



# Vaccine-Preventable Diseases Reported in North Carolina, 2021

Controlling vaccine-preventable diseases (VPDs) requires the consistent, concerted and coordinated efforts of public health agencies and healthcare providers to rapidly identify and report suspected cases and swiftly implement control measures. Although many VPDs remain at or near record low levels, maintaining high immunization rates is still critical to prevent reemergence. This annual surveillance report summarizes 13 VPDs reported in North Carolina during 2021 in the table below. Additional details about diseases for which cases were reported are presented on subsequent pages.

**Surveillance Highlights:** In North Carolina, hepatitis A increased significantly compared to the average of the previous five years (2016-2021) due to an ongoing outbreak among users of injection and non-injection drugs and persons experiencing homelessness. Case numbers for several diseases were lower than the five-year average, likely influenced by the COVID-19 pandemic. Pertussis decreased significantly compared to the five-year average. Varicella became a reportable disease in North Carolina during mid-2020. No cases of diphtheria, measles, polio, rubella, congenital rubella syndrome, or tetanus were reported.

**Report Specifications.** Notable information about this report includes:

- Cases presented include those classified as confirmed or probable.
- Case counts are based on the earliest date of illness identification which is typically the onset date. Therefore, case counts in this report may differ slightly from those included in national summaries which can be based on other dates such as date of initial report or the date when cases were closed and reported to the Centers for Disease Control and Prevention (CDC).
- Unless otherwise noted, ages are based on the date when the case was entered in the North Carolina Electronic Disease Surveillance System.
- Incidence rates are based on data obtained from the U.S. census population estimates project. Rates for 2021 were calculated using 2021 population estimates. Note that estimates of rates based on a small number of cases are unstable and can fluctuate widely. Therefore, these estimates should be interpreted with caution. Ninety-five percent confidence intervals are shown for demographic-specific rates.
- The 13 VPDs summarized in this report are shown in the table below. Data for other VPDs such as influenza and hepatitis B are shown in separate reports.

| Number of Cases of VPDs Reported in North Carolina, 2016-2021 |      |      |      |      |      |                            |      |                     |
|---|------|------|------|------|------|----------------------------|------|---------------------|
| Disease   | 2016 | 2017 | 2018 | 2019 | 2020 | Previous five-year average | 2021 | Significant Change* |
| Diphtheria  | 0    | 0    | 0    | 0    | 0    | 0                          | 0    | --                  |
| <i>Haemophilus influenzae</i> , invasive disease              | 180  | 206  | 209  | 241  | 129  | 193                        | 110  | --                  |
| Hepatitis A   | 52   | 30   | 101  | 162  | 509  | 171                        | 945  | ↑                   |
| Measles   | 1    | 0    | 3    | 0    | 0    | 1                          | 0    | --                  |
| Meningococcal invasive disease                                | 5    | 9    | 9    | 9    | 7    | 8                          | 9    | --                  |
| Mumps   | 35   | 37   | 12   | 89   | 21   | 39                         | 2    | --                  |
| Pertussis   | 300  | 430  | 385  | 496  | 191  | 360                        | 52   | ↓                   |
| Pneumococcal meningitis                                       | 30   | 52   | 44   | 54   | 22   | 40                         | 25   | --                  |
| Polio   | 0    | 0    | 0    | 0    | 0    | 0                          | 0    | --                  |
| Rubella   | 0    | 0    | 0    | 0    | 0    | 0                          | 0    | --                  |
| Congenital rubella syndrome                                   | 0    | 0    | 0    | 0    | 0    | 0                          | 0    | --                  |
| Tetanus   | 0    | 3    | 3    | 0    | 0    | 1                          | 0    | --                  |
| Varicella   | n/a  | n/a  | n/a  | n/a  | 13   | --                         | 32   | --                  |

\* ↑ = significant increase ( $\geq 2$  standard deviations above average) ↓ = significant decrease ( $\geq 2$  standard deviations below average) -- = no significant change

## ***Haemophilus influenzae*, invasive disease**

### **Background**

*Haemophilus influenzae* can cause a variety of clinical syndromes, including invasive diseases like bacteremia, pneumonia, meningitis, and epiglottitis. *H. influenzae* organisms are divided into serotypes a, b, c, d, e, and f, based on proteins found in the capsule that surrounds the organism. Strains without a capsule are called non-typeable. All serotypes, including non-typeable serotypes, can cause invasive disease and are reportable in North Carolina. *Haemophilus influenzae* serotype b (Hib) is the most virulent and is the only serotype for which there is a vaccine.

*H. influenzae* is often part of the normal respiratory flora. Carriage of Hib has dramatically decreased due to vaccination, but non-typeable strains can be found in the nose and throat of up to 80% of the population. It is transmitted from person to person by respiratory droplets. *H. influenzae* is not carried by animals and does not persist for long in the environment.

Hib was the leading cause of bacterial meningitis in children under 5 years of age before vaccine was available. Approximately 4-5% of Hib meningitis cases were fatal, and 20% of children who survived had complications such as hearing loss or developmental delays. Hib meningitis and other invasive Hib infections are now rare in the United States since the introduction of Hib vaccine into the routine childhood immunization series.

### **Immunization**

The first conjugate Hib vaccine was licensed in 1987. Hib vaccine is currently a recommended routine childhood vaccine in the United States. Infants should receive 3 or 4 doses (depending on the type of vaccine) by 15 months of age. There are no vaccines for non-b or nontypeable *H. influenzae*.

### **Epidemiology**

#### National

The rate of Hib disease has decreased by greater than 99% in children since 1987, while rates in adults have remained the same. Rates of Hib among Alaska Native populations remain higher than the rest of the United States. The success of the vaccine has caused a shift in the epidemiology of *H. influenzae*. The majority of invasive *H. influenzae* infections are now caused by nontypeable strains and primarily affect children under 5 years of age and adults over 65 years of age.

#### North Carolina

The number of invasive *H. influenzae* cases in North Carolina decreased for the second consecutive year. In 2021, 110 cases were reported, which is fewer than half the number of cases that were reported just two years before. It is possible that the COVID-19 pandemic affected *H. influenzae* surveillance and testing procedures, although the exact cause of the large decrease in cases during 2020 and 2021 is unknown.

Just one case of invasive *H. influenzae* reported in 2021 was type b. The large majority cases in North Carolina were caused by nontypeable strains. The age group most affected in North Carolina reflects the national trend; adults aged 50 years and older made up 65% of cases.

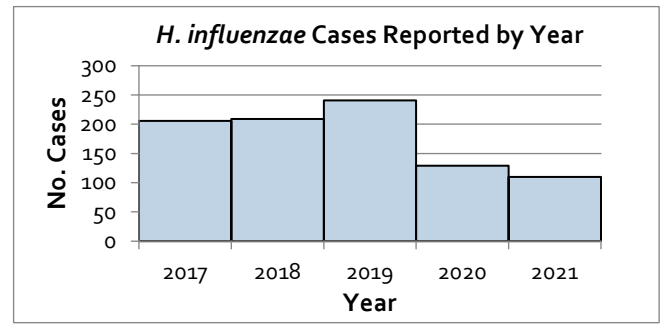
### **Outbreaks**

No outbreaks of invasive *H. influenzae* were reported in North Carolina during 2021.

# Haemophilus influenzae , invasive disease, 2021

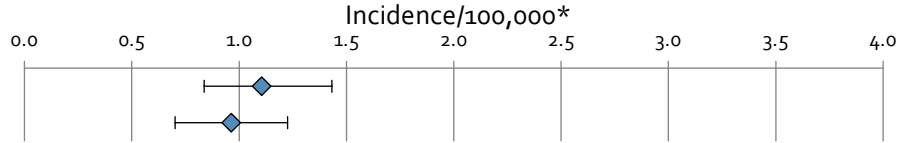
## Annual Summary

|                     | 2017              | 2018 | 2019 | 2020 | 2021 |     |
|---------------------|-------------------|------|------|------|------|-----|
| Incidence / 100,000 | 2.1               | 2.1  | 2.4  | 1.3  | 1.1  |     |
| No. cases           | 206               | 209  | 241  | 129  | 110  |     |
| Serotypes           | type b, <5 years  | 0%   | 0%   | 0%   | 0%   |     |
|                     | type b, ≥ 5 years | 1%   | 0%   | 0%   | 0%   |     |
|                     | non-b, typeable   | 19%  | 16%  | 17%  | 22%  | 25% |
|                     | nontypeable       | 65%  | 70%  | 68%  | 66%  | 56% |
|                     | unknown           | 16%  | 14%  | 15%  | 12%  | 18% |

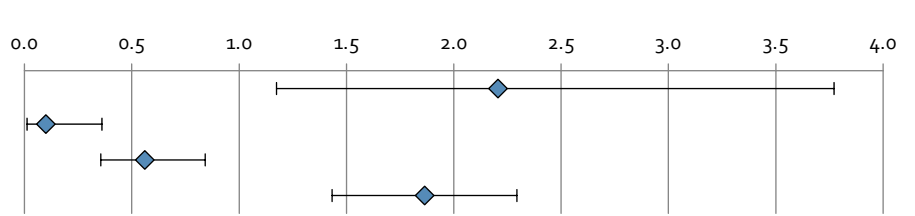


## Case Demographics, 2021

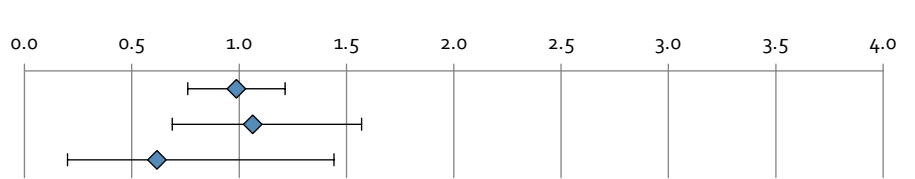
| Sex     | No. cases | % of total | Incidence/100,000 |
|---------|-----------|------------|-------------------|
| Male    | 57        | 52%        | 1.1               |
| Female  | 52        | 47%        | 1.0               |
| Unknown | 1         | 1%         | --                |



