COLORADO
Department of Public Health & Environment

Vaccine-Preventable Diseases in Colorado:

2021 Surveillance Report

Contents

Introduction

This report is published by the Vaccine-Preventable and Invasive Disease Unit, part of the Communicable Disease branch within the Disease Control and Public Health Response division of the Colorado Department of Public Health and Environment. The tables and graphs in this report summarize 2021 surveillance data for confirmed and probable cases of select vaccine-preventable diseases (VPD) in Colorado. This report also describes the burden and distribution of VPDs and trends over time.

Surveillance

Colorado Board of Health regulations (6 CCR 1009-1) require health care providers and laboratories to report cases of diphtheria, invasive *Haemophilus influenzae*, measles, meningococcal disease, mumps, pertussis, invasive pneumococcal disease, polio, rubella, tetanus, and varicella, among others, to CDPHE. Health care providers can include a physician, nurse, physician assistant, or other person knowing of or suspecting a case (including but not limited to coroners, infection preventionists, school nurses, or licensed daycare providers). Laboratories include Colorado laboratories, out-of-state laboratories that maintain a physical presence in Colorado, and in-state laboratories that send specimens to out-of-state referral laboratories.

CDPHE receives federal funding from the Centers of Disease Control and Prevention (CDC) to conduct enhanced statewide surveillance for *Haemophilus influenzae,* meningococcal disease, mumps, and varicella. In addition, CDPHE receives CDC funding to conduct active, population-based surveillance for invasive *Haemophilus influenzae*, invasive pneumococcal disease, pertussis, and several other invasive bacterial infections in the five county metro-area (Adams, Arapahoe, Denver, Douglas, and Jefferson) as part of the Emerging Infections Program Active Bacterial Core Surveillance System. Enhanced surveillance involves additional data collection and validation.

All cases are to be reported with the patient's name, date of birth, sex, race, ethnicity, and address (including city and county), phone number, email address, preferred language, and name and address of the responsible physician or other health care provider in order to locate the patient for follow up.

Data sources

The data that form the basis of this report are cases of VPD among people living in Colorado at the time their illness was diagnosed. Most cases of VPD are reported via electronic laboratory reporting (ELR) and are triaged by the CDPHE Integrated Disease Reporting Program (IDRP)

and entered into the Colorado Electronic Disease Reporting System (CEDRS). Other reports are called or faxed to CDPHE or a local public health agency (LPHA). The VPD unit also requests death certificate matches from the CDPHE Office of Vital Statistics twice a year to detect VPD-related deaths not reported by providers or laboratories.

Laboratory and clinical data are obtained from health care providers directly, from review of medical records, or from patient interviews conducted by LPHAs or CDPHE. Data on immunization history are obtained from the Colorado Immunization Information System and from cases and providers.

Colorado rates were calculated as cases per 100,000 population using final 2021 population estimates from the State Demography Office within the Department of Local Affairs.

School-required vaccines

Colorado law (Board of Health rule 6 CCR 1009-2) requires all students attending Colorado schools and licensed child care facilities to be vaccinated against certain diseases, unless an exemption is filed. In addition to the vaccines required for school entry, there are several vaccines recommended by the Advisory Committee on Immunization Practices (ACIP) that provide protection against other preventable diseases. These include COVID-19, meningococcal disease, hepatitis A, rotavirus, human papillomavirus, and influenza.

Vaccines required to enter child care	**Vaccines required to enter school (K-12)**
Hepatitis B (HepB)	Hepatitis B (HepB)
Diphtheria, tetanus, pertussis (DTaP)	Diphtheria, tetanus, pertussis (DTaP)*
Haemophilus influenzae type b (Hib)	Inactivated poliovirus (IPV)*
Inactivated poliovirus (IPV)	Measles, mumps, rubella (MMR)*
Pneumococcal conjugate (PCV)	Varicella (chickenpox)*
Measles, mumps, rubella (MMR)	Tetanus, diphtheria, pertussis (Tdap)**
Varicella (chickenpox)	

*Students aged 4 through 6 years are required to have their final doses of DTaP, IPV, MMR, and varicella prior to kindergarten entry.

**Students are required to have Tdap prior to entry into sixth grade. One dose of Tdap is required for sixth through 12th grades.

Students physically attending on-campus college or university classes must provide proof of immunity to measles, mumps, and rubella diseases.

New college and university students living in student housing must have documentation of a meningococcal ACWY vaccine within the last five years, or they must review and sign the meningococcal disease information and vaccine waiver (page 2).

Impact of the COVID-19 pandemic on cases of vaccine-preventable diseases

On March 5, 2020, the CDPHE Lab identified the first case of COVID-19 disease in Colorado. In the following weeks, the daily lives of most Coloradans changed drastically. A variety of public health measures and behavior changes intended to reduce the spread of the novel coronavirus may have also reduced the incidence of several vaccine-preventable diseases in Colorado. The changes that began in 2020 and continued into 2021 that may have had an impact include: Masking in social, scholastic, and congregate care settings, social distancing, stay-at-home orders, more remote work and school, widespread use of isolation and quarantine, enhanced illness and symptom-based exclusion policies for group settings, and changes in patterns of seeking health care and provider testing practices. In addition, decreases in uptake of all routine vaccines were observed, which may impact rates of disease in Colorado in the future.

Vaccine-preventable diseases epidemiology and surveillance data

Reported cases of select* vaccine preventable diseases, Colorado, 2016-2021							
Report year	**Invasive H. influenzae type b (Hib)**	**Measles**	**Meningococcal disease**	**Mumps**	**Pertussis (Whooping cough)**	**Invasive pneumococcal disease**	**Varicella**
2021	0	0	6	0	61	455	113
Five-year average (2016-2020)	<1	<1	6	50	518	561	240
2020	0	0	6	46	124	407	96
2019	0	1	6	68	461	595	241
2018	1	0	7	33	616	636	259
2017	0	0	6	83	672	655	272
2016	0	1	4	18	716	513	330
***The vaccine preventable diseases listed here are cases classified as confirmed or probable and are part of the Vaccine Preventable and Invasive Diseases Unit's routine surveillance activities. Other vaccine preventable diseases not listed in this table are investigated by other units within the Communicable Disease branch.							

Note: During 2016-2021, no congenital rubella, diphtheria, polio, or rubella cases were reported. Two tetanus cases were reported during 2015, one during 2018, and one during 2020. Case counts for hepatitis A, hepatitis B, and influenza are available in other CDPHE surveillance reports, as described below. Five-year averages were rounded to the closest whole number.

Diphtheria

Diphtheria, an extremely rare disease in the United States, is caused by infection with toxigenic (toxin-producing) strains of the bacterium *Corynebacterium diphtheriae*. Important sites of infection are the respiratory mucosa (respiratory diphtheria) and skin (cutaneous diphtheria).

No cases of toxigenic diphtheria were reported in Colorado or the United States during 2021. The last case of diphtheria reported in Colorado was in 1985.

Until 2019, the case definition only included cases based on isolation of toxin-producing *C. diphtheria* from respiratory sites. During 2019, the case definition was changed to allow for toxin-producing specimens from non-respiratory anatomical sites. The change in case definition

increased the number of suspected cases investigated. Toxin testing of isolates is performed at CDC.

CDC's Advisory Committee on Immunization Practices recommends routine vaccination with diphtheria-containing vaccine, DTaP (diphtheria, tetanus, and acellular pertussis) at 2, 4, 6, and 15 through 18 months and 4 through 6 years[1], followed by a dose of Tdap at 11-12 years old. Pregnant people are recommended to receive a single dose of Tdap (tetanus, diphtheria, and pertussis) during every pregnancy, and adults should receive a single dose of Td or Tdap vaccine every 10 years. Adults who have never received Tdap also are recommended to receive a booster dose of Tdap.[2]

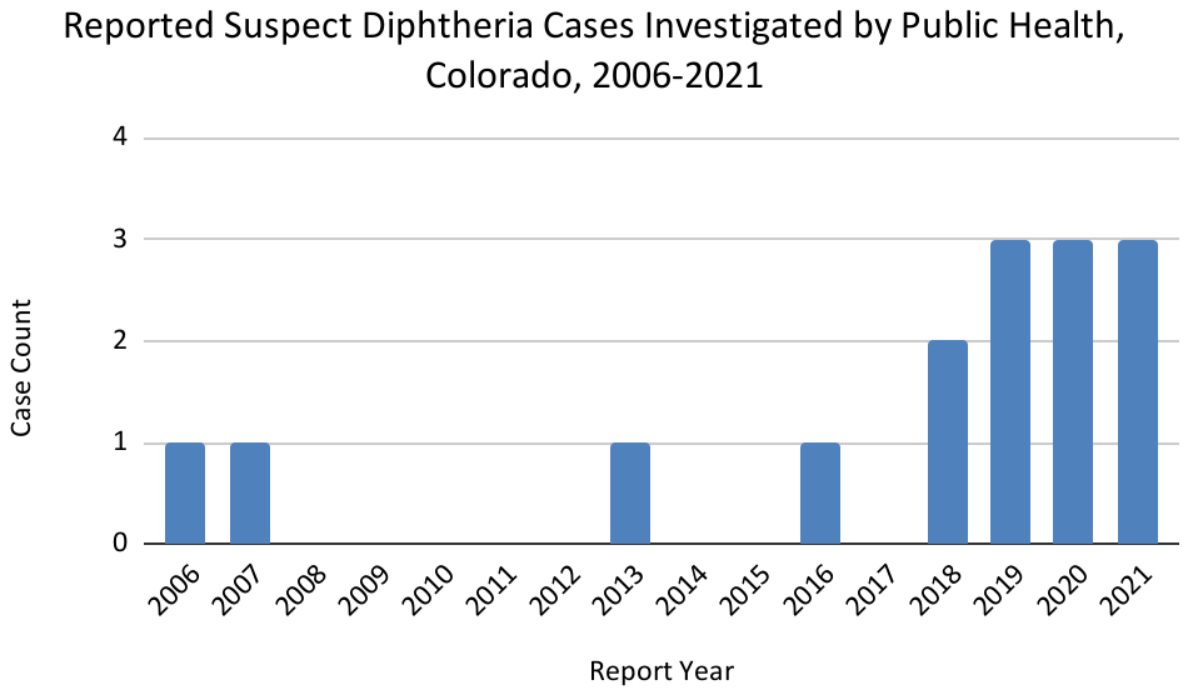

Figure 1. There were three reported suspect cases of diphtheria in Colorado in 2021. All three were tested at CDC for toxin-producing C. diphtheria *but were found to be non-toxin producing.*

