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.

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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 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 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%.

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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.

Following the introduction of a pneumococcal vaccine for children in 2000, the incidence of pneumococcal disease dropped significantly. At the time of its introduction, about 80% of disease was caused by the 7 serotypes contained in the new vaccine. After the vaccine was introduced, there was a rapid reduction in disease caused by those serotypes and a rapid 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.

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 13 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, containing 14 serotypes, 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. This pneumococcal polysaccharide vaccine is commonly known as PPSV23. The PPSV23 vaccine is licensed for routine use in adults 65 years and older and persons with certain risk factors who are age 2–49 years.

The first pneumococcal conjugate vaccine, PCV7, was licensed in early 2000. Ten years later, in 2010, a new pneumococcal conjugate vaccine product (PCV13) 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 Unites States. PCV13 is recommended for use in preventing pneumococcal disease in infants and young children, beginning as young as 6 weeks.

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. Generally speaking, a pure polysaccharide vaccine induces only short-term immunity and doesn't work as well in children younger than 2 years.

The pneumococcal conjugate vaccine includes purified capsular polysaccharides from the bacteria that are "conjugated" (or joined) to 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 (PPSV23) 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.

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 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 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 (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 former 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.

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 12–15 months.

Can older children be given PCV13?
Yes, this option includes 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 (a surgically implanted device that provides a sense of sound to a person who is profoundly deaf or severely hard of hearing); or have a cerebrospinal fluid leak. These children may get a single dose of PCV13 regardless of their history with PCV7 or PPSV23.

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 24–59 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 individuals who are age five years or older.

Do some children need to get both PCV13 and PPSV23?
Yes, children at high risk of invasive pneumococcal disease should receive PCV13 and then also receive PPSV23 when age two years or older. PPSV23 is not given routinely to healthy children.

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

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.
Vaccination 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 PPSV23 can find a chart at www.immunize.org/catg.d/p2015.pdf

Who recommends pneumococcal vaccines?
The Centers for Disease Control and Prevention and the Advisory Committee on Immunization Practices recommend routine vaccination for infants and young children with PCV13 vaccine. The Centers for Disease Control and Prevention, the Advisory Committee on Immunization Practices, 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 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 polysaccharide 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 PCV13 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. Data from the clinical trials for PCV13 showed similar results as for PCV7. Most reactions were mild and, on average, about half of the children were drowsy after the shot, had a temporary loss of appetite, or had redness or tenderness where the shot was given. About 1 out of 3 had swelling where the shot was given, about 1 of 3 had a mild fever, about 1 in 20 had a higher fever (over 102ºF), and about 8 out of 10 became fussy or irritable.

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.

Who should NOT receive pneumococcal vaccine?
- For both PPSV23 and PCV13, 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 PCV13 are inactivated vaccines containing only a portion of the microbe; therefore the vaccines cannot possibly cause pneumococcal disease.