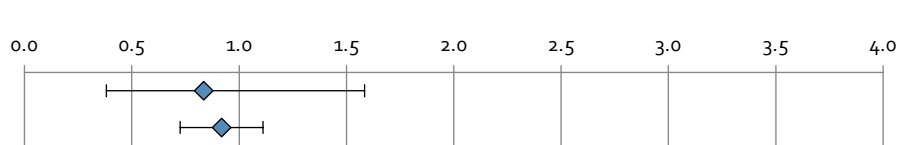
| Age Group    | No. cases | % of total | Incidence/100,000 |
|--------------|-----------|------------|-------------------|
| Under 5 yrs. | 13        | 12%        | 2.2               |
| 5-19 yrs.    | 2         | 2%         | 0.1               |
| 20-49 yrs.   | 23        | 21%        | 0.6               |
| 50+ yrs.     | 72        | 65%        | 1.9               |
| Unknown      | 0         | 0%         | --                |



| Race                | No. cases | % of total | Incidence/100,000 |
|---------------------|-----------|------------|-------------------|
| White               | 73        | 66%        | 1.0               |
| Black               | 25        | 23%        | 1.1               |
| Other               | 5         | 5%         | 0.6               |
| Multiple or Unknown | 7         | 6%         | --                |



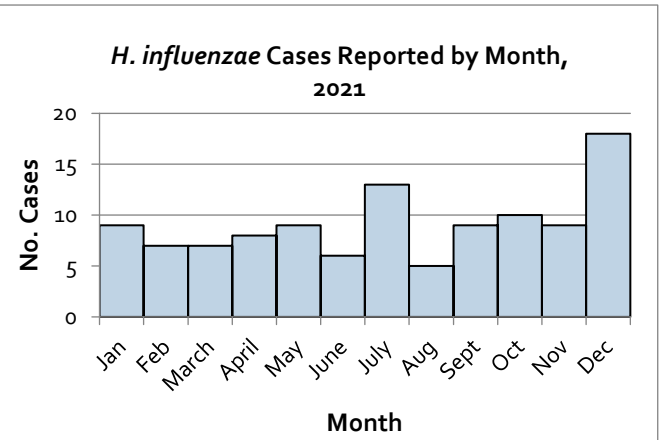
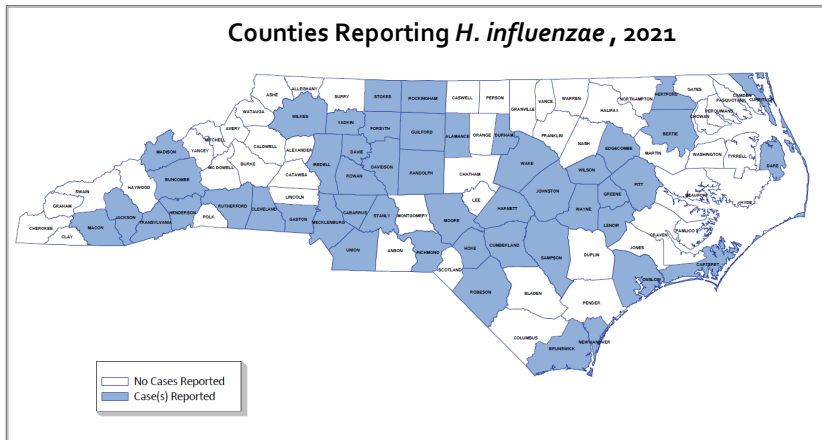
| Hispanic Ethnicity | No. cases | % of total | Incidence/100,000 |
|--------------------|-----------|------------|-------------------|
| Yes                | 9         | 8%         | 0.8               |
| No                 | 87        | 79%        | 0.9               |
| Unknown            | 14        | 13%        | --                |



\*Point estimates and 95% confidence intervals are shown

## Geographic Distribution

## Cases By Month



## Hepatitis A

### Background

Hepatitis A virus (HAV) is a cause of acute liver disease transmitted by the fecal-oral route. In the United States, person-to-person transmission is most common. Common signs and symptoms include nausea, vomiting, abdominal pain, fatigue, and jaundice; however, infection is often asymptomatic in children under 6 years of age. HAV infection is laboratory confirmed by demonstration of IgM antibody directed against the virus in the patient's serum.

Common-source outbreaks of HAV can occur via fecal contamination of food or water, but a specific source is rarely identified. People at increased risk for acquiring HAV infection include travelers to endemic areas, men who have sex with men, and users of injection drugs, but no risk factor is identified for the majority of cases. Control and prevention of hepatitis A rests upon promotion of personal hygiene, immunization, and proper food and water sanitation.

People with HAV infection are infectious from 2 weeks before jaundice onset to 1 week after. If the patient did not have jaundice, or the jaundice onset date is unknown, the infectious period is considered to be from 1 week before to 2 weeks after the onset of other symptoms. Shedding can be longer in some cases, particularly in young children.

Post-exposure prophylaxis (PEP) should be considered for susceptible individuals who are household or sexual contacts to a case. Child care center staff and attendees should receive PEP if one or more cases are identified in the facility, or if cases are identified in two or more households of childcare attendees. If a case is identified in a food handler who worked while infectious, PEP may be considered for other food handlers and patrons. PEP is not generally considered effective if it is given more than two weeks after the exposure.

### Immunization

Hepatitis A vaccine has been one of the great success stories of public health. Hepatitis A vaccines were first licensed in 1995, and the number of people for whom vaccine is recommended has gradually expanded since that time. Two doses of hepatitis A vaccine administered at least six months apart are currently recommended as a routine immunization for all children beginning at 12 months of age. Hepatitis A vaccine is also recommended for high-risk populations such as international travelers, men who have sex with men, people who use injection or non-injection drugs, people experiencing homelessness, and people who are or were recently incarcerated. People in these high risk groups should be offered hepatitis A vaccine even if receipt of the second dose is unlikely; even one dose of hepatitis A vaccine is highly effective at preventing infection.

### Epidemiology

#### National

Incidence of hepatitis A remained high in 2021 due to large outbreaks in several states. Infections among certain high-risk populations made up the majority of outbreak-associated cases, including people who use drugs (injection or non-injection) and people experiencing homelessness.

#### North Carolina

Reported cases of hepatitis A in 2021 increased significantly when compared to the previous 5-year average, primarily due to a statewide outbreak (discussed below). The 945 reported cases are the most in North Carolina since at least 1991. Ten hepatitis A-associated deaths were reported in 2021.

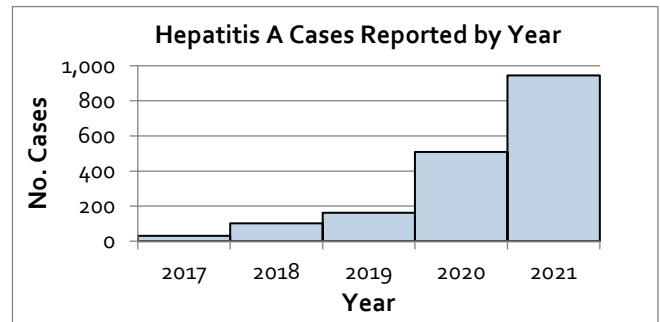
### Outbreaks

A statewide outbreak of hepatitis A began in April 2018 and continued throughout 2021. The outbreak peaked in April of 2021, when 114 new cases were reported. Of the 945 hepatitis A cases in 2021, 639 (68%) were outbreak-associated and primarily occurred among people who use injection or non-injection drugs.

# Hepatitis A, 2021

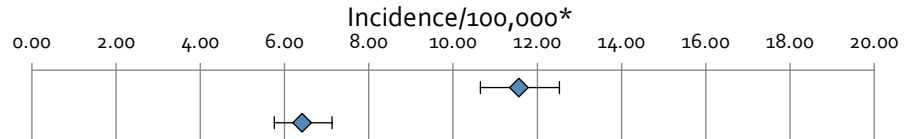
## Annual Summary

|                     | 2017 | 2018 | 2019 | 2020 | 2021 |
|---------------------|------|------|------|------|------|
| Incidence / 100,000 | 0.30 | 0.98 | 1.56 | 4.85 | 8.91 |
| No. cases           | 30   | 101  | 162  | 509  | 945  |

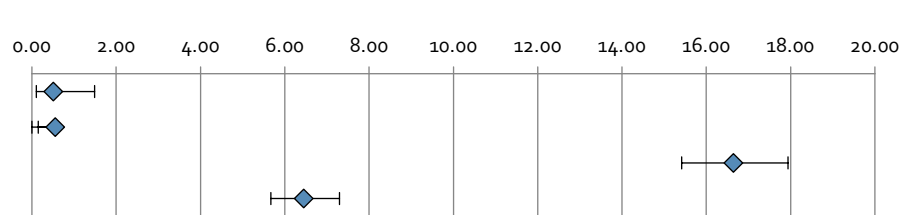


## Case Demographics, 2021

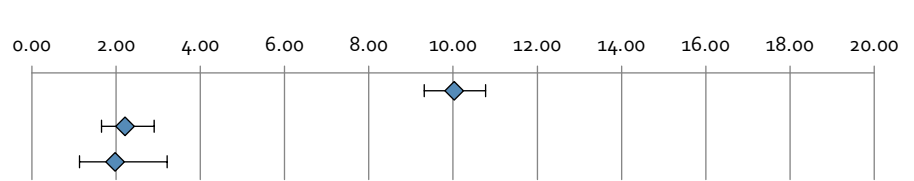
| Sex     | No. cases | % of total | Incidence/100,000 |
|---------|-----------|------------|-------------------|
| Male    | 596       | 63%        | 11.56             |
| Female  | 346       | 37%        | 6.41              |
| Unknown | 3         | 0%         | --                |



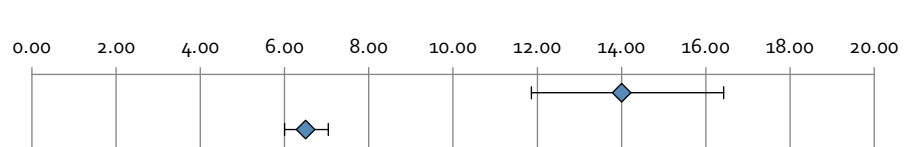
| Age Group    | No. cases | % of total | Incidence/100,000 |
|--------------|-----------|------------|-------------------|
| Under 5 yrs. | 3         | 0%         | 0.51              |
| 5-19 yrs.    | 11        | 1%         | 0.55              |
| 20-49 yrs.   | 682       | 72%        | 16.64             |
| 50+ yrs.     | 249       | 26%        | 6.45              |
| Unknown      | 0         | 0%         | --                |



| Race                | No. cases | % of total | Incidence/100,000 |
|---------------------|-----------|------------|-------------------|
| White               | 741       | 78%        | 10.02             |
| Black               | 52        | 6%         | 2.21              |
| Other               | 16        | 2%         | 1.98              |
| Multiple or Unknown | 136       | 14%        | --                |



