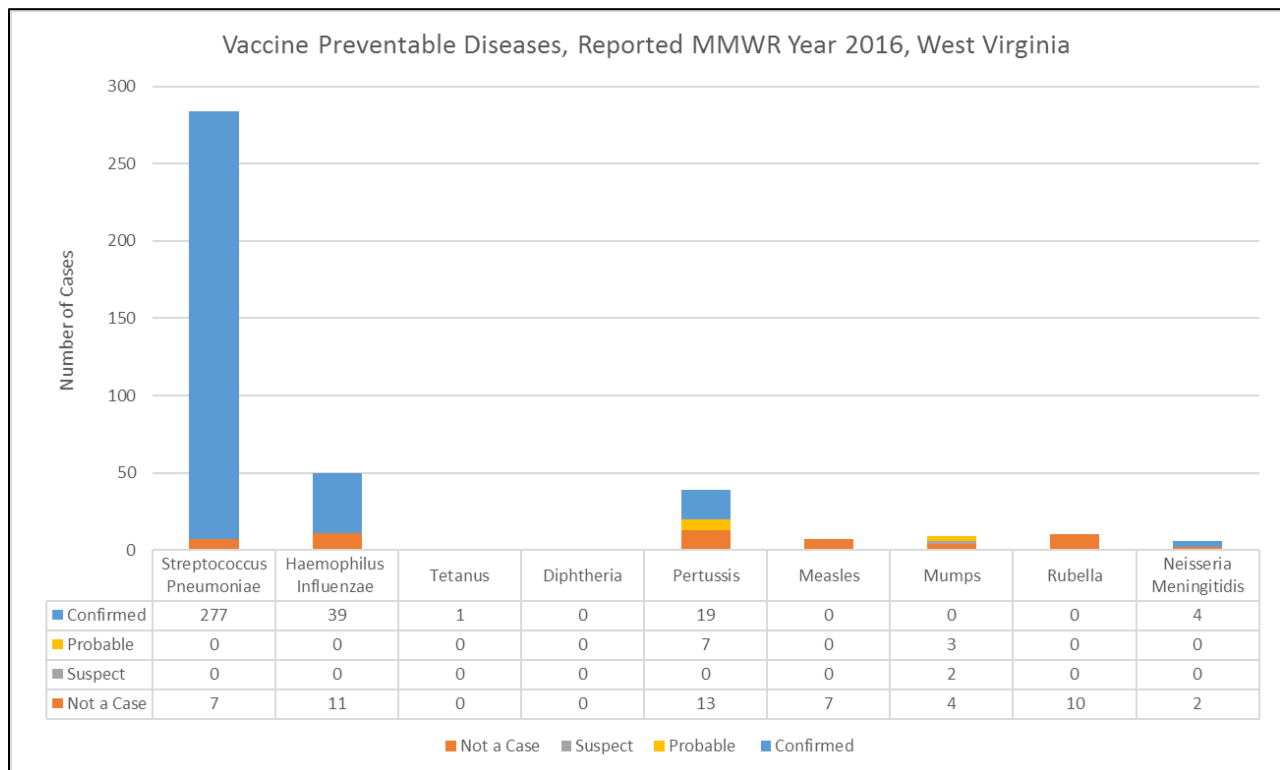


2016 Vaccine-Preventable Disease Surveillance Summary

The West Virginia Legislative Code of State Rules, title 64, series 7 (the Reportable Disease Rule, 64CSR-7) mandates the reporting of certain diseases and conditions to public health authorities. The Reportable Disease Rule mandates reporting individual cases of the following vaccine-preventable diseases (VPD): **Diphtheria; Haemophilus influenzae; Invasive Meningococcal Disease; Mumps; Pertussis; Pneumococcal Disease (invasive); Poliomyelitis; Rubella; Measles; Tetanus**. In West Virginia, individual cases of **Varicella (Chickenpox)** are not reportable; however, weekly aggregate totals are reportable to the local health department. VPD cases are classified using the surveillance case definitions defined by the Council for State and Territorial Epidemiologists (CSTE). These surveillance definitions can be found for all nationally notifiable conditions at <https://wwwn.cdc.gov/nndss/conditions/>.

The following is a summary of the reported VPD cases in West Virginia during the Morbidity and Mortality Weekly Report (MMWR) year 2016. The surveillance data are based on report date which indicates the date that a case is entered in to the West Virginia Electronic Disease Surveillance System (WVEDSS) which does not necessarily reflect the date of the positive laboratory test or date of symptom onset. The 2016 VPD surveillance data were downloaded from WVEDSS, summarized, and analyzed using Microsoft Excel 2016.

Figure 1. Vaccine-Preventable Disease cases reported in West Virginia during MMWR year 2016.



Diphtheria

Diphtheria is an acute disease caused by toxigenic strains of the bacterium *Corynebacterium diphtheriae* (*C. diphtheriae*). The disease is specific to humans and is classified based on site of infection since Diphtheria can involve almost any mucous membrane. Transmission occurs through exposure to respiratory tract droplets or discharges from skin lesions of an infected person.

Diphtheria toxoid vaccine is available in pediatric (DTaP) and adolescent and adult (Tdap) formulations. The DTaP is approved for children 6 weeks through 6 years of age and the Tdap is approved for persons 10 years of age and older. Both the pediatric and adolescent and adult formulations also contain pertussis vaccine and tetanus toxoid. West Virginia requires Diphtheria/Tetanus/Pertussis vaccination for K-12 entry.

During the 2016 MMWR year, there were zero (0) reported cases of Diphtheria in West Virginia. The last reported case of Diphtheria in West Virginia was in 1976.

Haemophilus influenzae

Haemophilus influenzae (*H. influenzae*) is an aerobic, gram-negative coccobacillus that causes bacterial infections that are often severe. There are six (6) antigenically distinct capsular polysaccharide strains of *H. influenzae* that have been designated types a through f. Strains that are nonencapsulated lack capsule genes and have been designated nontypable. *H. influenzae* enters the body through the nasopharynx in result of person to person transmission via inhalation of respiratory tract droplets or direct contact with respiratory tract secretions. Vaccination is only available for the encapsulated “b” strain, referred to as *Haemophilus influenzae* type b (Hib). West Virginia requires Hib for pre-K entry.

During the 2016 MMWR year, thirty-nine (39) reports of confirmed *Haemophilus influenzae* were reported in the WVEDSS. Of the 39 reports 54% (n=21) were nontypable, 26% (n=10) either did not have serotyping performed or the serotype was unknown, and 20% (n=8) were a serotype other than b. Zero cases of *H. influenzae* type b were reported in WVEDSS for MMWR year 2016; however, we cannot rule out serotype b for those *H. influenzae* cases where isolates were not tested or unknown.

Of the 39 *H. influenzae* cases reported during the 2016 MMWR year, two (2) were under 5 years of age. Of the two cases under 5 years of age, 50% (n=1) were reported with complete vaccination history and 100% (n=2) had isolates serotyped. Neither of the two cases under 5 years of age resulted in serotype b.

Figure 2. Number of invasive *Haemophilus influenzae* cases reported in West Virginia by report year, 2007-2016. Source WVEDSS.

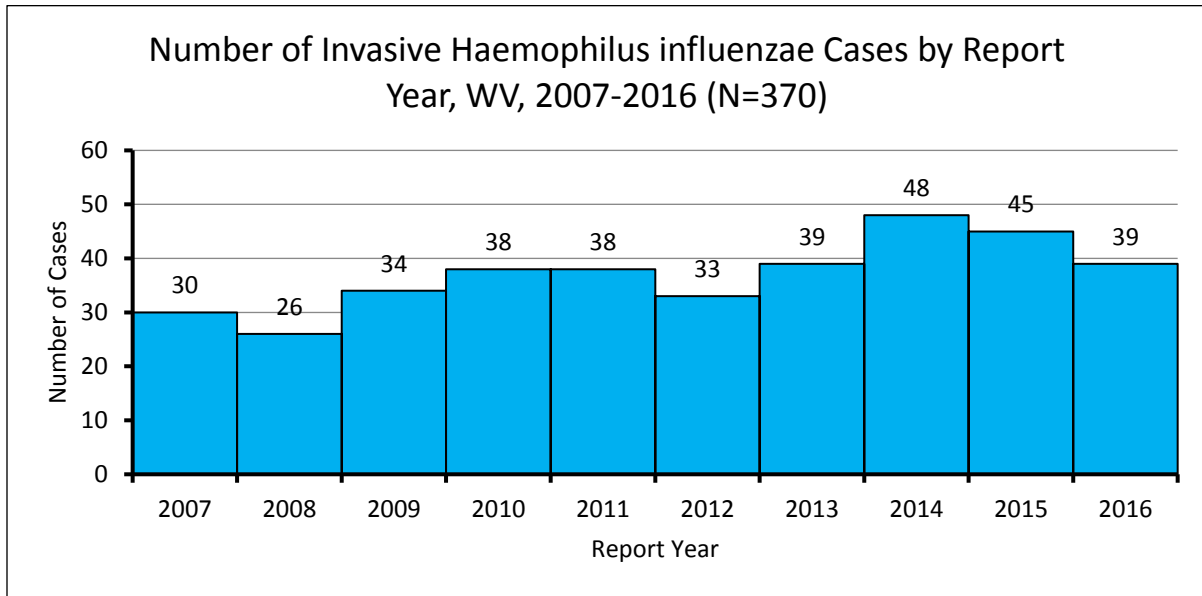


Figure 3. Number of invasive *Haemophilus influenzae* cases reported in West Virginia by age group, 2007-2016. Source WVEDSS.

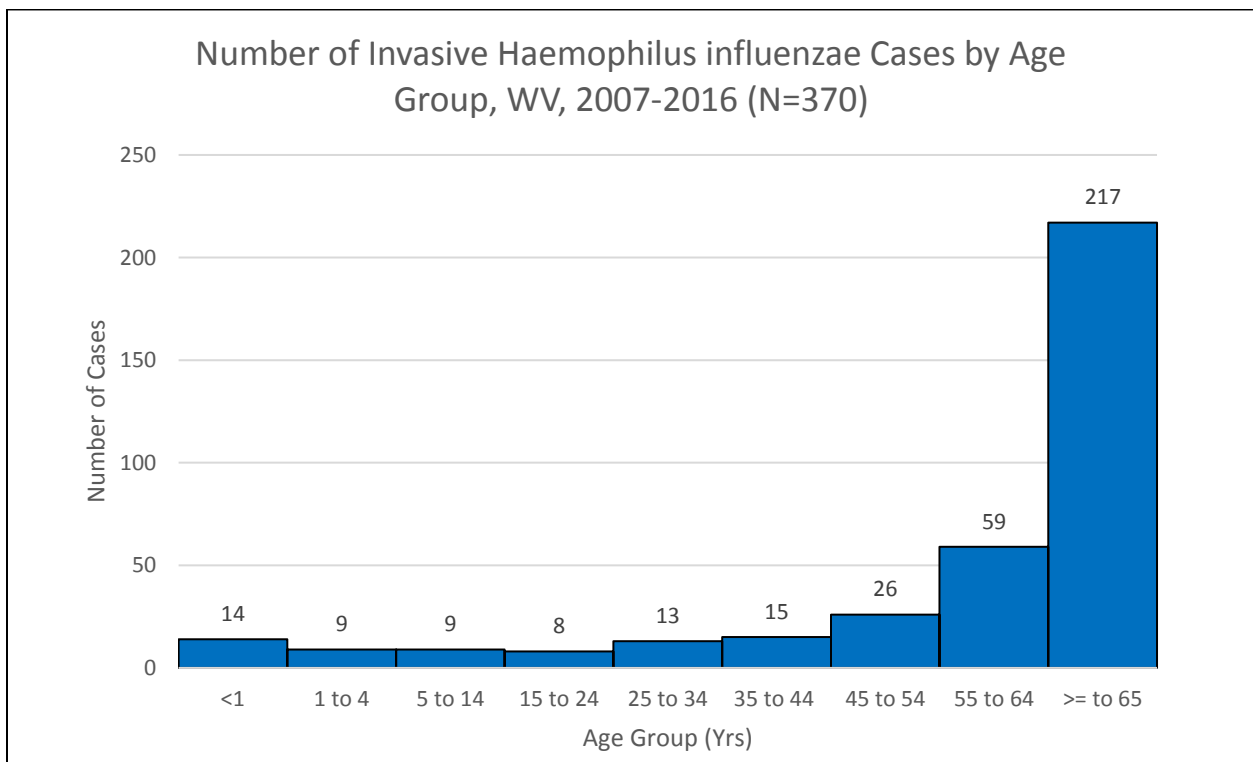


Figure 4. Number of invasive *Haemophilus influenzae* cases reported in West Virginia stratified by age group, for report years 2007-2016. Source WVEDSS.

