



**COLORADO**  
Disease Control & Environmental  
Epidemiology Division  
Department of Public Health & Environment

# *Haemophilus influenzae* (Invasive)

Colorado Communicable Disease Manual

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## 24-Hour Reportable Disease

### The Disease and Its Epidemiology

#### A. Etiologic Agent

*Haemophilus influenzae* invasive disease is caused by the bacterium *H. influenzae* (*H. flu*), which is a small pleomorphic gram-negative coccobacillus (short, thick rod) that may be encapsulated (typeable) or unencapsulated (nontypeable). There are six capsular polysaccharide serotypes, which are designated as types a through f. *Haemophilus influenzae* type b (Hib) caused more than 95% of invasive *H. flu* disease among children less than 5 years of age prior to the introduction of effective vaccines. Nontype b encapsulated strains and nontypeable strains occasionally cause invasive disease. Nontypeable strains are generally less virulent than encapsulated strains and more commonly cause infections of the upper and lower respiratory tract.

#### B. Clinical Description

Invasive disease caused by *Haemophilus influenzae* may produce any of several clinical syndromes, including meningitis (infection of the tissue surrounding the brain and spinal cord), bacteremia (blood infection) or sepsis, epiglottitis (which may cause airway obstruction), pneumonia, septic arthritis (joint infection), and cellulitis (skin infection). Less common forms of invasive disease are osteomyelitis (bone infection) and pericarditis (infection of the sac covering the heart). Nontypeable strains rarely cause serious infection in children, but are a common cause of ear infections in children and bronchitis in adults.

#### C. Reservoirs

Humans are the only known reservoir. The upper respiratory tract of humans is the natural habitat of the organism. *H. flu* organisms colonize the nasopharynx and may remain only transiently or for several months in the absence of symptoms (asymptomatic carrier) and without treatment.

#### D. Modes of Transmission

The mode of transmission is person-to-person by inhalation of respiratory droplets or by direct contact with discharges from the nose and throat of an infected person. The portal of entry is the nasopharynx. In neonates, infection is acquired intrapartum by aspiration of amniotic fluid or contact with genital tract secretions containing the organism.

#### E. Incubation Period

The incubation period is unknown.

#### F. Period of Communicability or Infectious Period

*H. flu* is noninfectious within 24 to 48 hours of starting effective antibiotic treatment. Droplet precautions are recommended for hospitalized cases for 24 hours after initiation of parenteral (i.e., IV) antimicrobial

therapy. Untreated *H. flu* is communicable as long as organisms are present, which may be for a prolonged period even without nasal discharge.

## G. Epidemiology

Before the widespread use of Hib conjugate vaccines, Hib was the most common cause of bacterial meningitis in children less than 5 years of age. In the pre-vaccine era, the peak incidence for most forms of invasive disease occurred in children 6 to 18 months of age in the United States, however, the peak age for epiglottitis was 2 to 4 years. Invasive *H. flu* disease is unusual beyond 5 years of age. As of the late 1990s, Hib meningitis has virtually disappeared in the United States due to widespread Hib vaccine use in early childhood, and invasive Hib disease in infants and young children has decreased by 99% to less than one case per 100,000 children younger than 5 years of age. Unimmunized children less than 4 years of age are at increased risk of invasive Hib disease, especially if they have prolonged close contact (such as a household setting) with a child with invasive Hib disease. Secondary cases in families and childcare centers are rare. Invasive *H. flu* occurs worldwide; in developing countries, *H. flu* (including all serotypes and nontypeable strains) causes an estimated 480,000 pneumonia deaths each year among children less than 5 years of age.

## Case Definition

### Clinical Description

Invasive disease caused by *Haemophilus influenzae* may produce any of several clinical syndromes, including meningitis, bacteremia, epiglottitis, or pneumonia.

### Laboratory Criteria for Diagnosis

Isolation of *H. influenzae* or detection of *H. influenzae* nucleic acid from a normally sterile site (e.g., positive culture or PCR from blood or cerebrospinal fluid [CSF] or, less commonly, joint, pleural, or pericardial fluid). Isolates from all invasive *H. influenzae* cases should be sent to the CDPHE Lab for serotyping.