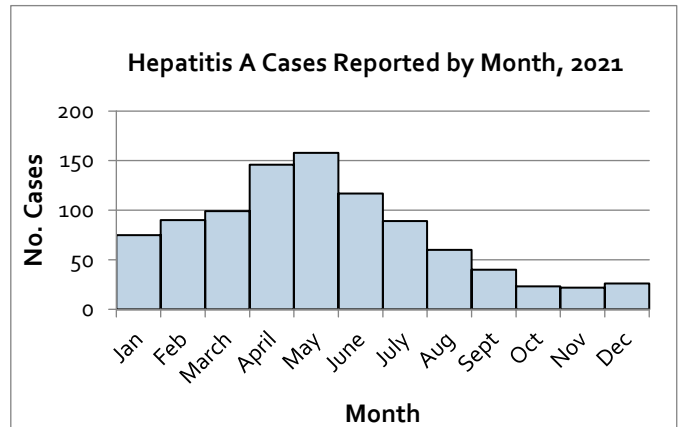
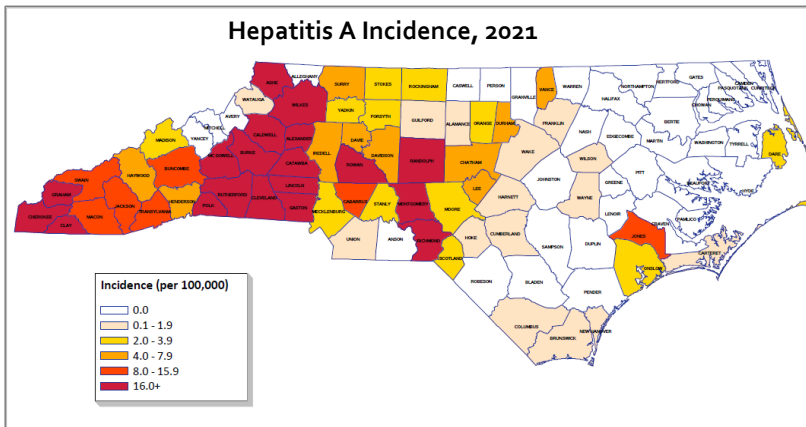
| Hispanic Ethnicity | No. cases | % of total | Incidence/100,000 |
|--------------------|-----------|------------|-------------------|
| Yes                | 151       | 16%        | 14.00             |
| No                 | 616       | 65%        | 6.50              |
| Unknown            | 178       | 19%        | --                |



\*Point estimates and 95% confidence intervals are shown

## Geographic Distribution

## Cases By Month



## **Meningococcal Invasive Disease**

### **Background**

Invasive meningococcal disease caused by *Neisseria meningitidis* is an acute, serious illness that can cause several syndromes including meningitis, bacteremia, and sepsis. Infections can rapidly progress and result in death. Timely and appropriate antibiotic therapy is important for the treatment of this disease; however, even with the widespread use of antibiotics, the case-fatality rate is estimated to be 10-14%. Six serogroups are responsible for the vast majority of invasive disease: A, B, C, W, X, and Y.

Humans act as a natural reservoir for *N. meningitidis*. Up to 10% of adults are asymptomatic carriers, although most carriers develop immunity against the organism and do not develop invasive disease. Cases of meningococcal disease can occur sporadically or as part of outbreaks. Outbreaks can occur among groups living in close-contact settings, such as college dormitories, or among high-risk populations in a community setting.

Patients are considered infectious beginning 7 days before symptom onset until 24 hours after starting appropriate antibiotics. Post-exposure prophylaxis (PEP) should be given to close contacts within 24 hours after the index patient is identified, if possible. PEP is of limited value if started more than 14 days after the last exposure. Effective antimicrobial regimens for prophylaxis include rifampin, ceftriaxone, and ciprofloxacin. PEP is critically important for close contacts of patients with invasive meningococcal infections, and is recommended for household contacts, childcare contacts, and others with direct exposures to the patient's oral secretions. PEP is not recommended for casual contacts such as coworkers, classmates, or healthcare workers who were not directly exposed to oral secretions.

### **Immunization**

The quadrivalent meningococcal conjugate vaccine was first licensed in 2005. It contains four serogroups (A, C, Y, and W). Two doses are recommended for children as part of the routine immunization schedule; the first at 11-12 years, and the second at age 16 years. Vaccination with the quadrivalent and serogroup B vaccine is recommended apart from the routine schedule for various populations considered to be at increased risk for disease, such as immunocompromised children and adults, military recruits, and laboratory workers.

### **Epidemiology**

#### National

The incidence rate of meningococcal disease in the U.S. has been declining since the 1990s, and remains very low at 0.11 per 100,000 persons. Rates are highest in children less than one year of age, followed by adolescents and young adults. Serogroup B causes the majority of cases in children under five years of age.

#### North Carolina

Rates of meningococcal invasive disease are at an all-time low in North Carolina, reflecting the national trend; the incidence rate in 2021 was just 0.09 per 100,000 persons. From 2017-2021, 43 cases of meningococcal invasive disease were identified; serogroup B caused the largest share of infections (28%) followed by serogroup Y (26%). No deaths associated with meningococcal disease were reported in 2021.

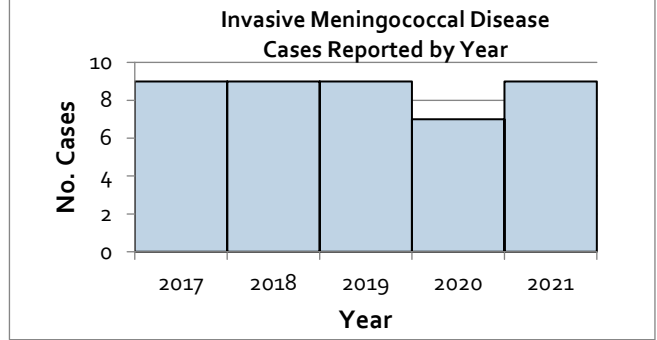
### **Outbreaks**

No outbreaks of meningococcal invasive disease occurred in North Carolina during 2021.

# Meningococcal Invasive Disease, 2021

## Annual Summary

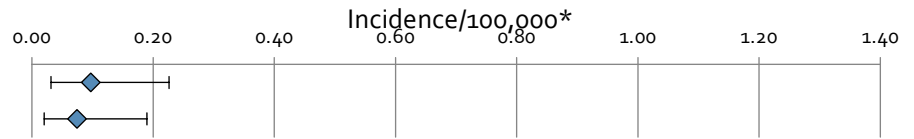
|                     | 2017    | 2018 | 2019 | 2020 | 2021 |
|---------------------|---------|------|------|------|------|
| Incidence / 100,000 | 0.09    | 0.09 | 0.09 | 0.07 | 0.09 |
| No. of cases        | 9       | 9    | 9    | 7    | 9    |
| Serogroups          | A       | 0%   | 0%   | 0%   | 0%   |
|                     | C       | 11%  | 0%   | 33%  | 0%   |
|                     | Y       | 11%  | 11%  | 33%  | 43%  |
|                     | W-135   | 11%  | 22%  | 0%   | 14%  |
|                     | B       | 33%  | 44%  | 22%  | 43%  |
|                     | Unknown | 22%* | 22%  | 11%  | 0%   |



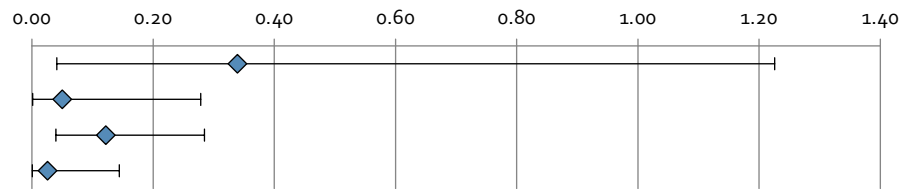
\*1 unknown, 1 could not distinguish between C & W-135

## Case Demographics, 2021

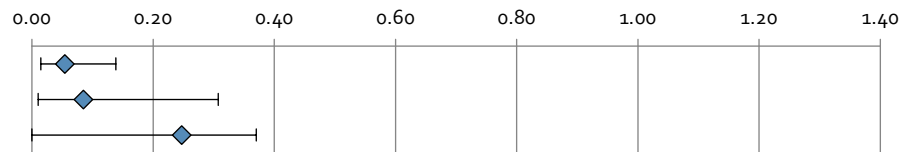
| Sex     | No. cases | % of total | Incidence/100,000 |
|---------|-----------|------------|-------------------|
| Male    | 5         | 56%        | 0.10              |
| Female  | 4         | 44%        | 0.07              |
| Unknown | 0         | 0%         | --                |



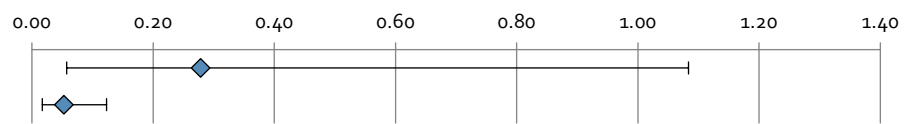
| Age Group    | No. cases | % of total | Incidence/100,000 |
|--------------|-----------|------------|-------------------|
| Under 5 yrs. | 2         | 22%        | 0.34              |
| 5-19 yrs.    | 1         | 11%        | 0.05              |
| 20-49 yrs.   | 5         | 56%        | 0.12              |
| 50+ yrs.     | 1         | 11%        | 0.03              |
| Unknown      | 0         | 0%         | --                |



| Race                | No. cases | % of total | Incidence/100,000 |
|---------------------|-----------|------------|-------------------|
| White               | 4         | 44%        | 0.05              |
| Black               | 2         | 22%        | 0.09              |
| Other               | 2         | 22%        | 0.25              |
| Multiple or Unknown | 1         | 11%        | --                |



