



Health, Healthy Living and Seniors

Public Health and Primary Health Care
Communicable Disease Control
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November, 2015

Re: Invasive Pneumococcal Disease Reporting and Case Investigation

Reporting of invasive pneumococcal disease (*Streptococcus pneumoniae*) is as follows:

Laboratory:

- All specimens isolated from sterile sites (refer to case definition) that are positive for *S. pneumoniae* are reportable to the Public Health Surveillance Unit by secure fax (204-948-3044).

Health Care Professional:

- Cooperation in Public Health investigation is appreciated.

Regional Public Health or First Nations Inuit Health Branch (FNIHB):

- Once the case has been referred to Regional Public Health or FNIHB, the *Communicable Disease Control Investigation Form* (www.gov.mb.ca/health/publichealth/cdc/protocol/form2.pdf) should be completed and returned to the Public Health Surveillance Unit by secure fax (204-948-3044).

Sincerely,

“Original Signed By”

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Invasive Pneumococcal Disease (*Streptococcus pneumoniae*) (Pneumococcus)



Communicable Disease Control Branch

1. Case Definition

Confirmed Case: Clinical evidence^a of invasive disease with laboratory confirmation of at least one of:

- Isolation of *Streptococcus pneumoniae* (*S. pneumoniae*) from a normally sterile^b site
- OR
- Demonstration of *S. pneumoniae* nucleic acid by nucleic acid amplification test (NAAT) from a normally sterile^b site (1). Not routinely performed in Manitoba.

2. Reporting Requirements

Laboratory:

- All positive laboratory results must be faxed to the Public Health Surveillance Unit (204-948-3044 secure fax).
- Manitoba clinical laboratories are required to submit isolate sub-cultures from individuals who tested positive for invasive *S. pneumoniae* to Cadham Provincial Laboratory (CPL) within seven days of report.

Health Care Professional:

- Confirmed cases and deaths in individuals where the health care professional believes that invasive pneumococcal disease was present at death or contributed to the individual's death are reportable to Manitoba Health, Public Health Surveillance Unit (form available at: www.gov.mb.ca/health/publichealth/cdc/protocol/form2.pdf).
- Adverse reactions to vaccines should be reported to Manitoba Health, Public Health Surveillance Unit within seven days after becoming aware of the event (form available at: www.gov.mb.ca/health/publichealth/cdc/docs/aeft_form.pdf).

3. Clinical Presentation/Natural History

The major clinical syndromes of invasive pneumococcal disease (IPD) are pneumonia with bacteremia, bacteremia without another site of infection and meningitis (1, 2). Non-invasive but more frequent presentations include pneumonia without bacteremia, sinusitis and otitis media (3). Pneumococcus occasionally causes periorbital cellulitis, endocarditis, osteomyelitis, pericarditis, peritonitis, pyogenic arthritis, soft tissue infection and neonatal septicemia (4). *Streptococcus pneumoniae* nasopharyngeal colonization and transmission are common but clinical illness is infrequent (5).

Pneumonia with Bacteremia: Pneumonia is the most common clinical presentation in adults (2, 6) but pneumococcal pneumonia itself is not considered to be “invasive” disease (2). Bacteremia occurs in approximately 25-30% of patients with pneumococcal pneumonia (2). Symptom onset is abrupt and usually includes fever and chills or rigors (2). Other common symptoms include pleuritic chest pain, productive cough, dyspnea, tachypnea, tachycardia, hypoxia, malaise and weakness (2). Onset may be less abrupt in the elderly and fever with shortness of breath or altered mental status may be the presenting symptoms (7). Fever, vomiting and convulsions may be the initial manifestations in young children (7). Complications of pneumococcal pneumonia include empyema, pericarditis and endobronchial obstruction, occasionally with atelectasis and lung abscess formation (2).

