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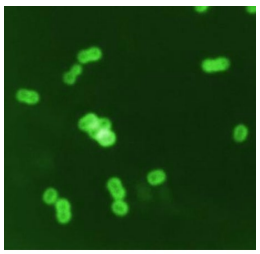
Pneumococcal Disease

Pneumococcal disease is a vaccine-preventable disease caused by infection with the bacterium *Streptococcus pneumoniae* (also called pneumococcus). Pneumococcal vaccine recommendations were updated for adults in June 2024 and for children in June 2023 by the Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP).



Streptococcus pneumoniae, fluorescent antibody (FA) CDC 1004

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The Disease

S. pneumoniae is a gram-positive diplococcus (occurs in pairs) with a polysaccharide (sugar) outer capsule. Capsules are antigenic, are used to classify *S. pneumoniae* serotypes, and are a factor for pathogenicity. Over 100 distinct serotypes have been identified. However, most infections are caused by a few serotypes, reflected in vaccine composition.

Respiratory tracts of healthy persons commonly carry *S. pneumoniae*. Such nasopharyngeal carriage is a necessary precursor of pneumococcal disease, but in the majority of cases this carriage does not result in disease. Transmission of the bacteria occurs person-to-person through respiratory droplets and there are no animal reservoirs.

Clinical manifestations of disease range from mild non-invasive infections to serious invasive illness. Non-invasive infections include otitis media (ear infection) and sinusitis (sinus infection). Invasive pneumococcal disease (IPD) is defined by infection of the lung or a normally sterile site. IPD includes pneumonia (lung infection), meningitis (infection of membranes protecting the brain and spinal cord), and bacteremia (bloodstream infection). Severe infections may result in long-term sequalae or death. The most common invasive clinical presentation among adults is pneumococcal pneumonia while among children, the most common invasive clinical presentation is bacteremia and the most common non-invasive presentation is otitis media.

Laboratory testing is needed to differentiate *S. pneumoniae* from other bacterial infections causing similar illnesses. Isolation of *S. pneumoniae* from the lung or a normally sterile site (e.g., blood, cerebrospinal fluid (CSF), pleural fluid, middle ear fluid, etc.) definitively diagnoses pneumococcal disease. In adults a urine antigen test can also diagnose pneumococcal pneumonia.

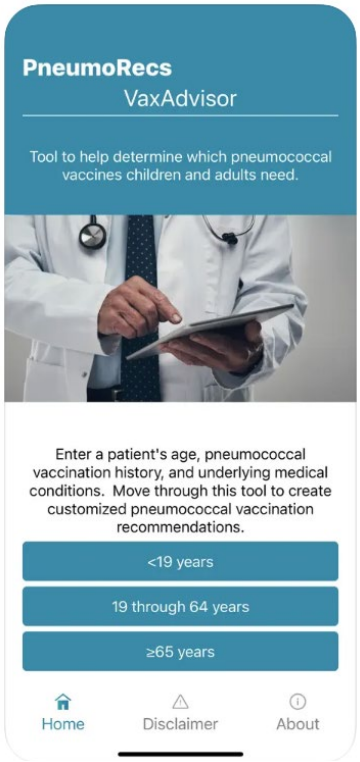
Broad-spectrum antibiotics are used to treat pneumococcal disease. Antibiotic testing allows for more targeted (narrow-spectrum) antibiotic use. Some infections are resistant to one or more antibiotics, which can lead to treatment failures. Other treatment guidelines vary by syndrome.

Pneumococcal infections typically increase during autumn and winter. Children <5 years of age and adults ≥65 years of age are at increased risk of pneumococcal disease. Other risk factors include childcare attendance, homelessness, certain chronic and immunocompromising conditions, and behavioral factors (e.g., smoking). Alaska Native, American Indian, and African American groups in the United States also have increased rates of pneumococcal disease.

Pneumococcal Vaccines

Vaccination is the best way to prevent pneumococcal infection. Pneumococcal vaccines are available for all children <5 years of age, all adults ≥50 years of age, and individuals 5–50 years of age with certain risk conditions. There are two types of pneumococcal vaccines: pure polysaccharide vaccines and conjugate vaccines. Polysaccharide vaccines do not produce a T-cell response (needed for long-term immunity) and are not immunogenic among young children or older adults. Pneumococcal conjugate vaccines (PCVs) contain purified capsular polysaccharide conjugated (attached) to a nontoxic variant of diphtheria toxin. Conjugate vaccines are effective for all age groups and induce a T-cell response resulting in long-term immunity.

The first pneumococcal vaccine, a polysaccharide vaccine covering 14 serotypes (14-valent), was licensed for use in the United States in 1977. In 1983, this vaccine was replaced by a 23-valent polysaccharide vaccine (PPSV23).