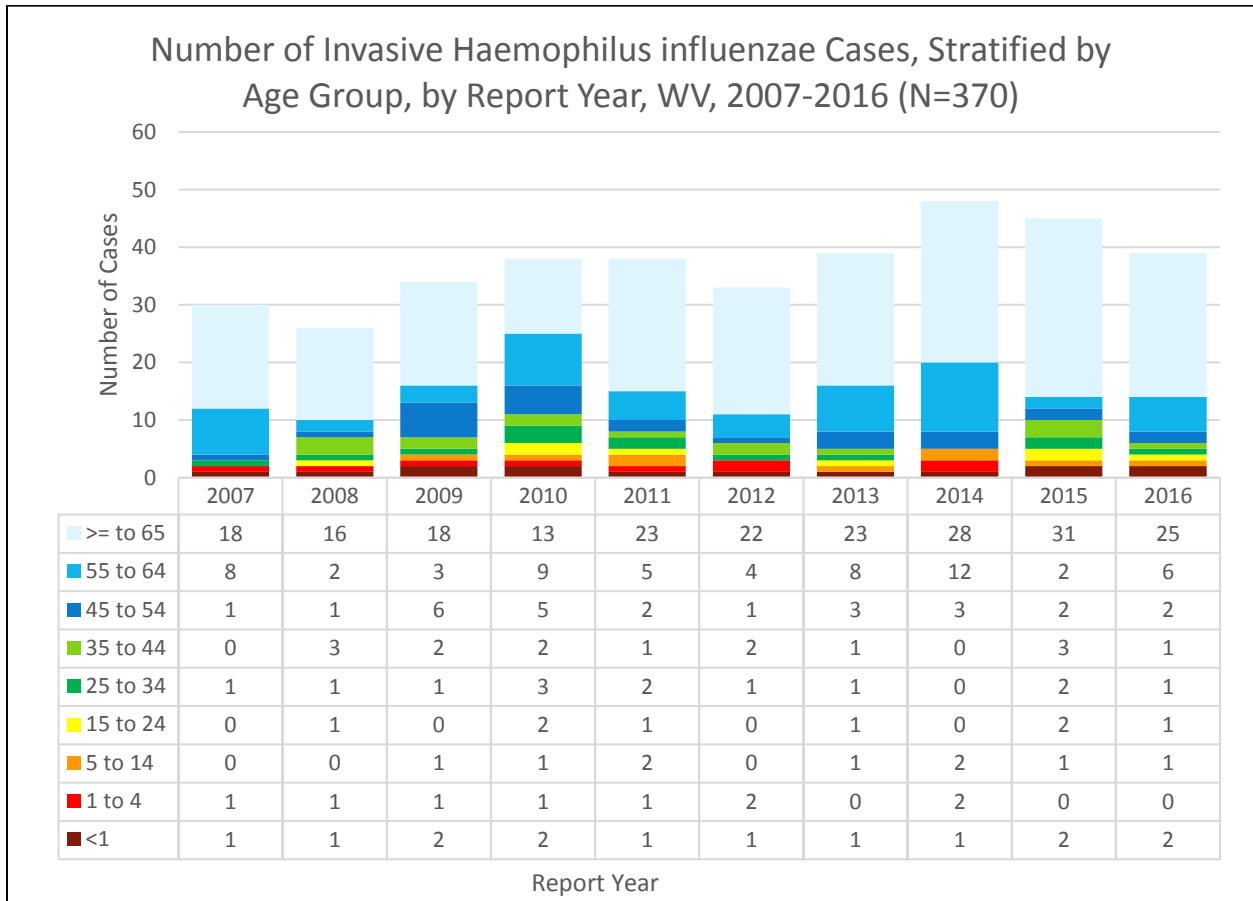


Figure 5. Number of invasive *Haemophilus influenzae* cases reported in West Virginia by month of illness onset, 2007-2016. Source WVEDSS.

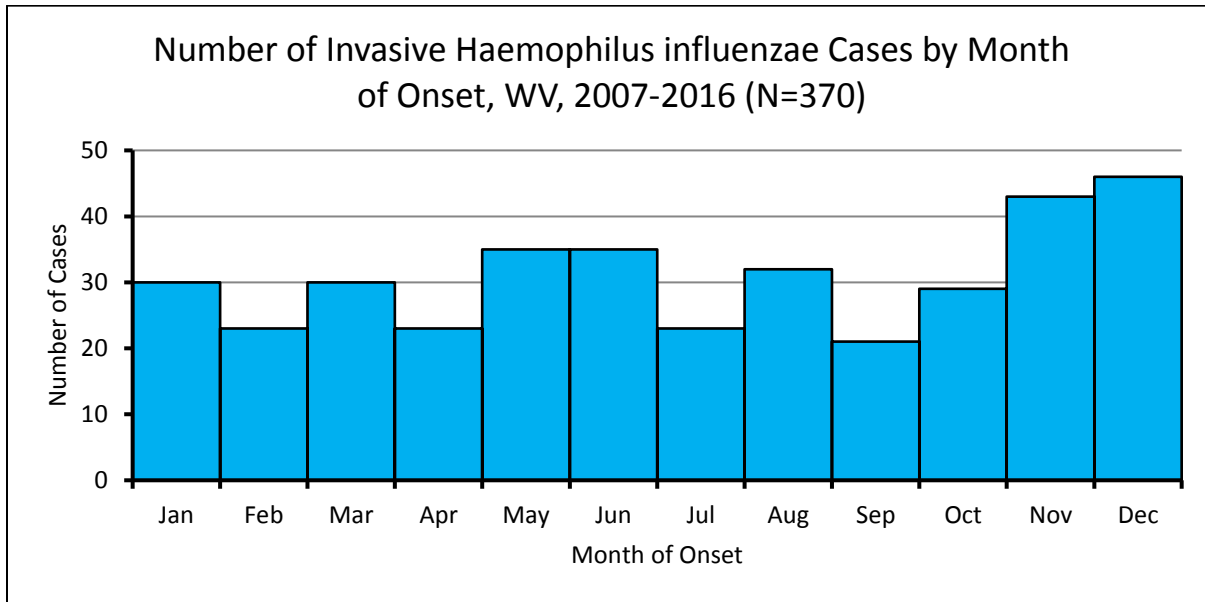


Figure 6. The age-specific incidence of *Haemophilus influenzae* cases reported in West Virginia, 2007-2016. Source WVEDSS.

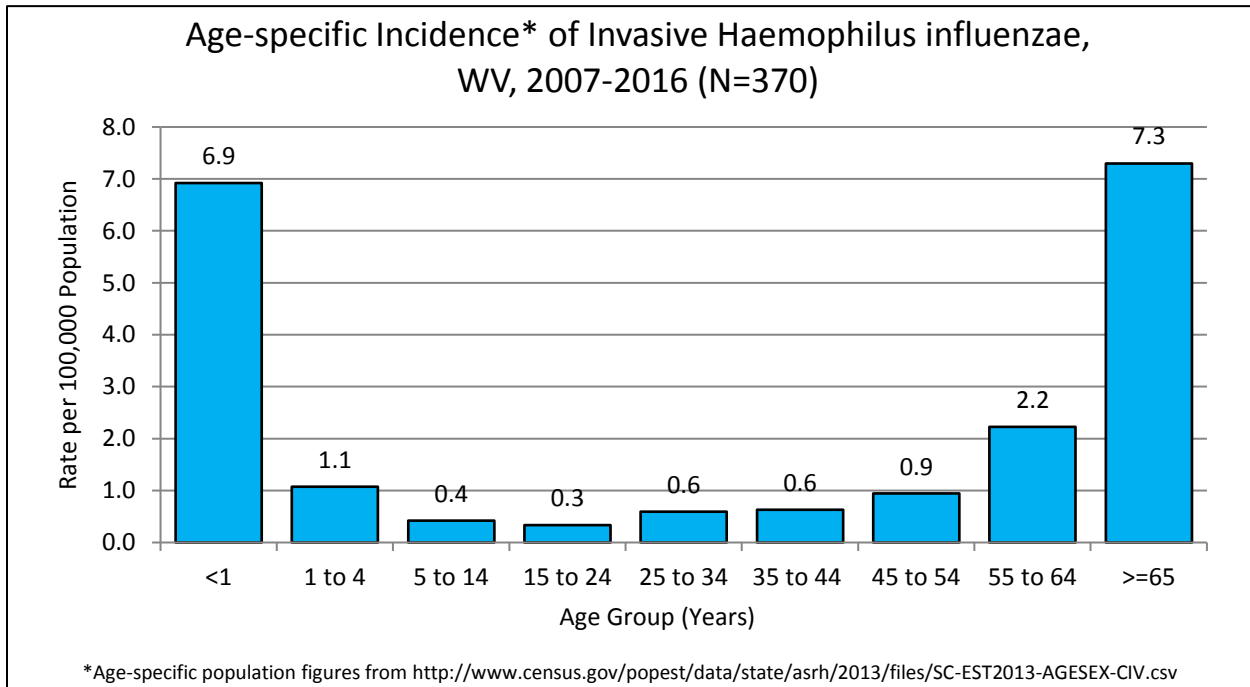
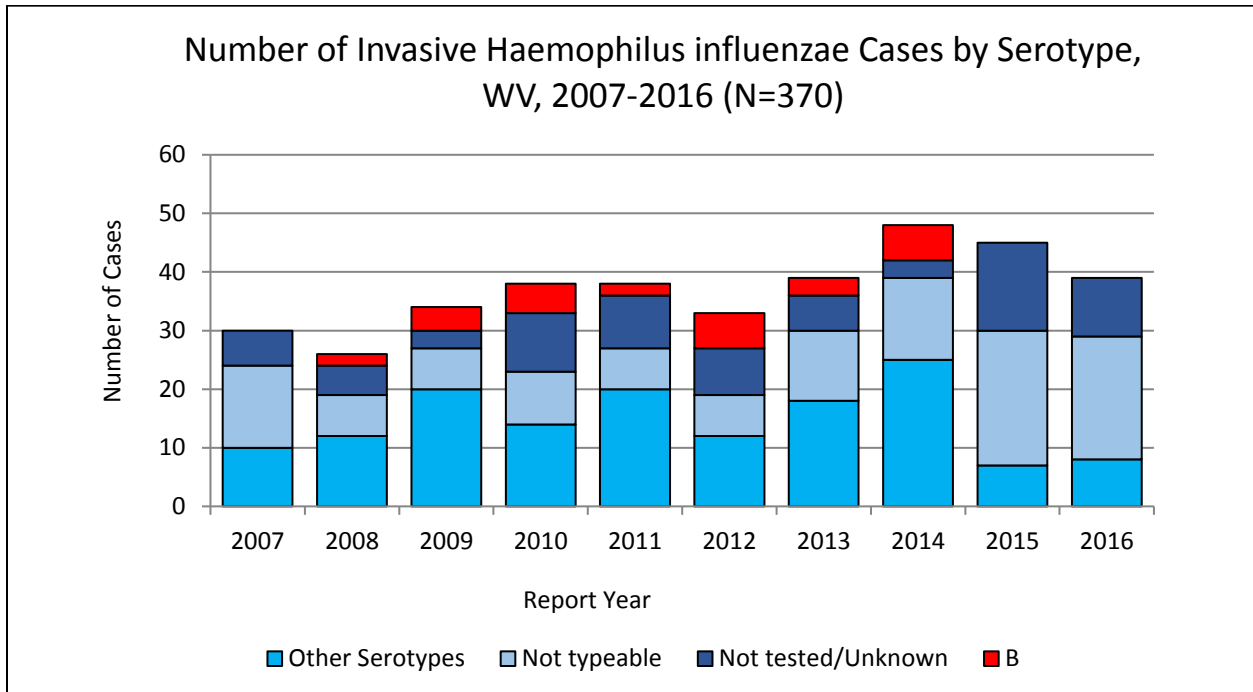


Figure 7. The number of invasive *Haemophilus influenzae* cases reported in West Virginia by serotype, 2007-2016. Source WVEDSS.