Haemophilus influenzae (Hi)

Haemophilus influenzae is a bacteria that can cause many different kinds of infections from mild ear infections to severe disease, like bloodstream infections. Only *H. influenzae* infections in sterile sites of the body such as blood, spinal fluid, and joint fluid are considered invasive and must be reported to CDPHE. These infections with *H. influenzae* are usually severe, requiring

[1] CDC. Prevention of Pertussis, Tetanus, and Diphtheria with Vaccines in the United States: Recommendations of the Advisory Committee.
[2] CDC. Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP)- United States, 2019. MMWR 2020 Jan 24; 69(3);77-83.

treatment in a hospital, and can sometimes result in death. The most common types of invasive infections caused by *H. influenzae* are: Pneumonia (infection in the lungs), bacteremia (infection in the blood), meningitis (infection of the tissue covering of the brain and spinal cord), and infectious arthritis (inflammation of the joint). CDPHE does not track non-invasive *H. influenzae* disease, such as ear infections.

There are six serotypes, or strains, of *H. influenzae* (a through f), depending on the outer covering of the bacteria, or polysaccharide capsule. There is also a strain of *H. influenzae* called non-typeable because this strain lacks a capsule around the bacteria. CDPHE requires labs to send isolates from all invasive *H. influenzae* cases to the CDPHE Lab to determine the serotype and track trends in disease. A few cases every year have an unknown serotype — occasionally, a laboratory discards an isolate before submitting it for serotyping. .

Before the introduction of effective vaccines, *H. influenzae* type b (Hib) caused more than 95% of invasive disease in children younger than 5 years old.[3] In the post-vaccine era, non-typeable *H. influenzae* causes the majority of invasive disease in all age groups. Hib is rare in Colorado. Only Hib is preventable by vaccination; the other types of *H. influenzae* are not.

ACIP recommends routine vaccination with a conjugate Hib vaccine series beginning at 2 months old, in either a two-dose or a three-dose series, depending on the vaccine used. A booster of any licensed conjugate Hib vaccine at age 12 through 15 months is recommended.[4]

[3] CDC. Prevention and Control of *Haemophilus influenzae* Type b Disease: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2014 Feb 28 ; 63 (RR01); 1-14.
[4] CDC. Prevention and Control of *Haemophilus influenzae* Type b Disease: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2014 Feb 28 ; 63 (RR01); 1-14.

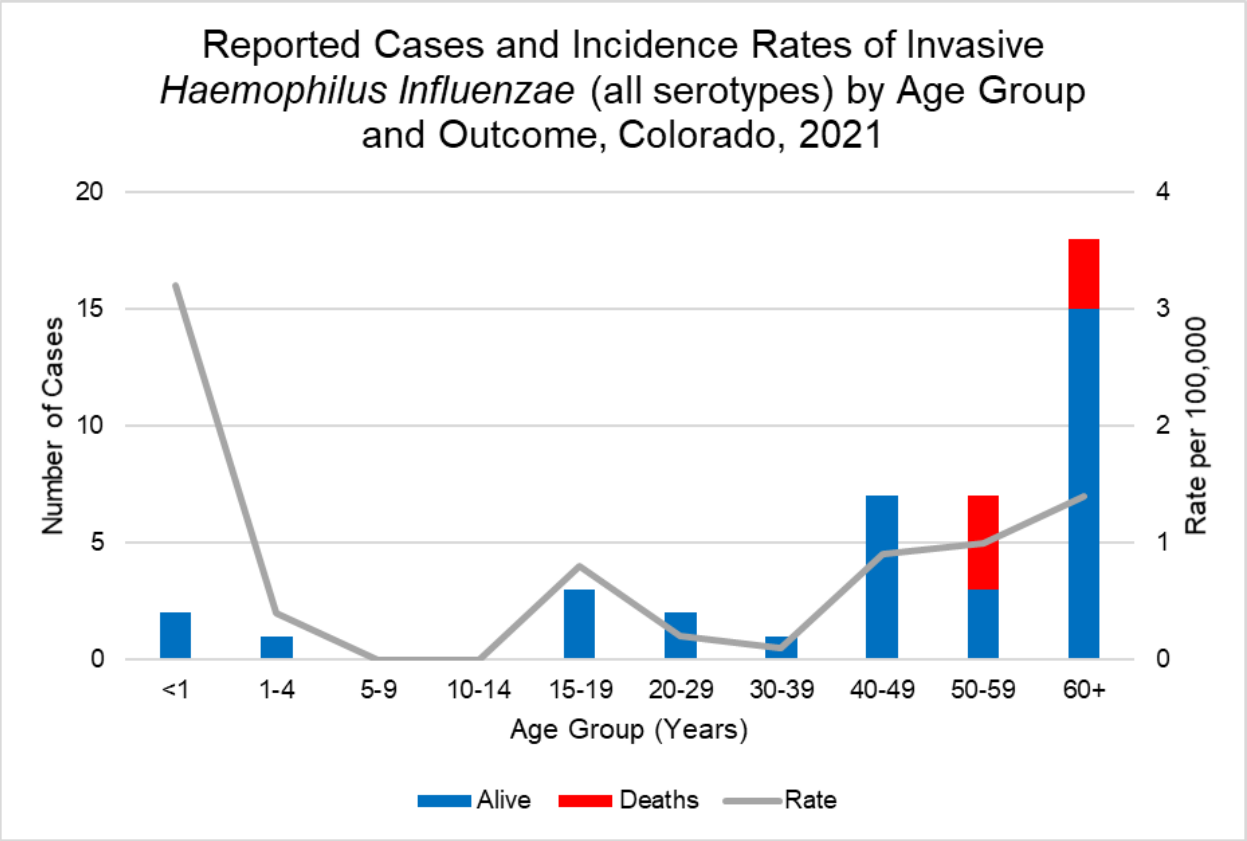

Figure 2. There were 41 total cases of Haemophilus influenzae *in 2021.*

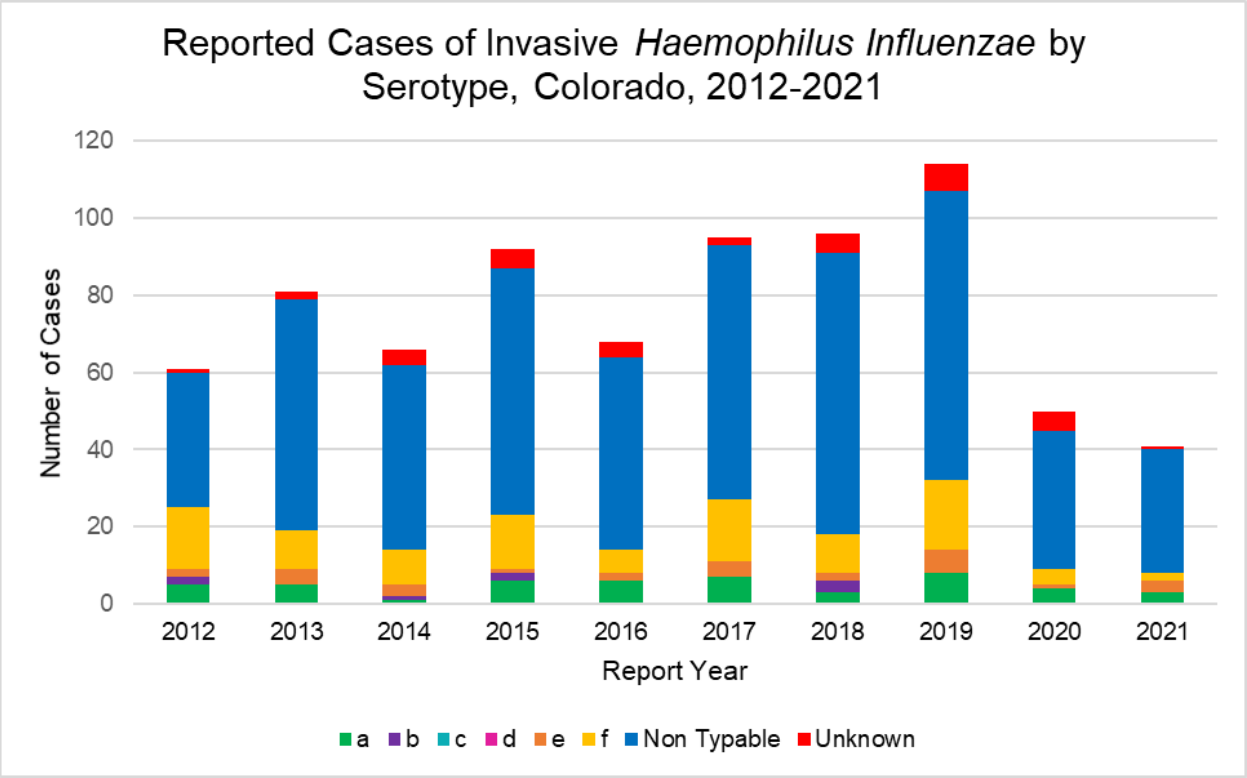

Figure 3. Cases of invasive Haemophilus influenzae *decreased in 2021, likely due to precautions implemented for COVID-19.*