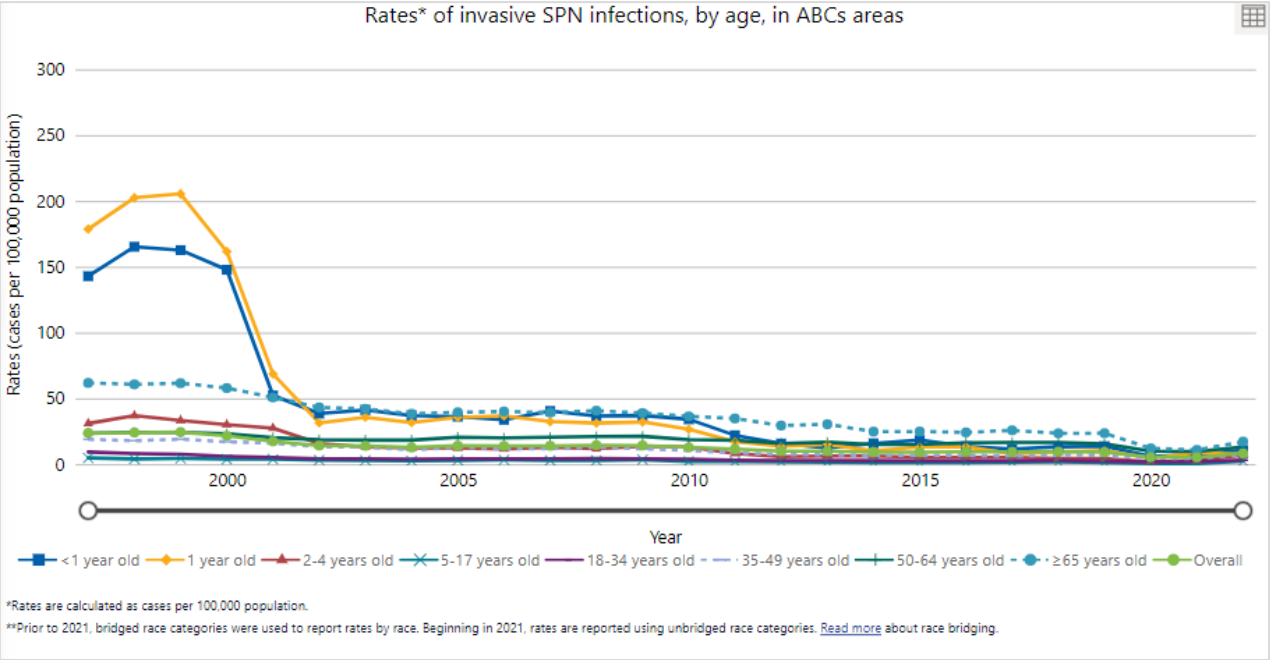
The first pneumococcal conjugate vaccine was licensed for use in this country in 2000 and covered seven serotypes (PCV7). In 2010, a 13-valent vaccine (PCV13) replaced PCV7. PCV15 became available in 2022, PCV20 in 2023, and PCV21 in 2024.

Protection from pneumococcal vaccines is serotype-specific. For some serotypes, there may be cross-protection from a related serotype in the vaccine (e.g., serotype 6B in PCV7 provided cross-protection against serotype 6A).

Currently, PPSV23, PCV15, PCV20, and PCV21 are available in this country. For children <5 years of age, routine vaccination with four doses of PCV15 or PCV20 is recommended. For adults ≥50 years of age who have not received a conjugate vaccine, vaccination with PCV15, PCV20, or PCV21 is recommended. For adults who received PCV15, a dose of PPSV23 is recommended one year later; PPSV23 is not indicated for adults given PCV20 or PCV21. Adults ≥65 years who previously received PCV13 and PPSV23 may receive PCV20 or PCV21 based on shared clinical decision-making. Individuals with high-risk conditions may have additional vaccine recommendations (see Resources).

Invasive Pneumococcal Disease (IPD) Trends in the United States

CDC began national surveillance for IPD in 1998 through the Active Bacterial Core surveillance (ABCs) program (https://www.cdc.gov/abcs/bact-facts/data-dashboard.html). In 2022 the overall rate of IPD was 8.3 cases per 100,000 population and the rate of IPD deaths was 0.9 per 100,000 population. Case rates are highest among young children (10.8 cases per 100,000 for children <1 year of age in 2022) and older adults (27.5 cases per 100,000 for adults ≥85 years of age in 2022).



Compared to the pre-conjugate vaccine era, conjugate vaccines have reduced the rate of IPD by 91% among children <5 years. Through a combination of herd immunity and direct vaccination, conjugate vaccines also reduced the rate of IPD among unvaccinated older children and adults. IPD is not notifiable in Washington so state-specific data are not available.

In the United States, pneumococcal conjugate vaccines have nearly eliminated disease due to serotypes covered by the vaccines. However, these declines have been partially offset by increased disease caused by serotypes not covered by vaccines, a phenomenon called serotype replacement. Vaccination still remains essential to reduce the risk of this potentially severe infection.

Resources

CDC – Pneumococcal disease: https://www.cdc.gov/pneumococcal/about/index.html

WA DOH – Pneumococcal disease and vaccine: https://doh.wa.gov/you-and-your-family/immunization/diseases-and-vaccines/pneumococcal-vaccine

CDC Pink Book – Background: https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-17-pneumococcal-disease.html

CDC – Vaccine recommendations and a link to the vaccine advisor app: https://www.cdc.gov/pneumococcal/hcp/vaccine-recommendations/index.html

CDC – ABCs surveillance data: https://www.cdc.gov/abcs/downloads/SPN_Surveillance_Report_2022.pdf