### Case Classification

Confirmed:	A clinically compatible case that is laboratory confirmed (positive culture or PCR from a normally sterile site)
Probable:	A clinically compatible case with detection of <i>H. influenzae</i> type b antigen in CSF

Note: Positive antigen test results from urine or serum samples are unreliable for diagnosing *H. influenzae* disease.

## Reporting Criteria

### What to Report to the Colorado Department of Public Health and Environment (CDPHE) or local health agency

- Confirmed, probable, and suspect invasive *H. influenzae* cases.
- *H. flu* cases should be reported within 24 hours of a presumptively positive laboratory test or suspected diagnosis.
- Cases should be reported using telephone, fax or the Colorado Electronic Disease Reporting System (CEDRS) to CDPHE or local health departments. See below for phone and fax numbers.
- Only confirmed and probable invasive *H. flu* cases are reported to CDC.
- *Note:* Sputum and throat are not considered normally sterile sites; therefore, *H. influenzae* isolated from these sites does not need to be reported.

## Purpose of Surveillance and Reporting

- To identify cases for investigation.
- To identify exposed persons, assure timely administration of antimicrobial prophylaxis, and prevent further spread of the disease.
- To monitor trends in disease incidence and serotype.
- To provide data about ongoing vaccine effectiveness.

## Important Telephone and Fax Numbers

CDPHE Communicable Disease Epidemiology Branch

- Phone: 303-692-2700 or 800-866-2759
- Fax: 303-782-0338
- After hours: 303-370-9395

CDPHE Microbiology laboratory: 303-692-3480

Communicable Disease (CD) Manual website: <https://www.colorado.gov/pacific/cdphe/communicable-disease-manual>

The following documents are available on the CD Manual website:

- Summary of Invasive *Haemophilus influenzae* Investigation and Control Guidelines
- Flowchart to Determine Need for Prophylaxis and Hib Vaccination of *H. influenzae serotype b* (Hib) Close Contacts 6 Weeks to 47 Months of Age
- Detailed Vaccination Schedule for *Haemophilus influenzae* type b Conjugate Vaccine

## State Laboratory Services

### Laboratory Testing Services Available

- The CDPHE Microbiology Laboratory will confirm and serotype isolates of *Haemophilus influenzae*.
- Isolates from all invasive *H. flu* disease cases should be sent to the CDPHE Microbiology Laboratory for serotyping. Serotyping aids in public health surveillance, investigation, and disease control.

## Case Investigation

All reports of invasive *H. flu* disease should be investigated, including suspect cases. The first steps are to determine whether the case is clinically compatible with invasive *H. flu* disease and review the reported positive lab findings. When investigating a suspect case with a clinical presentation consistent with meningitis, the Suspect Bacterial Meningitis (Meningococcal) Information Collection Form, which is available on the CD Manual website, is useful for organizing laboratory and clinical information. Additional laboratory and clinical information may help differentiate between possible viral versus bacterial meningitis (see table on the “Suspect Bacterial Meningitis (Meningococcal) Information Collection Form”).

Cases should be investigated to:

- Identify close contacts of the case and if necessary provide recommendations for antibiotic chemoprophylaxis to prevent secondary cases.
- Provide information about the disease, its transmission, and methods of prevention.
- Promptly identify clusters or outbreaks of disease and initiate appropriate prevention and control measures.

If the *H. flu* case is unable to be interviewed due to their age or medical condition, information may be obtained from the hospital infection control practitioner, healthcare provider, parents/relatives, friends and/or others involved with the case.

## A. Case Investigation / Forms

- Organized local health departments have primary responsibility for interviewing cases in their jurisdictions.
- Public health nursing services should consult with their CDPHE Regional Epidemiologist to establish primary responsibility for interviewing cases and implementing disease control measures for *H. flu* cases in their jurisdictions.
- For confirmed and probable cases complete the Active Bacterial Core Surveillance (ABCs) Case Report form, which is available on the CD Manual website, or enter information directly into CEDRS, including the “extended record” screens.
- Only the following sections of the ABCs form need to be completed: 1-5, 8-11, 14, 17, 18a, 19, 20, 23 and 24.
- All information from completed ABCs report forms should be entered into CEDRS or completed report forms may be faxed or mailed to CDPHE. On the CEDRS extended record screen only the sections in red text need to be completed.