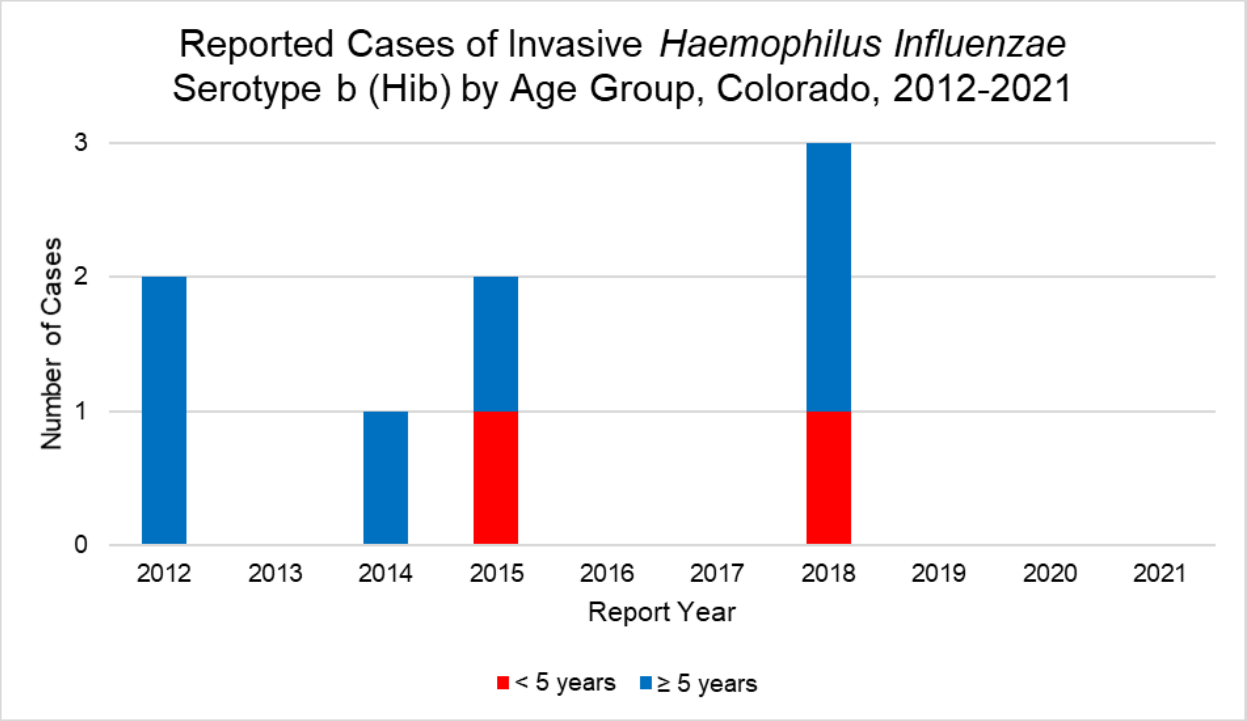

Figure 4. Of the two cases of Hib <5 years old reported 2012-2021, one was unvaccinated.

Hepatitis A and B

Hepatitis A (HAV) and hepatitis B (HBV) viral infections are reportable in Colorado. Hepatitis A is typically transmitted by consuming contaminated food or water or person-to-person spread that appears only as an acute (newly occurring) infection that does not become chronic. People with hepatitis A infection can have a mild illness lasting a few weeks to a more severe illness requiring hospitalization. Most people with hepatitis A infection usually improve without treatment.

A vaccine to prevent hepatitis A infection was introduced in 1995. CDC's Advisory Committee on Immunization Practices (ACIP) recommends that all children receive two doses of hepatitis A vaccine beginning at 1 year or older, with a minimum of 6 months between doses.[5] A two-dose series of hepatitis A vaccine with a minimum interval of six months or a three-dose series of combined hepatitis A and hepatitis B vaccine are recommended for adults who want protection from hepatitis A or who are at risk for infection.[6]

Hepatitis B is typically a bloodborne illness that can occur as an acute or chronic infection. It can range in severity from a mild illness that clears on its own within a few weeks to a serious chronic illness that can result in death. The virus can replicate in the liver for years, oftentimes without obvious symptoms, until severe, irreparable damage has occurred.

ACIP recommends infants receive a three-dose series of hepatitis B vaccines at age 0, 1, and between 6 and 18 months.[7] Children not previously vaccinated with hepatitis B vaccine should receive a three-dose series, to include an interval of at least four weeks between the first and second dose, an interval of at least eight weeks between the second and third dose, AND an interval of at least 16 weeks between the first and third doses.[8] Hepatitis B vaccination is recommended for all unvaccinated adults at risk for HBV infection and for all adults requesting protection from HBV infection. Acknowledgment of a specific risk factor should not be a requirement for vaccination.[9]

Beginning in October 2018, Colorado experienced a significant increase in hepatitis A cases that were linked to a nationwide outbreak affecting people experiencing homelessness and people who use drugs. At least 37 states were impacted by similar outbreaks. The Colorado Department of Public Health and Environment partnered with local public health agencies and community organizations to support case follow-up, outreach, immunization, and education efforts.[10] This outbreak continued to increase through much of 2019, with cases reaching peak

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[5] CDC. Recommended Immunization Schedules for Persons Aged 0 Through 18 Years, United States, 2021.
[6] Prevention of Hepatitis A Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices, 2020. *Recommendations and Reports* / July 3, 2020 / 69(5);1–38.
[7] CDC. Recommended Child and Adolescent Immunization Schedule for ages 18 years or younger, United States, 2021.
[8] CDC. Catch-up immunization schedule for persons aged 4 months–18 years who start late or who are more than 1 month behind, United States, 2021.
[9] CDC. Epidemiology and Prevention of Vaccine-Preventable Disease. Hamborksy J, Kroger A, Wolfe S, eds. 13th ed. Washington D.C. Public Health Foundation, 2015.
[10] Immunize Colorado. Hepatitis A Prevention. https://www.immunizecolorado.org/resources/video-how-to-protect-yourself-against-hepatitis-a/.

incidence around the end of 2019. This outbreak was declared to be over in February 2021, after three consecutive calendar months at an adjusted post-outbreak baseline rate of ≤five cases per month. At the closure of the outbreak, a total of 418 cases were reported in Colorado. Since the closure of the outbreak, the incidence of hepatitis A cases has returned to pre-outbreak levels, with 11 confirmed cases reported in 2021.

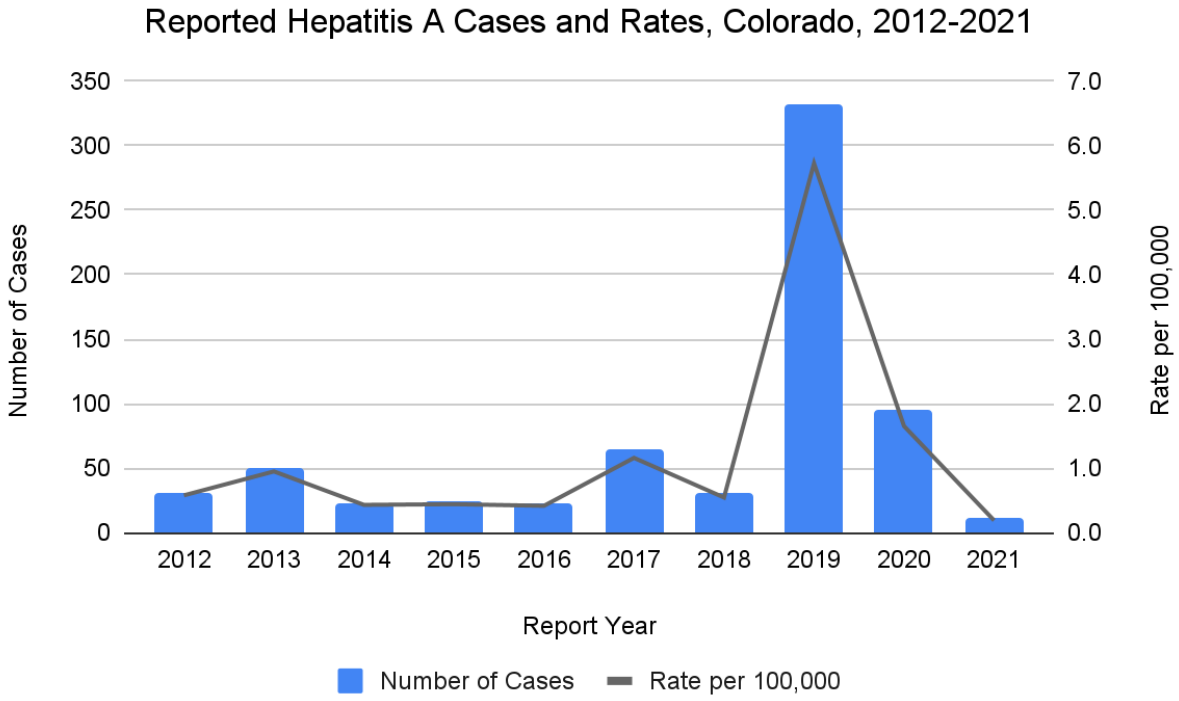

Figure 5. Reported cases of hepatitis A increased significantly during 2019 and 2020, returning to pre-outbreak levels in 2021.

See the full viral hepatitis reports online..

Influenza

Influenza (also known as flu) is a contagious respiratory illness caused by influenza viruses. It can cause mild to severe illness and, in some cases, may lead to death. The recovery time for influenza may range from a few days up to two weeks, and some patients may develop more severe complications such as pneumonia, inflammation of the heart (myocarditis) or brain (encephalitis), and multi-organ failure.

Influenza-associated hospitalizations among patients of all ages and influenza-associated deaths in children younger than 18 years old are reportable in Colorado. CDPHE conducts additional influenza surveillance activities, including: Reporting of influenza-like illness visits from a select network of outpatient clinical sites, reporting of influenza testing activity by sentinel

hospital laboratories, monitoring circulating influenza viruses through molecular testing at the CDPHE State Laboratory, and reporting of outbreaks of influenza in correctional facilities and group residential settings.

ACIP recommends routine annual influenza vaccination for all people aged 6 months and older who do not have contraindications.

See the full influenza seasonal summary report online.