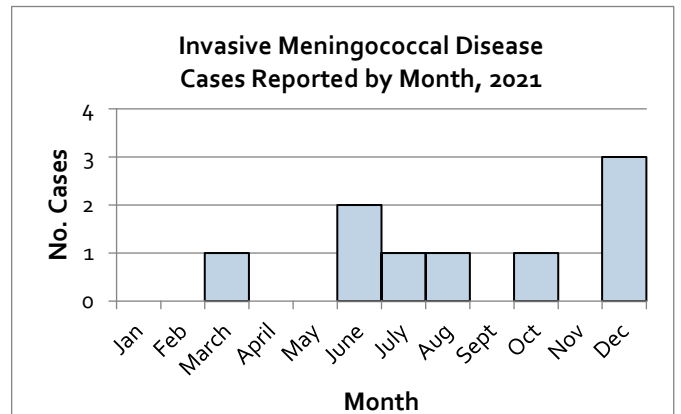
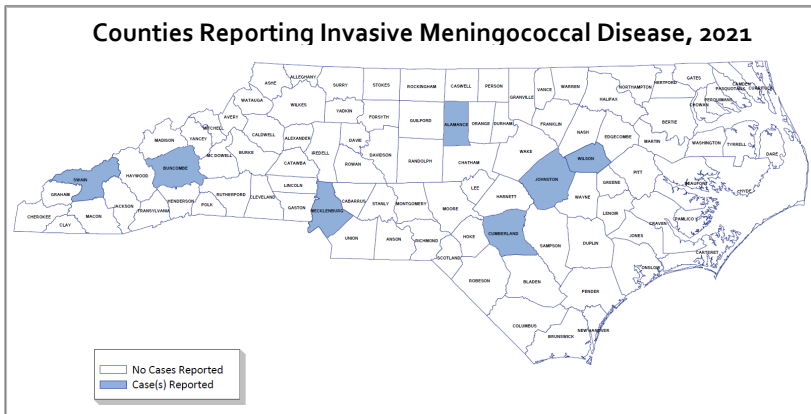
| Hispanic Ethnicity | No. cases | % of total | Incidence/100,000 |
|--------------------|-----------|------------|-------------------|
| Yes                | 3         | 33%        | 0.28              |
| No                 | 5         | 56%        | 0.05              |
| Unknown            | 1         | 11%        | --                |



\*Point estimates and 95% confidence intervals are shown

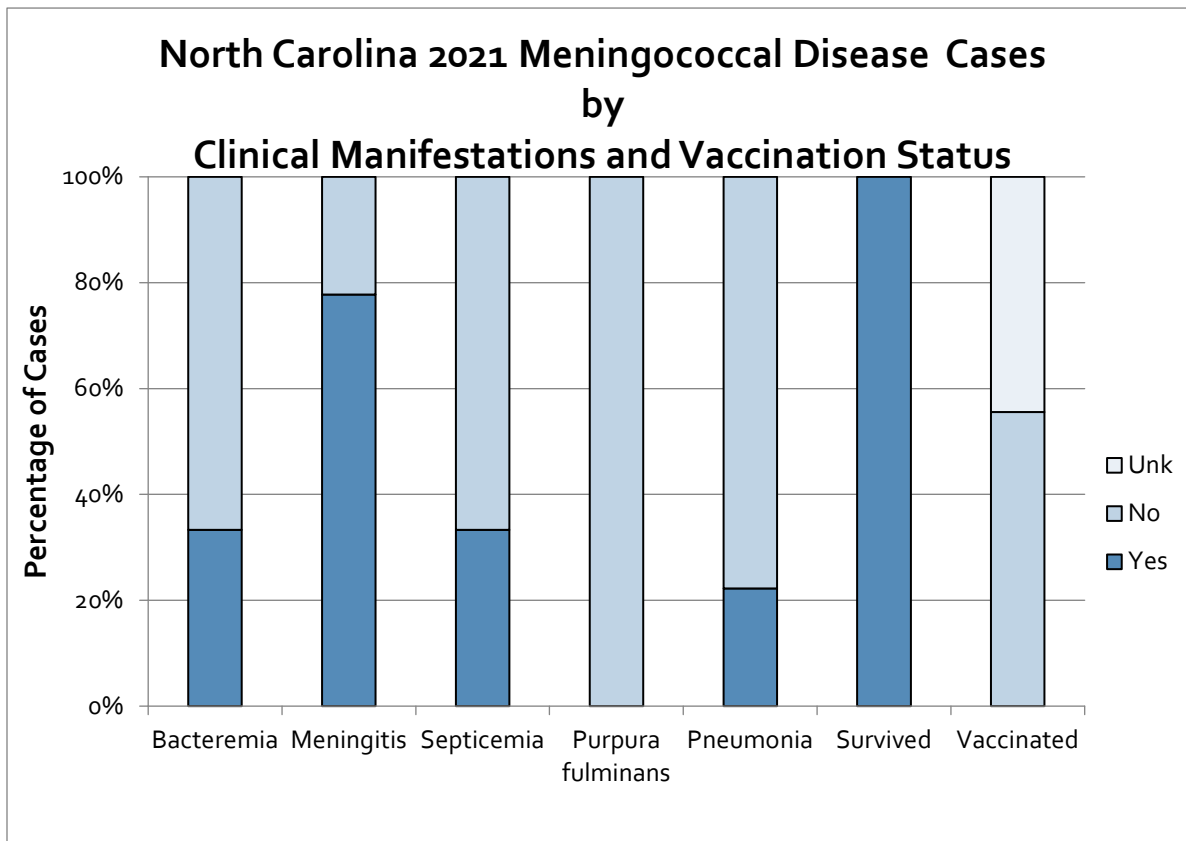
## Geographic Distribution

## Cases By Month

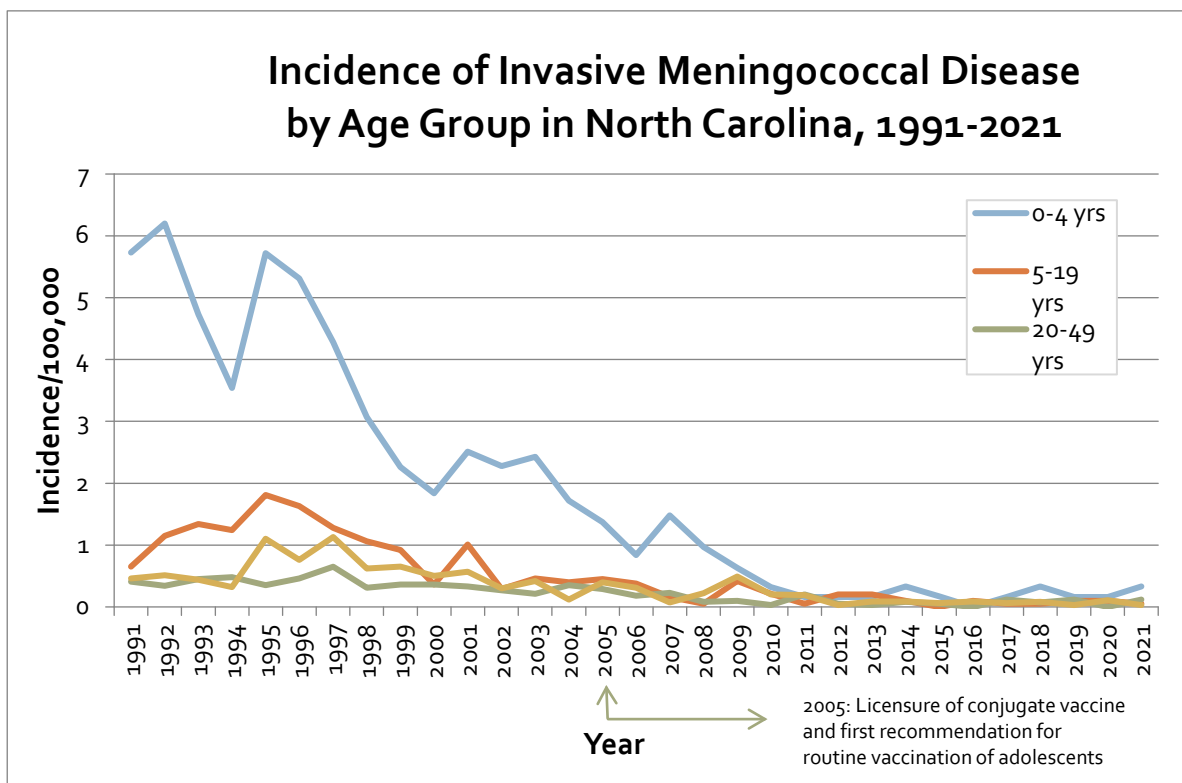


# Meningococcal Invasive Disease, 2021 (continued)

2021 Case Summary



## Meningococcal Disease Incidence by Age Group





## **Mumps**

### **Background**

Mumps is a viral illness best known for causing swelling of the salivary glands below the ears and above the jaw, called parotitis. Complications are possible from mumps, including orchitis (inflammation of the testicles) in males, oophoritis (inflammation of the ovaries) in females, deafness, and meningitis. People with mumps are considered contagious from 2 days before to 5 days after symptoms begin. A significant number of people infected with the mumps virus may not have symptoms (30-40%).

Suspected cases of mumps should avoid contact with others from the time of diagnosis until 5 days after the onset of parotitis. Suspected cases should stay home from work or school and stay in a separate room from other people if possible. Susceptible close contacts to mumps cases should be offered vaccine and instructed to monitor for signs and symptoms of mumps. Healthcare workers with unprotected exposure to a mumps patient must show evidence of immunity to mumps or be excluded from work from day 12-25 after exposure.

Vaccination is the best way to prevent mumps. People without evidence of immunity should receive age-appropriate measles-mumps-rubella (MMR) vaccine. People born before 1957 are considered immune based on likely exposure during childhood. Persons who are unvaccinated are more likely to contract mumps and have complications than persons who are vaccinated.

### **Immunization**

Two doses of MMR vaccine are routinely recommended for children; the first at 12-15 months, and the second at 4-6 years.

### **Epidemiology**

#### National

Before the U.S. mumps vaccination program began in 1967, about 200,000 cases of mumps were reported each year. Since that time, there has been more than a 99% decrease in mumps cases in the United States. The number of reported cases of mumps nationally spiked during 2016-2019, with an average of over 4,500 cases per year. However, cases decreased again in 2020 and remained low during 2021. It is possible that control measures implemented in response to the COVID-19 pandemic affected transmission of mumps.