Invasive Meningococcal Disease

Neisseria meningitidis (*N. meningitidis* or meningococcus) is an aerobic, gram-negative diplococcus that has 13 antigenically distinct polysaccharide capsule types as well as some strains that do not have a capsule and are not groupable. *N. meningitidis* is one of the leading causes of bacterial meningitis and sepsis in the United States and has been estimated by the World Health Organization to be the cause of 171,000 deaths worldwide in 2000. Among adolescents and young adults, approximately 90% of invasive meningococcal disease (IMD) is caused by serogroups B, C, Y, or W. Meningococci bacteria, transmitted by droplet aerosol or nasopharynx secretions of colonized persons, attach to and multiply on the mucosal cells of the nasopharynx. There are currently both polysaccharide and conjugate meningococcal vaccines licensed in the United States.

During the 2016 MMWR year, four (4) confirmed cases of *N. meningitidis* were reported in the WVEDSS. Of the 4 confirmed cases reported 75% (n=3) were reported with complete vaccination history and 100% (n=4) were serogroup B.

Figure 8. *The number of invasive meningococcal disease cases reported in West Virginia by report year, 2007-2016. Source WVEDSS.*

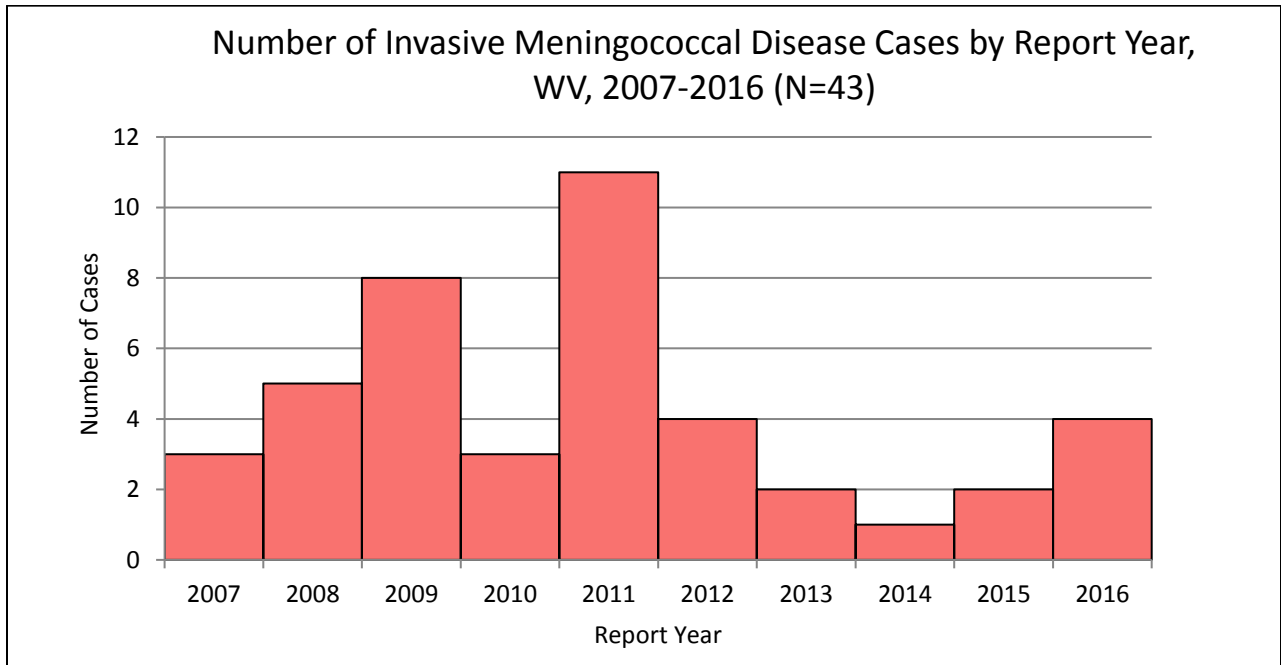


Figure 9. *The number of invasive meningococcal disease cases reported in West Virginia by month of illness onset, 2007-2016. Source WVEDSS.*

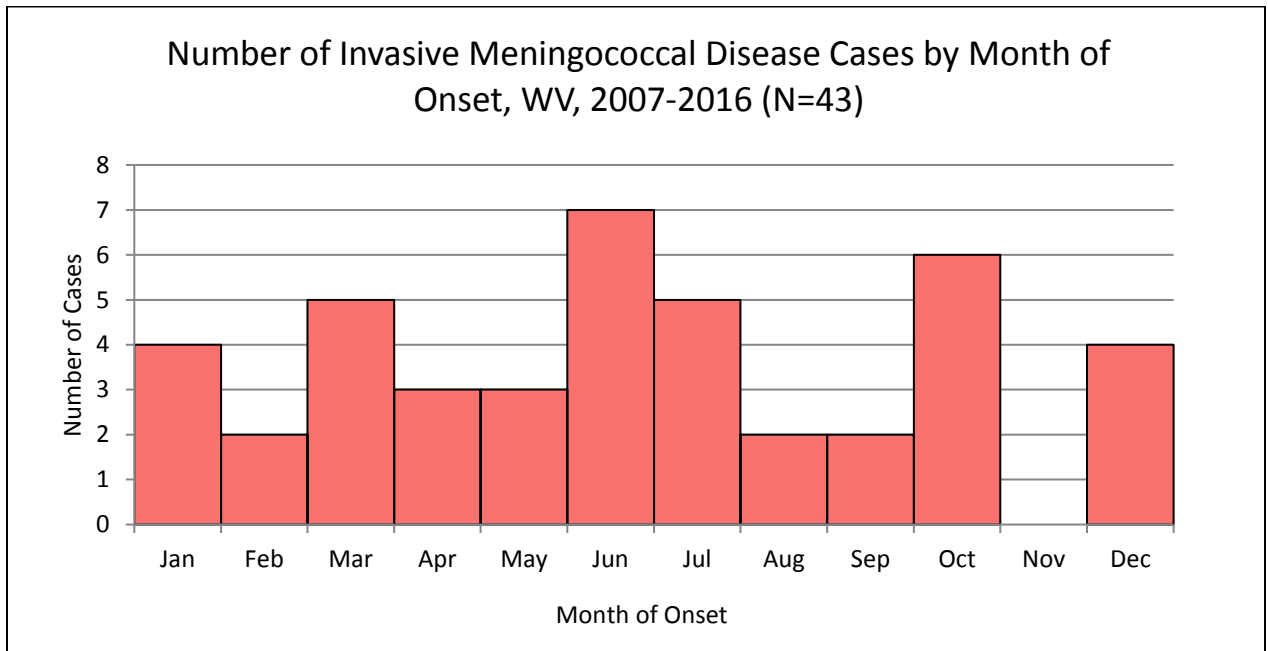
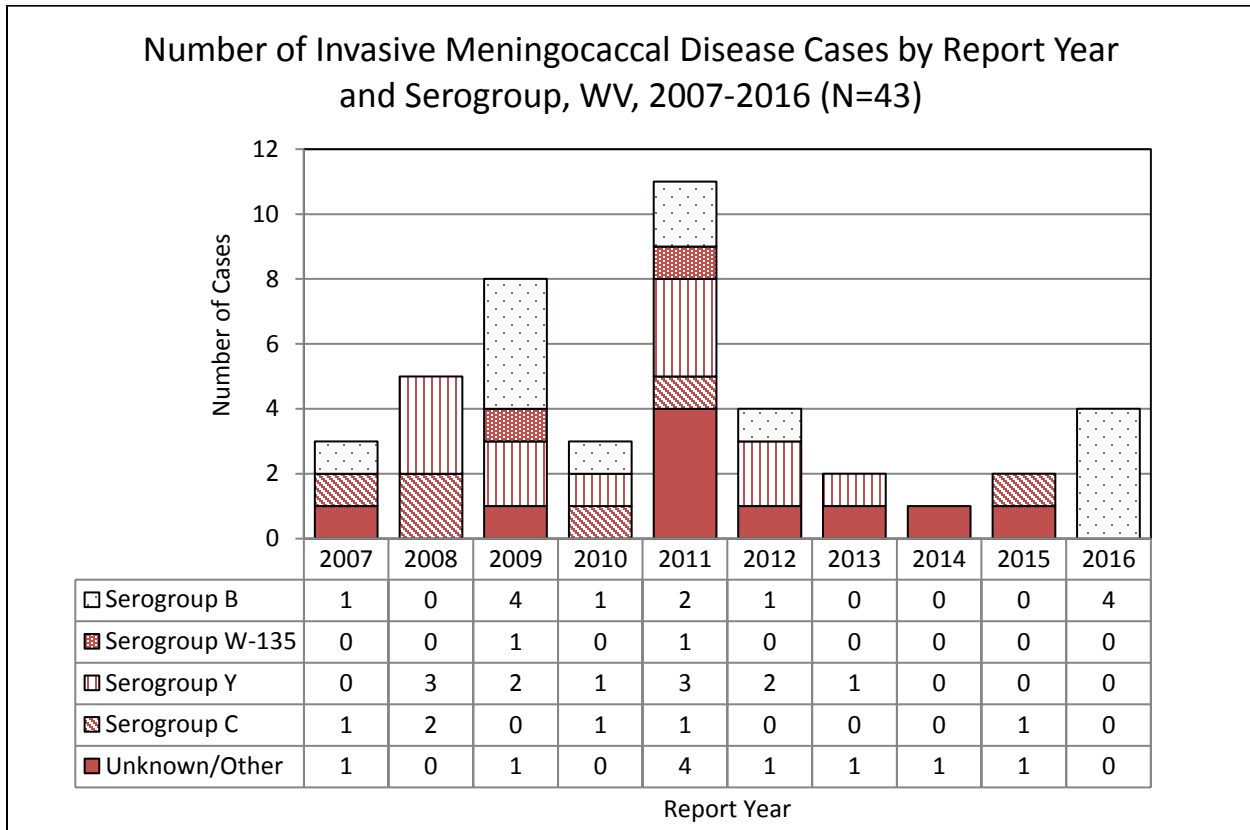


Figure 10. *The number of invasive meningococcal disease cases reported in West Virginia by report year and serogroup, 2007-2016. Source WVEDSS.*



Measles

Measles is a highly communicable paramyxovirus that has only one antigenic type. Measles is an acute, viral, systemic infection, primarily of the respiratory epithelium of the nasopharynx. The virus invades and replicates in the respiratory epithelium and regional lymph nodes. A prodrome of fever that increases in stepwise fashion, followed by cough, coryza, or conjunctivitis occurs 10 to 12 days after exposure. A maculopapular rash occurs 2 to 4 days after the prodrome and about 14 days after exposure. The measles rash starts on the face and upper neck and persists for 5 to 6 days, gradually proceeding downward and outward. Transmission of measles occurs person to person by contact with respiratory droplets.

Vaccination for measles is available and routinely recommended in the United States. The measles virus vaccine is available combined with mumps and rubella vaccines as MMR, or combined with mumps, rubella, and varicella vaccine as MMRV. West Virginia requires MMR vaccination for pre-K entry.

During the MMWR year 2016, there were zero (0) confirmed cases of measles reported in the WVEDSS. The last reported case of measles in West Virginia was in 2009.

