Pneumococcal Disease, Invasive (IPD)

Revision Dates

<table>
<thead>
<tr>
<th>Case Definition</th>
<th>August 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting Requirements</td>
<td>May 2018</td>
</tr>
<tr>
<td>Remainder of the Guideline (i.e., Etiology to References sections inclusive)</td>
<td>June 2005</td>
</tr>
</tbody>
</table>

Case Definition

**Confirmed Case**
Clinical evidence of invasive disease\(^{(A)}\) with laboratory confirmation of infection:
- Isolation of *Streptococcus pneumoniae* from a normally sterile site (not including the middle ear)\(^{(B)}\)

**OR**
- Detection of *S. pneumoniae* DNA\(^{(C)}\) by specific nucleic acid test (e.g., PCR) from a normally sterile site (excluding the middle ear)\(^{(B)}\).

\*The following probable case definition is provided as a guideline to assist with case finding and public health management, and should not be reported to AHW.

**Probable Case**
Clinical evidence of invasive disease\(^{(A)}\) with no other apparent cause and with non-confirmatory laboratory evidence:
- Detection of *S. pneumoniae* antigen\(^{(C)}\) from a normally sterile site (excluding the middle ear)\(^{(B)}\).

---

\(^{(A)}\) Invasive disease usually manifests itself as pneumonia with bacteremia, bacteremia without a known site of infection and meningitis. Pneumonia without bacteremia is not notifiable. Sputum and bronchial lavages are not considered sterile specimens.

\(^{(B)}\) Normally sterile site specimens are defined as:
- blood,
- cerebrospinal fluid (CSF),
- pleural fluid,
- peritoneal fluid,
- pericardial fluid,
- bone,
- joint fluid or
- specimens taken during surgery (e.g., muscle collected during debridement for necrotizing fasciitis or fluid from a deep abscess). NOTE: A specimen taken from a non-sterile site collected during a sterile procedure is not considered a “normally sterile site”.

\(^{(C)}\) Demonstration of *S. pneumoniae* DNA or antigen does not permit determination of serotype. Serotyping is carried out in a reference laboratory and is important for monitoring changes in disease epidemiology, including the impact of vaccination programs and serotype replacement.
Reporting Requirements

1. Physicians, Health Practitioners and Others
   Physicians, health practitioners and others shall notify the Medical Officer of Health (MOH) (or designate) of the zone, of all confirmed cases in the prescribed form by mail, fax or electronic transfer within 48 hours (two business days).

2. Laboratories
   All laboratories shall report all positive laboratory results by mail, fax or electronic transfer within 48 hours (two business days) to the:
   - Chief Medical Officer of Health (CMOH) (or designate), and
   - MOH (or designate) of the zone.

   Isolates collected from a normally sterile site (i.e., invasive) should be submitted to the National Center for Streptococcus located at the Provincial Laboratory for Public Health in Edmonton, Alberta for *streptococcus pneumonia* serotyping for passive surveillance and evaluation of immunization programs.

3. Alberta Health Services and First Nations Inuit Health Branch
   - The MOH (or designate) of the zone where the case currently resides shall forward the initial Notifiable Disease Report (NDR) of all confirmed cases to the CMOH (or designate) within two weeks of notification and the final NDR (amendment) within four weeks of notification.
   - For out-of-province and out-of-country reports, the following information should be forwarded to the CMOH (or designate) by phone, fax or electronic transfer within 48 hours (two business days):
     - name,
     - date of birth,
     - out-of-province health care number,
     - out-of-province address and phone number,
     - positive laboratory report, and
     - other relevant clinical / epidemiological information.
Etiology (1,2)
Invasive pneumococcal disease (IPD) is an acute bacterial disease caused by Streptococcus pneumoniae. S. pneumoniae is a gram-positive encapsulated diplococci. Although the bacteria are typically observed in pairs (diplococci) they may also occur singularly or in short chains. Capsular polysaccharides are the primary basis for the pathogenicity of the organism. There are approximately 90 known pneumococcal capsular serotypes. Pneumococci are sensitive to heat and many disinfectants. The bacteria can survive up to 25 days in dust, 1-11 days on glass, and seven days in sputum.

Clinical Presentation (1)
Pneumococci are common inhabitants of the respiratory tract. The bacteria may be isolated from the nasopharynx. The rate of asymptomatic carriage varies with age and the presence of upper respiratory infections. The duration of carriage varies but is generally longer in adults than children.

The symptoms of IPD depend on the clinical presentation. Manifestations include pneumonia, meningitis, bacteremia (septicemia), endocarditis, arthritis, and peritonitis. Bacteremia without a focus is the most common manifestation in children less than five years (50–60% of all cases). Otitis media is frequently caused by S. pneumoniae but isolation of S. pneumoniae from the middle ear is not reportable.