Adolescents and college-aged adults are at increased risk for disease, likely due to close-contact, congregate settings like schools and universities.

#### North Carolina

Two cases of mumps were reported in 2021, the lowest number of cases in the state since 2002.

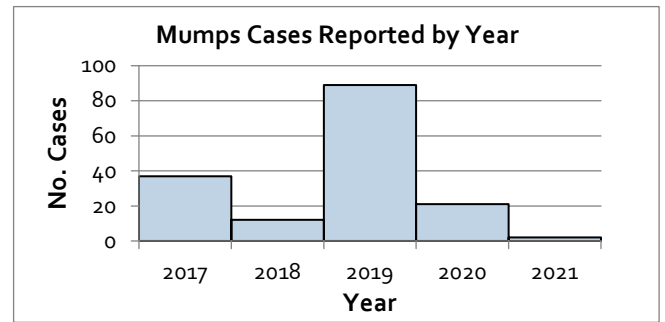
### **Outbreaks**

No outbreaks of mumps were reported in 2021.

# Mumps, 2021

## Annual Summary

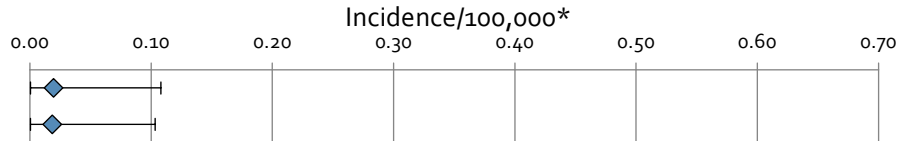
|  | 2017 | 2018 | 2019 | 2020 | 2021 |
|--|------|------|------|------|------|
| Incidence / 100,000                    | 0.38 | 0.12 | 0.89 | 0.21 | 0.02 |
| No. cases                              | 37   | 12   | 89   | 21   | 2    |
| Confirmed                              | 62%  | 25%  | 70%  | 57%  | 0%   |
| Probable                               | 38%  | 75%  | 30%  | 43%  | 100% |
| Unvaccinated or unknown immune status* | 30%  | 50%  | 13%  | 52%  | 50%  |



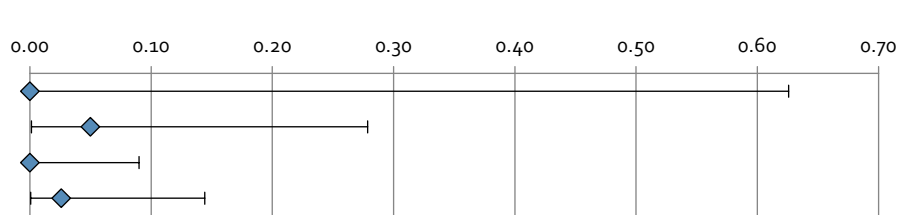
\*Cases born before 1957 are considered immune

## Case Demographics, 2021

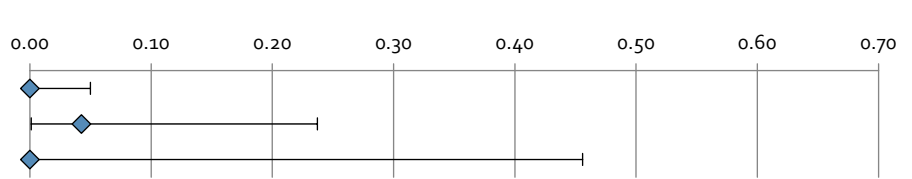
| Sex     | No. cases | % of total | Incidence/100,000 |
|---------|-----------|------------|-------------------|
| Male    | 1         | 50%        | 0.02              |
| Female  | 1         | 50%        | 0.02              |
| Unknown | 0         | 0%         | --                |



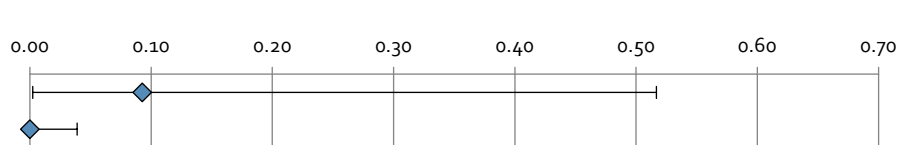
| Age Group    | No. cases | % of total | Incidence/100,000 |
|--------------|-----------|------------|-------------------|
| Under 5 yrs. | 0         | 0%         | 0.00              |
| 5-19 yrs.    | 1         | 50%        | 0.05              |
| 20-49 yrs.   | 0         | 0%         | 0.00              |
| 50+ yrs.     | 1         | 50%        | 0.03              |
| Unknown      | 0         | 0%         | --                |



| Race                | No. cases | % of total | Incidence/100,000 |
|---------------------|-----------|------------|-------------------|
| White               | 0         | 0%         | 0.00              |
| Black               | 1         | 50%        | 0.04              |
| Other               | 0         | 0%         | 0.00              |
| Multiple or Unknown | 1         | 50%        | --                |



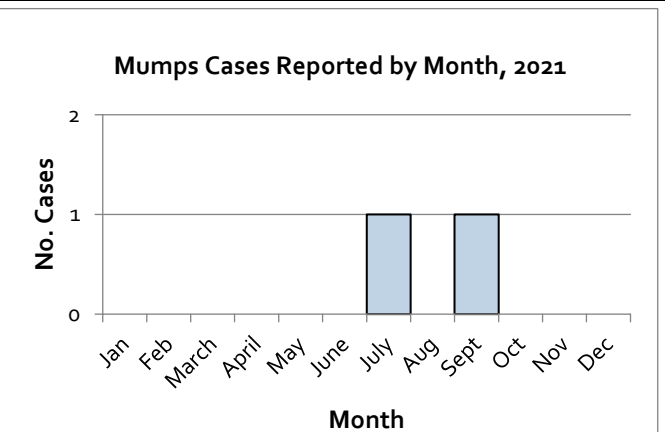
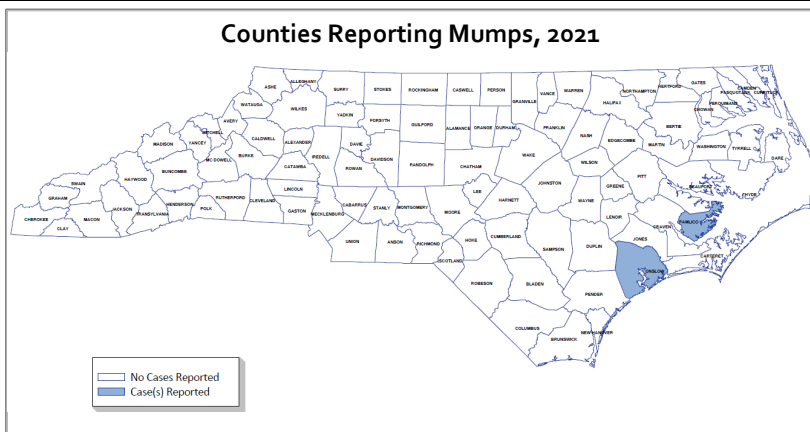
| Hispanic Ethnicity | No. cases | % of total | Incidence/100,000 |
|--------------------|-----------|------------|-------------------|
| Yes                | 1         | 50%        | 0.09              |
| No                 | 0         | 0%         | 0.00              |
| Unknown            | 1         | 50%        | --                |



\*Point estimates and 95% confidence intervals are shown

## Geographic Distribution

## Cases By Month



## **Pertussis**

### **Background**

Pertussis (commonly known as “Whooping Cough”) is a highly contagious respiratory infection spread from person to person through respiratory droplets from a cough or sneeze or by direct contact with respiratory secretions. Pertussis is primarily a toxin-mediated disease. *Bordetella pertussis* causes disease by attaching to the cilia in the upper respiratory tract and releasing toxins that paralyze the cilia, causing inflammation of the respiratory tract. The incubation period of pertussis ranges from 5-21 days, but typically is 10-14 days. People with pertussis are infectious from the start of symptoms through 3 weeks of cough, or if treated, until completion of appropriate antibiotic treatment.

Pertussis occurs in three disease stages. The first is the catarrhal stage, which generally begins with the gradual onset of runny nose, sneezing and low-grade fever with a mild, occasional cough, similar to the common cold. Next is the paroxysmal stage, characterized by the onset of paroxysms, or uncontrollable fits of coughing. Following one of these fits of coughing, the patient may gasp for air, which can sometimes result in a “whooping” sound. The paroxysmal stage can be quite long with paroxysms increasing in frequency during the first 1-2 weeks and then remaining stable for 2-3 weeks. A gradual recovery begins during the convalescent stage and the coughing fits become less frequent. Secondary infections are most likely to occur during this stage, and paroxysms can recur with later respiratory infections for many months after the onset of pertussis.

Post-exposure prophylaxis (PEP) is recommended for household contacts of pertussis cases, as well as high-risk contacts such as infants, women in the third trimester of pregnancy, and immunocompromised persons. Azithromycin is the most common choice of antimicrobial used for both treatment of pertussis and PEP.

### **Immunization**

The current pertussis vaccines available in the United States contain acellular pertussis antigens in combination with tetanus and diphtheria toxoids (DTaP and Tdap). Five doses of DTaP are recommended for children at 2, 4, 6, and 15-18 months and 4-6 years. One dose of Tdap is recommended for adolescents, preferably at 11-12 years. Tdap is also recommended for pregnant women during the 3<sup>rd</sup> trimester of each pregnancy to facilitate the transfer of maternal antibodies to the infant.

### **Epidemiology**

#### National

In recent years, an increasing burden of disease has been observed in children, likely due to the transition to the acellular pertussis vaccine in the 1990s. Almost 19,000 cases and an incidence rate of 5.67 per 100,000 persons occurred in the United States during 2019. However, pertussis cases dropped significantly during the COVID-19 pandemic, with 5,398 reported in 2020 and just 1,609 in 2021. It is likely that control measures and restrictions implemented during the COVID-19 pandemic were effective against preventing transmission of pertussis.

Pertussis is cyclical in nature with peaks occurring every 3-5 years, likely because of an increase in the number of susceptible people accumulating following peak years. Infants are at highest risk of complications and death from pertussis. Secondary bacterial pneumonia is the most common complication in both infants and other age groups.