Mumps

Mumps is an acute, systemic viral illness characterized by swelling of one or more of the salivary glands. The mumps virus is a paramyxovirus that has a single-stranded RNA genome which replicates in the nasopharynx and regional lymph nodes causing a viremia after 12 to 25 days. Person to person transmission of the mumps virus occurs through contact with infectious respiratory tract secretions or saliva. The currently licensed mumps virus vaccine was recommended for routine use in the United States in 1977 for all children 12 months of age and older. Two mumps vaccines are available in the United States. The MMR vaccine is mumps virus combined with measles and rubella. The other, ProQuad or MMRV, is mumps virus combined with measles, rubella, and varicella. West Virginia requires two doses of MMR vaccine for pre-K entry.

During the 2016 MMWR year 2016, there were zero (0) confirmed, three (3) probable, and two (2) suspect cases of mumps reported in the WVEDSS. Of the five (5) reported cases, 80% (n=4) had appropriate clinical specimens obtained and submitted to the laboratory and 100% (n=5) were reported with complete vaccination histories.

Figure 11. *The number of mumps cases reported in West Virginia by report year, 2007-2016.*
Source WVEDSS.

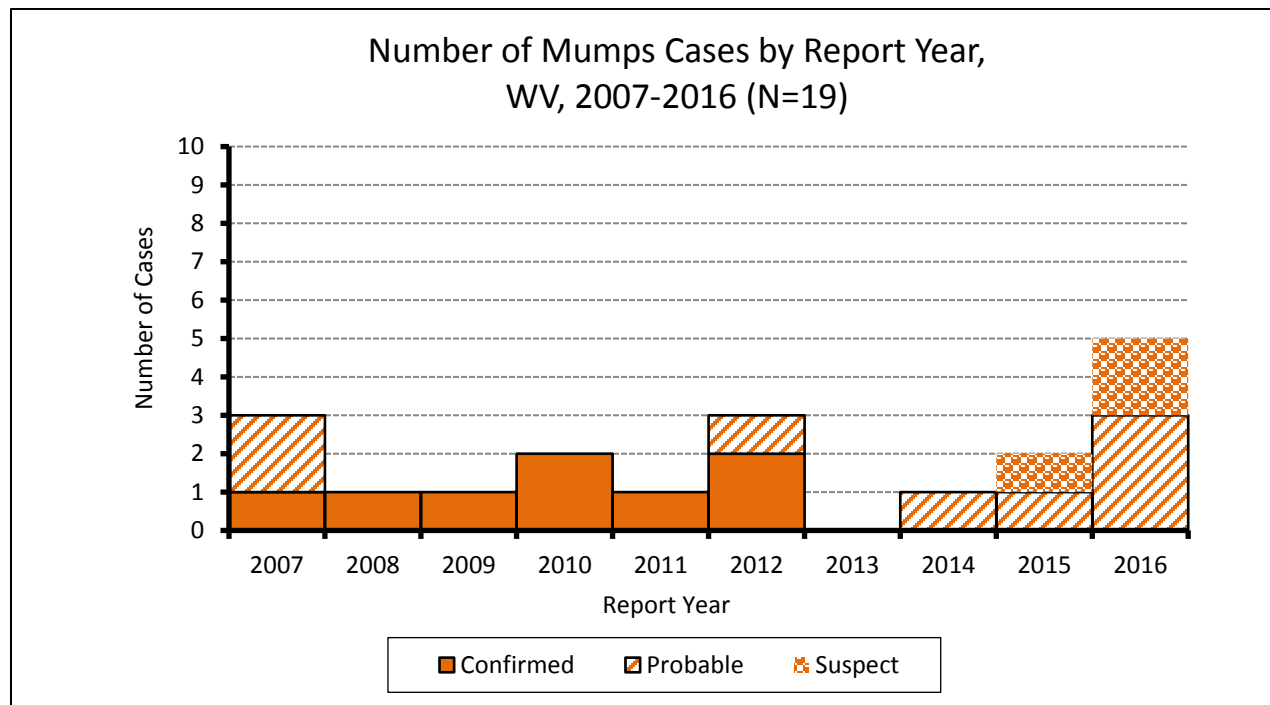


Figure 12. The number of mumps cases reported in West Virginia by month of illness onset, 2007-2016. Source WVEDSS.

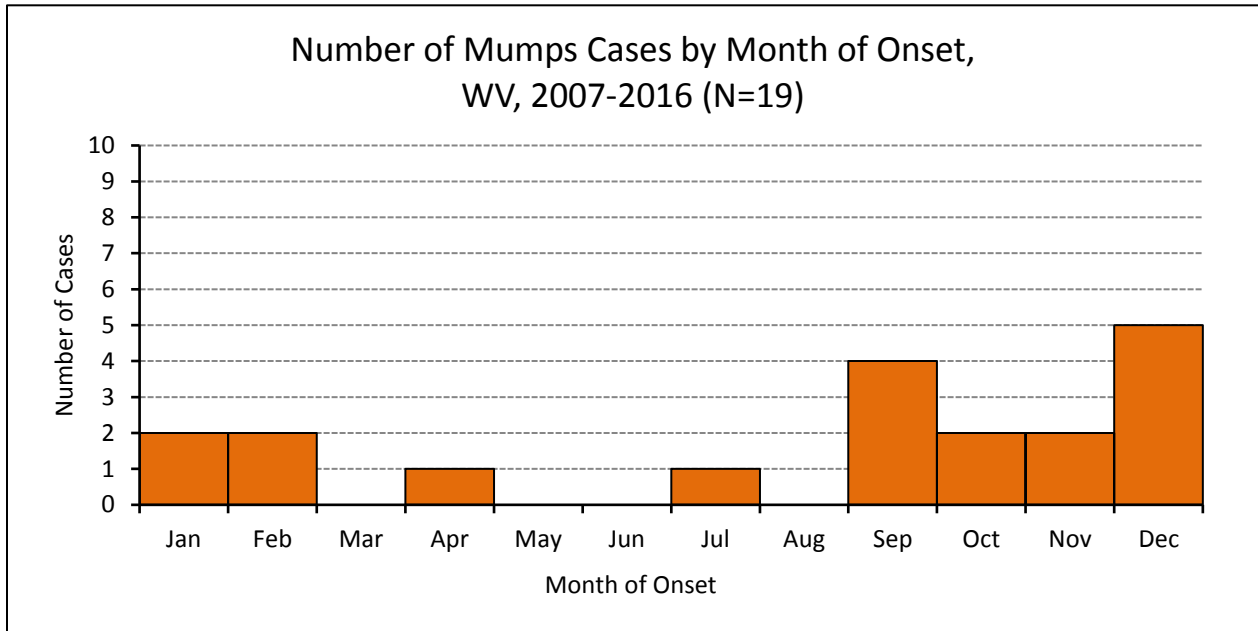
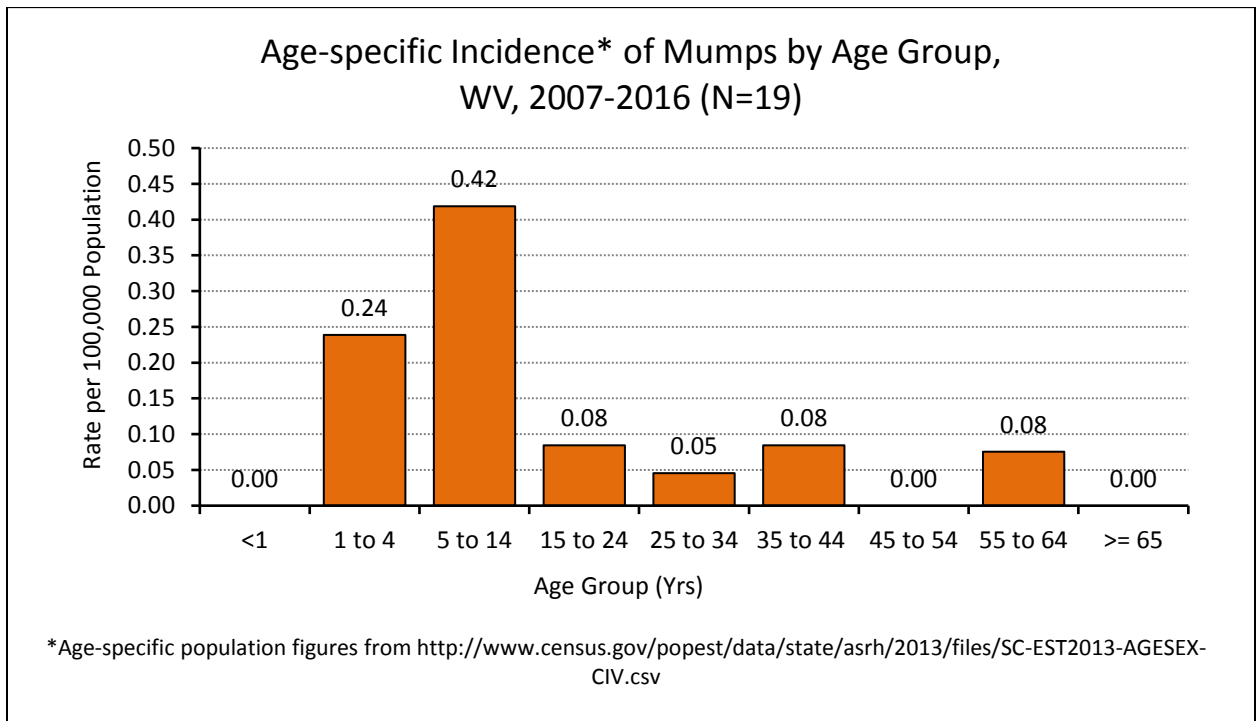


Figure 13. The age-specific incidence of mumps cases reported in West Virginia by age group, 2007-2016. Source WVEDSS.



Pertussis

Pertussis is an acute, highly infectious disease caused by a fastidious gram-negative bacterium called *Bordetella pertussis* (*B. pertussis*). Pertussis is often referred to as whooping cough due to the distinct high-pitched “whoop” that can be heard following intense coughing spells. Pertussis has an insidious onset that often mimics the common cold with nonspecific cough, low-grade fever and runny nose. This is referred to as the catarrhal stage and lasts one to two weeks during which the cough worsens. Pertussis is usually suspected and diagnosed during the next stage, the paroxysmal stage. The paroxysmal stage lasts one to six weeks and is characterized by paroxysms or numerous, rapid coughs. Paroxysmal attacks increase in frequency during the first one or two weeks of the paroxysmal stage and remain at the same level for the next two to three weeks before they gradually decrease. A gradual recovery is made during the final stage, the convalescent stage. During the convalescent stage the cough weakens and becomes less paroxysmal, eventually disappearing in two to three weeks. Subsequent respiratory infections can occur for months after the onset of pertussis. Transmission of pertussis occurs person to person by close contact with large respiratory droplets, typically generated by coughing or sneezing.

Acellular pertussis vaccines are available in pediatric (DTaP) and adolescent and adult (Tdap) formulations. The DTaP is approved for children 6 weeks through 6 years of age and the Tdap is approved for persons 10 years of age and older. Both the pediatric and adolescent and adult formulations also contain diphtheria and tetanus toxoids. West Virginia requires Diphtheria/Tetanus/Pertussis vaccination for K-12 entry.

During MMWR year 2016, there were nineteen (19) confirmed and seven (7) probable cases of pertussis reported in the WVEDSS. Of the 26 reported cases, 100% (n=26) had clinical specimens obtained, 77% (n=20) met the clinical case definition and were laboratory confirmed, 4% (n=1) were confirmed by isolation of *B. pertussis* by culture, and 85% (n=22) were reported with complete vaccination histories.

Figure 14. The number of confirmed and probable pertussis cases reported in West Virginia by report year, 2007-2016. Source WVEDSS.