## B. Identify and Evaluate Contacts

The main focus of *H. flu* investigations is to prevent secondary cases of *H. flu* serotype b disease among young children who are close contacts of the index case. Identification of young children who are household or childcare contacts of invasive Hib disease cases and assessment of their vaccination status helps identify persons who may need antimicrobial prophylaxis and/or vaccination. Antibiotic prophylaxis is only recommended for household contacts and possibly childcare contacts of confirmed and probable *H. flu* serotype b cases in certain circumstances (see Disease Control Measures, section B (Prophylaxis) - Antimicrobial prophylaxis). Do not wait for serotype information to begin the investigation of contacts, as prophylaxis should be started as soon as possible when indicated. The risk of secondary Hib cases is greatest during the first week after the onset of illness in the index case.

- Obtain information about the case’s household contacts, including the ages of children in the household and whether any children in the household are immunocompromised.
- Household contacts are defined as persons residing with the index case or nonresidents who spent 4 or more hours with the index case for at least 5 of the 7 days preceding the day of hospital admission of the index case.
- Obtain the Hib vaccination records for any children < 5 years of age defined as household contacts.
- Determine whether the case attends childcare.
- If the case attends childcare, obtain the age range of the children in the childcare classroom or childcare home. Determine if any children in the classroom or home childcare are immunocompromised.

Symptomatic Contacts (Exposure during the 7 days prior to hospitalization of the case.)

- Invasive *H. flu* symptoms include some of the following: fever, stiff neck, drowsiness, irritability, sudden vomiting, or an infection of the joint that is red or tender or swollen.
- Contacts having symptoms of invasive *H. flu* should contact their physician immediately.

Asymptomatic Contacts (Exposure during the 7 days prior to hospitalization of the case.)

- In certain situations antibiotic prophylaxis is recommended (see Disease Control Measures, section B (Prophylaxis) - Antimicrobial prophylaxis).
- Provide information about *H. flu* disease symptoms to parents of young children who are close contacts.
- Recommend Hib vaccination for unimmunized or underimmunized children < 5 years of age.
- Counsel contacts to seek medical care if symptoms develop.

## C. Reported Incidence Is Higher than Usual/Outbreak Suspected

Call the CDPHE Communicable Disease Program if there are a higher number of cases in your area than usual or an outbreak is suspected.

## Disease Control Measures

### A. Treatment

- Antimicrobial therapy should begin immediately.
- Recommended treatment is cefotaxime or ceftriaxone.
- Acceptable alternative regimens are meropenem or the combination of chloramphenicol and ampicillin. If these alternative antibiotics are used and the case is <2 years of age or the case has a susceptible household contact, the case should receive rifampin prophylaxis at the end of therapy.
- Treatment course is usually 10 days, however, longer treatment may be indicated for complicated cases.

### B. Prophylaxis

#### Antimicrobial prophylaxis

Antibiotic prophylaxis is only recommended for household contacts and possibly childcare contacts of confirmed and probable H. flu serotype b (Hib) cases in certain circumstances. Prophylaxis is not recommended for contacts of nontypeable H. flu or nontype b strains. Regardless of serotype, testing of contacts is not recommended. When indicated, prophylaxis should be started as soon as possible, since the risk of secondary cases is greatest during the first week after hospitalization of the index case.

#### ◦ Household Contacts

Household contacts are defined in Case Investigation, section B (Identify and Evaluate Contacts). If anyone in the household meets the following criteria, then antibiotic prophylaxis is recommended for all household contacts of the confirmed or probable H. flu serotype b case, except pregnant women:

- ▶ Any household contact is <12 months of age and has not completed the Hib primary vaccine series.  
OR
- ▶ Any household contact is an immunocompromised child, regardless of Hib immunization status.  
OR
- ▶ Any household contact is <4 years of age and unimmunized or incompletely immunized for Hib.

The number of doses in a Hib primary vaccine series or a complete Hib vaccine series depends on the vaccine brand and the age of the child when the first Hib vaccine dose was administered. Refer to the Flowchart to Determine Need for Prophylaxis and Hib Vaccination of H. influenzae serotype b (Hib) Close Contacts 6 Weeks - 47 Months of Age and the Detailed Vaccination Schedule for Haemophilus influenzae type b Conjugate Vaccine table to determine if a child has completed the primary Hib vaccine series or the complete Hib vaccine series.

