
Pneumococcus: Questions and Answers

Information about the disease and vaccines

What causes pneumococcal disease?

Pneumococcal disease is caused by *Streptococcus pneumoniae*, a bacterium. 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 nasopharynx of 5%–70% of normal, healthy adults.

What diseases can pneumococci bacteria cause?

There are three major conditions caused by invasive pneumococcal disease: 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. It is estimated that 175,000 hospitalizations due to pneumococcal pneumonia occur each year in the United States. 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. The fatality rate is 5%–7% and may be much higher in the elderly.

Pneumococcal bacteremia (blood infection) occurs in about 25%–30% of patients with pneumococcal pneumonia. More than 50,000 cases of pneumococcal bacteremia occur each year in the United States. Bacteremia is the most common clinical presentation among children younger than age two years, 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 patients.

Pneumococci cause 13%–19% of all cases of bacterial meningitis (infection of the covering of the brain or spinal cord) in the United States. There are 3,000–6,000 cases of pneumococcal meningitis each year. Symptoms may include headache, tiredness, vomiting, irritability, fever, seizures, and coma. Children younger than age one year have the highest rate of pneumococcal meningitis, approximately 10 cases per 100,000 persons. The case fatality rate is high

(30% overall, up to 80% in the elderly).

Pneumococci are also a common cause of acute otitis media (middle ear infection). Approximately 28%–55% of such ear infections are caused by *S. pneumoniae*. In the U.S., 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 20 million visits annually.

How serious is pneumococcal disease?

Pneumococcal disease is a serious disease that causes much sickness and death. In fact, pneumococcal disease kills more people in the United States each year than all other vaccine-preventable diseases combined. More than 40,000 cases and more than 4,400 deaths from invasive pneumococcal diseases (bacteremia and meningitis) are estimated to have occurred in the United States in 2005. More than half 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 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 a vaccine was available in the United States, pneumococcal disease caused serious disease 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. Children younger than age two years are at the highest risk for serious pneumococcal disease.

Since the introduction of a pneumococcal vaccine for children, the incidence of pneumococcal disease has dropped. Data from 2003 indicated that rates of invasive pneumococcal disease declined 70%–80% among children younger than age 2 years compared

to 1998–99 (prior to vaccine licensure). There also has been a smaller decline in the rate of invasive pneumococcal disease in older age groups, probably due to a reduction in transmission from vaccinated children to their family members and other close contacts.

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. Studies indicate that in some areas of the United States up to 40% of invasive pneumococci are resistant to common antibiotics. 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.

How common is pneumococcal disease in the United States?

Healthcare providers are not required by law to report pneumococcal disease to health authorities, so exact numbers are not known. Estimates have been made from a variety of population studies, however, and it is believed that more than 40,000 cases of invasive pneumococcal disease (meningitis and blood infections) occur each year in the United States. (Pneumonia and middle ear infections are most common but are not considered “invasive” diseases.) The incidence of the disease varies greatly by age group. The highest rate of invasive pneumococcal disease occurs in young children, especially those younger than age two years. Children with certain chronic diseases (e.g., sickle cell disease or HIV infection) are at very high risk of invasive disease.

Can you get pneumococcal disease more than once?

Yes. There are 90 known subtypes of pneumococcus bacteria, with 23 subtypes included in the current pneumococcal polysaccharide (adult) vaccine and 7 subtypes included in the current conjugate (child) vaccine. 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 was licensed in the United States in 1977. In 1983, an improved pneumococcal polysaccharide vaccine was licensed, containing purified protein from 23 types of pneumococcal bacteria (the old formulation contained 14 types). This pneumococcal polysaccharide vaccine is commonly known as PPSV23. The PPSV23 vaccine is licensed for use in adults and persons with certain risk factors who are age two years and older.

The pneumococcal conjugate vaccine was licensed in early 2000. It is recommended for use in preventing pneumococcal disease in infants and young children (from age six weeks to the 5th birthday). It is commonly known as PCV7.

What kind of vaccines are they?

Both pneumococcal vaccines are made from inactivated (killed) bacteria. The pneumococcal polysaccharide vaccine (PPSV23) contains long chains of polysaccharide (sugar) molecules that make up the surface capsule of the bacteria. The 23 types of pneumococci that are included cause 88% of invasive pneumococcal disease.

The pneumococcal conjugate vaccine (PCV7) includes purified capsular polysaccharide of seven types of the bacteria “conjugated” (or joined) to a harmless variety of diphtheria toxin. The seven types of purified bacteria included account for 86% of bacteremia, 83% of meningitis, and 65% of acute otitis media (ear infection) among children younger than age six years in the United States.