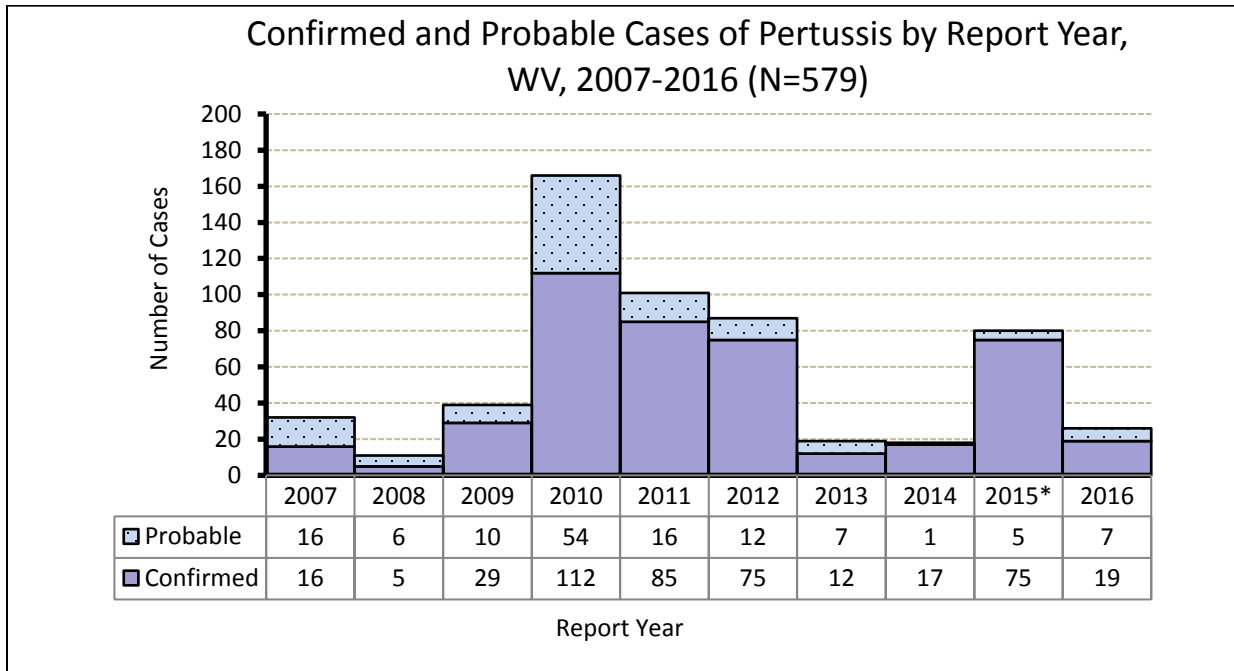


Figure 15. The number of pertussis cases reported in West Virginia by month of illness onset, 2007-2016. Source WVEDSS.

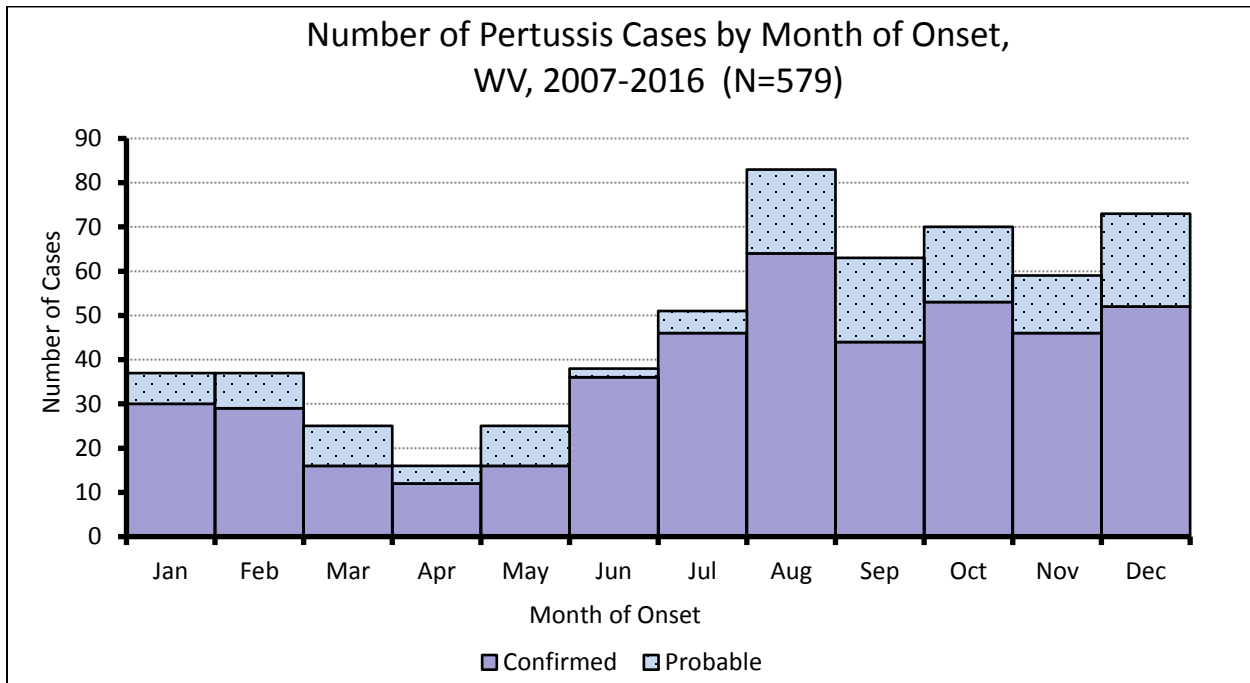


Figure 16. *The age-specific incidence of pertussis cases reported in West Virginia by report year, 2007-2016. Source WVEDSS.*

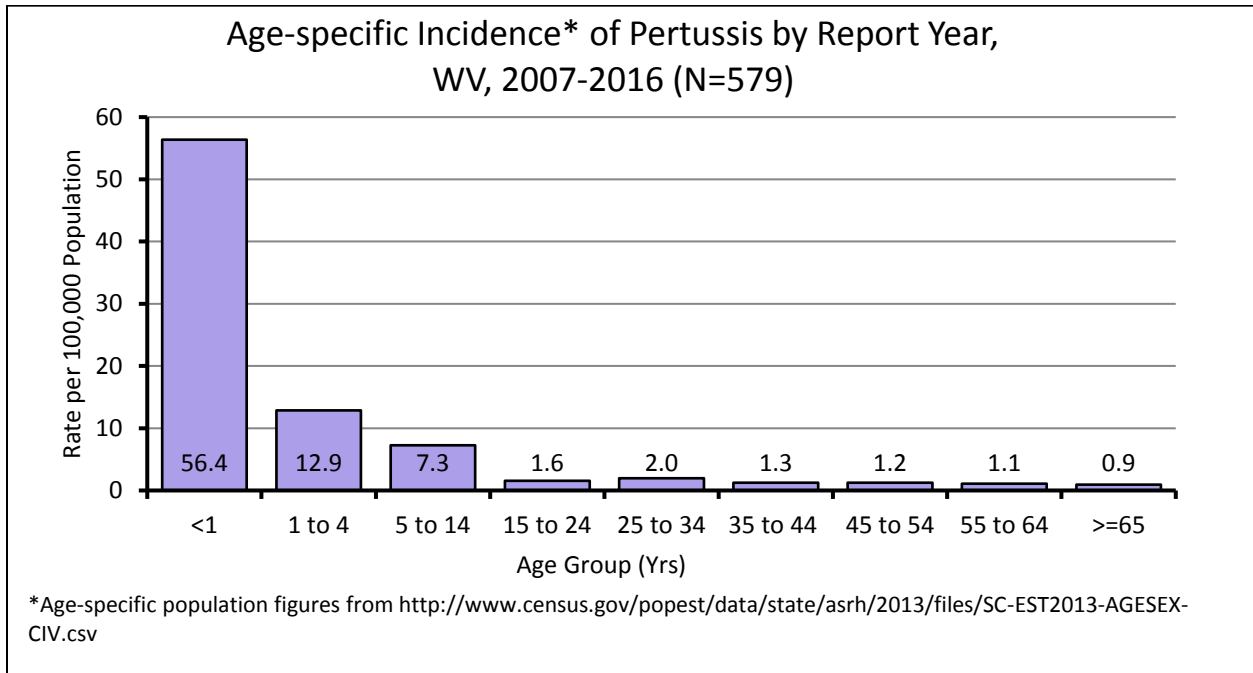


Figure 17. *The number of pertussis cases reported in West Virginia by report year and confirmation method, 2007-2016. Source WVEDSS.*

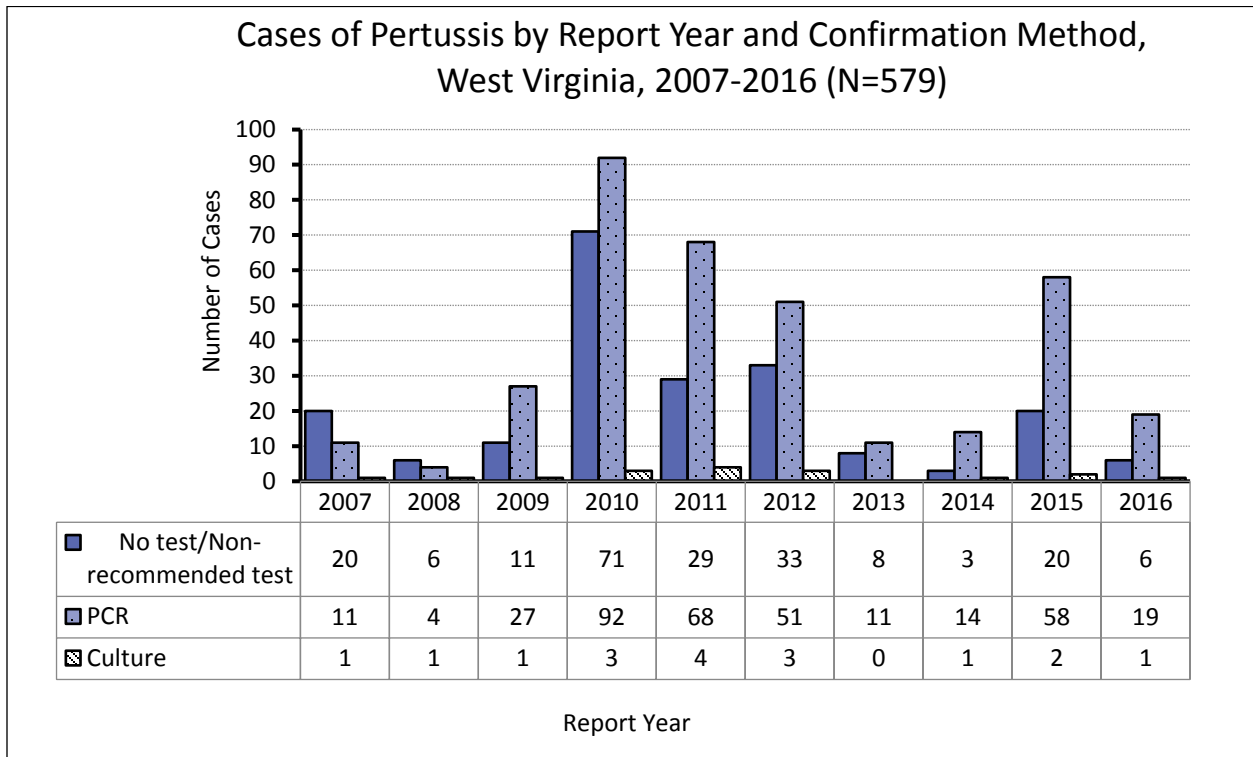
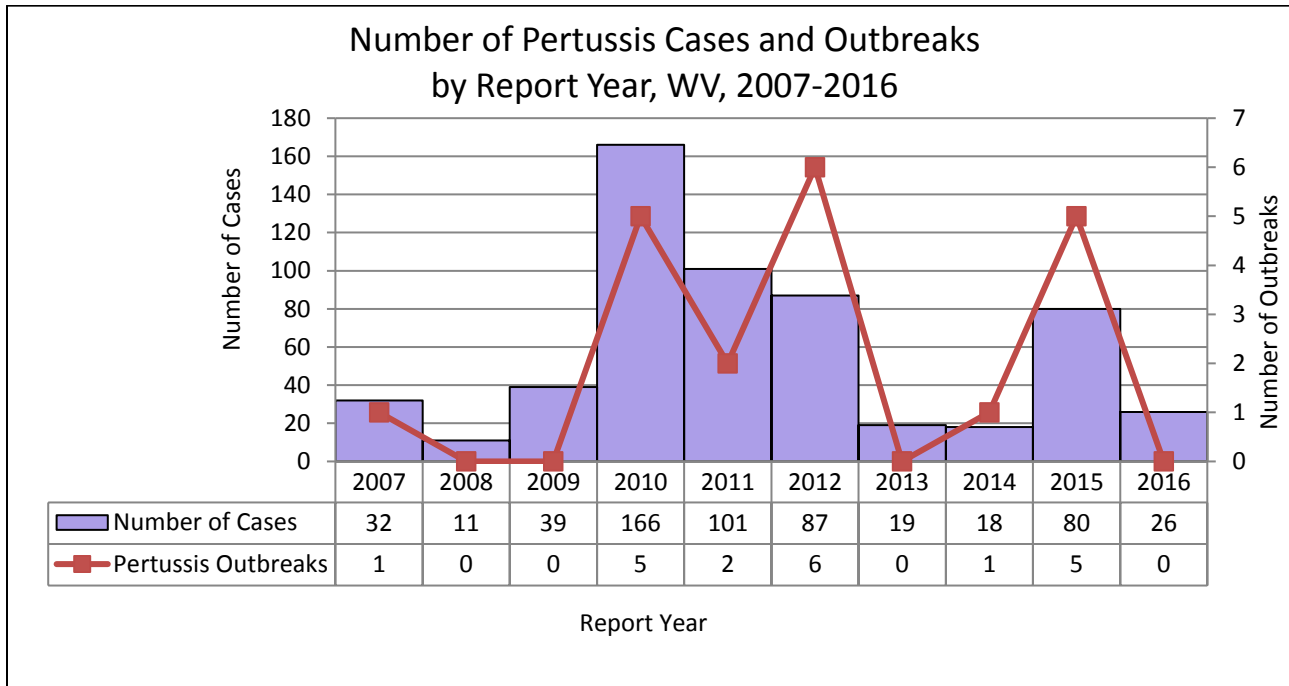


