

Pneumococcal Disease, Invasive

September 2016 | Page 1 of 9

Section 1

ABOUT THE DISEASE

A. Etiologic Agent

Invasive pneumococcal disease is caused by the bacterial pathogen *Streptococcus pneumoniae* (the pneumococcus, or “*Strep pneumo*”). Pneumococci are lancet-shaped, Gram-positive diplococci with more than 90 serotypes identified on the basis of unique polysaccharide capsules.

B. Clinical Description

Clinical manifestations vary. In the U.S., *S. pneumoniae* is one of the leading causes of bacteremia, pneumonia, meningitis, and acute otitis media (AOM) among children and adults. AOM is the most common pneumococcal infection among children. Pneumococcal pneumonia is the most common form of pneumococcal disease in adults. Typical clinical manifestations of pneumococcal pneumonia include sudden onset, high fever, rigors, pleuritic chest pain, dyspnea (labored breathing), tachypnea (unusually rapid breathing), and cough productive of “rusty” sputum. Onset may be less abrupt in the elderly; fever, shortness of breath, or altered mental status may be the first indication of pneumonia. In infants and young children, fever, vomiting and convulsions may be the initial manifestation.

Pneumococci are a common cause of sinusitis and conjunctivitis in children. Occasionally they also cause endocarditis, osteomyelitis, pericarditis, pyogenic arthritis, soft tissue infection, and early-onset neonatal septicemia.

C. Vectors and Reservoirs

Humans are the only known reservoir. Pneumococci are commonly found in the upper respiratory tract of healthy people worldwide.

D. Modes of Transmission

Pneumococci can be spread from person to person by respiratory droplets and by autoinoculation in persons carrying the bacteria in their upper respiratory tract. Different pneumococcal serotypes have different propensities for causing asymptomatic colonization, otitis media, meningitis, and pneumonia. Invasive disease arises in colonized individuals mostly on the basis of host factors.

While person-to-person transmission of the organisms is common, illness among casual contacts and attendants is rare. The spread of the organism within a family or household (or congregate setting) is influenced by such factors as crowding and viral respiratory infections. Outbreaks of pneumococcal pneumonia are rare. When outbreaks occur, they are usually in crowded environments, such as jails and nursing homes.

E. Incubation Period

The incubation period varies by type of infection, and it is difficult to establish because most people acquire the organism as colonization of the airway and disease does not result. However, it can be as short as 1-3 days.

F. Period of Communicability or Infectious Period

The period of communicability for pneumococcal disease is unknown, but presumably transmission can occur as long as the organism appears in respiratory secretions. Because organisms are transmitted, but disease does not usually result, isolation of colonized or infected people is not necessary.

G. Epidemiology

Pneumococci are common inhabitants of the respiratory tract and may be isolated from the nasopharynx of 5% to 90% of healthy persons. Rates of asymptomatic carriage vary with age, environment, and the presence of upper respiratory infections. Among school-aged children, 20-60% may be colonized. Only 5-10% of adults without children are colonized, although on military installations as many as 50-60% of service personnel may be colonized. The duration of carriage varies and is generally longer in children than adults.

Pneumococcal infections are most prevalent during the winter months. In the U.S., approximately 90% of invasive pneumococcal disease cases are in adults. It is estimated that about 900,000 people get pneumococcal pneumonia each year in the U.S., and 5-7% die from it. As many as 400,000 hospitalizations for pneumococcal pneumonia are estimated to occur annually. More than 12,000 cases of pneumococcal bacteremia, with or without pneumonia, occur each year. The overall case-fatality rate for bacteremia is about 20%, but may be as high as 60% among elderly patients. Bacteremia without a known site of infection is the most common invasive clinical presentation of pneumococcal infection among children 2 years of age and younger, accounting for approximately 70% of invasive disease in this age group. Pneumococci cause over 50% of all cases of bacterial meningitis in the United States. An estimated 3,000 to 6,000 cases of pneumococcal meningitis occur each year. The case-fatality rate of pneumococcal meningitis is about 8% among children and 20% among adults. There were an estimated 3,700 deaths in the United States from pneumococcal meningitis and bacteremia in 2013. Many of these deaths were in unvaccinated individuals. Neurologic sequelae are common among survivors.