How is this vaccine given?

The polysaccharide vaccine (PPSV23) can be given as a shot in either the muscle or the fatty tissue of the arm or leg. The conjugate vaccine (PCV7) is given as a shot in the muscle.

Who should get the pneumococcal polysaccharide vaccine (PPSV23)?

- 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
- 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 19–64 who have asthma
- Adults ages 19–64 who smoke cigarettes
- In special situations, public health authorities may recommend the use of PPSV23 after PCV7 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 PPSV23 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 (PCV7)?

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 PCV7 vaccine on schedule.

What is the schedule for the routine doses of PCV7 for children?

All infants and toddlers should get four doses of PCV7 vaccine, usually given at ages two, four, six, and 12–15 months.

What if my three-year-old child never got his PCV7 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 24–59 months needs a single dose of PCV7. Your healthcare provider can tell you how many doses are needed to complete the series at a certain age. PCV7 is not routinely recommended for individuals who are age five years or older.

Do some children need to get both PCV7 and PPSV23?

Yes, children at high risk of invasive pneumococcal disease should receive PCV7 and then also receive PPSV23 when age two years or older. PPSV23 is not given routinely to healthy children.

If influenza is recommended for healthcare workers to protect high-risk patients from getting influenza, why isn't pneumococcal vaccine also recommended?

Influenza virus is easily spread from healthcare workers to their patients, and infection usually leads to clinical illness. Pneumococcus is probably not spread from healthcare workers to their patients as easily as is influenza, and infection with pneumococcus does not necessarily lead to clinical illness. Host factors (such as age, 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.

Revaccination is not done routinely, but a single revaccination dose is recommended for groups of people at highest risk of serious infection. No one should receive more than two doses of PPSV23.

For example, persons who received a first dose when they were younger than age 65 years should receive a second dose at age 65 years if at least five years have elapsed since the previous dose. Likewise, persons age two years or older who are at high 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 or more years after the first dose.

Anyone interested in the full list of recommendations for revaccination with PPV can find a chart at www.immunize.org/catg.d/p2015.pdf.

Who recommends pneumococcal vaccines?

The Centers for Disease Control and Prevention, the American Academy of Pediatrics, and the American Academy of Family Physicians have all recommended routine vaccination for infants and young children with PCV7 vaccine. The Centers for Disease Control and Prevention, the American College of Obstetricians and Gynecologists, the American Academy of Family Physicians, and the American College of Physicians all recommend the PPSV23 vaccine.

Should all nursing home patients ages 65 years and older be vaccinated against pneumococcal disease?

Yes.

Can pregnant women get this vaccine?

The safety of PPSV23 vaccine for pregnant women has not been studied, although no adverse consequences have been reported among newborns whose mothers were vaccinated with pneumococcal poly-

saccharide vaccine during pregnancy. Women who are at high risk of pneumococcal disease should be vaccinated before becoming pregnant, if possible. Unvaccinated pregnant women who are in a high-risk group should consult with a healthcare professional about getting the vaccination during pregnancy.

How safe is this vaccine?

PPSV23 and PCV7 are both very safe vaccines.

For PPSV23, 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 PCV7, about 10%–20% of children develop redness, tenderness, or swelling where the shot was given. About 11% may have a mild fever.

How effective is pneumococcal polysaccharide vaccine (PPSV23)?

Overall, PPSV23 is 60%–70% effective in preventing invasive disease. Older adults (e.g., older than age 65 years) and persons with significant underlying illnesses do not respond as well, but vaccination with PPSV23 is still recommended because such persons

are at high risk of developing severe pneumococcal disease.

How effective is pneumococcal conjugate vaccine (PCV7)?

In a large clinical trial, PCV7 was shown to be 97% effective in preventing invasive disease caused by the pneumococci contained in the vaccine and 89% effective against all types of *S. pneumoniae*, including those not found in the vaccine. Children with chronic diseases such as sickle cell disease and HIV infection also seem to respond well to PCV7.

Who should NOT receive pneumococcal vaccine?

- For both PPSV23 and PCV7, persons who had a severe allergic reaction to one dose should not receive another (such reactions are rare).
- Persons who are moderately or severely ill should wait until their condition improves to be vaccinated.

Can the vaccine cause pneumococcal disease?

No. Both PPSV23 and PCV7 are inactivated vaccines containing only a portion of the microbe; therefore the vaccines cannot possibly cause pneumococcal disease.