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- a Mainly pneumonia with bacteremia, bacteremia without a known site of infection and meningitis. Pneumonia without bacteremia is not notifiable (1).
 - b For this case definition, examples of specimens from sterile sites include: blood; cerebrospinal, synovial or peritoneal fluid; bone. The middle ear and pleural cavity are excluded as sterile sites for this case definition. The following specimens are NOT acceptable: sputum, bronchial lavage, eye or middle ear fluid, pleural fluid.

Bacteremia: Bacteremia with no other site of infection is the most common presentation of invasive pneumococcal infection among children two years of age or younger (2, 6). At initial presentation, fever may be the only symptom in patients with bacteremia; however, more serious infection such as meningitis may develop (8). Case fatality rates for pneumococcal bacteremia range from 5% to 20% (9), but may be much higher in the elderly (2, 5).

Meningitis: Meningitis may follow direct extension from the sinuses or middle ear or bacteremia (4, 10). For infants, early symptoms of meningitis may include fever, irritability, lethargy and loss of appetite (11). In older children and adults, other symptoms include headache, stiff neck, photophobia, nausea, vomiting (11), seizures and coma (2). The case fatality rate of pneumococcal meningitis is about 30% but may be as high as 80% in the elderly (2). Neurologic sequelae are common for survivors (2).

4. Etiology

Streptococcus pneumoniae; also known as pneumococcus (7). At least 90 pneumococcal serotypes have been identified on the basis of the polysaccharide capsule (4). The distribution of disease-causing serotypes varies among geographic regions and for disease presentation within regions (2).

5. Epidemiology

5.1 Reservoir and Source

The only natural reservoir of *S. pneumoniae* is humans who carry it in the nasopharynx (9). Most children are colonized with and become carriers of one or more strains of *S. pneumoniae* during the first year of life (9). Carriage is usually asymptomatic (9). Conjugate pneumococcal vaccine reduces the carriage rate of vaccine strains (10).

5.2 Transmission

The organism is spread from person to person by respiratory droplets (2, 4, 7). Transmission from a case to casual contacts is infrequent (5). The spread

of *S. pneumoniae* within a family or household is influenced by factors such as crowding, season and the presence of upper respiratory infections or pneumococcal disease such as pneumonia or otitis media (2). In adults, crowded living conditions and close contact as in military camps, correctional facilities and homeless shelters have been associated with outbreaks but not contact in schools and the workplace (10). Child care centres appear to facilitate spread of *S. pneumoniae* in young children (10, 12-13).

5.3 Occurrence

General: In industrialized countries, the annual incidence of IPD ranges from 8 to 34 cases/100,000 population, with the highest rates occurring in infants and children aged < 2 years and in the elderly (5). Infection is more frequent among malnourished populations and lower socioeconomic groups, especially in developing countries (7). In temperate zones, invasive pneumococcal infections are more common during winter and early spring when respiratory diseases are more prevalent (2).

Canada: Age-specific incidence rates (per 100,000 population per year) in Canada in 2000 to 2004 were 39.8 among infants < 1 year of age, 24.6 among children 1 to 4 years, and 13.3 among adults ≥ 60 years (14). The rate of IPD among children < 5 years was dramatically reduced within two years following initiation of a universal Pneu-C-7 infant immunization program in British Columbia in September 2003 (15) and Alberta in 2002 (16). From 2005-2008, there was a large outbreak (mainly in adults) of serotype 5 *S. pneumoniae* that affected British Columbia, Alberta, Saskatchewan and Manitoba (17).

Manitoba: Until 1999, only pneumococcal meningitis was reportable in Manitoba. Since other invasive presentations of pneumococcal disease became reportable, the most commonly reported presentation for each year in 2000 to 2009 was bacteremia. Incidence (per 100,000) during 2000-2009 was 8.7 overall, 48.4 for infants < 1 year, 19.8 among children 1 to 4 years of age and 15.1 among adults ≥ 60 years.

5.4 Incubation Period

The incubation period is not well defined and varies for type of infection; it may be as short as one to three days (4, 7).