Pneumococcal pneumonia is the most common clinical presentation among older children and adults. Symptoms generally include a rapid onset of fever and shaking, chills or rigors. The individual may also experience chest pain, productive cough, dyspnea, tachypnea, hypoxia, tachycardia, malaise, and weakness. The case fatality rate is between 5 and 7% but is typically higher in elderly persons.

It may be very difficult to distinguish pneumococcal infections from other infections, as fever may be the only initial symptom, especially in children. Most often the colonization starts in the nose or throat. It is a common bacterial complication of influenza and measles.

Pneumococcal infections can be a cause of bacterial meningitis. Clinical symptoms may include headache, lethargy, vomiting, irritability, fever, seizures, and coma. The case fatality rate is about 30% and tends to be much higher in elderly persons. Neurologic sequelae are common among survivors.

Diagnosis
The diagnosis is made by the isolation of S. pneumoniae from a normally sterile site excluding the middle ear. Material obtained should be Gram stained and cultured by appropriate microbiologic techniques. Recovery of pneumococci from an upper respiratory tract culture is not useful in patients with otitis media, pneumonia or sinusitis. Blood cultures should be obtained, and cultures of other appropriate fluids (e.g., CSF, pleural fluid) may also be indicated. Sensitivity of strains should be determined.

Epidemiology
Reservoir
Pneumococci are ubiquitous. The reservoir is humans. This bacterium is frequently colonizing the upper respiratory tract of healthy people (carriers).

Transmission
Transmission is person to person via droplet spread, through direct contact with oral secretions or indirect contact with articles freshly soiled with respiratory discharges.
It has been estimated that 40% of individuals become carriers of the bacteria by age one. The spread of disease most often involves carriers. Children who attend daycares or dayhomes have a higher carrier rate due to the increased frequency and level of contact with other children.

**Incubation Period**
The incubation period varies by the type of infection but may be as short as 1-3 days.

**Period of Communicability**
The period of communicability is variable, but persists as long as the organism is present in the respiratory tract. Individuals are no longer infectious 24 hours following initiation of antibiotics.

**Host Susceptibility**
Any process that affects the anatomic or physiologic integrity of the lower respiratory tract (e.g., influenza, pulmonary edema, chronic lung disease, etc.) increases the individual’s susceptibility to symptomatic pneumococcal infection. Individuals most susceptible to serious and invasive pneumococcal infections are typically those with chronic medical conditions including anatomic or functional asplenia, sickle cell disease, chronic cardiovascular disease, diabetes mellitus, cirrhosis, Hodgkin's disease, lymphoma, multiple myeloma, chronic renal failure, nephrotic syndrome, HIV infection, and recent organ transplant. There is also an increased risk of invasive disease when adults are in contact with young children as children are more likely to be colonized. In developing countries malnutrition and low birth weight are risk factors for pneumonia in infants and young children.

Infection generally confers immunity to the specific serotype. This immunity may last for years.

**Occurrence**

**General (1-4)**
Worldwide occurrence. Most *S. pneumoniae* serotypes have been shown to cause serious disease, but only a few serotypes produce the majority of pneumococcal infections. The 10 most common serotypes account for approximately two-thirds of invasive disease worldwide. Over 90% of all pneumococcal infections are caused by 23 strains. Data from the United States indicates that the most common types of pneumococci in serious infections have been types 1, 3, 4, 7, 8 and 12 in adults and types 6, 14, 19 and 23 in infants and children. This, however, is slowly changing because of the use of vaccine. Pneumococcal infections are most common during the winter and spring months.

IPD predominantly affects infants, the elderly, and individuals with underlying medical conditions. It is more common in lower socioeconomic groups, in children attending daycare, and in developing countries. Incidence is high in children in many developing countries and is the most common cause of death (due to pneumonia). Children with functional or anatomic asplenia, particularly those with sickle cell disease, and children with HIV infection are at very high risk of invasive disease. Recurring epidemics have been reported in gold and diamond miners in South Africa and Papua New Guinea. Increased incidence is often associated with epidemics of influenza.

In the United States, until the year 2000, *S. pneumoniae* infections caused 100,000–135,000 hospitalizations for pneumonia and approximately 60,000 cases of invasive disease (3,300 cases of meningitis). Children living in the North and Aboriginal children have a higher incidence rate of IPD than Caucasians.
Canada (3,5)
The overall incidence of IPD in Canada is not known but it has been estimated that there are about 500,000 cases of pneumococcal disease each year. *S. pneumoniae* is the leading cause of invasive bacterial infections in children including bacteremia, septicemia, pneumonia, and meningitis. Studies conducted have estimated the annual incidence rate for IPD in all age groups to be between 11.6–17.3/100,000. Children less than five years, especially those less than two years, and the elderly have the highest incidence. There are an estimated 65 cases of meningitis, 700 cases of bacteremia, 2,200 cases of pneumonia requiring hospitalization, 9,000 cases of pneumonia not requiring hospitalization, and an average of 15 deaths per year due to *S. pneumoniae* infection in children under the age of five. Aboriginal children living in northern Canada have a three times higher incidence rate than non-Aboriginals.