Measles

Measles is an acute illness caused by the measles virus. Clinical symptoms of measles are characterized by a generalized rash lasting more than three days, a temperature of greater than 101°F/38.3°C, and the onset of a cough, runny nose, and/or red swollen eyes. In 2000, measles was declared eliminated from the United States. Although endemic (acquired in the United States) measles has been eliminated nationally, importation of measles will continue to occur, as measles remains endemic in many other parts of the world. Thus, current measles epidemiology in the United States and Colorado is determined by characteristics of the imported cases and their susceptible contacts.

ACIP recommends routine vaccination with the measles, mumps, and rubella (MMR) vaccine at age 12 through 15 months and a second dose at age 4 through 6 years. Adults with no evidence of immunity should get at least one dose of MMR vaccine. People who attend college, travel internationally, or who work in health care settings should have two doses of MMR vaccine.[11]

[11] CDC. Prevention of Measles, Rubella, Congenital Rubella Syndrome and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP). 2013 Jun 14; 62 (RR04); 1-34.

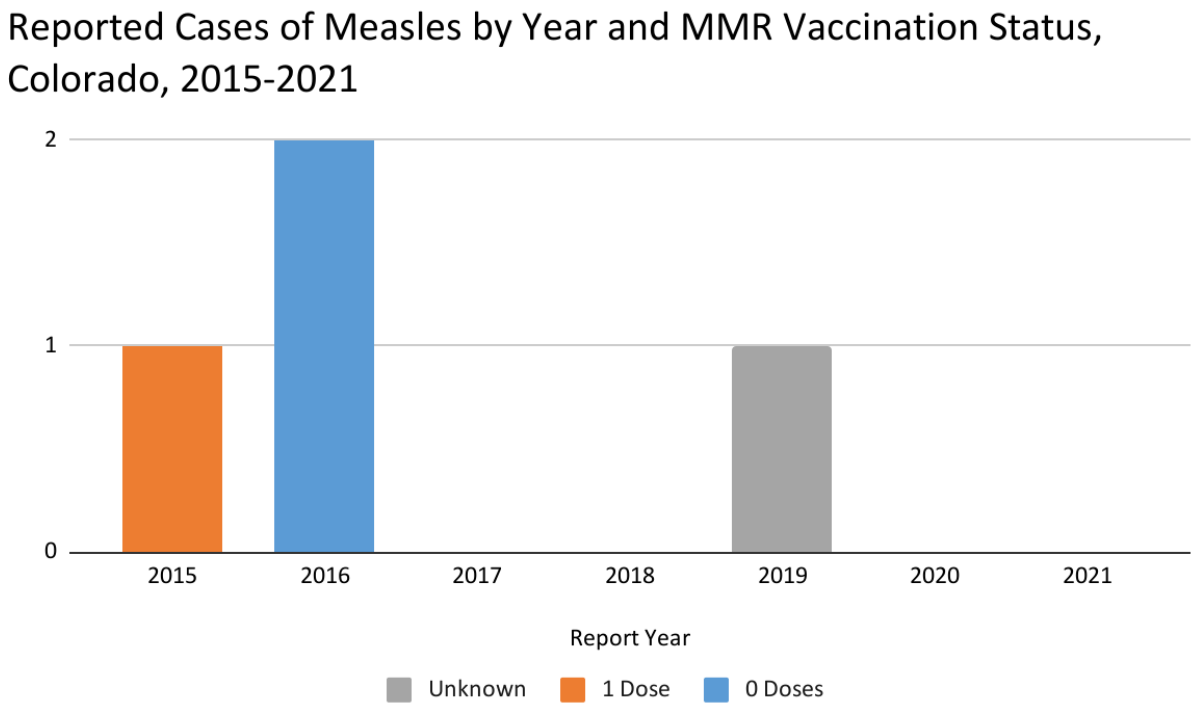

Figure 6. One of the unvaccinated cases from 2016 was too young to receive measles vaccination. The case in 2015 had one recorded vaccine, but it was administered prior to the recommended age for vaccination. The second unvaccinated case in 2016 was an adult eligible for vaccination. No cases of measles were reported in 2017 or 2018. The unvaccinated case in 2019 was an adult eligible for vaccination. No cases of measles were reported during 2020 or 2021.

Meningococcal disease

Meningococcal disease is a serious and often life-threatening infection caused by the bacterium *Neisseria meningitidis*. When this bacteria invades otherwise sterile sites of the body like blood or spinal fluid, meningococcal disease occurs. Of the several types of *N. meningitidis*, serogroups A, B, C, W, and Y are the main causes of invasive meningococcal disease.

Invasive *N. meningitidis* infection can cause several types of illnesses, including meningitis (inflammation of the membrane around the brain and spinal cord), sepsis (infection of the blood), or pneumonia (infection of the lungs). These diseases develop rapidly, even among previously healthy people. Despite appropriate antibiotic treatment, about 15% of cases of meningococcal disease are deadly. Among those who survive, 10–20% have long-term effects that may include limb loss, extensive skin scarring, hearing loss, mild to moderate cognitive defects, or seizure disorders.[12]

N. meningitidis is spread via small droplets or mucus by coughing, sharing drinks or vaping/smoking devices, or by being in close or lengthy contact with someone who carries the

[12] Meningococcal Vaccination: Recommendations of the Advisory Committee on Immunization Practices, United States, 2020 Recommendations and Reports / September 25, 2020 / 69(9);1–41.

bacteria. Many people carry the bacteria in their nose or throat, but most do not develop invasive disease.[13] Invasive meningococcal disease occurs throughout the year in Colorado.

The ACIP recommends routine vaccination with a quadrivalent meningococcal conjugate vaccine (MenACWY) among children aged 11 to 12 years, with a booster dose at 16 years. ACIP also recommends routine vaccination for people at increased risk of developing meningococcal disease. In the fall of 2015, ACIP began recommending that children and young adults aged 16 to 23 years may be vaccinated with a serogroup B meningococcal (MenB) vaccine to provide short-term protection against most strains of serogroup B meningococcal disease.[14]

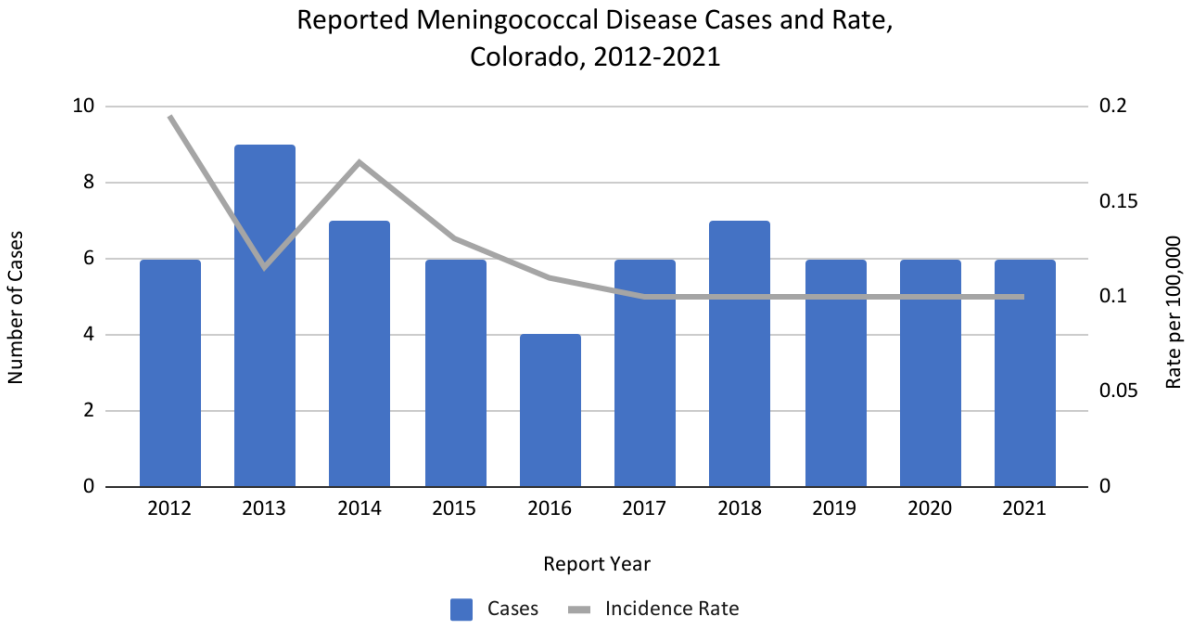

Figure 7. Meningococcal disease rates have remained relatively steady over the last few years, with an average of six cases per year over the last five years.

[13] VPD Surveillance Manual,Meningococcal Disease: Chapter 8: Meningococcal Disease. Lucy A. McNamara, PhD, MS; Amy Blain, MPH.
[14] Meningococcal Vaccination: Recommendations of the Advisory Committee on Immunization Practices, United States, 2020 Recommendations and Reports / September 25, 2020 / 69(9);1–41.

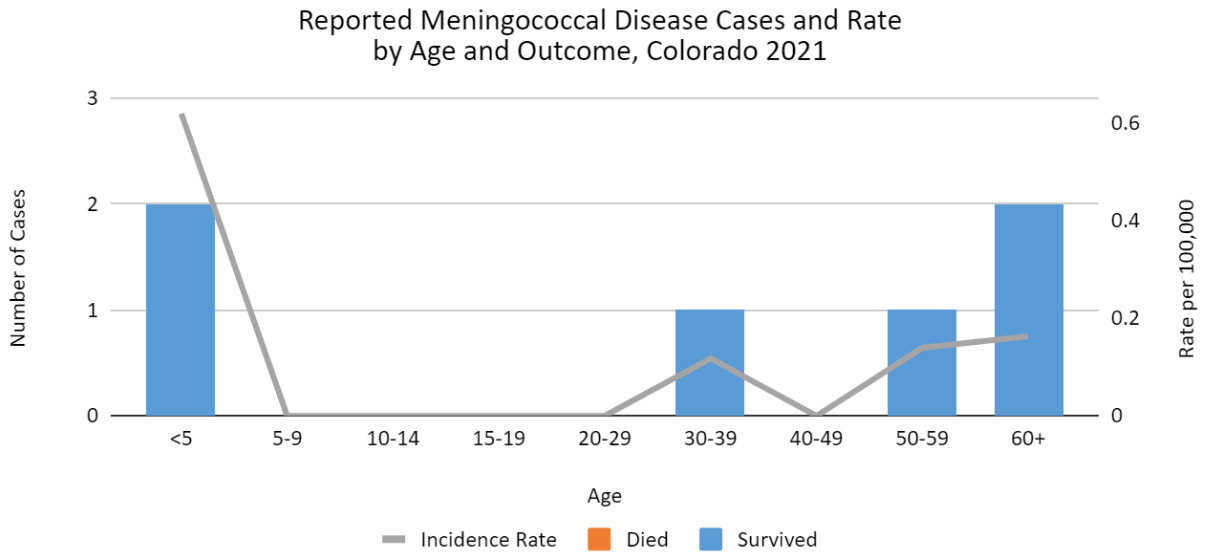

Figure 8. Of the six cases of meningococcal disease in 2021, two were in children younger than 5 years. There were no deaths due to meningococcal disease during 2021.

