

***Streptococcus pneumoniae* Invasive Disease**

PROTOCOL CHECKLIST

- Check the laboratory report to make sure the specimen was collected from a normally sterile site and meets the case definition.
- Collect pertinent information from the health care provider. This includes demographics, relevant medical records, laboratory reports, and, for cases in children <6 years old, the child's vaccination history.
- For cases in people ≥ 6 years old, interviews/investigations are not recommended. Surveillance for *S. pneumoniae* invasive disease in people ≥ 6 years old is now conducted only through electronic laboratory reporting (ELR) surveillance.
- For cases in children <6 years old, enter all data obtained into Merlin and report the case to the Bureau of Epidemiology (BOE). Cases in people ≥ 6 years old will be automatically created and reported in Merlin based on ELR results.
- For cases in children <6 years old, inquire about child care attendance or institutional settings.
 - If the child attends day care or an institutional setting, the facility should be contacted to inform them of the case and to inquire about other recent cases. Use the case as an educational opportunity.
- For cases in children <6 years old, determine if the case has indications for pneumococcal vaccine and recommend age-appropriate vaccination with either PCV13 or PPV23.

Streptococcus pneumoniae Invasive Disease

1. DISEASE REPORTING

A. Purpose of reporting and surveillance

- To track the prevalence of drug resistance in a clinically important organism, which will help guide empiric treatment of infections and monitor the emergence of drug resistance
- To provide ongoing data for the assessment of disease burden and the effects of routine immunizations

B. Legal reporting requirements

Laboratories and physicians are required to report cases to the local county health department within one working day of identification/diagnosis.

C. County health department investigation responsibilities

1. Begin investigation for reported cases <6 years of age within two business days of receiving report from a provider or laboratory.
2. For cases in children <6 years old, report all confirmed cases in Merlin.
3. There are no investigation responsibilities for cases in individuals ≥6 years of age.

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2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic agent

S. pneumoniae is a gram-positive bacterium. Nearly all strains causing invasive disease are encapsulated, which means they are more of a threat to people that lack a spleen and to small children, especially those 6 months to 1 year of age, who do not yet make antibodies to the polysaccharide capsule.

B. Description of illness

Acute otitis media (AOM) is the most common clinical manifestation of *S. pneumoniae* infection among children. However, *S. pneumoniae* often causes invasive disease, including pneumonia, bacteremia, and meningitis. Approximately 12% of patients with invasive pneumococcal disease die of their illness, but case-fatality rates are higher for the elderly and patients with certain underlying illnesses. AOM and upper respiratory infections do not commonly progress to invasive disease, but they do contribute significantly to the burden and cost of health care.

C. Reservoirs

Humans are the only known reservoir. Pneumococci are in the upper respiratory tract of 15% of well adults; in child care settings, up to 65% of children are colonized.

D. Modes of transmission

Invasive disease is not transmitted person to person as it only occurs after the bacteria that have colonized or infected a person breach the host's defenses.

Individuals with acute respiratory tract infections (particularly nasal) can transmit bacteria that may cause noninvasive infection (i.e., upper respiratory infections). Transmission is person to person by large droplet spread or by contact with respiratory secretions. Casual contact can result in asymptomatic nasopharyngeal carriage of the organism without illness developing.

E. Incubation period

Unknown, but as short as 1-4 days. The incubation period is difficult to establish because most people acquire the organism as colonization of the airway and do not develop disease.

F. Period of communicability

As long as the organism is present in respiratory secretions. If treated with appropriate antibiotics, ill persons are considered noninfectious 24 hours after treatment begins.

G. Treatment

Penicillin, ceftriaxone, or cefotaxime have traditionally been the drugs of choice. When resistance is widespread, empiric treatment usually includes a broad-spectrum cephalosporin and, often, vancomycin, until results of antibiotic sensitivity testing are available.

H. Prophylaxis

Not indicated for sporadic cases. Close contacts of ill persons at high risk of acquiring invasive pneumococcal infection (i.e., persons who are immunocompromised, persons with sickle cell disease, or persons with functional or anatomic asplenia) should be directed to discuss current health status, including immunization history, with their primary care physician or routine immunization provider.

I. Epidemiology

Pneumococci are ubiquitous, with many healthy people having colonization in their upper respiratory tracts. Serotypes most often responsible for causing infection are those most frequently found in carriers. The spread of the organism is influenced by factors such as crowding, seasonal differences, vaccination coverage, and the presence of viral upper respiratory infections, including influenza.

S. pneumoniae infections are among the leading causes worldwide of illness and death for young children, persons with underlying debilitating medical conditions, and the elderly. Pneumococcus is the most commonly identified cause of bacterial pneumonia, and since the widespread use of the *Haemophilus influenzae* type b vaccine, pneumococcus has become the most common cause of bacterial meningitis in the U.S. Pneumococcal infections are most prevalent during winter months and are most common in infants, young children, and the elderly, and in African Americans, American Indians, and Alaska Natives.