#### North Carolina

Just 52 cases of pertussis were reported in North Carolina during 2021, the lowest number since 1992. It is likely that the low number of cases was influenced by the COVID-19 pandemic. One infant case was reported in 2021. No deaths associated with pertussis were reported in 2021.

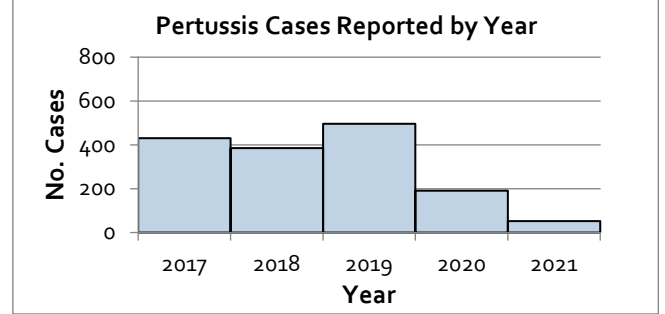
### **Outbreaks**

No outbreaks of pertussis were reported during 2021.

# Pertussis, 2021

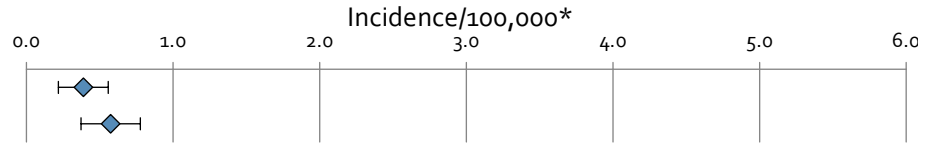
## Annual Summary

|                     | 2017 | 2018 | 2019 | 2020 | 2021 |
|---------------------|------|------|------|------|------|
| Incidence / 100,000 | 4.4  | 3.9  | 4.9  | 1.9  | 0.5  |
| No. cases           | 430  | 385  | 496  | 191  | 52   |
| Culture confirmed   | 3%   | 3%   | 3%   | 4%   | 4%   |
| PCR confirmed       | 48%  | 50%  | 52%  | 65%  | 25%  |
| Epi-link confirmed  | 9%   | 8%   | 11%  | --   | --   |
| Probable            | 41%  | 38%  | 33%  | 30%  | 71%  |

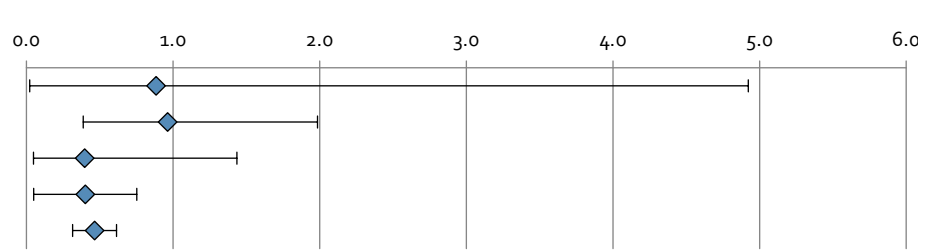


## Case Demographics, 2021

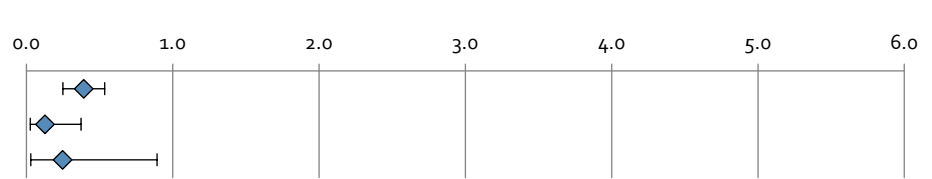
| Sex     | No. cases | % of total | Incidence/100,000 |
|---------|-----------|------------|-------------------|
| Male    | 20        | 38%        | 0.4               |
| Female  | 31        | 60%        | 0.6               |
| Unknown | 1         | 2%         | --                |



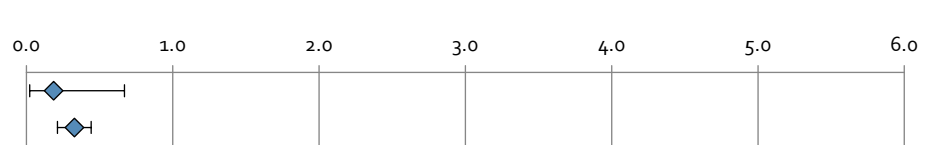
| Age Group        | No. cases | % of total | Incidence/100,000 |
|------------------|-----------|------------|-------------------|
| Infants (<1 yr.) | 1         | 2%         | 0.9               |
| 1-6 yrs.         | 7         | 13%        | 1.0               |
| 7-10 yrs.        | 2         | 4%         | 0.4               |
| 11-19 yrs.       | 5         | 10%        | 0.4               |
| 20+ yrs.         | 37        | 71%        | 0.5               |
| Unknown          | 0         | 0%         | --                |



| Race                | No. cases | % of total | Incidence/100,000 |
|---------------------|-----------|------------|-------------------|
| White               | 29        | 56%        | 0.4               |
| Black               | 3         | 6%         | 0.1               |
| Other               | 2         | 4%         | 0.2               |
| Multiple or Unknown | 18        | 35%        | --                |



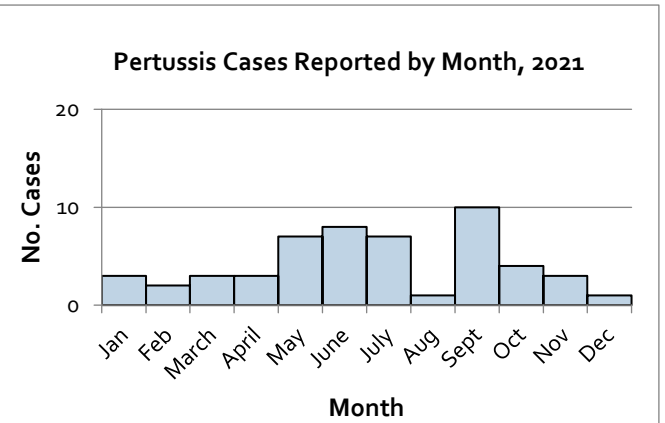
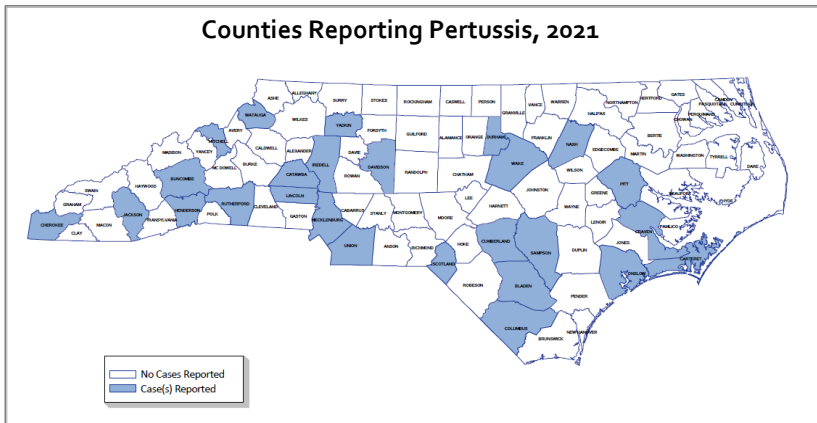
| Hispanic Ethnicity | No. cases | % of total | Incidence/100,000 |
|--------------------|-----------|------------|-------------------|
| Yes                | 2         | 4%         | 0.2               |
| No                 | 31        | 60%        | 0.3               |
| Unknown            | 19        | 37%        | --                |