Adults with certain medical conditions are at highest risk for invasive pneumococcal disease. For adults aged 18-64 years with hematologic cancer, the rate of invasive pneumococcal disease in 2010 was 186 per 100,000, and for persons with HIV infection the rate was 173 per 100,000 (as compared to approximately 12.9 cases per 100,000 total population). Other conditions that place adults at highest risk for invasive pneumococcal disease include other immunocompromising conditions, either from disease or drugs, functional or anatomic asplenia, and chronic renal disease. Conditions that increase the risk of IPD include chronic heart disease, pulmonary disease (including asthma in adults), liver disease, smoking cigarettes (in adults), CSF leak, and having a cochlear implant.

Children at increased risk for IPD include those younger than 2 years of age; in group care; who have certain conditions (sickle cell disease, HIV infection, or chronic heart or lung conditions); with cochlear implants or cerebrospinal fluid leaks; and some American Indian, Alaska Native, and African American children.

Impact of vaccination: Following the introduction of the pneumococcal conjugate vaccines in the U.S. (PCV7 in 2000 and PCV 13 in 2010) significant declines in IPD were reported among children under five years of age. Overall, IPD decreased from 100 cases per 100,000 children in 1998 to 9 cases per 100,000 in 2015. IPD caused by the 13 serotypes covered by PCV 13 decreased from 91 cases per 100,000 in 1998 to 2 cases per 100,000 people in 2015.

Declines in invasive pneumococcal disease were seen as early as 2001 among adults between the ages of 19 and 64 years old and adults 65 years or older because of the use of pneumococcal conjugate vaccines in children. Overall, invasive pneumococcal disease in adults 19 through 64 years old decreased from 16 cases per 100,000 people in 1998 to 7 cases per 100,000 people in 2015. IPD in adults 65 or older decreased from 59 cases per 100,000 in 1998 to 23 cases per 100,000 in 2015. PCV13 was introduced in 2012 for use among adults 19 years or older with highest risk immunocompromising conditions (asplenia, cochlear implants and CSF fluid leaks) and in 2014 for all adults 65 years or older. However, pneumococcal polysaccharide vaccine (PPSV23) has been available since 1984 and is recommended for adults 65 years of age or older and for persons 2 years or older with chronic medical conditions. Overall, the vaccine is 60-70% effective in preventing IPD caused by serotypes included in the vaccine.

The most up-to-date vaccine recommendations are located at <http://www.cdc.gov/vaccines/hcp/acip-recs/index.html>.