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An increased risk of invasive pneumococcal disease has been associated with day care attendance. Infections are more common and more severe in people who are immunocompromised due to HIV infection, have functional or anatomical asplenia (especially sickle cell disease), have chronic heart or lung disease, or have other chronic medical conditions.

Outbreaks of pneumococcal pneumonia are rare. When outbreaks occur, they are usually in crowded environments, such as jails and nursing homes.

Before 1990, *S. pneumoniae* was almost uniformly susceptible to penicillin; however, during the 1990s, resistance to penicillin and multiple classes of antimicrobial agents spread rapidly. In 2000, a 7-valent pneumococcal polysaccharide-protein conjugate vaccine (PCV7) was introduced into the routine childhood immunization program. It included several strains that were commonly non-susceptible to penicillin, and following its introduction, the incidence of pneumococcal invasive disease declined substantially.

In 2010, a 13-valent pneumococcal polysaccharide-protein conjugate vaccine (PCV13) was introduced. The new vaccine added six serotypes that previously caused an increasing proportion of invasive disease since the introduction of PCV7. PCV13 is recommended as a 4-dose series at ages 2, 4, 6, and 12–15 months.

J. *S. pneumoniae* in Florida

The proportion of reported *S. pneumoniae* isolates that are antibiotic resistant has been stable in Florida for at least five years. The majority of cases occur during the winter months.

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3. CASE DEFINITION

Background

Streptococcus pneumoniae infections cause many clinical syndromes, depending on the site of infection (e.g., acute otitis media, pneumonia, bacteremia, or meningitis).

Clinical criteria for case classification

Not applicable.

Laboratory criteria for case classification

Confirmatory:

- Isolation of *S. pneumoniae* from a normally sterile site (e.g., blood, cerebrospinal fluid, joint fluid, pleural fluid, pericardial fluid)
- **And for resistant isolates:** Intermediate- or high-level resistance of the *S. pneumoniae* isolate to at least one antimicrobial agent currently approved for use in treating pneumococcal infection.

Presumptive:

Identification of *S. pneumoniae* from a normally sterile body site by a culture-independent diagnostic test.

Epidemiological criteria for case classification

Not applicable.

Case classification

Confirmed:

A person with confirmatory laboratory evidence.

Probable:

A person with presumptive laboratory evidence.

Criteria to distinguish a new case from previous reports

A new case should be created when a positive laboratory result is received on a specimen collected more than 30 days after the most recently collected positive specimen associated with a previously reported case in the same individual.

Comments

Report both resistant and non-resistant isolates. *S. pneumoniae* invasive diseases cases in people ≥6 years old are only reportable for laboratories participating in electronic laboratory reporting. Cases in people ≥6 years old will be automatically created and reported in Merlin based on ELR results. For people ≥6 years old, case reports received from health care providers or via paper laboratory results do not need to be investigated or entered into Merlin; however, county health departments can choose to enter and report these cases.

All cases in children <6 years old are reportable for all laboratories and health care providers. All cases in children <6 years old need to be investigated and reported, regardless of the method through which the case reports were received. **Extended data in Merlin is only required for those cases in people <6 years old.**

Resistance defined by Clinical and Laboratory Standards Institute (CLSI) approved methods and CLSI approved interpretive minimum inhibitory concentration (MIC) standards (µg/mL) for *S. pneumoniae*. CLSI recommends that all invasive *S. pneumoniae* isolates found to be “possibly resistant” to beta-lactams (i.e., an oxacillin zone size of <20 mm) by oxacillin screening should undergo further susceptibility testing by using a quantitative MIC method acceptable for penicillin, extended-spectrum cephalosporins, and other drugs as clinically indicated.

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4. LABORATORY TESTING

A. Criteria for diagnosis

1. Isolation of *S. pneumoniae* from a normally sterile site
 - a. Common sterile sites include blood, CSF, pleural fluid, peritoneal fluid, pericardial fluid, deep tissue specimen taken during surgery, gallbladder, bone, or joint fluid.
 - b. Sites that are not considered sterile include bronchial wash, wound, eye, stool, urine, or middle ear. Isolates from non-sterile sites submitted for testing do not meet the case definition.
2. Identification of *S. pneumoniae* from a normally sterile body site by a culture-independent diagnostic test. See 4.A.1.a-b. above for information on sterile sites.

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3. A single case should be defined as a health event with a specimen collection date that occurs more than 30 days from the last known specimen with a positive lab finding.

B. Interpretation of results

Specific antimicrobial susceptibility testing results are required for reporting if susceptibility testing was done. If all the susceptibility test results are susceptible, report the case as drug-susceptible. If **any** results are intermediate or resistant, report the case as drug-resistant. In some cases susceptibility testing will not have been done (i.e., if the patient died). In those cases, report the case as drug-susceptible and include an explanation in the case notes as to why susceptibility testing was not done.

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5. CASE INVESTIGATION

A. Confirm the diagnosis

Confirm that *S. pneumoniae* was cultured from a normally sterile site.

