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 use in certain situations for people age 2 years and older.

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 and for children in 2023. Either PCV15 or PCV20 are recommended for use in preventing pneumococcal disease in all infants and young children, beginning as young as 6 weeks. PCV21 (Capvaxive, Merck) was licensed for adults in 2024 and contains 11 of the same sertypes as PCV20 plus 10 additional serotypes unique to PCV21; it is not intended for children.

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

What are the recommendations for pneumococcal vaccination of children?

All children are recommended to get either PCV15 or PCV20 as a series of 4 doses at ages 2, 4, and 6 months, and 12 through 15 months. PCV13 may be used if PCV15 or PCV20 are unavailable. Children younger than age 5 years who miss their routine shots or start the series at a later age should still get vaccinated with PCV15 or PCV20. The number of doses recommended and the intervals between doses will depend on the child's age when they begin vaccination.

Children 2 years and older with certain medical conditions should also get additional doses of pneumococcal vaccine following completion of PCV vaccination, if they have not yet received PCV20. The number and types of doses will depend upon the child's vaccination history, age, and medical condition. Ask your healthcare provider about pneumococcal vaccination if your child

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has a chronic health condition or has a weakened immune system due to illness or treatment.

The current CDC Recommended Child/Adolescent Immunization Schedule (see www.cdc.gov/vaccines/hcp/imz-schedules/child-adolescent-age.html) details the specific pneumococcal vaccination instructions for children with a history of previous pneumococcal vaccination with different products. CDC's PneumoRecs VaxAdvisor app (available at www.cdc.gov/pneumococcal/hcp/vaccine-recommendations/app.html) is a simple tool to determine what pneumococcal vaccination is due based on a person's age, health condition, and vaccination history.

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. As of October 2024, all adults age 50 years or older and who have not had pneumococcal vaccination previously (or whose history is unknown) should receive a pneumococcal conjugate vaccine: either one dose of PCV21 or PCV20 alone, or one dose of PCV15 followed one year later by pneumococcal polysaccharide vaccine (PPSV23). Adults who have had only a dose of PPSV23 may receive a dose of PCV15, PCV20, or PCV21 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 or PCV21 alone, or one dose of PCV15 followed by PPSV23 at a later date. 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/hcp/imz-schedules/adult-age.html) details the specific pneumococcal vaccination instructions for adults with a history of previous pneumococcal vaccination with different products. The CDC PneumoRecs VaxAdvisor app (available at www.cdc.gov/pneumococcal/hcp/vaccine-recommendations/app.html) is a simple tool to determine what pneumococcal vaccinations is due based on a person's age, health condition, and vaccination history.

Can older children be given PCV15 or PCV20?

Yes. Certain older children and teens at increased risk pneumococcal disease may be recommended to receive PCV15 or PCV20, based on their health condition and vaccination history. Your healthcare provider can tell you what type of vaccination is needed.

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 PCV. 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. The CDC PneumoRecs VaxAdvisor app can provide individualized guidance based on age, health condition, and vaccination history.

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

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

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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, do I need another pneumococcal vaccine?

A person who has received PPSV23 after turning age 65 years, and who has not previously received a pneumococcal conjugate vaccine (PCV15, PCV20, or PCV21) should receive one of these PCV options at least one year after receiving 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 or PCV21 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 the use of pneumococcal conjugate vaccines 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?

PPSV23 is not recommended for people who have already received PCV13, PCV20, or PCV21. As of October 2024, PPSV23 is only recommended for individuals age 2 years or older with specific high risk conditions who receive PCV15, but never at the same visit. It may be given as little as 8 weeks following PCV15 to people age 2 years or older with immunocompromising conditions, cochlear implants, or cerebrospinal fluid leaks. An interval of at least 1 year after PCV15 is recommended for those age 2 years or older with other non-immunocompromising risk conditions. A person who inadvertently receives PPSV23 first should wait at least one year before receiving PCV15, PCV20, or PCV21.