\*Point estimates and 95% confidence intervals are shown

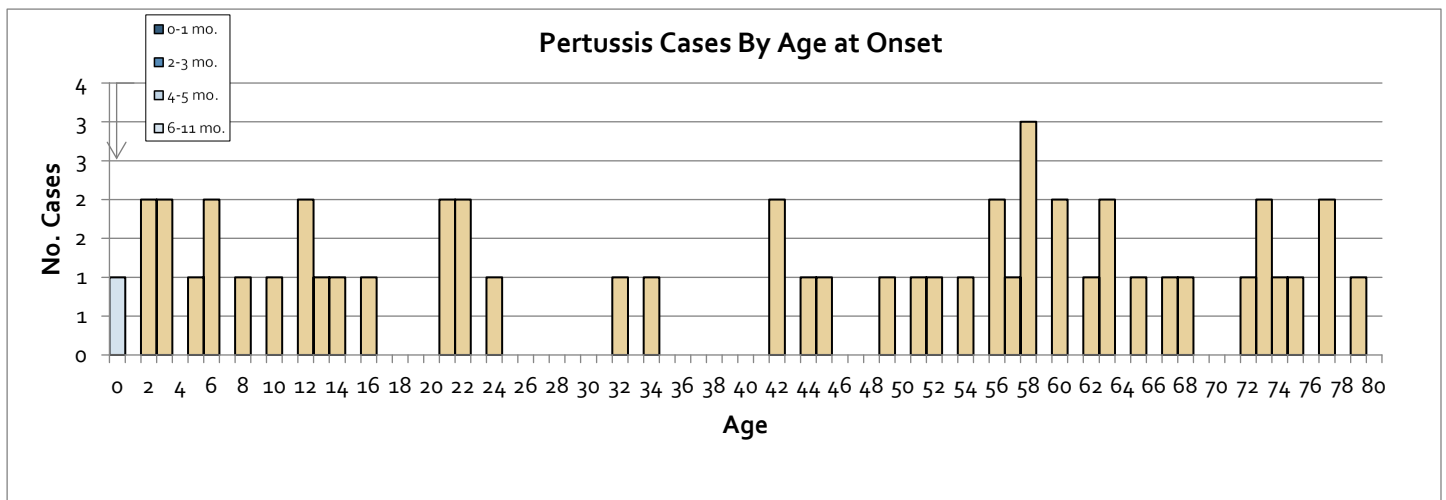
## Geographic Distribution

## Cases By Month



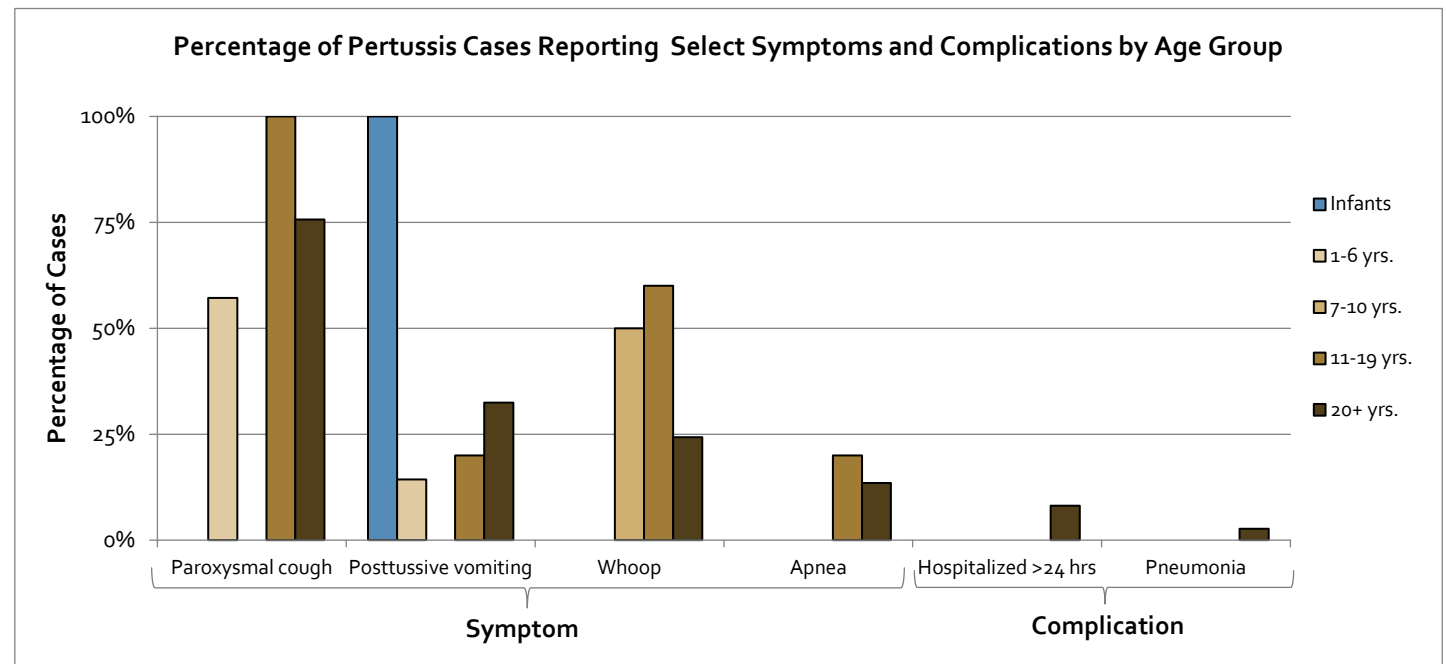
# Pertussis, 2021 (continued)

## Age Distribution



## Clinical Information

|   | Age Groups |      |          |     |           |     |            |      |          |     | All Ages |     |
|---|------------|------|----------|-----|-----------|-----|------------|------|----------|-----|----------|-----|
|   | Infants    |      | 1-6 yrs. |     | 7-10 yrs. |     | 11-19 yrs. |      | 20+ yrs. |     |          |     |
| No. cases                                       | 1          |      | 7        |     | 2         |     | 5          |      | 37       |     | 52       |     |
| Symptoms (No. cases, % of known responses)      |            |      |          |     |           |     |            |      |          |     |          |     |
| Paroxysmal cough                                | 0          | 0%   | 4        | 57% | 0         | 0%  | 5          | 100% | 28       | 76% | 37       | 71% |
| Posttussive vomiting                            | 1          | 100% | 1        | 14% | 0         | 0%  | 1          | 20%  | 12       | 32% | 15       | 29% |
| Whoop   | 0          | 0%   | 0        | 0%  | 1         | 50% | 3          | 60%  | 9        | 24% | 13       | 25% |
| Apnea   | 0          | 0%   | 0        | 0%  | 0         | 0%  | 1          | 20%  | 5        | 14% | 6        | 12% |
| Complications (No. cases, % of known responses) |            |      |          |     |           |     |            |      |          |     |          |     |
| Hospitalized >24 hrs                            | 0          | 0%   | 0        | 0%  | 0         | 0%  | 0          | 0%   | 3        | 8%  | 3        | 6%  |
| Pneumonia                                       | 0          | 0%   | 0        | 0%  | 0         | 0%  | 0          | 0%   | 1        | 3%  | 1        | 2%  |
| Seizures  | 0          | 0%   | 0        | 0%  | 0         | 0%  | 0          | 0%   | 0        | 0%  | 0        | 0%  |
| Encephalopathy                                  | 0          | 0%   | 0        | 0%  | 0         | 0%  | 0          | 0%   | 0        | 0%  | 0        | 0%  |
| Died  | 0          | 0%   | 0        | 0%  | 0         | 0%  | 0          | 0%   | 0        | 0%  | 0        | 0%  |



## **Pneumococcal Meningitis**

### **Background**

*Streptococcus pneumoniae* (pneumococcus) is a gram-positive bacterium that can cause many clinical syndromes including pneumonia, bacteremia, and meningitis. Pneumococcal meningitis is the only form of invasive disease that is reportable in North Carolina. There are over 90 pneumococcal serotypes, and vaccines are available to protect against those that are most likely to cause invasive disease. Pneumococcal infections are most common during the late winter and early spring.

Transmission of pneumococcus occurs as the result of direct contact with respiratory droplets from an infected person. Certain groups are at higher risk of invasive pneumococcal disease, including children less than 2 years of age, adults over 65, and people with certain chronic medical conditions. Contacts to people infected with pneumococcus are not generally at increased risk for disease and antibiotic prophylaxis is rarely indicated.

### **Immunization**

PCV13 is a conjugate vaccine that protects against the thirteen serotypes most commonly associated with severe infections. PPSV23 is a pneumococcal polysaccharide vaccine, and protects against 23 of the most common *S. pneumoniae* serotypes.

Routine vaccination with a series of 4 PCV13 vaccinations prior to 15 months of age is recommended for all children. Pneumococcal vaccination with PCV13 followed by PPSV23 is recommended for all adults over the age of 65 and for adults aged 18-64 who are at increased risk of infection. The recommended number of doses for high-risk adults and additional recommendations for catch-up vaccination and vaccination of individuals with certain conditions can be found at the CDC's website at [www.cdc.gov/vaccines/vpd/pneumo/hcp/recommendations.html](http://www.cdc.gov/vaccines/vpd/pneumo/hcp/recommendations.html)

### **Epidemiology**

#### National

The first pneumococcal conjugate vaccine, PCV7, was introduced in 2000. Since that time, rates of invasive pneumococcal disease have declined significantly among children less than 5 years of age, and rates have continued to decline with the use of PCV13 as a routine childhood vaccination.

#### North Carolina

Rates of pneumococcal meningitis have been consistent in North Carolina for several years although cases have decreased in the past two years during the COVID-19 pandemic; 25 cases were reported during 2021, fewer than the five-year average of 40 cases.

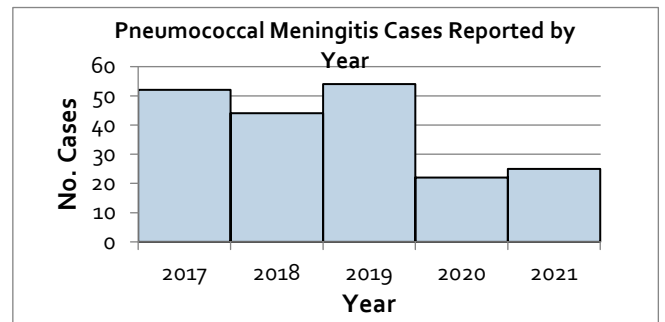
### **Outbreaks**

No outbreaks of pneumococcal meningitis were reported in 2021.

# Pneumococcal Meningitis, 2021

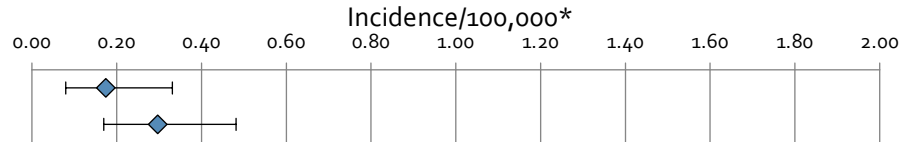
## Annual Summary

|   | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|------|------|------|------|------|
| Incidence / 100,000                                       | 0.53 | 0.44 | 0.54 | 0.22 | 0.25 |
| No. cases   | 52   | 44   | 54   | 22   | 25   |
| <5 yrs.   | 6%   | 7%   | 17%  | 9%   | 16%  |
| ≥ 5 yrs.  | 94%  | 93%  | 83%  | 91%  | 84%  |
| Unvaccinated or unknown vaccination status (<5 yrs. only) | 0%   | 0%   | 63%  | 0%   | 75%  |

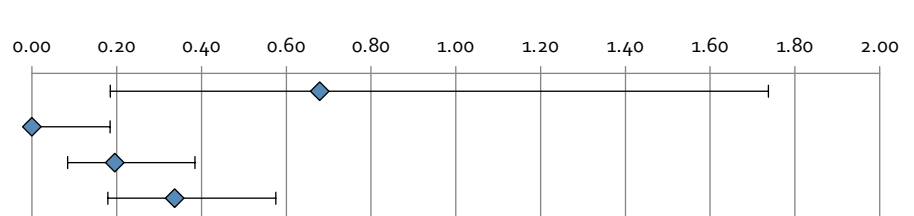


## Case Demographics, 2021

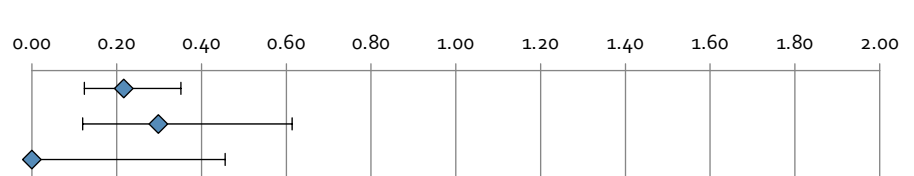
| Sex     | No. cases | % of total | Incidence/100,000 |
|---------|-----------|------------|-------------------|
| Male    | 9         | 36%        | 0.17              |
| Female  | 16        | 64%        | 0.30              |
| Unknown | 0         | 0%         | --                |



