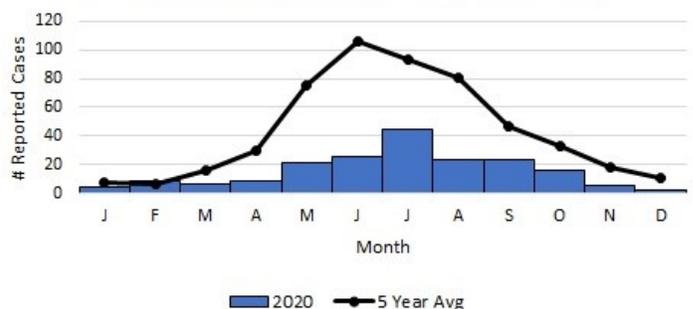Confirmed and Probable Spotted Fever Group Rickettsiosis by Age Range, NC
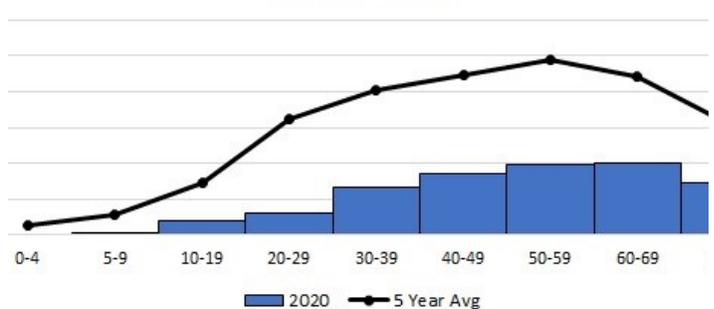
Geographic Distribution

Confirmed and Probable Incidence of Spotted Fever Group Rickettsiosis Cases by County of Residence, NC, 2020

Incidence (per 100,000)
- 0.0
- 0.1 - 1.9
- 2.0 - 3.9
- 4.0 - 7.9
- 8.0 - 15.9
- 16.0+

Cases by Age

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

[1] Rocky Mountain Spotted Fever Facts: https://www.cdc.gov/ticks/tickbornediseases/rmsf.html

[2] Data are based on a national surveillance data found at: https://wonder.cdc.gov/nndss/static/2019/annual/2019-table2p-H.pdf

[3] CDC Spotted Fever Group Rickettsiosis Case Definition: https://wwwn.cdc.gov/nndss/conditions/spotted-fever-rickettsiosis/case-definition/2020/