Figure 18. *The number of pertussis cases and outbreaks reported in West Virginia by report year, 2007-2016. Source WVEDSS.*



Pneumococcal Disease (Invasive)

Streptococcus pneumoniae (*S. pneumoniae*) bacteria are gram-positive, facultative anaerobic organisms that cause an acute bacterial infection. Ninety-two serotypes of streptococcus pneumonia bacteria have been documented. Pneumococcal pneumonia is the most common clinical presentation among adults. This typically causes abrupt onset of fever, chills or rigors, pleuritic chest pain, productive cough, dyspnea, tachypnea, hypoxia, tachycardia, malaise, and weakness. Two other common clinical syndromes of pneumococcal disease are bacteremia and meningitis. Transmission of *S. pneumoniae* occurs through person to person contact with respiratory droplets or by autoinoculation in persons who carry the bacteria in their upper respiratory tract.

Both polysaccharide and conjugate vaccines are available and licensed in the United States. The polysaccharide vaccine (PPSV23) covers 23 types of pneumococcus, which accounts for 60 - 70% of bacteremic pneumococcal disease. The conjugate vaccine (PCV13) covers 13 types of pneumococcus and is conjugated to nontoxic diphtheria toxin. The serotypes contained in the conjugate vaccine accounted for 61% of invasive pneumococcal disease cases among children younger than 5 years of age. West Virginia requires pneumococcal vaccination (PCV13) for pre-K entry.

During the MMWR year 2016, there were 277 confirmed cases of Streptococcus Pneumoniae reported in the WVEDSS, 4% (n=12) of which were under five (5) years of age. Of the 12 cases under 5 years of age, 42% (n=5) were reported with complete vaccination histories and 58% (n=7) had isolates serotyped and tested for antibiotic resistance.

Figure 19. The number of invasive streptococcus pneumoniae cases reported in West Virginia by report year, 2007-2016. Source WVEDSS.

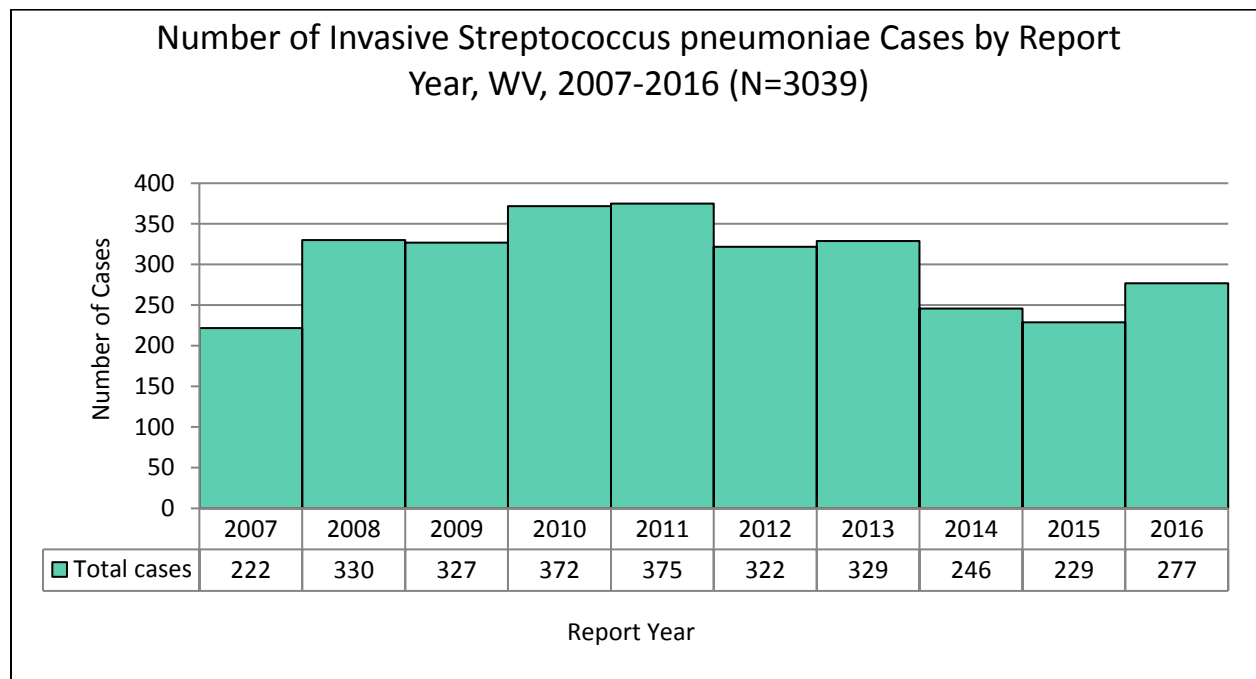


Figure 20. The number of invasive Streptococcus pneumoniae cases under 5 years of age reported in West Virginia by report year, 2007-2016. Source WVEDSS.

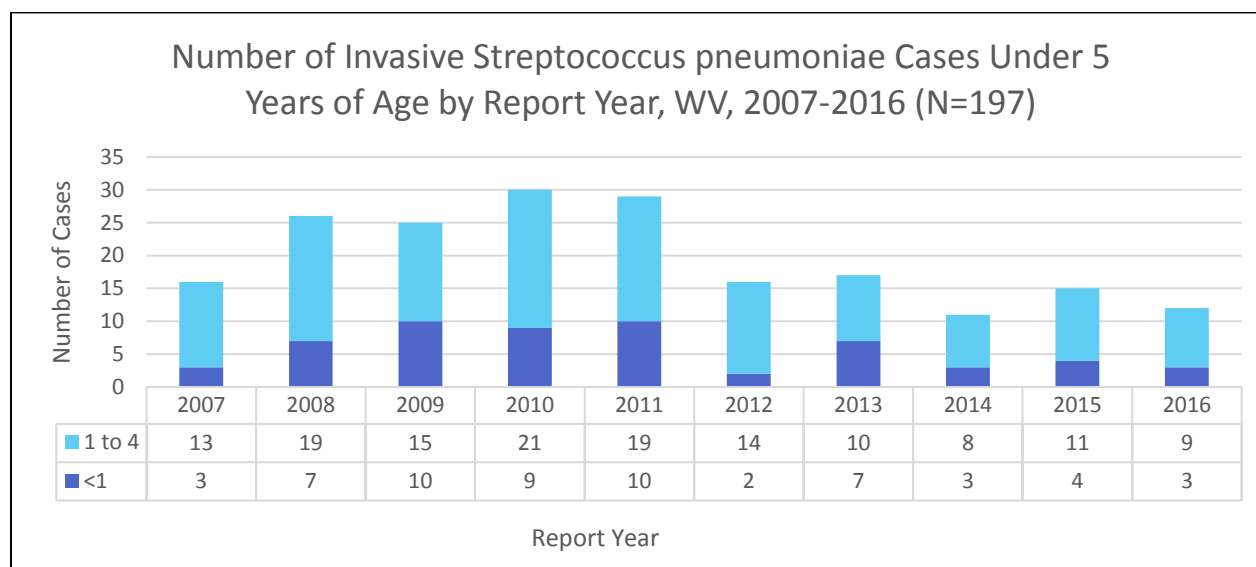


Figure 21. The number of invasive *Streptococcus pneumoniae* cases reported in West Virginia stratified by age group, for report years 2007-2016. Source WVEDSS.

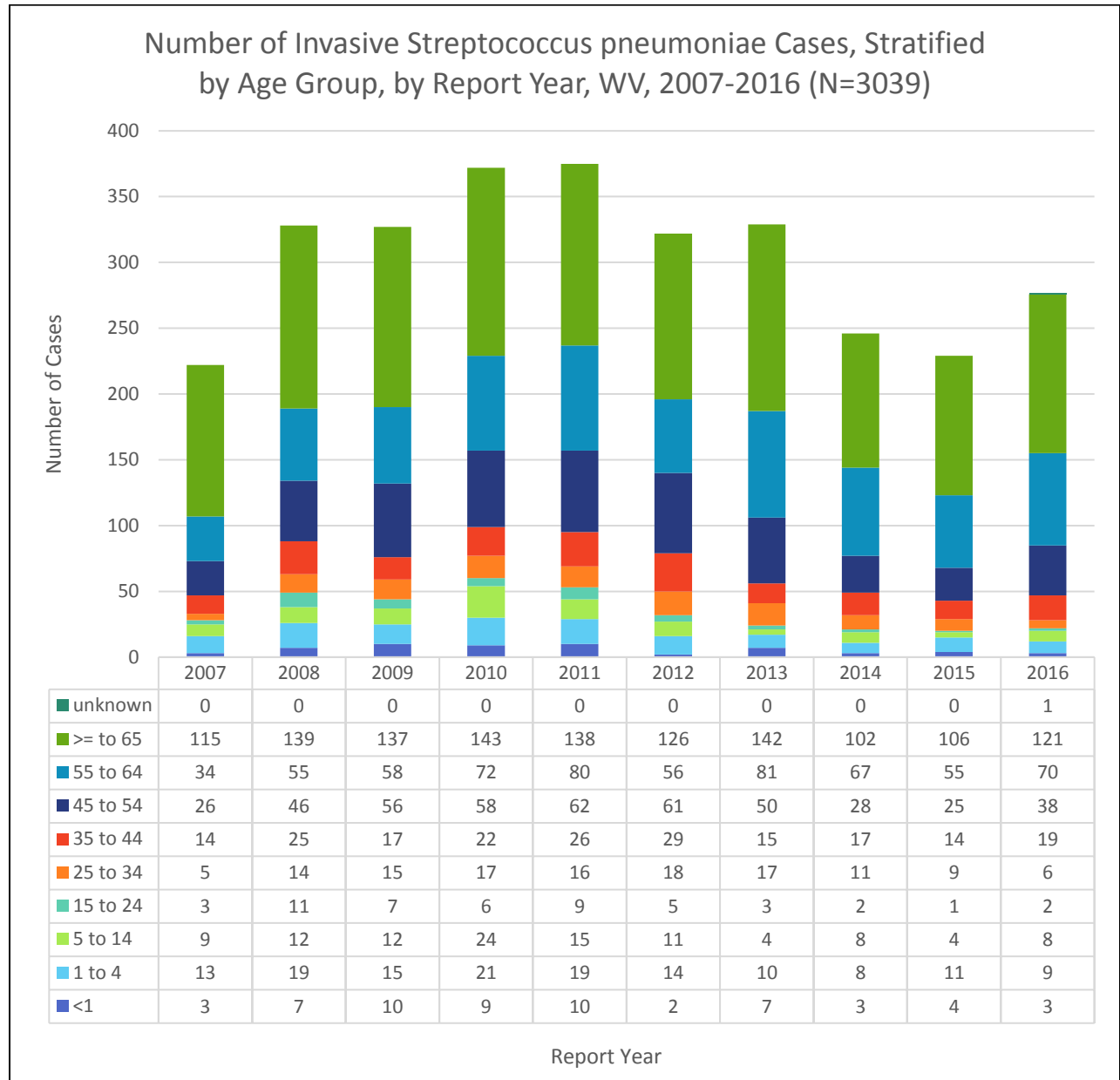


Figure 22. The number of invasive *Streptococcus pneumoniae* cases reported in West Virginia by month of illness onset, 2007-2016. Source WVEDSS.