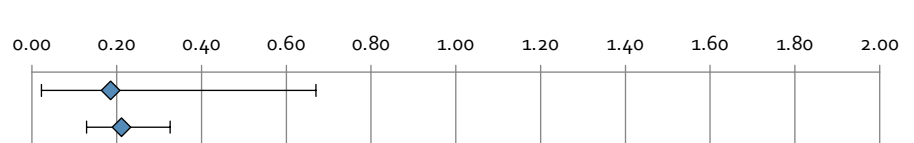
| Age Group    | No. cases | % of total | Incidence/100,000 |
|--------------|-----------|------------|-------------------|
| Under 5 yrs. | 4         | 16%        | 0.68              |
| 5-19 yrs.    | 0         | 0%         | 0.00              |
| 20-49 yrs.   | 8         | 32%        | 0.20              |
| 50+ yrs.     | 13        | 52%        | 0.34              |
| Unknown      | 0         | 0%         | --                |



| Race                | No. cases | % of total | Incidence/100,000 |
|---------------------|-----------|------------|-------------------|
| White               | 16        | 64%        | 0.22              |
| Black               | 7         | 28%        | 0.30              |
| Other               | 0         | 0%         | 0.00              |
| Multiple or Unknown | 2         | 8%         | --                |



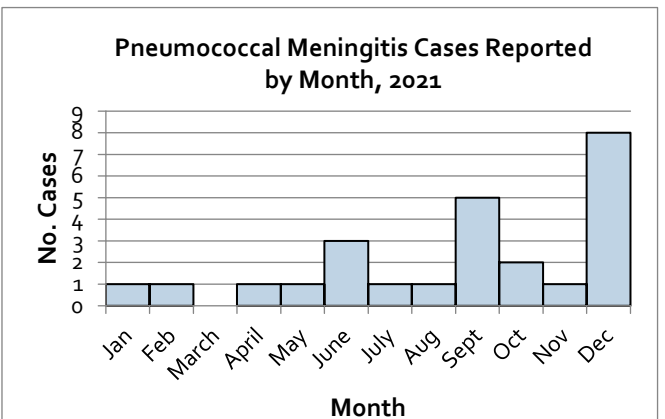
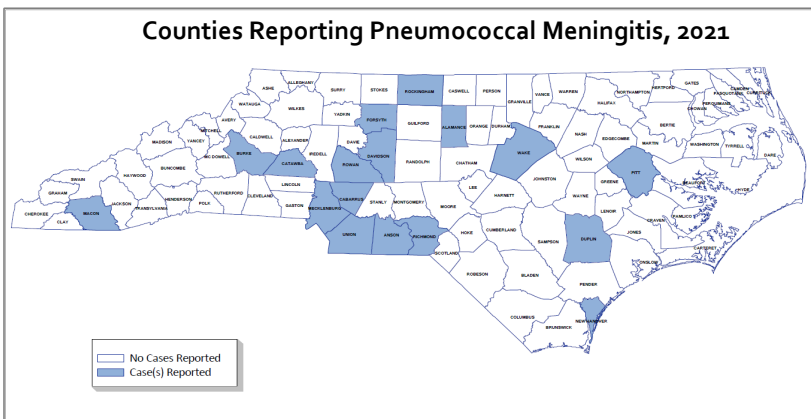
| Hispanic Ethnicity | No. cases | % of total | Incidence/100,000 |
|--------------------|-----------|------------|-------------------|
| Yes                | 2         | 8%         | 0.19              |
| No                 | 20        | 80%        | 0.21              |
| Unknown            | 3         | 12%        | --                |



\*Point estimates and 95% confidence intervals are shown

## Geographic Distribution

## Cases By Month



## **Varicella**

### **Background**

Varicella (chickenpox) is a viral illness best known for causing an itchy, blister-like rash that can spread over the entire body. Varicella is caused by the varicella-zoster virus (VZV). In addition to the rash, symptoms may include fever and headache. Although rare, severe complications like skin infections, pneumonia, and encephalitis can occur. People with varicella are considered contagious from 1-2 days before the rash appears until all the skin lesions are crusted over, which typically takes 4-6 days after the onset of the rash.

Suspected cases of varicella should stay home from work or school until all skin lesions are crusted over. Exposure to an infectious person is defined as a) direct contact with respiratory or nasal secretions, b) face-to-face exposure within three feet, and c) sharing the same confined space in close proximity. People exposed to varicella who do not have evidence of immunity should receive the varicella vaccine within five days of exposure. Susceptible people who are at high-risk for severe disease, including immunocompromised children and pregnant women, should receive varicella immunoglobulin.

Vaccination is the best way to prevent varicella. People without evidence of immunity should receive age-appropriate varicella vaccine. People born before 1980 are considered immune based on likely exposure during childhood. Persons who are unvaccinated are more likely to contract varicella and have complications than persons who are vaccinated.

### **Immunization**

Two doses of varicella vaccine are routinely recommended for children; the first at 12-15 months, and the second at 4-6 years. The varicella vaccine is commonly given with the measles-mumps-rubella vaccine in the MMRV combination vaccine.

### **Epidemiology**

#### National

Before the vaccine was developed, varicella was a common childhood illness. The varicella vaccination program began in 1995 and has been a great success, reducing the number of annual cases in the United States by approximately 96%. Chickenpox is now rare in the United States, although outbreaks continue to occur among in child care and school settings. Outbreaks are typically smaller in size and shorter in duration compared to outbreaks that occurred before the vaccine was available.

#### North Carolina

Varicella became reported in North Carolina in mid-2020. Thirty-two cases were reported in 2021, the first full year of data available.

### **Outbreaks**

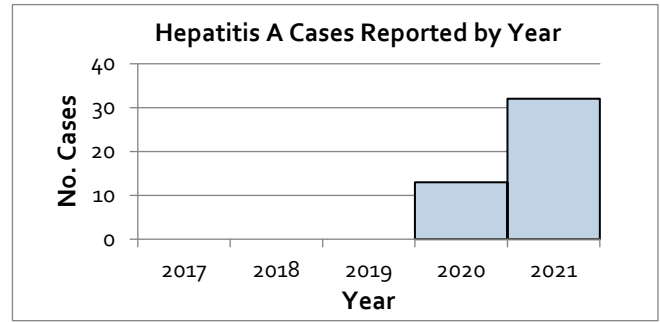
No outbreaks of varicella were reported in 2021.



# Varicella, 2021

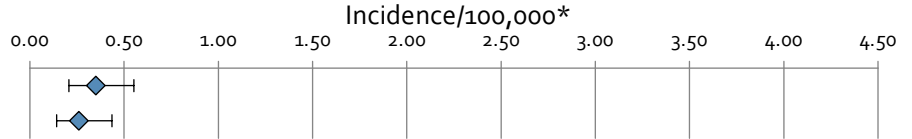
## Annual Summary

|                     | 2017 | 2018 | 2019 | 2020 | 2021 |
|---------------------|------|------|------|------|------|
| Incidence / 100,000 | 0.00 | 0.00 | 0.00 | 0.12 | 0.30 |
| No. cases           | -    | -    | -    | 13   | 32   |

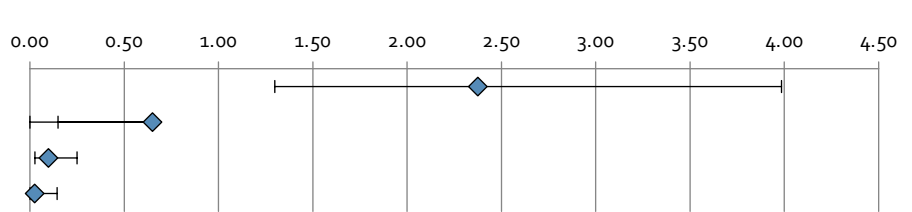


## Case Demographics, 2021

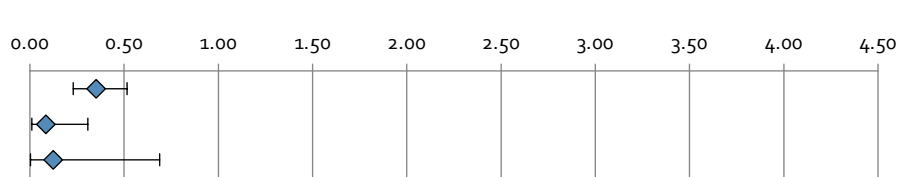
| Sex     | No. cases | % of total | Incidence/100,000 |
|---------|-----------|------------|-------------------|
| Male    | 18        | 56%        | 0.35              |
| Female  | 14        | 44%        | 0.26              |
| Unknown | 0         | 0%         | --                |



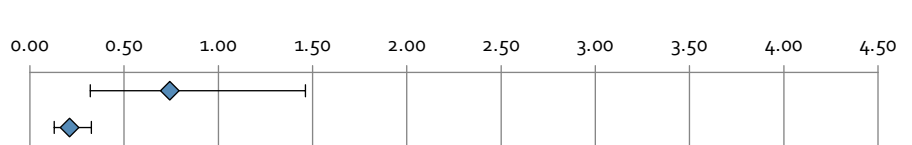
| Age Group    | No. cases | % of total | Incidence/100,000 |
|--------------|-----------|------------|-------------------|
| Under 5 yrs. | 14        | 44%        | 2.38              |
| 5-19 yrs.    | 13        | 41%        | 0.65              |
| 20-49 yrs.   | 4         | 13%        | 0.10              |
| 50+ yrs.     | 1         | 3%         | 0.03              |
| Unknown      | 0         | 0%         | --                |



| Race                | No. cases | % of total | Incidence/100,000 |
|---------------------|-----------|------------|-------------------|
| White               | 26        | 81%        | 0.35              |
| Black               | 2         | 6%         | 0.09              |
| Other               | 1         | 3%         | 0.12              |
| Multiple or Unknown | 3         | 9%         | --                |



| Hispanic Ethnicity | No. cases | % of total | Incidence/100,000 |
|--------------------|-----------|------------|-------------------|
| Yes                | 8         | 25%        | 0.74              |
| No                 | 20        | 63%        | 0.21              |
| Unknown            | 4         | 13%        | --                |



\*Point estimates and 95% confidence intervals are shown

## Geographic Distribution

## Cases By Month

