

# Pneumococcus: Questions and Answers

## INFORMATION ABOUT THE DISEASE AND VACCINES

### What causes pneumococcal disease?

Pneumococcal disease is caused by the bacterium *Streptococcus pneumoniae*, also called pneumococcus. There are more than 90 subtypes. Most subtypes can cause disease, but only a few produce the majority of invasive pneumococcal infections. The 10 most common subtypes cause 62% of invasive disease worldwide.

### How does pneumococcal disease spread?

The disease is spread from person to person by droplets in the air. The pneumococci bacteria are common inhabitants of the human respiratory tract. They may be isolated from the nasal passages and throat of 5%–70% of normal, healthy adults, depending on the population and setting.

### What diseases can pneumococci bacteria cause?

There are three major conditions caused by pneumococci: pneumonia, bacteremia, and meningitis. They are all caused by infection with the same bacteria, but have different symptoms.

Pneumococcal pneumonia (lung disease) is the most common disease caused by pneumococcal bacteria. The incubation period is short (1–3 days). Symptoms include abrupt onset of fever, shaking chills or rigors, chest pain, cough, shortness of breath, rapid breathing and heart rate, and weakness. As many as 400,000 hospitalizations from pneumococcal pneumonia are estimated to occur annually in the United States. Pneumococci account for about 30% of adult community-acquired pneumonia. Complications of pneumococcal pneumonia include empyema (infection of the pleural space), pericarditis (inflammation of the sac surrounding the heart), and respiratory failure. The fatality rate is 5%–7% and may be higher than 50% among elderly people.

An estimated 5,000 cases of pneumococcal bacteremia (blood infection without pneumonia) occur each year in the United States. Pneumococcal bacteremia occurs in about 25%–30% of patients with pneumococcal pneumonia. Bacteremia is the most common clinical presentation among children age two years and younger, accounting for 70% of invasive disease in this group. The overall case-fatality rate for bacteremia is about 20% but may be as high as 60% among elderly

people. Patients with asplenia who develop bacteremia may experience a severe illness.

Pneumococci cause 50% of all cases of bacterial meningitis (infection of the covering of the brain or spinal cord) in the United States. There are an estimated 2,000 cases of pneumococcal meningitis each year. Symptoms may include headache, tiredness, vomiting, irritability, fever, seizures, and coma. The case-fatality rate of pneumococcal meningitis is 8% among children and 22% among adults but may be higher among elderly people. Permanent neurologic damage is common among survivors. People with a cochlear implant appear to be at increased risk of pneumococcal meningitis. With the decline of invasive Hib disease, pneumococci has become the leading cause of bacterial meningitis among children younger than 5 years of age in the United States.

Pneumococci are also a common cause of acute otitis media (middle ear infection). By age 12 months, more than 60% of children have had at least one episode of acute otitis media. Approximately 20% of such ear infections are caused by *S. pneumoniae*. In the United States, there were 5 million cases of otitis media each year in children younger than age five years prior to the use of the pneumococcal conjugate vaccine. Middle ear infections are the most frequent reason for pediatric office visits in the United States, resulting in more than 18 million visits annually. Complications of pneumococcal otitis media may include infection of the mastoid bone of the skull and meningitis.

### How serious is pneumococcal disease?

Pneumococcal disease is a serious disease that causes much sickness and death. An estimated 30,400 cases and 3,690 deaths from invasive pneumococcal diseases (bacteremia and meningitis) are estimated to have occurred in the United States in 2016. Many of these cases occurred in adults for whom pneumococcal polysaccharide vaccine was recommended. Young children and the elderly (individuals younger than age five years as well as those older than age 65 years) have the highest incidence of serious disease.

Case-fatality rates are highest for meningitis and bacteremia, and the highest mortality occurs among the

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elderly and patients who have underlying medical conditions. Despite appropriate antimicrobial therapy and intensive medical care, the overall case-fatality rate for pneumococcal bacteremia is about 20% among adults. Among elderly patients, this rate may be as high as 60%.

Before the routine use of a vaccine for children in the United States, pneumococcal disease was a significant problem in children younger than age five years. Each year it was responsible for causing 700 cases of meningitis, 13,000 blood infections, five million ear infections, and 200 deaths.

### **Is there a treatment for pneumococcal disease?**

Penicillin is the drug of choice for treatment of pneumococcal disease; however, resistance to penicillin and other antibiotics has been on the rise. In 2016, an estimated 30% of pneumococcal bacteria were resistant to one or more antibiotics. How common drug resistance is depends on what part of the country you live in. Treating patients infected with resistant organisms requires expensive alternative antimicrobial agents and may result in prolonged hospital stays. The increased difficulty of treating this serious bacterial infection makes prevention through vaccination even more important.

### **How long is a person with pneumococcal disease contagious?**

The exact period of communicability is not known. It appears that transmission can occur as long as the organism remains in respiratory secretions.

### **Can you get pneumococcal disease more than once?**

Yes. There are more than 90 known subtypes of pneumococcus bacteria. Having been infected with one type does not always make the patient immune to other types. Even if an individual has had one or more episodes of invasive pneumococcal disease, he or she needs to be vaccinated.