Seven *S. pneumoniae* serotypes (14, 6B, 19F, 18C, 4, 23F, and 9V) account for more than 80% of invasive isolates from children less than five years of age. Seven to 10% of the strains isolated from clients with IPD have reduced sensitivity to penicillin.

Alberta (6)
Prior to 1998, only pneumococcal meningitis was reported. Reporting of all invasive pneumococcal disease began in 1998. From 1998 to 2003, 1,774 cases were reported (79 in 1998, 236 in 1999, 314 in 2000, 390 in 2001, 370 in 2002, and 385 in 2003)). During this reporting period the highest rates occurred in children under the age of five and adults over the age of 30 years with the number of cases reported increasing with age. Serotypes 14 and 4 were the most commonly identified. In 2002, seven serotypes (14, 19F, 4, 6B, 3, 9V, and 22F) were identified in more than 50% of reported cases.

**Key Investigation**
**Single Case/Household Cluster**
- Determine immunization status.
- Identify underlying medical conditions.
- Identify outcome following infection.

**Control**
**Management of a Case**
- Routine practices for hospitalized individuals.
- Droplet precautions may be warranted when antibiotic resistant infection is present.

**Treatment of a Case (1)**
- The preferred therapy for most infections is penicillin G (or one of its analogs) for 10-14 days.
- For persons allergic to penicillin, cephalosporins or erythromycin maybe given for pneumonia, and chloramphenicol for meningitis.
- The route, dosage, schedule, and duration depend on the severity of the illness.
- Antibiotic resistant pneumococci strains have become more common. The preferred treatment for antibiotic resistant strains includes vancomycin, ceftriaxone or cefotaxime alone or in combination with rifampin.

**Management of Contacts**
- Invasive pneumococcal infections are not highly contagious. Follow-up of contacts is not required.
Preventive Measures (5,7,8)

- Promote immunization with pneumococcal vaccine as per the current Alberta Immunization Policy.
  - Pneumococcal conjugate, 13-valent vaccine is offered in a provincially funded program to the following:
    - All children 2 months up to and including 5 years of age.
    - High risk individuals 6 years of age and older (refer to the Alberta Immunization Policy)
  - Pneumococcal polysaccharide, 23-valent vaccine is offered in a provincially funded program to the following:
    - All individuals 65 years of age and older
    - Individuals 2 – 64 years of age with certain risk factors or chronic conditions (refer to the Alberta Immunization Policy)

- Certain risk factors or chronic conditions put children and adults at an increased risk of acquiring invasive pneumococcal disease. Individuals with the following risk factors should be assessed for eligibility under the provincially funded program for both pneumococcal conjugate and/or pneumococcal polysaccharide vaccine (as per the current Alberta Immunization Policy):
  - Aboriginal children
  - Chronic cerebrospinal fluid leak
  - Chronic neurologic condition that may impair clearance of oral secretions
  - Cochlear implants (including those children who are to receive implants)
  - Chronic renal disease (including nephrotic syndrome)
  - Chronic cardiac or pulmonary disease (excluding asthma unless treated with high dose oral corticosteroid therapy)
  - Poorly controlled diabetes mellitus
  - Asplenia (functional or anatomic)
  - Sickle cell disease or other hemoglobinopathy
  - Congenital immunodeficiency involving any part of the immune system, including B-lymphocyte (humoral) immunity, T-lymphocyte (cell) mediated immunity, complement system (properdin, or factor D deficiencies), or phagocytic functions
  - Hematopoietic stem cell transplant (candidate or recipient)
  - Human immunodeficiency virus (HIV) infection
  - Hodgkin’s disease, lymphoma, multiple myeloma and leukemia
  - Immunosuppressive therapy including use of long-term corticosteroids, chemotherapy, radiation therapy, post organ transplant therapy, and anti-rheumatic therapy
  - Chronic liver disease including hepatitis B and C, and hepatic cirrhosis due to any cause
  - Malignant neoplasms including leukemia and lymphoma
  - Solid organ transplant
  - Alcoholism
  - Persons living in chronically disadvantaged situations
  - Residents of long-term care facilities

- Educate the public about the risks of disease transmission.
- Educate physicians and other healthcare professionals about the risks of pneumococcal disease for individuals with specified underlying medical conditions and others identified as at risk.
References