B. Check the laboratory report

Antibiotic susceptibility testing results are required for reporting. If these were not included in the original laboratory report, contact the laboratory and request them. In the rare instance where susceptibility testing was not done, these cases should be reported as drug-susceptible. An explanation for why susceptibility testing was not done should be included in the case notes.

C. Investigate vaccination status (cases in children <6 years old)

The Advisory Committee on Immunization Practices (ACIP) recommends that all children ≤59 months of age receive pneumococcal conjugate vaccine. The ACIP also recommends that persons aged ≥2 years who are at increased risk of serious pneumococcal infection because of underlying medical conditions and all persons aged ≥65 years receive a dose of the 23-valent pneumococcal polysaccharide vaccine.

Check the vaccination status of all children <6 years old with invasive *S. pneumoniae* and record them in the extended data screen. Vaccination status may be available in Florida SHOTS (now accessible via Merlin), in the child's medical records, or through interviews with the child's caregiver(s).

D. Merlin data entry

Create a case in Merlin under **Merlin disease code: 04800 *Streptococcus pneumoniae* Invasive Disease**. For cases in children <6 years old, enter the data collected into Merlin, being sure to complete all required fields on the Basic Data, Case Symptoms, Extended Data screens and attach all relevant labs. Surveillance for *S. pneumoniae* invasive disease

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in people ≥6 years old is now conducted only through ELR surveillance. Cases in people ≥6 years old will be automatically created and reported in Merlin based on ELR results. *S. pneumoniae* meningitis cases should **not** be reported under disease code Meningitis, Bacterial or Mycotic-32090.

E. Follow up on any epi-links

Investigate any epi-links among cases <6 years of age (cluster, household, co-workers, etc.) in an effort to identify and respond to outbreaks.

Contact investigation is of no practical value for sporadic cases.

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6. CONTROLLING FURTHER SPREAD

A. Contact management

Contact management for sporadic cases is not indicated.

B. Environmental measures

In child care settings, the regularly scheduled cleaning of toys with an approved disinfectant is recommended.

C. Education

The risk of contacts or household members acquiring the disease is low.

- Key patient education facts to convey:
 - Invasive disease is not usually spread person to person.
 - Antibiotic prophylaxis is not routinely recommended for contacts of cases of *S. pneumoniae* invasive disease.
 - In the event that close contacts develop signs and symptoms of severe illness, medical attention should be sought immediately.
- Those at high risk of acquiring invasive pneumococcal infection (i.e., persons who are immunocompromised, persons with sickle cell disease, or persons with functional or anatomic asplenia) should be directed to discuss current health status, including immunization history, with their primary care physician or routine immunization provider.

D. Vaccination

Current recommendations for pneumococcal vaccine usage can be found at www.cdc.gov/vaccines/vpd/pneumo/index.html

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7. MANAGING SENSITIVE SITUATIONS

A. Outbreak investigation in any age groups

Enhanced investigation of *S. pneumoniae* invasive disease cases (among any age group) clustered in time and place among groups that share common space (i.e., child care facilities, institutions) is recommended. If an outbreak is suspected, notify BOE immediately.

B. Child care and *S. pneumoniae* in children <6 years old

- As of January 1, 2012, pneumococcal vaccination is required for child care attendance in Florida for children 2 to 59 months of age. Current immunization requirements for child care centers are available at: FloridaHealth.gov/programs-and-services/immunization/children-and-adolescents/school-immunization-requirements/index.html#childcare.
- Out-of-home child care increases the risk for invasive pneumococcal disease and AOM among children. Child care attendance is also a risk factor for other acute upper respiratory tract infections among children aged <5 years.
- For cases of invasive *S. pneumoniae* in children <6 years old inquire about child care attendance and follow-up with the child care center to inquire about additional cases and encourage age appropriate pneumococcal vaccination.
The director should review children's vaccination records and the records of anyone identified to be at high risk of pneumococcal disease to verify that those individuals are up-to-date for PCV7, PCV13, or PPV23 vaccinations, as appropriate. Parents of children who are not up-to-date should be reminded to have their children age-appropriately immunized.

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9. REFERENCES

- A. Preventing Pneumococcal Disease Among Infants and Young Children; Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR December 9, 2005 / 54(RR14); 1-16. Available at www.cdc.gov/mmwr/preview/mmwrhtml/rr4909a1.htm**
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- C. *Streptococcus pneumoniae* Disease. CDC Disease Listing. Available at www.cdc.gov/pneumococcal/clinicians/clinical-features.html**
- D. CDC. Defining the public health impact of drug-resistant *Streptococcus pneumoniae*: report of a working group. MMWR 1996; 45 (No. RR-1); 1-14.**
- E. Advisory Council for Immunization Practices (ACIP) Recommendations. Available at www.cdc.gov/vaccines/hcp/acip-recs/index.html**
- F. CDC. Licensure of 13- Valent Pneumococcal Conjugate Vaccine for Adults Aged 50 Years and Older. MMWR 2012; 61(RR21); 394-395.**