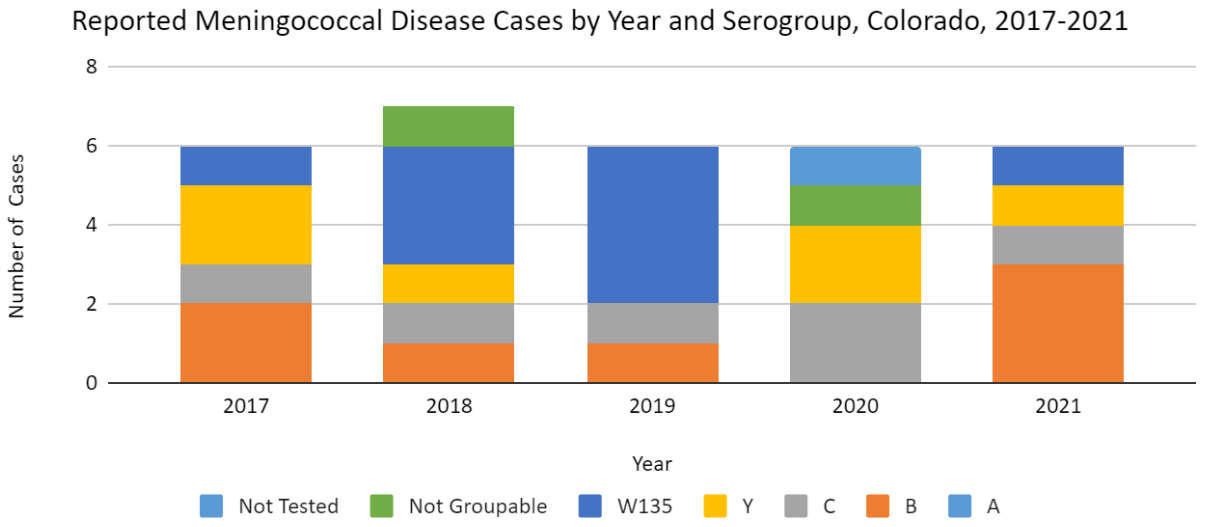

Figure 9. Meningococcal conjugate vaccines contain antigens from serogroups A, C, Y, and W-135. Of the six cases in 2021 with disease caused by these serogroups, none were known to have been vaccinated against meningococcal disease.

Mumps

Mumps is an acute viral illness. The classic symptom of mumps is swelling of the parotid gland (parotitis) or other salivary glands along the jaw. Swelling usually lasts at least two days but may last up to 10 days. Other symptoms of mumps include jaw pain, tiredness, and swelling of the

testicles or ovaries. Some people with mumps only have respiratory symptoms or no symptoms at all.

Results from several outbreak investigations have shown that hospitalizations and overall complications are lower in people who were fully vaccinated compared with people who were unvaccinated. Severe complications of mumps are uncommon but occur more often in adults than children. Among all people infected with mumps, reported rates of pancreatitis, deafness, meningitis, and encephalitis were less than 1%.[15]

ACIP recommends routine vaccination with the measles, mumps, and rubella (MMR) vaccine at age 12 through 15 months and a second dose at age 4 through 6 years. Adults with no evidence of immunity should get at least one dose of MMR vaccine. People who attend college, travel internationally, or who work in health care settings should receive two doses of MMR vaccine.[16]

Since 2016, the United States and Colorado have seen an increase in mumps outbreaks. Some of the common outbreak settings were households, workplaces, schools, universities, sports teams and their facilities, and church groups.[17] Colorado has seen outbreaks in other settings where people have regular close contact, such as close-knit religious groups, adults being held in immigration detention centers, and resort communities.

[15] Centers for Disease Control and Prevention. (2018, January 31). *Mumps - Vaccine Preventable Diseases Surveillance Manual*. Centers for Disease Control and Prevention. https://www.cdc.gov/vaccines/pubs/surv-manual/chpt09-mumps.html.
[16] CDC. Prevention of Measles, Rubella, Congenital Rubella Syndrome and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP). 2013 Jun 14; 62 (RR04); 1-34.
[17] Centers for Disease Control and Prevention. (2021, July 12). *Mumps*. Centers for Disease Control and Prevention. https://www.cdc.gov/mumps/outbreaks.html.

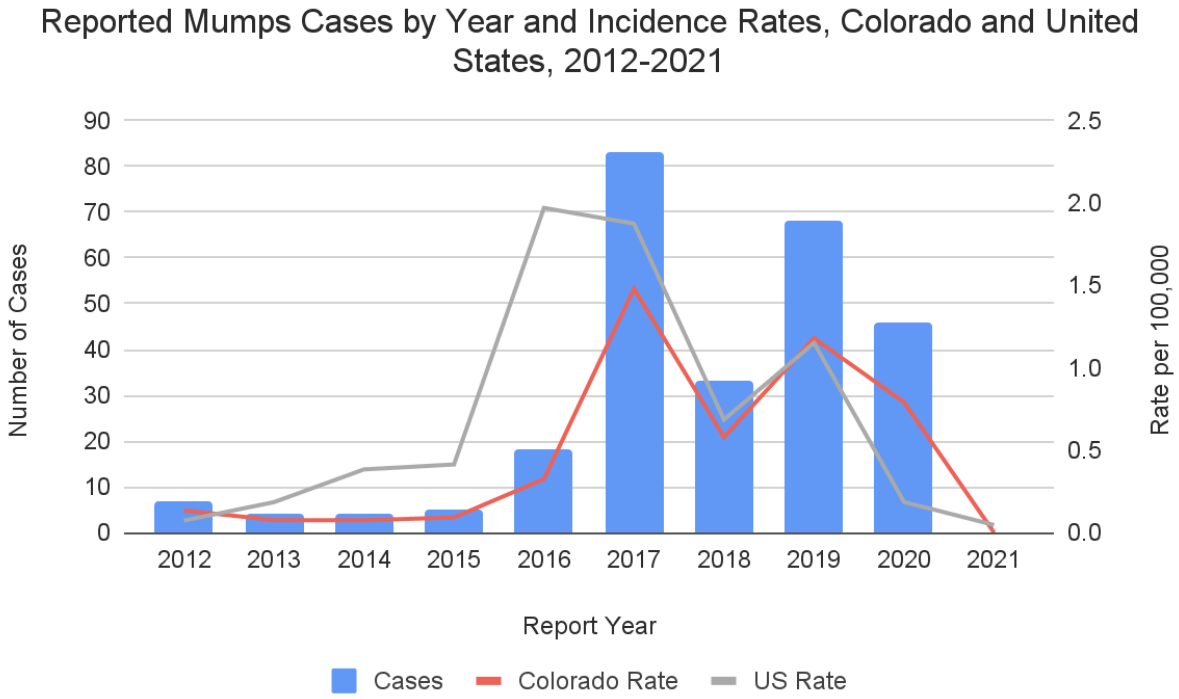

Figure 10. Early 2020 saw several outbreaks of mumps across Colorado. However after COVID-19 began to spread throughout the state and measures to contain COVID-19 were initiated, mumps cases decreased. In 2021, there were no reported cases of mumps in Colorado.

Pertussis (Whooping cough)

Pertussis, or "whooping cough," is a respiratory disease caused by the bacterium *Bordetella pertussis* that is easily spread from person to person. The illness is typically characterized by a prolonged, paroxysmal cough (coughing fits).

Pertussis rarely causes severe complications in healthy, vaccinated people. However, infants are at greatest risk for pertussis-related complications and death. Pneumonia is the most common complication in all age groups; seizures and encephalopathy (brain swelling) are rare and generally occur only among very young infants. Death is infrequent and most likely to occur in unvaccinated infants, although deaths occasionally occur in older children and adults with serious underlying health conditions.

Laboratory surveillance to monitor changes in *B. pertussis* is important. Isolates of *B. pertussis* collected through enhanced surveillance are vital to understanding the evolution of *B. pertussis* and how those changes may impact the current pertussis vaccination program and other prevention strategies.

Starting in 2012, Colorado and the United States experienced epidemic levels of pertussis. While cases began decreasing in 2014, levels remained high until 2020, compared to the annual average number of cases in the 1980s and 1990s. Multiple factors have likely

contributed to the increase, including waning immunity from acellular pertussis vaccines; heightened provider and public awareness; improved testing; and possibly molecular changes within the pertussis bacterium. In 2021, although overall cases of pertussis remained low compared to pre-pandemic years, the incidence of pertussis remained high among young infants compared to other age groups.