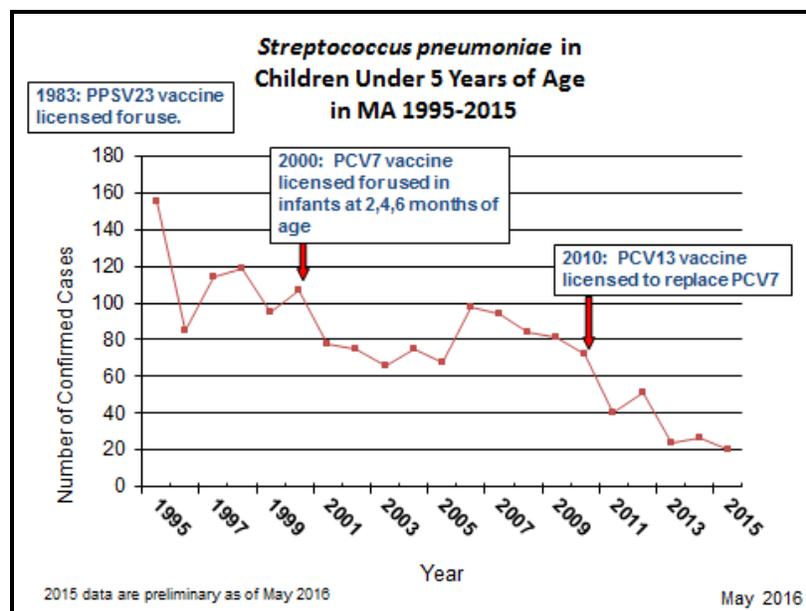


Figure 1: MDPH 2016

Antimicrobial resistance: The emergence of drug resistant *S. pneumoniae* (DRSP) has made treatment of pneumococcal disease more difficult. Because of a lack of rapid, sensitive, and specific diagnostic tests, therapy for pneumonia and milder illnesses, such as otitis media, remains empiric. Because of the increasing prevalence of DRSP, groups of experts have provided national guidance for treating infections commonly caused by pneumococcus, such as otitis media and pneumonia. Few communities exist in which resistance remains uncommon. For these reasons, clinicians and public health officials should follow national guidelines rather than attempt to create local treatment recommendations based on local resistance data. Clinicians may prescribe empiric antibacterial therapy that is not indicated or is unnecessarily broad. Inappropriate antimicrobial use contributes to the development of DRSP.

H. Bioterrorist Potential

This pathogen is not considered to be of risk for use in bioterrorism.

Section 2

REPORTING CRITERIA AND LABORATORY TESTING

A. What to Report to the Massachusetts Department of Public Health (MDPH)

- *S. pneumoniae*, invasive disease, should be reported to the local board of health (LBOH) in the community where the case is diagnosed or suspect case is identified.
- Isolation of *S. pneumoniae* from a normally sterile site should be reported directly to the MDPH within 24 hours.

B. Laboratory Testing Services Available

105 CMR 300.000 requires all laboratories performing examinations on any specimens derived from Massachusetts residents under 18 years of age to submit *S. pneumoniae* isolates from sterile sites to MA SPHL for serotyping. Serotyping is done on a quarterly basis for surveillance and research purposes only. If serotyping results are required by a provider for clinical decision-making or management, isolates can be sent to a reference laboratory for serotyping by PCR. The Centers for Disease Control and Prevention (CDC), Streptococcal Reference Laboratory can serotype pneumococcal isolates from blood, CSF, or other sterile sites, but will do so in outbreak situations only.

For more information on submitting specimens, contact the MA SPHL Bacteriology Reference Laboratory at (617) 983-6607. Remember, when submitting any clinical specimens to the MA SPHL, you must use the MA SPHL Specimen Submission Form found on the MDPH website at <http://www.mass.gov/eohhs/docs/dph/laboratory-sciences/general-submission-form.pdf>

Section 3

REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To define national and local trends in pneumococcal disease.
- To monitor the impact of the use of pneumococcal polysaccharide vaccine (PPSV23) and pneumococcal conjugate vaccine (PCV 7 and PCV13) on disease.

B. Laboratory and Health Care Provider Reporting Requirements

S. pneumoniae, invasive infection, is reportable to the LBOH. The MDPH requests that health care providers immediately report to the LBOH in the community where the case is diagnosed, all confirmed or suspect cases of *S. pneumoniae* invasive disease, as defined by the reporting criteria in Section 2A.

Any cluster of invasive pneumococcal disease should be reported immediately to the LBOH and to MDPH.

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield evidence of *S. pneumoniae* from a normally sterile site shall report such evidence of infection directly to the MDPH within 24 hours.

C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities

Reporting Requirements

MDPH regulations (*105 CMR 300.000*) stipulate that invasive pneumococcal disease is reportable to the LBOH and that each LBOH must report any case of invasive pneumococcal disease or suspect case of invasive pneumococcal disease, as defined by the reporting criteria in Section 2A. Cases should be reported to the MDPH Bureau of Infectious Disease, Office of Integrated Surveillance and Informatics Services (ISIS) via MAVEN. Refer to the List of Diseases Reportable to Local Boards of Health for information on prioritization and timeliness requirements of reporting and case investigation <http://www.mass.gov/eohhs/docs/dph/cdc/reporting/rprtbdiseases-lboh.pdf>

Case Investigation

Individuals <18 years of age

It is the responsibility of the LBOH to complete all questions in each of the question packages by interviewing the case and others who may be able to provide information. Much of the information required can be obtained from the health care provider or from the medical record.

