Pneumococcus: Questions and Answers

Q&A

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 100 subtypes. Most subtypes can cause disease, but only a few produce the majority of invasive pneumococcal infections.

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.

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 much higher in older adults.

An estimated 4,000 cases of pneumococcal bacteremia (blood infection without pneumonia) occur each year in the United States. 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. Pneumococcal bacteremia occurs in about 25%–30% of patients with pneumococcal pneumonia. 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. 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 have 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.* 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 30,300 cases and 3,250 deaths from invasive pneumococcal diseases (bacteremia and meningitis) are estimated to have occurred in the United States in 2019. 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 older 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.

Is there a treatment for pneumococcal disease?

Antibiotics are recommended for the treatment of pneumococcal disease; however, 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 can require 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 100 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 (PPSV) and pneumococcal conjugate vaccine (PCV).

The first PPSV, containing 14 serotypes, was licensed in the United States in 1977. In 1983, an improved PPSV (Pneumovax, Merck) was licensed, containing purified polysaccharide from 23 types of pneumococcal bacteria. This PPSV is commonly known as PPSV23. The PPSV23 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 PCV, PCV7 (Prevnar 7, Pfizer), was licensed in 2000. In 2010, an improved PCV (PCV13; Prevnar13, Pfizer) was licensed and replaced PCV7 for use in the routine vaccination of children. PCV15 (Vaxneuvance, Merck) was licensed for adults in 2021 and for children in 2022. PCV20 (Prevnar 20, Pfizer) was licensed for adults in 2021. Either PCV13 or PCV15 are recommended for use in preventing pneumococcal disease in all infants and young children, beginning as young as 6 weeks.

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. Additional reductions in severe pneumococcal disease occurred after the introduction of PCV13.

What kind of vaccines are they?

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, 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 vaccines include 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 (PPSV23) can be given as a shot in either the muscle or the fatty tissue of the arm or leg. The conjugate vaccine (PCV13, PCV15, or PCV20) is given as a shot in the muscle.

What are the recommendations for pneumococcal vaccination of children?

All children are recommended to get either PCV13 or PCV15 as a series of 4 doses at ages 2, 4, and 6 months, and 12 through 15 months. Children younger than age 5 years who miss their routine shots or start the series at a later age should still get vaccinated with PCV13 or

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PCV15. The number of doses recommended and the intervals between doses will depend on the child's age when they begin their vaccination.

Children 2 years and older with certain medical conditions should also get PPSV23 following completion of PCV vaccination; this includes children

- with a long-term health problem such as cardiovascular disease, sickle cell anemia, lung disease, diabetes, or leaks of cerebrospinal fluid
- who have or are 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)
- with 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
- who are taking any drug or treatment that lowers the body's resistance to infection, such as long-term steroids, certain cancer drugs, or radiation therapy

How do I determine what kind of pneumococcal vaccination I need as an adult?

Recommendations for pneumococcal vaccination of adults differ by age, health condition, and past history of pneumococcal vaccination. All adults who are age 65 years or older and who have not had pneumococcal vaccination before (or whose history is unknown) should receive a pneumococcal conjugate vaccine (PCV): either one dose of PCV20 alone, or one dose of PCV15 followed one year later by pneumococcal polysaccharide vaccine (PPSV23). Adults who have only had a dose of PPSV23 may receive either PCV20 or PCV15 at least one year later.

Adults age 19 through 64 years with certain health conditions who have not had pneumococcal vaccination before (or whose history is unknown) should receive either one dose of PCV20 alone or one dose of PCV15 followed by PPSV23. These underlying medical conditions or other risk factors include:

- Immunocompromising conditions, including chronic kidney failure, nephrotic syndrome, immunodeficiency, immunosuppression due to treatment, cancer, HIV infection, cancers of the blood and lymph systems, lack of a spleen or a non-functional spleen, sickle cell disease, or other hemoglobinopathies (if PCV15 is given, may consider PPSV23 as soon as 8 weeks later)
- Cochlear implant or cerebrospinal fluid leak (if PCV15 is given, may consider PPSV23 as soon as 8 weeks later)
- Other non-immunocompromising conditions, including alcoholism, chronic heart/liver/lung disease, cigarette smoking, and diabetes mellitus (if PCV15 is given, give PPSV23 at least 1 year later).

The current CDC Recommended Adult Immunization Schedule (www.cdc.gov/vaccines/schedules/hcp/imz/adult.html) details the specific pneumococcal vaccination instructions for adults with a history of previous pneumococcal vaccination with different products.

Can older children be given PCV13 or PCV15?

Yes. Children age 6 years and older who did not complete vaccination with PCV13 and who are at increased risk 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 or PCV15 regardless of their history of PCV7.

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. Pneumococcal vaccination is not routinely recommended for healthy children 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.

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If influenza vaccine is recommended for healthcare 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.

If I have already received a dose of PPSV23 at age 65 years should I still receive PCV15 or PCV20?

A person who has received PPSV23 after turning age 65 years, and who has not previously received either PCV15 or PCV20, may receive either PCV15 or PCV20 at least one year after PPSV23.

If I received PCV13 and a dose of PPSV23 since 65, should I get a dose of PCV20 now?

You may get a dose of PCV20 at least 5 years after your last pneumococcal vaccine dose for additional protection. Talk with your healthcare provider.

Who recommends pneumococcal vaccines?

The Centers for Disease Control and Prevention, the American Academy of Pediatrics, American College of Physicians, American Academy of Family Physicians, American College of Obstetricians and Gynecologists, American College of Nurse-Midwives, American Pharmacists Association, and Society for Healthcare Epidemiology of American all recommend pneumococcal vaccination.

Can pneumococcal vaccination be given during pregnancy?

PPSV23 is recommended during pregnancy for people with a high-risk condition (e.g., immunocompromising conditions, chronic heart or lung disease, alcoholism, cigarette smoking). CDC has no recommendation regarding PCV15 or PCV20 during pregnancy. Pregnancy itself is not a reason to get any pneumococcal vaccine.

How safe are the pneumococcal vaccines?

Pneumococcal vaccines are very safe. For pneumococcal conjugate vaccines (PCV), side effects can include redness, swelling, pain, or tenderness where the shot is given, and fever, loss of appetite, fussiness (irritability), feeling tired, headache, muscle aches, joint pain, and chills can occur. Young children may be at increased risk for seizures caused by fever after PCV if it is given at the same time as inactivated influenza vaccine. Ask your healthcare provider for more information.

As with any vaccination, there is a very remote chance of a severe allergic reaction to the vaccine.

Who should NOT receive pneumococcal vaccine?

For both PPSV23 and PCV vaccines, 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. All pneumococcal vaccines are inactivated vaccines containing only a portion of the bacteria. The vaccines cannot cause pneumococcal disease.

Can PPSV23 and PCV vaccines be given at the same office visit?

No. When both vaccines are recommended, PCV should always be given first. For adults or children age 2 years or older with immunocompromising conditions, cochlear implants, or cerebrospinal fluid leaks who receive PCV13 or PCV15, PPSV23 may be given as little as 8 weeks later. For other adults who receive PCV15, PPSV23 should be given at least 1 year later. If PPSV23 is given first, then PCV15 or PCV20 should be given at least 1 year later.