ACIP recommends routine vaccination with pertussis-containing vaccine, DTaP (diphtheria, tetanus, and acellular pertussis vaccination) at 2, 4, 6, and 15 through 18 months and 4 through 6 years, followed by a dose of Tdap at 11-12 years. Pregnant people are recommended a single dose of Tdap during every pregnancy. For adults who have never received Tdap, a dose of Tdap can replace one of the 10-year Td booster doses.[18]

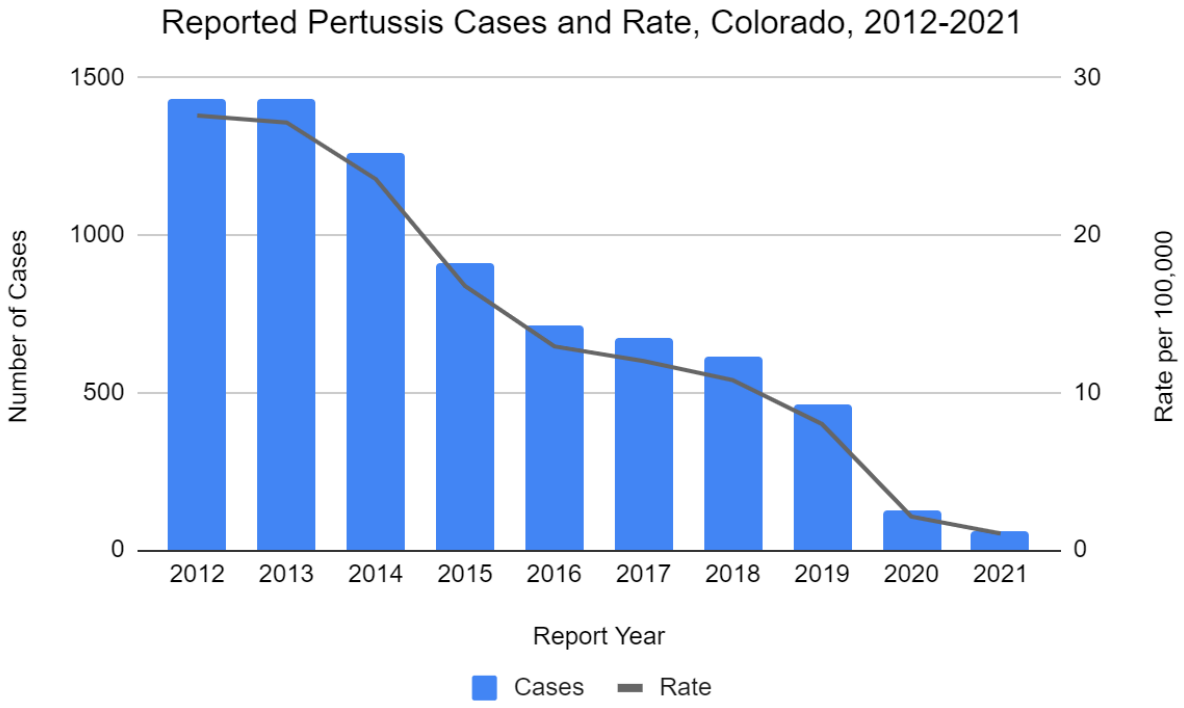

Figure 11. Cases of pertussis have been declining since 2012. During 2021, 1.05 people per 100,000 had pertussis in Colorado.

[18] CDC. Prevention of Pertussis, Tetanus, and Diphtheria with Vaccines in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2018 Apr 27; 67(2);1-44.

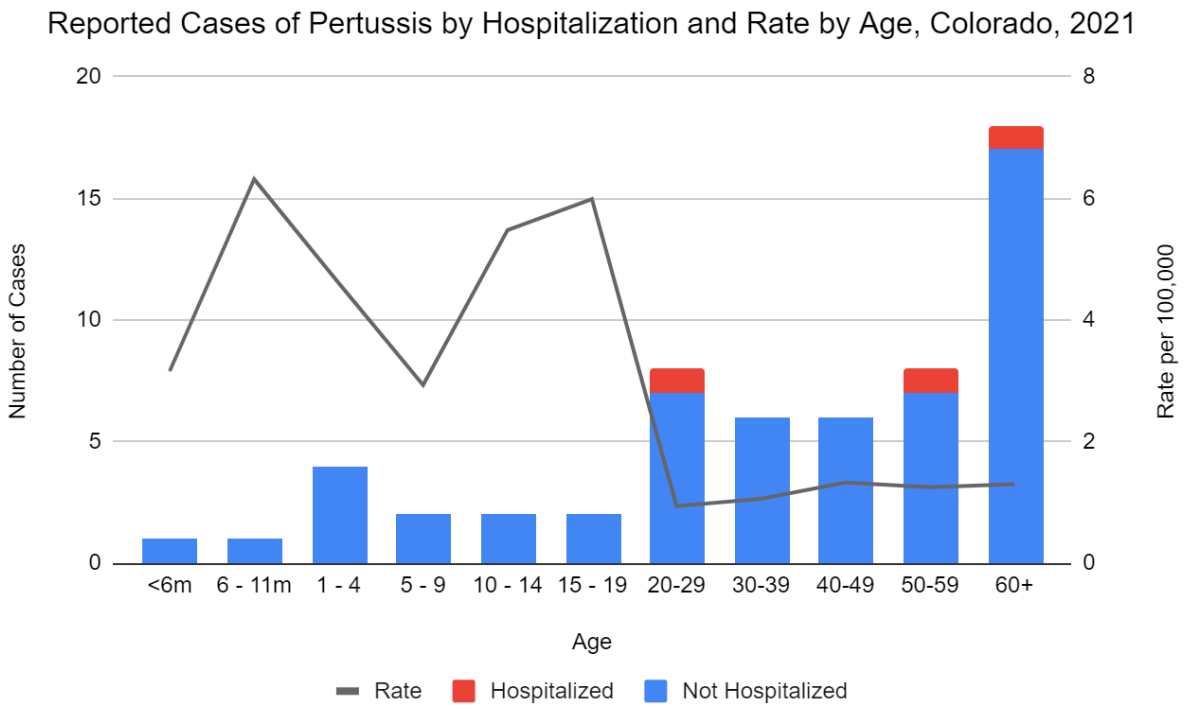

Figure 12. Cases and rate of pertussis by age in Colorado. Of the 61 cases reported in 2021, 11 were classified as confirmed and 50 were probable. The average number of days hospitalized in 2021 was 10.5 days, with the maximum being 21 days.

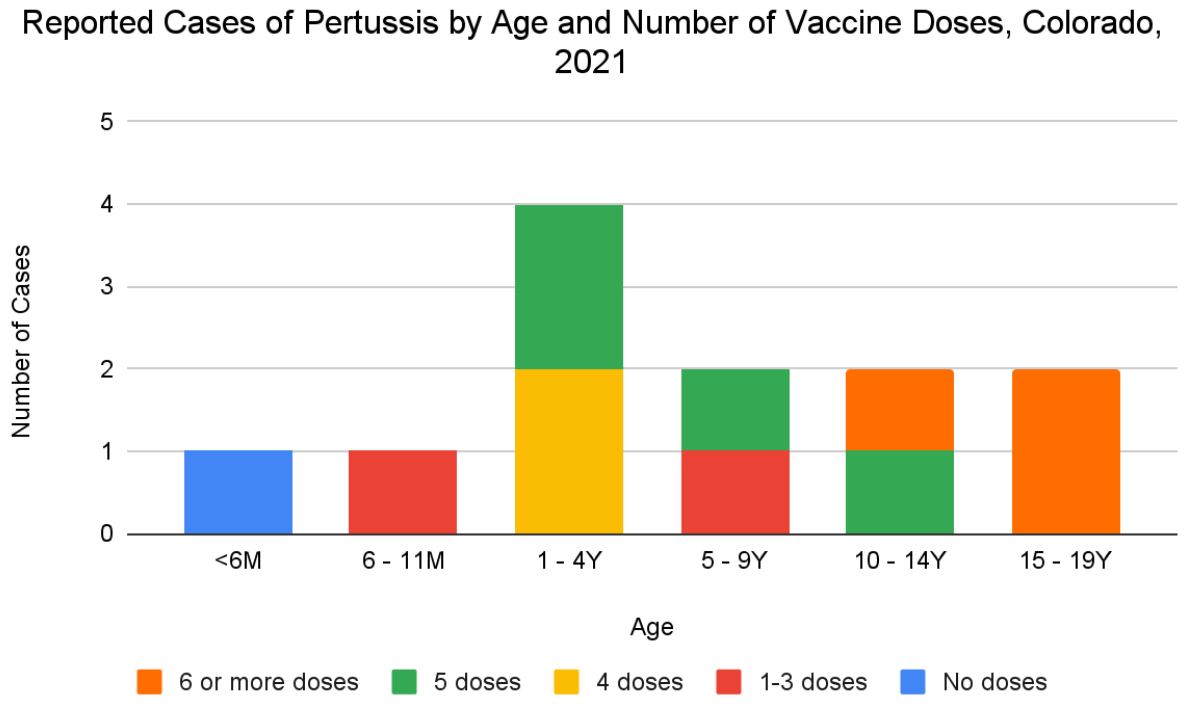

Figure 13. Cases of pertussis among individuals aged 0-19 years by number of vaccine doses. The single case <6 months old did not meet ACIP recommendations for vaccination at time of illness. Vaccination status was known for all cases in 2021, so the "unknown" category was removed.