Calling the provider

If the case was hospitalized (i.e. reporting facility is a hospital), call infection control at the named hospital. A list of infection preventionists can be found in the help section of MAVEN. If the case was seen at a clinician's office, ask to speak to a nurse working with the ordering provider.

Calling the case or parent/guardian of the case

Before calling the case, review the disease fact sheet by clicking on the Help Button located in MAVEN and/or the disease chapter in the Guide to Surveillance, Reporting and Control. The call may take a few minutes, so in order to maximize the chance of getting the information needed, it might be good to note the potential length of the call with your contact, and offer the opportunity to call back when it is more convenient. Asking questions about how the case or child is feeling may get the case or parent talking. If you are unable to answer a question they have, don't hesitate to call the Division of Epidemiology and Immunization at 617-983-6800 for assistance, and call the case back with the answer later. People are often more than willing to talk about their illness, and they may be very happy to speak with someone who can answer their questions.

Ensure that the specimen has been sent to the MA SPHL for serotyping. Call an epidemiologist at the MDPH Division of Epidemiology and Immunization, at (617) 983-6800 for assistance.

Using MAVEN

Administrative Question Package

Monitor your "Online LBOH Notification for Non-Immediate Disease" workflow in MAVEN for any new cases of *Streptococcus pneumoniae*. Once a new event appears in this workflow, open the Administrative Question Package (QP) and under the "Local Health and Investigation" section, answer the first question "Step 1 - LBOH acknowledged" by selecting "Yes". The "LBOH acknowledged date" will then auto

populate to the current day. Completing this first step will move the event out of this workflow and into your “Online LBOH notified but Case Report Forms (CRF) are pending” workflow. Note the date you started your investigation by answering “**Step 2 – Investigation started**” as “Yes” and then note the date where shown. Record your name, agency, and phone numbers where shown in “**Step 3 - LBOH/Agency Investigator.**”

Demographic Question Package

Record all demographic and employment information. It is particularly important to complete the Race/Ethnicity, Place of birth (country), and Occupation questions.

Clinical Question Package

Complete the “Diagnosis/Clinical Information” section, providing the diagnosis date, the date of symptom onset, and other medical information. For case classification purposes, it is particularly important that the Type of Infection question is answered.

Please note: If Streptococcus pneumoniae was isolated from an individual's blood, they should always be marked as having bacteremia without focus, unless there is an infection in another site, in which case they should be marked as bacteremia with focus. If the secondary site of infection is included in the list of infection types in MAVEN, please select that as well.

Vaccine and IG Information Question Package

Enter at least vaccine type and date for any documented doses of pneumococcal vaccine (e.g., PCV7, PCV13, and PPV23, along with recording other vaccines given the same day as the last dose of pneumococcal vaccine). If the case has no documentation of pneumococcal vaccines or does not know his or her history, “Vaccination history unknown” should be selected. If the case is known to be unvaccinated, “No vaccine administered” should be selected and an answer to the question “If not vaccinated, why not received?” should be entered.

Risk Exposure/Control & Prevention Question Package

Accurately record all risk questions included in the question package. Please note all information regarding childcare attendance and institutional settings.

Completing Your Investigation

1. If you were able to complete a case investigation and follow-up is complete, mark “**Step 4 – Case Report Form Completed**” as “Yes” and then choose Local Board of Health (LBOH) –Ready for MDPH review for the Completed by variable.
2. If you have made several attempts to obtain case information but have been unsuccessful (e.g., the case or health care provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the question packages with as much information as you have gathered, and then complete “**Step 4 - Case Report Form Completed**” as “No” and choose a primary reason why the case investigation was not completed from the choices provided in the primary reason answer variable list.
3. If you are not online for MAVEN you may submit a paper case report form. After completing the form, attach laboratory report(s) and fax or mail (in an envelope marked “Confidential”) to ISIS. The confidential fax number is (617) 983-6813. Call ISIS at (617) 983-6801 to obtain a copy of the case report form and to confirm receipt of your fax. The mailing address is **MDPH, Office of Integrated Surveillance and Informatics Services (ISIS), 305 South Street, 5th Floor, Jamaica Plain, MA 02130. Fax: (617) 983-6813**

4. Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.