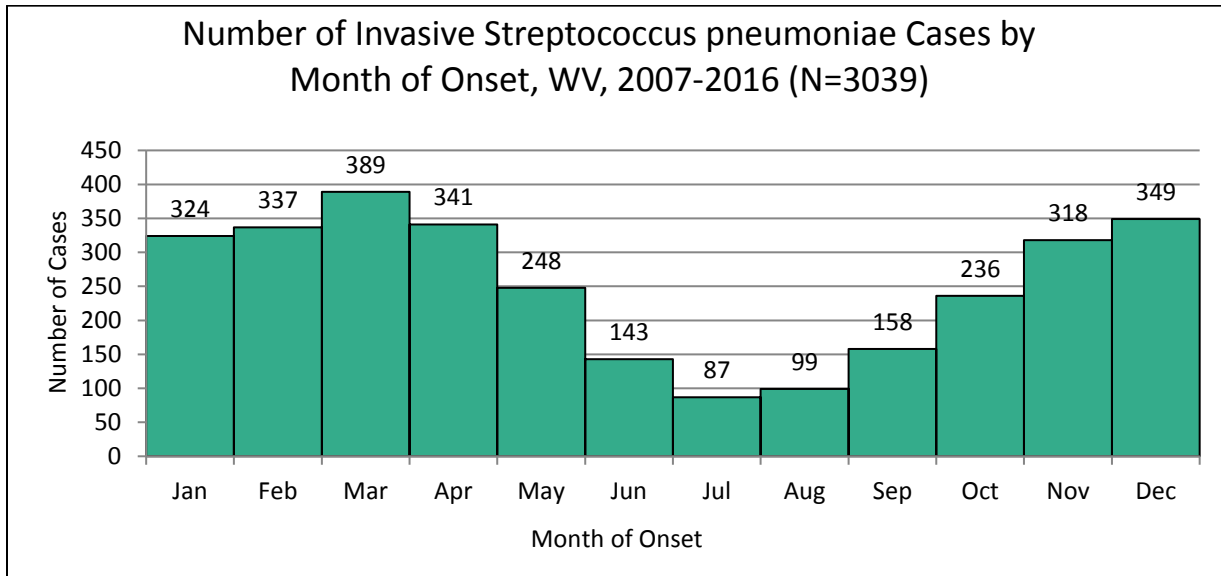


Figure 23. The number of invasive *Streptococcus pneumoniae* cases reported in West Virginia by age group, 2007-2016. Source WVEDSS.

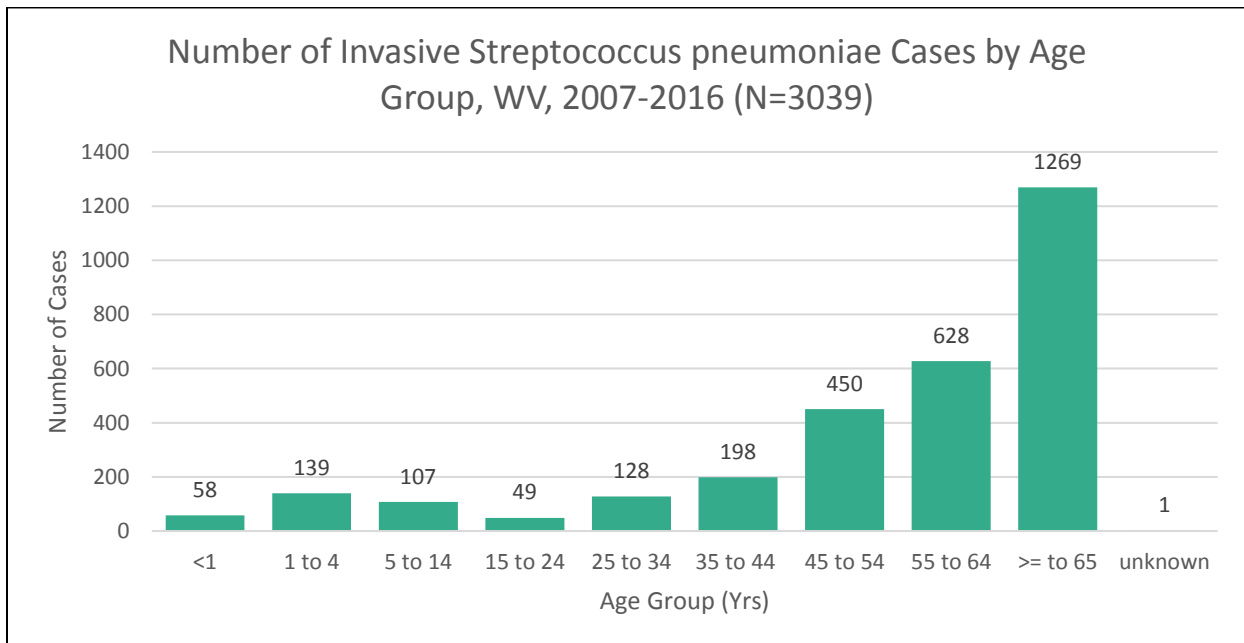
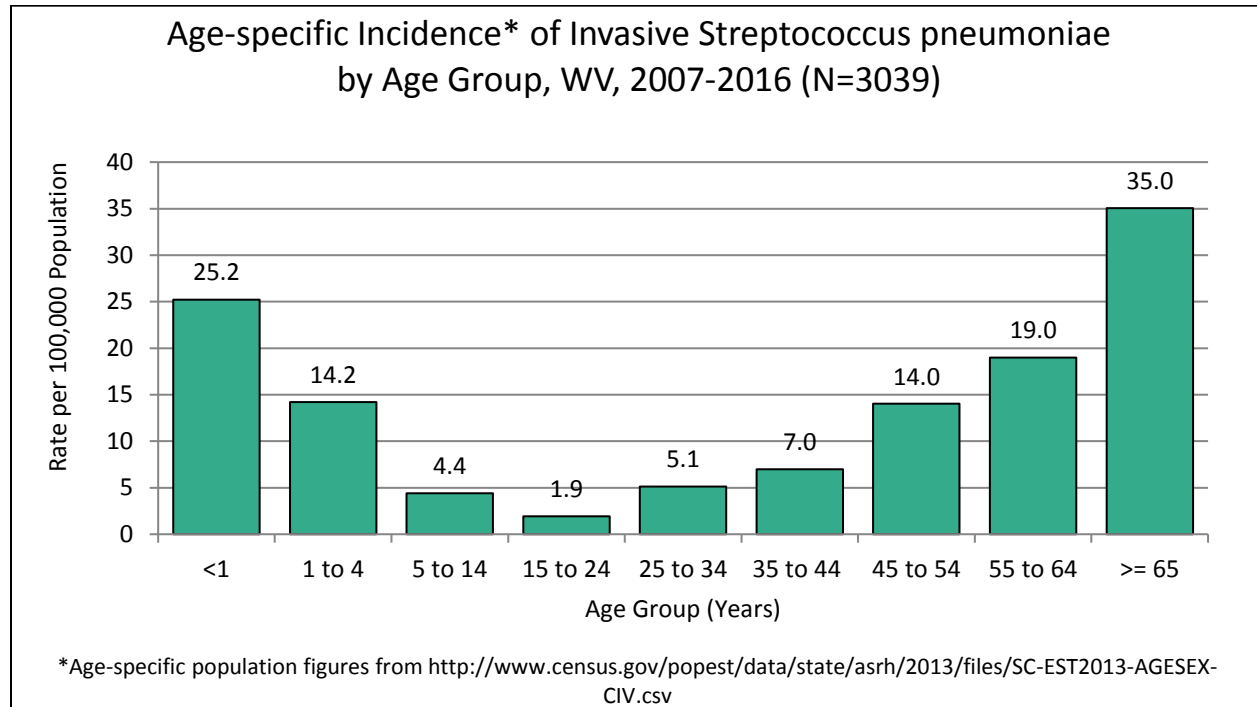


Figure 24. *The age-specific incidence of invasive streptococcus pneumoniae cases reported in West Virginia by age group, 2007-2016. Source WVEDSS.*



Poliomyelitis

The poliovirus is a highly infectious member of the enterovirus subgroup. The poliovirus has three serotypes (P1, P2, and P3). Humans are the only reservoir of poliovirus. It typically enters the body through the mouth (fecal-oral transmission) and replicates in the pharynx and GI tract before it invades local lymphoid tissue, enters the bloodstream, and then infects cells of the central nervous system where it destroys motor neurons resulting in the typical manifestations of poliomyelitis. Polio infections in children are often be asymptomatic. Although asymptomatic, an infected person still sheds the virus in the stool and is able to transmit the virus to others.

Paralytic polio is classified into three types: spinal polio, bulbar polio, bulbospinal polio. Spinal polio is characterized by asymmetric paralysis most often involving the legs. Bulbar polio leads to weakness of muscles innervated by cranial nerves. Bulbospinal polio is a combination of bulbar and spinal paralysis. For the less than 1% of polio infections in children that do result in flaccid paralysis, paralytic symptoms typically take anywhere from 1 to 18 days after prodromal symptoms to begin and then progress for 2 to 3 days. Most persons who experience paralytic poliomyelitis recover completely and muscle function returns to some degree.

The inactivated poliovirus vaccine (IPV) is now the exclusively recommended poliovirus vaccine and is highly effective in producing immunity to all three serotypes of poliovirus. West Virginia requires polio vaccination for K-12 entry.

The incidence of poliomyelitis declined rapidly following widespread use of poliovirus vaccine in the mid-1950's. The last case of poliomyelitis in the United States was in 1979 and the Western Hemisphere was certified polio free in 1994. Global eradication of poliovirus is now an important goal of the World Health Organization along with other international organizations.

During the MMWR year 2016, there were zero (0) cases of poliomyelitis reported in West Virginia. The last reported case of poliomyelitis in West Virginia was in 1970.

Rubella

The rubella virus is an enveloped RNA virus with a single antigenic type and is classified as a Togavirus. The rubella virus is transmitted person to person by respiratory droplets. The virus replicates in the nasopharynx and regional lymph nodes followed by a viremia 5 to 7 days after exposure. A 1 to 5 day prodrome of low-grade fever, malaise, lymphadenopathy, and upper respiratory symptoms typically precedes a maculopapular rash which occurs 14 to 17 days following exposure. The rash initially appears on the face and progresses from head to foot, lasting about 3 days.

The MMR vaccine and/or the MMRV vaccine are both available and routinely recommended for all children 12 months of age or older; however, the MMRV vaccine should not be given to anyone older than 12 years. West Virginia requires MMR vaccination for pre-K entry.

During the MMWR year 2016, there were zero (0) confirmed cases of rubella reported in West Virginia. The last reported case of rubella in West Virginia was 1992.

Tetanus

Tetanus is an acute, often fatal disease that is characterized by generalized rigidity and convulsive spasms of skeletal muscles. Tetanus is caused by an exotoxin that is produced by the bacterium *Clostridium tetani* (*C. tetani*) which is a gram-positive, anaerobic rod that may develop a terminal spore. *C. tetani* produces two exotoxins. The function of the first exotoxin, tetanolysin, is not known with certainty; however, the second exotoxin, tetanospasmin, is a neurotoxin responsible for the clinical manifestations of tetanus and is one of the most potent toxins known. Although the *C. tetani* organism is sensitive to heat and cannot survive in the presence of oxygen, the spore is very resistant to heat and usual antiseptics. The spores are widely distributed in soil and the intestines of many animals. Transmission usually occurs when the *C. tetani* bacterium enters the body through a wound where the spores germinate. It is not contagious from person to person. Once toxins are produced, they disseminate through blood and lymphatics and eventually act at several sites within the central nervous system.