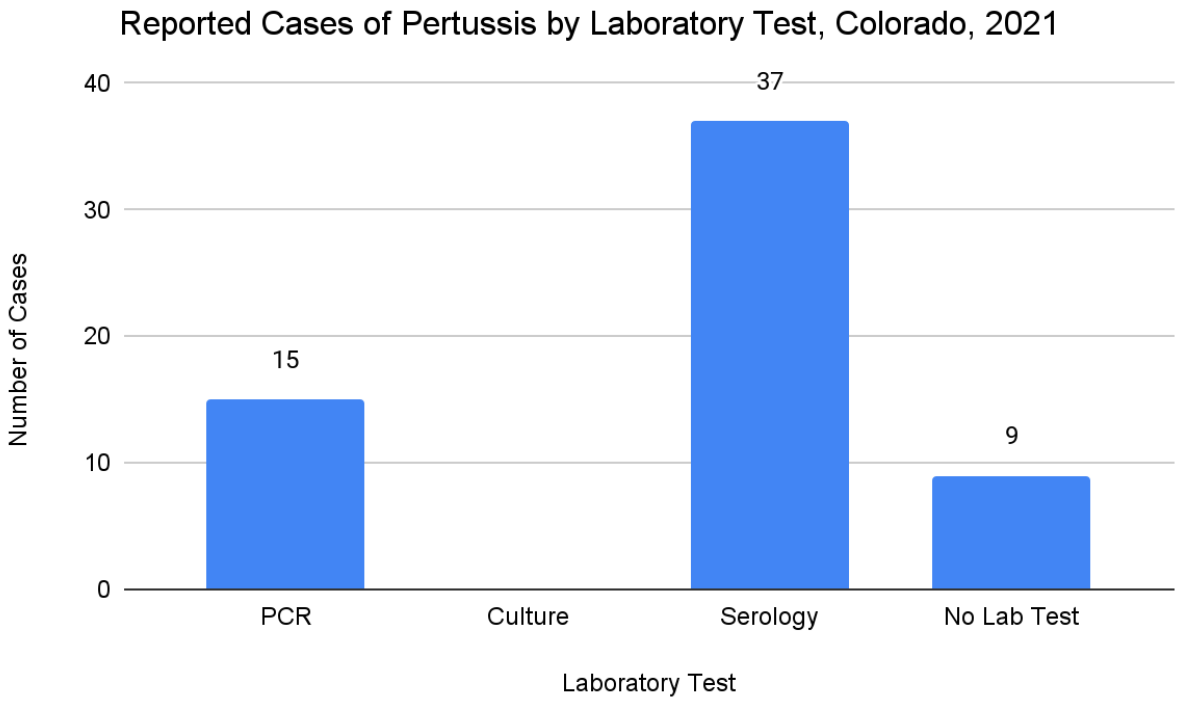

Figure 14. Cases of pertussis by reported laboratory test. Note: In some cases, a laboratory test was not performed as additional cases were ascertained through other case interviews.

Pneumococcal disease, invasive

Invasive pneumococcal disease (IPD) is an infection in the blood, spinal fluid, or other sterile body site with the bacteria, *Streptococcus pneumoniae*, or pneumococcus. Pneumococcus is the most common cause of bloodstream infections, pneumonia, meningitis, and middle ear infections in young children. Adults older than 65 years are also at increased risk, especially if they have certain chronic illnesses such as asthma, heart disease, or cancer. Two types of vaccines are available, conjugate vaccines (PCV13, PCV15, PCV20) and polysaccharide vaccines (PPSV23), to prevent against the most common strains of pneumococcal disease. A description of different types of vaccines can be found in CDC's The Pink Book[19].

Following the introduction of the pneumococcal conjugate vaccines in children in the United States (PCV7 in 2000, which was later replaced by PCV13 in 2010 and then by PCV15 in

[19] CDC. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hall E., Wodi A.P., Hamborsky J., et al., eds. 14th ed. Washington, D.C. Public Health Foundation, 2021.

2021), dramatic declines in invasive pneumococcal disease among those younger than 5 years old were reported nationwide. All children 2 to 59 months old should be routinely vaccinated with PCV13 or PCV15, following ACIP guidelines. The primary series beginning in infancy consists of three doses routinely given at 2, 4, and 6 months. A fourth (booster) dose is recommended at 12–15 months.[20]

PCV13 was introduced in 2012 for use among adults 19 years or older with immunocompromising conditions and in 2014 for all adults 65 years or older. In 2021, PCV15 and PCV 20 were recommended by ACIP for all adults 65 years or older and adults 19 through 64 years old with certain underlying medical conditions or other risk factors, replacing the recommendation of PCV13[21]. However, declines in invasive pneumococcal disease were seen as early as 2001 among adults because of the use of pneumococcal conjugate vaccines in children (community immunity protection). Adults 65 years or older who have not previously received pneumococcal vaccine or whose previous vaccination history is unknown should receive a dose of PCV15 or PCV20. If PCV 15 is used, a dose of PPSV23 should be given one year later.[22]

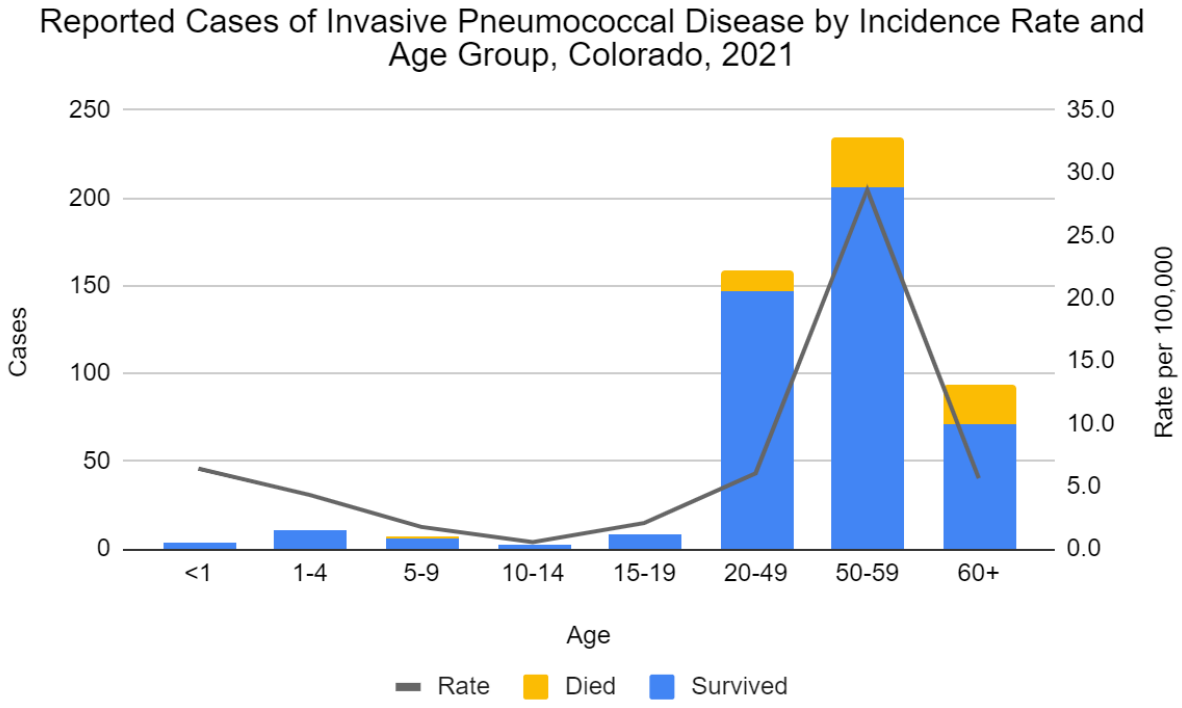

Figure 15. The highest rates of invasive pneumococcal disease occur in the 50-59-year-old population.

[20] CDC. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hall E., Wodi A.P., Hamborsky J., et al., eds. 14th ed. Washington, D.C. Public Health Foundation, 2021.

[21] https://www.cdc.gov/mmwr/volumes/71/wr/mm7104a1.htm.

[22] CDC. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hall E., Wodi A.P., Hamborsky J., et al., eds. 14th ed. Washington, D.C. Public Health Foundation, 2021.

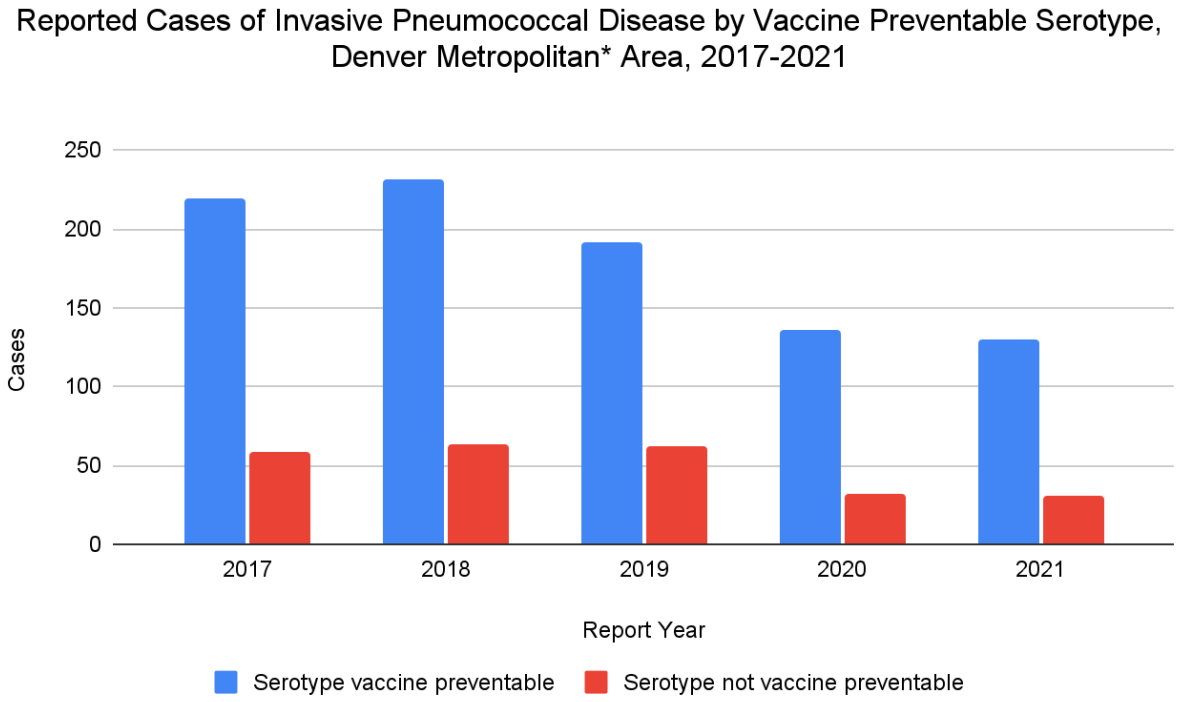

*Figure 16: *Isolates from residents in the Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) with invasive pneumococcal disease are serotyped at CDC as part of the Emerging Infections Program (EIP). Serotypes that are vaccine preventable include 1, 2, 3, 4, 5, 6A, 6B, 7F, 8, 9V, 10A, 11A, 12F, 14, 15B, 18C, 19A, 19F, 20, 22F, 23F, and 33F. This chart only includes specimens that were sent to CDC for serotyping.*

Polio

In the United States, the last polio case caused by wild poliovirus was identified in 1979. In 1994, the World Health Organization certified the Western Hemisphere as free of wild poliovirus.