If a delay of more than 1 or 2 days is anticipated in obtaining the serotype information, prophylaxis of household contacts may be started without serotype information in situations with significant concern of Hib disease. Contacts needing prophylaxis should be referred to their family doctor. In rare situations, a local health department or CDPHE physician may call in a prescription to a pharmacy.

#### ◦ Childcare Contacts

There is controversy and conflicting data regarding antibiotic prophylaxis of childcare contacts of a single Hib case. The following recommendations target children <3 years of age, because studies have shown higher secondary attack rates in household contacts <3 years of age. Prophylaxis of all childcare classroom or home childcare contacts (including staff) of confirmed and probable H. flu serotype b cases is recommended if either of the following criteria are met:

- ▶ Any childcare classroom contact or home childcare contact is <12 months of age and has not completed the Hib primary vaccine series.  
OR
- ▶ Any childcare classroom contact or home childcare contact is 12 to 35 months of age and unimmunized or incompletely immunized for Hib.

The number of doses in a Hib primary vaccine series or a complete Hib vaccine series depends on the vaccine brand and the age of the child when the first Hib vaccine dose was administered. Refer to the Flowchart to Determine Need for Prophylaxis and Hib Vaccination of *H. influenzae* serotype b (Hib) Close Contacts 6 Weeks to 47 Months of Age and the Detailed Vaccination Schedule for *Haemophilus influenzae* type b Conjugate Vaccine table to determine if a child has completed the primary Hib vaccine series or the complete Hib vaccine series.

There may be occasions when prophylaxis of childcare contacts is indicated prior to obtaining serotype information. Consult your CDPHE Epidemiologist for guidance.

Generally, prophylaxis of childcare contacts is not needed if all childcare classroom or home childcare contacts are  $\geq 3$  years of age. If there are immunocompromised children in the childcare classroom or home childcare, recommend antibiotic prophylaxis of the immunocompromised children, and contact your CDPHE Epidemiologist to discuss antibiotic prophylaxis of all the childcare classroom or home childcare contacts.

CDPHE Field Epidemiologists have sample letters that may be used to notify parents of the occurrence of a case of *H. flu* disease in a childcare facility, to educate them about signs and symptoms of the disease, and recommend prophylaxis if necessary.

- Antibiotic Prophylaxis

Rifampin is the drug of choice for prophylaxis. Rifampin prophylaxis is not recommended for pregnant women.

#### Rifampin Prophylaxis for Hib Exposure

Age Group	Dosage / Schedule
< 1 Month of Age	10 mg/kg orally once daily for 4 days
Children	20 mg/kg orally once daily for 4 days (maximum dose - 600 mg)
Adults	600 mg orally once daily for 4 days

Contacts needing prophylaxis should be referred to their family doctor. In rare situations, a local health department or CDPHE physician may call in a prescription to a pharmacy.

#### Vaccination

*Haemophilus influenzae* serotype b (Hib) vaccine is only effective against serotype b disease, and does not provide protection against other serotypes or nontypeable strains. Hib vaccine is routinely recommended for all children <5 years of age. There are three vaccine manufacturers of Hib vaccines; two of these vaccines are available combined with other antigens (Hepatitis B or DTaP and IPV). The number of doses needed to complete a Hib vaccine series varies by vaccine manufacturer and the age of the child when vaccination was started (children beginning vaccination at an older age need fewer doses).

- Cases

- ▶ Children <2 years of age with Hib disease should be immunized according to the age-appropriate schedule for unimmunized children, as if they had not received previous Hib vaccinations. Immunization should begin 1 month after the onset of disease. Immunization is recommended because children <2 years of age having Hib disease can remain at risk of developing a second episode of disease.
- ▶ Children  $\geq 2$  years of age with Hib disease do not need Hib vaccination, as disease almost always provides a protective immune response.

- Contacts
  - ▶ Household contacts, childcare classroom contacts, and home childcare contacts <5 years of age, who are unimmunized or incompletely immunized for *Haemophilus influenzae* type b (Hib), should receive Hib vaccine.
  - ▶ Refer to the Flowchart to Determine Need for Prophylaxis and Hib Vaccination of *H. influenzae* serotype b (Hib) Close Contacts 6 Weeks to 47 Months of Age
  - ▶ and the Detailed Vaccination Schedule for *Haemophilus influenzae* type b Conjugate Vaccine\_table to determine if a child has completed the Hib primary vaccine series or the complete Hib vaccine series.
  - ▶ CDPHE Field Epidemiologists have sample letters.