Individuals 18 years and older

No follow-up by the LBOH is required for cases of invasive pneumococcal disease in individuals 18 years or older. These cases will populate the “LBOH Notification, but no follow-up required” workflow and can be acknowledged by the LBOH by checking the box next to the event in the workflow and clicking the “Populate LBOH Notified to Yes” button at the bottom of the screen. Events can also be acknowledged by opening the Administrative Question Package (QP) and selecting “Yes” for the first question “Step 1 - LBOH acknowledged” under the “Local Health and Investigation” section.

Section 4

CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (105 CMR 300.200)

Isolation and quarantine are not applicable. There are currently no isolation and quarantine regulations pertaining to invasive pneumococcal disease. Ensure that the case is up-to-date for recommended pneumococcal vaccines.

B. Protection of Contacts of a Case

1. There are no routine control measures other than recommended age-appropriate immunization.
2. PCV13 and PPSV23 protect against invasive disease. Vaccination also decreases the need for antibiotics, therefore preventing antibiotic resistance. Investigation provides an opportunity to identify contacts with indications for pneumococcal vaccine. For up-to-date vaccination recommendations, please see the CDC’s Pneumococcal Vaccination page at <https://www.cdc.gov/vaccines/vpd-vac/pneumo/>. The Immunization Action Coalition (IAC) also has helpful resources at <http://www.immunize.org/pneumococcal-pcv/>

Please visit the MDPH web site at www.mass.gov/dph for links to advisories, alerts, and vaccination recommendations and requirements, including recommendations for revaccination.

C. Managing Special Situations

Hospital Settings

Standard precautions are recommended. Use this opportunity to review the vaccination status of patients, especially children, older adults, and immunocompromised individuals, to ensure that their PCV13 and PPSV23 status is up to date.

Childcare Settings

Use this opportunity to review the vaccination status of all children to ensure that their PCV13 and PPSV23 status is up to date.

Other Institutional Settings

Follow standard precautions. Use this opportunity to review the vaccination status of all residents. Immediately report any clusters to the LBOH and to the MDPH at (617) 983-6800.

D. Preventive Measures

Age-appropriate pneumococcal vaccine as recommended. Please visit the CDC, Immunization Action Coalition and MDPH web site at www.mass.gov/dph for the most up-to-date recommendations regarding the use of pneumococcal vaccine for children and adults. Vaccine Information Statements (VIS) for all vaccines, including pneumococcal vaccine, inactivated and live, attenuated influenza vaccine are available in English and in many other languages at the Immunization Action Coalition website at www.immunize.org/vis.

Section 5**ADDITIONAL INFORMATION**

The following are the formal CDC surveillance case definitions for invasive *S. pneumoniae* (2010). It is provided for your information only and should not affect the investigation and reporting of a case that fulfills the criteria in Section 2A of this chapter. (The CDC and the MDPH use the CDC case definitions to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

Note: The most up-to-date CDC case definitions are available on the CDC website at <https://wwwn.cdc.gov/nndss/case-definitions.html>. You can also find them under Help in MAVEN, in the folder "Case Classification Manual."

Case Definition of Invasive *S. pneumoniae**Clinical Description*

S. pneumoniae causes many clinical symptoms, depending on the site of infection (e.g., pneumonia, bacteremia, or meningitis).

Laboratory Criteria for Diagnosis

Isolation of *S. pneumoniae* from a normally sterile site (e.g., blood, CSF, or less commonly, joint, pleural, or pericardial fluid).

Case Classification

Suspected

Any reported case lacking confirmation of isolation of *Streptococcus pneumoniae* from a normally sterile site.

Confirmed

A clinically compatible case caused by laboratory-confirmed culture of *S. pneumoniae* from a normally sterile site.

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