ACIP recommends routine immunization with inactivated poliovirus vaccine (IPV) at ages 2, 4, 6 through 18 months, and 4 through 6 years.[23]

Rubella

No rubella cases were reported in Colorado during 2021. The last reported case of rubella in Colorado was in 2003.

ACIP recommends routine vaccination with the measles, mumps, and rubella (MMR) vaccine at age 12 through 15 months and a second dose at age 4 through 6 years. Adults with no evidence of immunity should get at least one dose of MMR vaccine. People who attend college,

[23] CDC. Updated Recommendations of the Advisory Committee on Immunization Practices (ACIP) Regarding Routine Poliovirus Vaccination. 2009 Aug 7; 58 (30); 829-830.

travel internationally, or who work in health care settings should have two doses of MMR vaccine.[24]

Tetanus

During 2012-2021, there were five cases of tetanus reported in Colorado (two in 2015, and one case in 2018, 2019, and 2020). No cases were reported for 2021. One of the 2015 cases had not received a tetanus vaccine in more than 25 years, and the vaccination status of the second 2015 case is unknown. The vaccination status of the 2018 and 2019 cases was unknown. The 2020 case was elderly and did not recall being vaccinated during adulthood and later died from the illness.

ACIP recommends routine vaccination with tetanus toxoid-containing vaccine, DTaP (diphtheria, tetanus, and acellular pertussis vaccination) at 2, 4, 6, and 15 through 18 months and 4 through 6 years, followed by a dose of Tdap at 11-12 years. Pregnant people are recommended a single dose of Tdap during every pregnancy. Adults should receive a single dose of Td vaccine every 10 years. A dose of Tdap can replace one of the 10-year Td booster doses. Adults who have never received Tdap also are recommended to receive a booster dose of Tdap.[25]

Varicella (chickenpox)

Chickenpox is caused by the varicella-zoster virus (VZV). Primary infection with VZV causes varicella (chickenpox). VZV has the ability to persist in the body as a latent infection. Shingles, also known as herpes zoster, results from the reactivation of the latent VZV infection. In Colorado, only cases of primary varicella (chickenpox) are reported to CDPHE. Providers are not required to report shingles cases in Colorado.

Varicella (chickenpox) causes a blister-like rash, itching, fatigue, and fever. The rash may first appear on the stomach, back, and face and can spread over the entire body, causing hundreds of itchy blisters. Varicella (chickenpox) is highly contagious and can be serious, especially in babies, pregnant people, and those with weakened immune systems. It is transmitted via respiratory airborne droplets, or contact with fluids from the mouth and nose or the blister-like rash. People with varicella (chickenpox) should not attend child care, school, or work until the rash has crusted over.

ACIP recommends a first varicella vaccine dose for children between 12 and 15 months, with a second dose administered between 4 and 6 years. A second dose of varicella vaccine is also recommended for people older than 6 years who have received only one dose.[26] Adults and

[24] CDC. Prevention of Measles, Rubella, Congenital Rubella Syndrome and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP). 2013 Jun 14; 62 (RR04); 1-34.
[25] CDC. Prevention of Pertussis, Tetanus, and Diphtheria with Vaccines in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2018 Apr 27; 67(2);1-44.
[26] CDC. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hall E., Wodi A.P., Hamborsky J., et al., eds. 14th ed. Washington, D.C. Public Health Foundation, 2021.

adolescents who have not received any varicella vaccination and do not have evidence of immunity should receive two doses, four to eight weeks apart. The vaccine may be given to anyone regardless of prior history of varicella.[27]

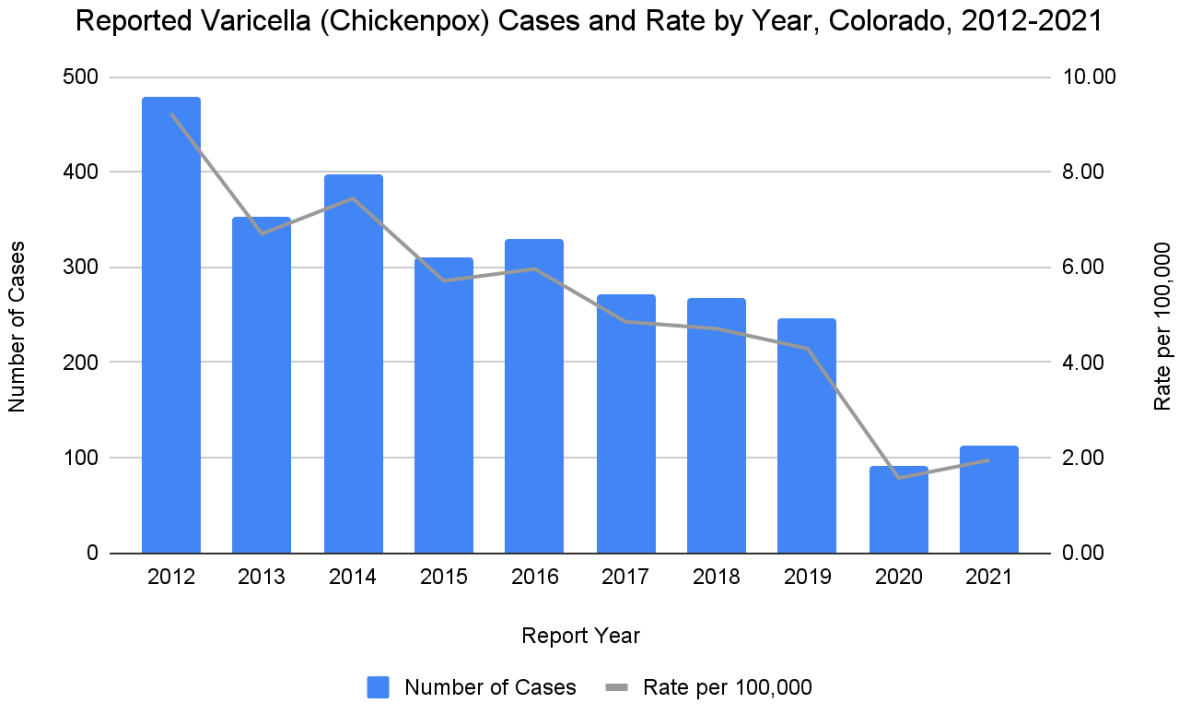

Figure 17. While varicella cases and rates had steadily decreased over the last few years, 2020 had a particularly low case count, likely due to social distancing and decreased interactions due to the pandemic. 2021 saw 113 total varicella cases, more than the 91 cases in 2020.

[27] CDC. Recommendations of the Advisory Committee on Immunization Practices (ACIP). 2007 June 22; 56 (RR04); 1-40.

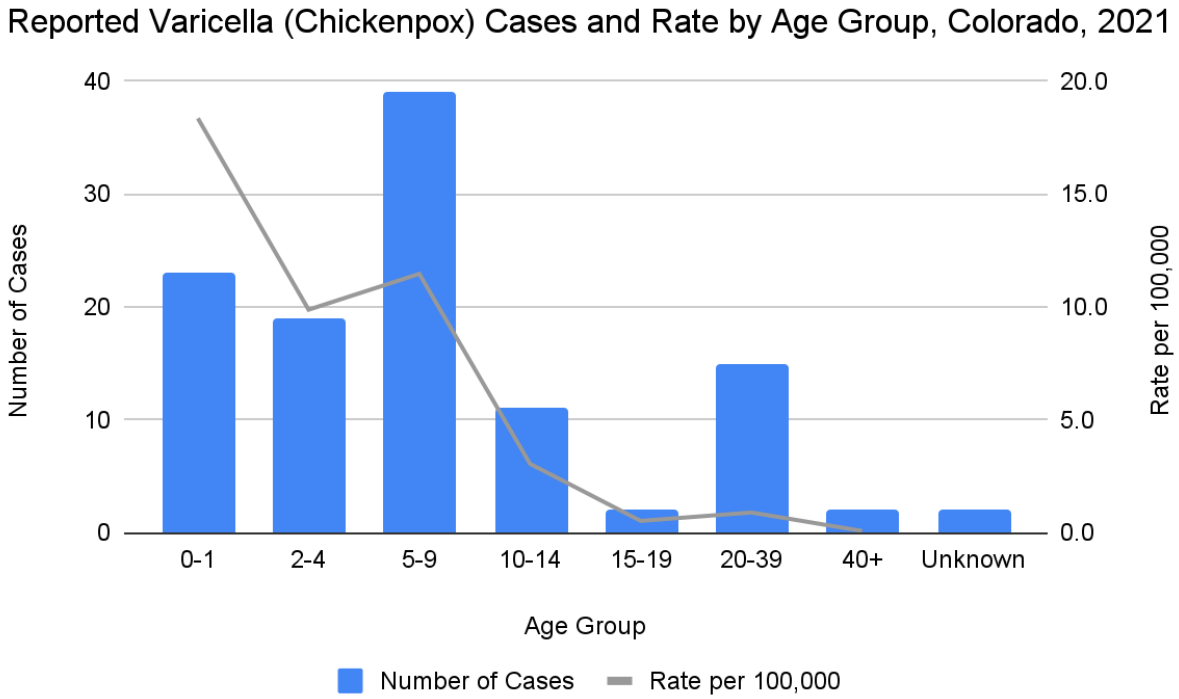

Figure 18: Due to educational privacy laws, some cases of varicella are reported anonymously. Of the 113 varicella cases reported in 2021, two cases were reported with unknown age. The highest incidence of varicella cases was in 0-1 year olds.