## C. Education

- Advise parents of the signs and symptoms of *H. flu* disease if children <4 years of age and/or immunocompromised children have been exposed.
- Recommend Hib vaccination for contacts <5 years of age, who are not up-to-date on their Hib vaccinations.
- CDPHE Field Epidemiologists have sample letters to notify parents.
- Information about Hib is available on CDC’s website: <http://www.cdc.gov/vaccines/vpd-vac/hib/default.htm>

## D. Managing Special Situations

### Childcare / Preschool

Refer childcare providers to the Infectious Disease in Child Care and School Settings: Guidelines for Child Care Providers: <https://www.colorado.gov/pacific/cdphe/infectious-disease-guidelines-schools-and-childcare-settings>

“Bacterial Meningitis” page for additional *H. flu* information. In certain circumstances antibiotic prophylaxis may be recommended for childcare classroom contacts or home childcare contacts.

- Determine the age range of the children in the case’s childcare classroom or home childcare.
- If there are children <3 years of age in the case’s classroom or home childcare, evaluate their Hib immunization records to determine if antibiotic prophylaxis may be necessary. See Disease Control Measures, section B (Prophylaxis) - Antimicrobial prophylaxis for details about evaluating the children’s Hib immunization records and the possible need for antibiotic prophylaxis.
- If there are children <5 years of age in the case’s classroom or home childcare determine if they are unimmunized or incompletely immunized for *Haemophilus influenzae* type b (Hib). See Disease Control Measures, section B (Prophylaxis) - Vaccination for information about reviewing Hib vaccination records and recommending Hib vaccination.

### School

Refer school personnel to the CDPHE the Infectious Disease in Child Care and School Settings: Guidelines for Child Care Providers: <https://www.colorado.gov/pacific/cdphe/infectious-disease-guidelines-schools-and-childcare-settings> “Bacterial Meningitis” page for additional information. The risk of secondary spread of *Haemophilus influenzae* type b (Hib) is a concern for unimmunized or incompletely immunized childcare contacts <3 years of age. Children <3 years of age are not typically in a school setting. Thus, the immunization records of school contacts do not routinely need to be reviewed and antibiotic prophylaxis is not routinely recommended for school contacts.

- Verify that the case is not in a classroom with children <3 years of age.
- If the case is in a classroom with children <3 years of age, consult your CDPHE Field Epidemiologist for guidance.

### Patients and Staff in Health Care Facilities (Hospitals and Long Term Care Facilities)

Hospitals and long term care facilities generally have written infection control policies and procedures for handling cases of communicable disease among patients and staff members. If a facility does not have such policies in place, provide the following recommendations:

- Standard and droplet precautions (respiratory isolation) are recommended during the first 24 hours of antimicrobial therapy of the case.
- Health care workers caring for Hib cases do not need prophylaxis.
- If the case has Hib and had close contact while infectious with children <4 years of age, who are not household or childcare contacts, discuss the type and duration of contact with your CDPHE Field Epidemiologist.

### E. Environmental Measures

No specific environmental measures are recommended. Hib does not survive in the environment on inanimate surfaces.

### References

American Academy of Pediatrics. *Red Book 2006: Report of the Committee on Infectious Diseases, 27<sup>th</sup> Edition*. Illinois, American Academy of Pediatrics, 2006.

CDC. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Atkinson W, Hamborsky J, McIntyre L, Wolfe S, eds. 12<sup>th</sup> ed. Washington DC: Public Health Foundation, 2011 or <http://www.cdc.gov/vaccines/pubs/pinkbook/index.html>

CDC. *Manual for the Surveillance of Vaccine-Preventable Diseases, 3<sup>rd</sup> Edition*. Wharton M, Hughes H, Reilly M, eds. 3<sup>rd</sup> ed. Atlanta, GA, 2002.

CDC Website: [www.cdc.gov](http://www.cdc.gov) (click on “Diseases and Conditions”)

Heymann, David, editor, *Control of Communicable Diseases Manual, 18<sup>th</sup> Edition*. Washington, DC, American Public Health Association, 2004.