### **When did pneumococcal vaccine become available?**

There are two types of pneumococcal vaccine – pneumococcal polysaccharide vaccine and pneumococcal conjugate vaccine.

The first pneumococcal polysaccharide vaccine, containing 14 serotypes, was licensed in the United States in 1977. In 1983, an improved pneumococcal polysaccharide vaccine (Pneumovax, Merck) was licensed, containing purified polysaccharide from 23 types of pneumococcal bacteria. This pneumococcal polysaccharide vaccine is commonly known as PPSV. The

PPSV vaccine is licensed for routine use in adults 65 years and older and people with certain risk factors who are age 2 through 64 years.

The first pneumococcal conjugate vaccine, PCV7 (Prenar 7, Pfizer), was licensed in 2000. In 2010, an improved pneumococcal conjugate vaccine (PCV13; Pnevna13, Pfizer) was licensed and replaced PCV7 for use in the routine vaccination of children. PCV13 offers additional protection against the types of pneumococcal bacteria that cause the majority of invasive pneumococcal disease in the United States. PCV13 is recommended for use in preventing pneumococcal disease in all infants and young children, beginning as young as 6 weeks. PCV13 is also recommended for all adults age 65 years or older, as well as in certain older children and adults ages 19 through 64 years at increased risk of invasive pneumococcal disease.

Following the introduction of PCV7 for children in 2000, the incidence of pneumococcal disease decreased significantly. At the time of its introduction, about 80% of disease was caused by the 7 serotypes contained in the vaccine. After the vaccine was introduced, there was a rapid reduction in disease caused by those serotypes and a rise of serotypes not covered in the vaccine. There also has been a substantial decline in the rate of invasive pneumococcal disease caused by the seven serotypes in unvaccinated adults, probably due to a reduction in transmission from vaccinated children to their family members and other close contacts.

### **What kind of vaccines are they?**

Both pneumococcal vaccines are made from inactivated (killed) bacteria. The pneumococcal polysaccharide vaccine (PPSV) contains long chains of polysaccharide (sugar) molecules that make up the surface capsule of the bacteria. Generally speaking, pure polysaccharide vaccines do not work well in children younger than 2 years, induce only short-term immunity, and multiple doses do not provide a “boost” to immunity.

The pneumococcal conjugate vaccine includes purified capsular polysaccharides from the bacteria that are “conjugated” (or joined) to a protein (a harmless variety of diphtheria toxin). The resultant conjugate vaccine is able to produce an immune response in infants and antibody booster response to multiple doses of vaccine.

### **How is this vaccine given?**

The polysaccharide vaccine (PPSV) can be given as a shot in either the muscle or the fatty tissue of the arm or leg. The conjugate vaccine (PCV13) is given as a shot in the muscle.

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**Who should get the pneumococcal polysaccharide vaccine (PPSV)?**

- All adults age 65 years or older
- Anyone age two years or older who has a long-term health problem such as cardiovascular disease, sickle cell anemia, alcoholism, lung disease, diabetes, cirrhosis, or leaks of cerebrospinal fluid
- Anyone who has or is getting a cochlear implant (a surgically implanted device that provides a sense of sound to a person who is profoundly deaf or severely hard of hearing)
- Anyone age two years or older who has a disease or condition that lowers the body's resistance to infection, such as Hodgkin's disease, kidney failure, nephrotic syndrome, lymphoma, leukemia, multiple myeloma, HIV infection or AIDS, damaged spleen or no spleen, or organ transplant
- Anyone age two years or older who is taking any drug or treatment that lowers the body's resistance to infection, such as long-term steroids, certain cancer drugs, or radiation therapy
- Adults ages 19 through 64 years who have asthma
- Adults ages 19 through 64 years who smoke cigarettes
- In special situations, public health authorities may recommend the use of PPSV after PCV13 for Alaska Native or American Indian children ages 24 through 59 months who are living in areas in which risk of invasive pneumococcal disease is increased.
- In special situations, public health authorities may recommend PPSV for Alaska Natives and American Indians ages 50 through 64 years who are living in areas in which the risk of invasive pneumococcal disease is increased.

**Who should get the pneumococcal conjugate vaccine (PCV13)?**

All infants beginning at two months of age should receive a four-dose series of vaccine; catch-up vaccination is recommended for children younger than age 5 years who did not receive vaccine on schedule. In addition, all healthy children younger than 5 years who have completed an age-appropriate schedule of vaccination with the earlier PCV7 vaccine are recommended to receive one additional dose of PCV13 as are children with specific medical conditions who haven't yet reached their 6th birthday.

One dose of PCV13 vaccine should be administered to adults age 65 years or older who have not previously

received it. One dose of PCV13 should also be given to persons ages 19 through 64 years who have not previously received PCV13 and who are at the highest risk of serious pneumococcal disease. This includes adults with functional or anatomic asplenia, those with chronic renal failure or nephrotic syndrome, a cerebrospinal fluid leak, cochlear implant, and those who are immunocompromised (including HIV infection), on immunosuppressive therapy, or have received an organ or bone marrow transplant.