5.5 Host Susceptibility

Serotype-specific immunity usually follows infection and may last for years (7). The duration of vaccine-induced immunity is not known (14). Results from serologic and case studies indicate that immunity induced by polysaccharide vaccine (Pneu-P-23) decreases over time (14). Invasive pneumococcal disease is of greater frequency and/or increased severity in the following individuals:

- Extremes of age: less than two years of age and 65 years of age and older (9, 14, 18);
- Black or Aboriginal populations (2, 4, 14, 19);
- Anatomical asplenia or functional asplenia (sickle-cell disease) (2, 4, 20);
- Chronic medical conditions (e.g., chronic cardiac and pulmonary disease such as bronchopulmonary dysplasia, diabetes mellitus, chronic renal disease, cirrhosis or cerebrospinal fluid (CSF) leak (14);
- Immunocompromising conditions (e.g., HIV infection, primary immunodeficiencies, malignancies, conditions resulting from immunosuppressive therapy, solid organ transplantation, use of long-term systemic corticosteroids, nephrotic syndrome (14);
- Children with or those receiving cochlear implants (meningitis only) (2, 4, 11, 14);
- Malnourished and children of low birth weight in developing countries (2);
- Individuals with viral respiratory infection, especially influenza (7, 10);
- Children < 5 years of age attending a child care facility (2-3);
- Other factors/conditions (e.g., cigarette smoking, alcoholism, homelessness) (7, 14, 21, 22).

5.6 Period of Communicability

The period of communicability is unknown (6). Communicability is probably for less than 24 hours after initiation of effective antimicrobial therapy (6).

6. Laboratory Diagnosis

Culture is preferred as antimicrobial susceptibility testing and serotyping can be performed on the isolate. Failure to isolate the organism from normally sterile sites may occur with prior antibiotic use and/or improper handling and transport of specimens (18).

Refer to the current *CPL Guide to Services* (<http://www.gov.mb.ca/health/publichealth/cpl/>) or the specimen collection manual for the local laboratory being used to ensure optimal site specific specimen collection.

7. Key Information for Public Health Response

- Determine risk factors for infection in the case.
- Immunization history of the case.

8. Control

8.1 Management of Cases

For individuals experiencing recurrent disease, investigation for underlying illness should be pursued (6). Medical risk factors for IPD are listed in section 5.5 “Host Susceptibility”. Immunization should be updated if necessary according to the current Manitoba Immunization Schedule (www.manitoba.ca/health/publichealth/cdc/schedule.html). Refer to the current eligibility criteria (www.manitoba.ca/health/publichealth/cdc/vaccineeligibility.html) for pneumococcal vaccine.

Treatment:

Antimicrobial therapy of IPD will be governed by clinical syndrome, severity of disease, patient age and co-morbidities, recent antibiotic use and local antimicrobial resistance patterns. The

recommendations below are general and do not constitute specific guidance for every case nor are they a comprehensive list of all possible antimicrobial treatment regimens. Consultation with an Infectious Disease clinical specialist at (204) 787-2071 may be indicated.

Meningitis:

- **Adults:** Until antibiotic susceptibility results are available, the recommended treatment of pneumococcal meningitis in adults is vancomycin in combination with a β -lactam antibiotic (10). If the organism is susceptible to a β -lactam antibiotic, vancomycin should be discontinued. Vancomycin may be used in adults with major penicillin and cephalosporin allergies; the addition of a carbapenem should be considered (10).
- **Children:**
 - Vancomycin in combination with cefotaxime or ceftriaxone is preferred for children six weeks of age or older in whom pneumococcus was identified in cerebrospinal fluid (CSF) (4, 23). If the organism is found to be susceptible to penicillin, cefotaxime or ceftriaxone, vancomycin should be discontinued and penicillin, cefotaxime or ceftriaxone continued (4). Vancomycin should be continued only if the organism is nonsusceptible to penicillin and to cefotaxime or ceftriaxone (4).
 - Consultation with a pediatric infectious disease specialist (204-787-2071) is recommended for all infants with pneumococcal meningitis and children who cannot be given either vancomycin or a third-generation cephalosporin due to a contraindication (e.g., allergies) (23).
 - Dexamethasone can be used as an adjunctive treatment for children older than six weeks of age with suspected bacterial meningitis. It

should be given before or within one hour of antibiotic administration (23).