Generalized tetanus is the most common type of reported tetanus while local and cephalic tetanus are uncommon forms.

Vaccines containing the tetanus toxoid are available and highly effective at preventing tetanus infection. The tetanus toxoid should be administered with diphtheria toxoid as DTaP, DT, Td, or Tdap. West Virginia requires Diphtheria/Tetanus/Pertussis vaccination for K-12 entry.

During the MMWR year 2016, there was one (1) confirmed case of tetanus reported in the WVEDSS.

Varicella (Chickenpox)

Varicella is a highly contagious, acute disease that is caused by varicella zoster virus (VZV) which is a member of the herpesvirus group. Chickenpox is the primary varicella infection. VZV can persist in sensory nerve ganglia after the primary infection as a latent infection. Recurrent infections are known as shingles or herpes zoster.

VZV enters the body through the respiratory tract and conjunctiva and is believed to replicate at the site of entry in the nasopharynx and in regional lymph nodes. Transmission occurs person to person from infected respiratory tract secretions, airborne droplets, or by direct contact of inhalation of aerosols from vesicular fluid of skin lesions. Chickenpox infections peak in the winter months and early spring. Four to six days after infection, a primary viremia occurs and disseminates the virus to other organs. A secondary viremia also occurs with viral infection of the skin. In the case of chickenpox, a mild prodrome may precede the onset of a rash. For adults, this might be 1 to 2 days of fever and malaise prior to rash onset, but in children the first sign of disease is often the rash. The rash typically appears first on the head and most concentrated on the trunk. Over several days successive crops of lesions present in several stages of development. In those who have not been vaccinated, the rash is generalized and pruritic and progresses rapidly from macules to papules to vesicular lesions before crusting. Healthy children will typically have 200 to 500 lesions in 2 to 4 successive crops. Lifetime immunity is usually developed from recovery from chickenpox infection. A second occurrence of chickenpox is not common in healthy persons, but it can happen in immunocompromised persons.

Vaccines containing VZV are licensed and available in the United States. Varivax contains only varicella zoster virus and ProQuad is a combination of measles, mumps, rubella, and varicella (MMRV). The titer of varicella zoster virus is higher in MMRV vaccine than in Varivax. The titer to measles, mumps, and rubella in MMRV vaccine is identical and equal to those in the MMR vaccine. Zostavax, a herpes zoster vaccine, is also available in the United States and is approved for use in persons 50 years of age and older. West Virginia requires varicella vaccination for pre-K entry.

Through weekly reporting of aggregate totals, 108 individual cases of chickenpox were reported in West Virginia during the 2016 MMWR year. One (1) chickenpox outbreak was reported during the 2016 MMWR year with 3 outbreak cases.

Figure 25. *The number of chickenpox cases reported in West Virginia by report year, 2007-2016. Source WVEDSS.*

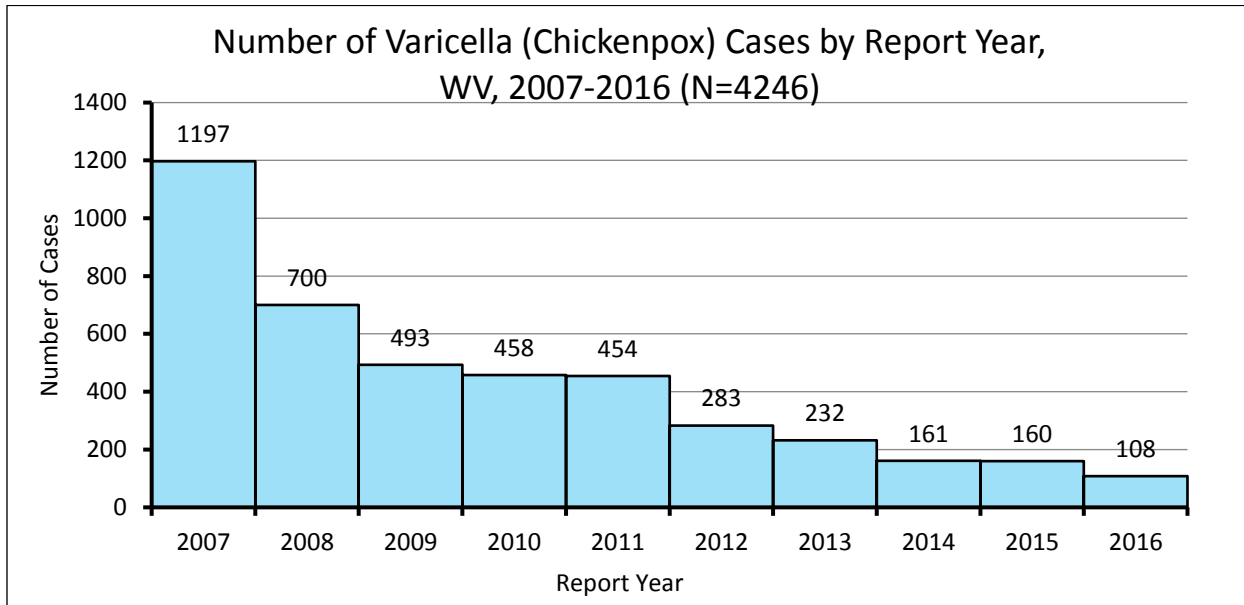


Figure 26. *The number of chickenpox cases and outbreaks reported in West Virginia by month of report, 2007-2016. Source WVEDSS.*

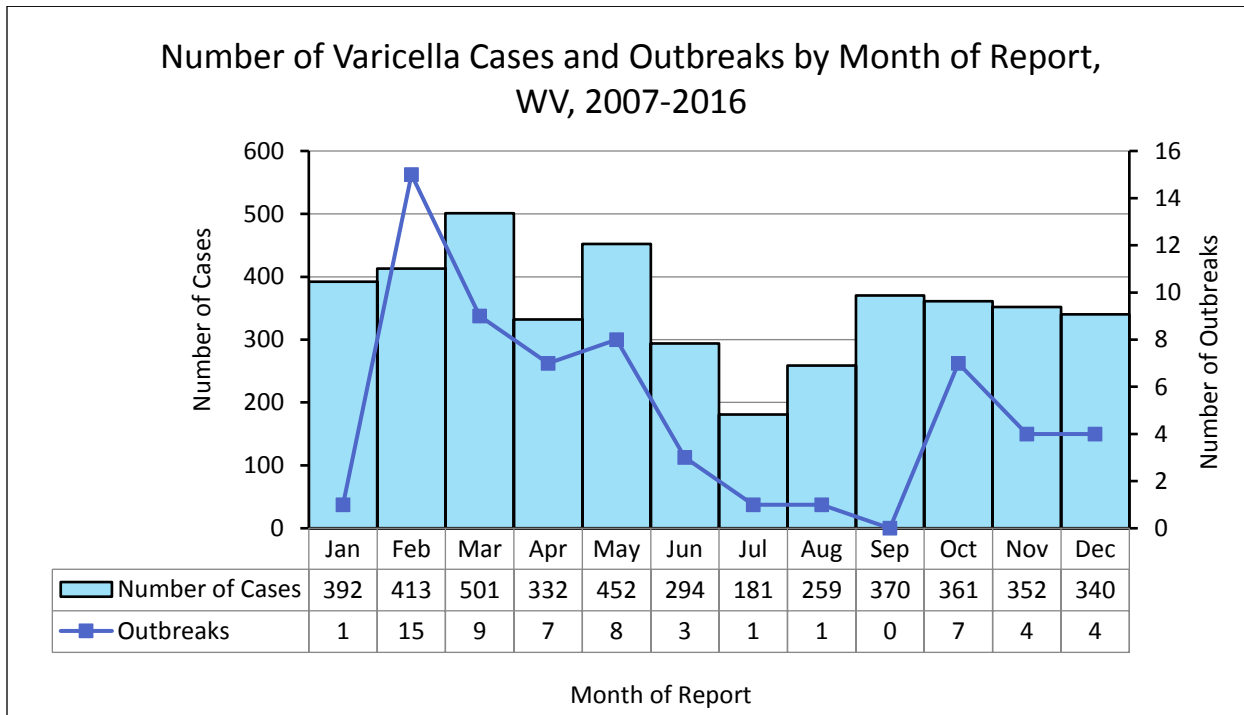
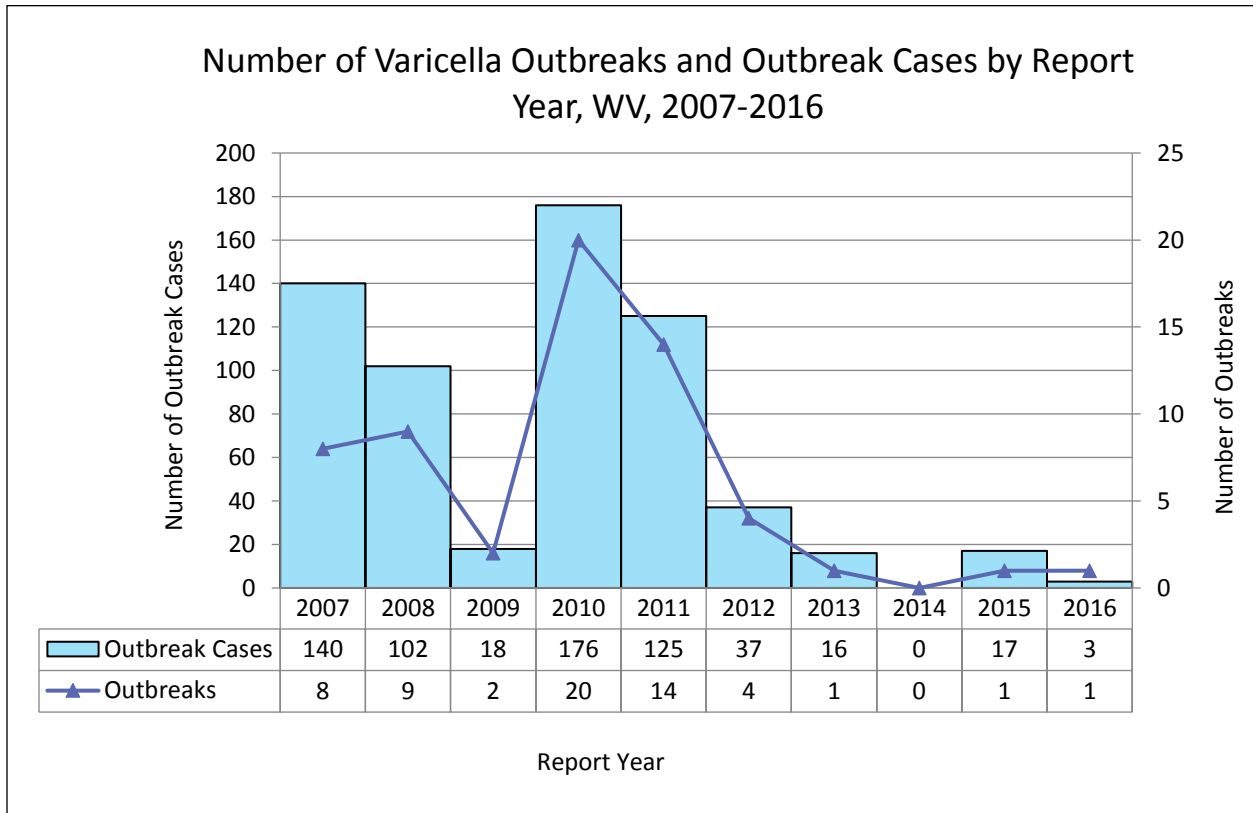


Figure 27. The number of chickenpox outbreaks and outbreak cases reported in West Virginia by report year, 2007-2016. Source WVEDSS.



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