**What is the schedule for the routine doses of PCV13 for children?**

All infants and toddlers should get four doses of PCV13 vaccine, usually given at ages two, four, six, and 12 through 15 months.

**Can older children be given PCV13?**

Yes. Children ages 6 through 18 years who are at increased risk for pneumococcal disease because of sickle cell disease, HIV infection, or other immunocompromising condition; have a cochlear implant; or have a cerebrospinal fluid leak should be vaccinated. These children may get a single dose of PCV13 regardless of their history with PCV7 or PPSV.

**What if my three-year-old child never got his PCV13 shots?**

The number of doses a child needs to complete the series depends on his or her current age. Older children need fewer doses. For example, a healthy unvaccinated child age 24 through 59 months needs a single dose of PCV13. Your healthcare provider can tell you how many doses are needed to complete the series at a certain age. PCV13 is not routinely recommended for healthy individuals who are age five years or older but is recommended for certain older children and adults who have a medical condition that increases their risk of pneumococcal disease.

You can find more information about pneumococcal vaccination schedules for children at [www.immunize.org/catg.d/p2016.pdf](http://www.immunize.org/catg.d/p2016.pdf).

**Do some children need to get both PCV13 and PPSV?**

Yes, children at high risk of invasive pneumococcal disease should receive PCV13 and then also receive PPSV when age two years or older. PPSV is not given routinely to healthy children.

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**If influenza vaccine is recommended for health-care personnel to protect high-risk patients from getting influenza, why isn't pneumococcal vaccine also recommended?**

Influenza virus is easily spread from healthcare personnel to their patients, and infection usually leads to clinical illness. Pneumococcus is probably not spread from healthcare personnel to their patients as easily as is influenza, and transmission of pneumococcus does not necessarily lead to clinical illness. Host factors (such as age and underlying illness) are more important in the development of invasive pneumococcal disease than just having the bacteria in one's nose or throat.

**My elderly neighbor got a second pneumococcal shot. I thought just one was required.**

All adults should receive a dose of PCV13 and PPSV at age 65 years. The PCV13 should be given first followed by the PPSV 1 year later. Adults should receive only one dose of PCV13. Most people who receive PPSV need only one dose at age 65 years. People who received a first dose of PPSV when they were younger than age 65 years (for example, because of lung or heart disease or cigarette smoking) should receive a second dose at age 65 years if at least five years have elapsed since the previous dose.

Likewise, people age two years through 64 years who are at highest risk for pneumococcal disease due to certain long-term health problems, in particular immunosuppression, HIV infection, and not having a functional spleen (or having no spleen) should get a second dose five years after the first dose, and then a third and final dose once they are age 65 years. A maximum of three lifetime doses of PPSV are currently recommended.

**If I have already received a dose of PPSV at age 65 years should I still receive PCV13?**

Yes. People who have previously received PPSV but have not received PCV13 should receive one dose of PCV13 at least 1 year after the most recent PPSV dose.

**If I received a dose of PCV13 before age 65 years, should I get another dose when I am 65?**

No. Only one lifetime dose of PCV13 is recommended for adults.

**Who recommends pneumococcal vaccines?**

The Centers for Disease Control and Prevention, the American Academy of Pediatrics, and the American Academy of Family Physicians recommend routine vaccination with PCV13 vaccine. The Centers for Dis-

ease Control and Prevention, the American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, the American Academy of Family Physicians, and the American College of Physicians all recommend the PPSV vaccine.

**Can pregnant women get this vaccine?**

Yes. Pregnancy is not a contraindication to either PCV13 or PPSV.

**How safe are the pneumococcal vaccines?**

PPSV and PCV13 are both very safe vaccines. For PPSV, about 30%–50% of the people who get the vaccine have very mild side effects, such as redness or pain where the shot was given. Fewer than 1% of recipients develop a fever, muscle aches, or more severe local reactions. Serious allergic reactions have been reported very rarely.

For PCV13 about 1 out of 3 children have swelling where the shot was given, about 1 of 3 have a mild fever, about 1 in 20 have a higher fever (over 102°F), and about 8 out of 10 become fussy or irritable. About half of the children were drowsy after the shot or had a temporary loss of appetite. No serious reactions have been associated with either PPSV or PCV13.

**How effective is pneumococcal polysaccharide vaccine (PPSV)?**

Overall, PPSV is 50%–80% effective in preventing invasive disease. Older adults (that is older than age 65 years) and people with significant underlying illnesses do not respond as well, but vaccination with PPSV is still recommended because they are at high risk of developing severe pneumococcal disease.

**Who should NOT receive pneumococcal vaccine?**

For both PPSV and PCV13, people who had a severe allergic reaction to one dose should not receive another (such reactions are rare). People who have a moderate or severe acute illness should wait until their condition improves to be vaccinated.

**Can the vaccine cause pneumococcal disease?**

No. Both PPSV and PCV13 are inactivated vaccines containing only a portion of the bacteria. The vaccines cannot cause pneumococcal disease.

**Can both pneumococcal vaccines be given at the same office visit?**

No. PPSV and PCV13 should be separated by at least 8 weeks, and in the case of healthy adults 65 years and older, by at least 1 year.