Other Invasive Infections:

- Penicillin G is the preferred therapy for other invasive pneumococcal infections where the organism is susceptible and the patient is not allergic to this agent (4, 7, 24). Cefotaxime or ceftriaxone may also be used (4, 24). If the organism demonstrates in vitro resistance to the recommended antimicrobial agents, therapy should be modified based on clinical response, susceptibility to other antimicrobial agents and the results of follow-up cultures of blood or other body fluids (4).
- Clindamycin or vancomycin may be considered for individuals with hypersensitivities to β -lactam antimicrobial agents (4). Vancomycin, which is initiated empirically, should not be continued if the organism is subsequently shown to be susceptible to other non- β -lactam antimicrobial agents (4).

Infection Control Measures: Hospitalized patients should be managed using Routine Practices. Refer to *Infection Control Guidelines: Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care. Canada Communicable Disease Report CCDR, 1999; 25S4: 1-142.*

8.2 Management of Contacts

No special management required unless in the setting of an institutional outbreak.

8.3 Management of Outbreaks

Definition of Outbreak: Two or more cases of IPD of the same serotype occurring within a closed setting^c within a 14 day period (25).

c Examples of closed settings: child care centre, school, residential home, hospital ward, military establishment, correctional facility, homeless shelter, household and other similar settings (25).

Recommendations for Outbreaks in Institutions or other Closed Population Groups:

- Immunization with the 23-valent pneumococcal polysaccharide vaccine, (Pneu-P-23) should be considered unless the disease-causing serotype is known not to be included in the vaccine (7).
- In child care facilities (i.e., children < 5 years of age), immunization of unimmunized children with pneumococcal conjugate vaccine should be considered even if the disease-causing serotype is not included in the vaccine. Immunization will confer protection against future exposures to vaccine strains.
- In rare circumstances, antibiotic prophylaxis may need to be considered (7).

Note: Specific vaccine products recommended in this protocol may change due to changes in supply, availability of new vaccines and changes to the National Advisory Committee on Immunization (NACI) recommendations. Refer to the current *Canadian Immunization Guide* and the respective product monographs for information on clinical use of pneumococcal vaccines.

8.4 Preventive Measures

- Routine immunization of infants and children and immunization of high risk children and adults according to the current Manitoba Immunization Schedule (www.gov.mb.ca/health/publichealth/cdc/schedule.html) and eligibility criteria (www.manitoba.ca/health/publichealth/cdc/vaccineeligibility.html).

Note: Refer to the current *Canadian Immunization Guide* and the respective product monographs for information on clinical use of pneumococcal vaccines.

- Antibiotic Chemoprophylaxis:
 - Oral penicillin V prophylaxis beginning before four months of age is recommended for children with functional or anatomic asplenia, regardless of their immunization


status (4). Duration of prophylaxis should be determined in consultation with a specialist.

- Individuals with sickle-cell disease or asplenia should be advised to seek medical attention early following development of fever as penicillin prophylaxis may not be effective in preventing all cases of invasive pneumococcal infections (4).
- Practicing good hand hygiene and cough etiquette (7).
- Avoidance of crowding in living quarters whenever practical, particularly in institutions and barracks (7).
- Reduction of exposure to known risk factors, such as indoor pollutants, tobacco smoke, and nutritional deficiencies (18).
- Ongoing surveillance to monitor shifts in prevailing pneumococcal serotypes that cause invasive disease (18).

9. References

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