Utah Department of Health & Human Services

Invasive *Haemophilus influenzae,* including type b

Disease plan

Quick links

Last updated: 6/6/2022, by Bree Barbeau

Questions about this disease plan?

Contact the Utah Department of Health and Human Services (DHHS) Office of Communicable Diseases (OCD): 801-538-6191

H. influenzae critical clinician information

Clinical evidence

Signs/symptoms

- The most common severe types of *H. influenzae* disease*:*
    - Pneumonia—fever, chills, shortness of breath, sweating, chest pain, headache, muscle pain, excessive tiredness
    - Bacteremia—fever, chills, pain in the belly, nausea, diarrhea, anxiety, shortness of breath, confusion
    - Meningitis—fever, headache, stiff neck, nausea, increased sensitivity to light, confusion

Period of communicability

- The contagious potential of invasive Hib disease is considered to be limited. However, certain circumstances, particularly close contact with a case-patient (e.g., household, child care, or institutional setting) can lead to outbreaks or direct, secondary transmission of the disease.

Incubation period

- Unknown, but may be as short as 2–4 days

Mode of transmission

- Person-to-person either by droplets or direct contact with nasopharyngeal secretion

Laboratory testing

Type of lab test

- Culture
- Serotyping by slide agglutination
- Polymerase chain reaction testing (especially useful for capsular typing)
- Nucleic acid amplification tests

Type of Specimens

- Blood
- Cerebrospinal fluid
- Other sterile body fluids

Treatment recommendations

Type of treatment

- Empiric Treatment for *Haemophilus influenzae*
    - Beta-lactams (e.g., amoxicillin, amoxicillin-clavulanate, or second- and third-generation cephalosporins), fluoroquinolones, macrolides, and tetracyclines.
    - Amoxicillin-clavulanate is a commonly used empiric treatment option for localized and non-life-threatening infections, such as otitis media, sinusitis, and acute exacerbations of chronic obstructive pulmonary disease.
    - In patients with systemic infections, such as bacteremia or meningitis, ceftriaxone is the treatment of choice.
- Directed Treatment for *Haemophilus influenzae*
    - For patients with mild to moderate infections treated in the outpatient setting (eg, chronic obstructive pulmonary disease exacerbations, pneumonia), use an oral beta-lactam (such as amoxicillin-clavulanate) or an oral second- or third-generation cephalosporin (such as cefuroxime, cefdinir, cefixime, or cefpodoxime)

- For patients with severe infections (eg, meningitis, epiglottitis, bacteremia, or other respiratory tract infections requiring hospitalization), use an intravenous third-generation cephalosporin such as ceftriaxone or cefotaxime.
- Alternative options to cephalosporins include fluoroquinolones, tetracyclines, and carbapenems.

Time period to treat

- Infected individuals should be treated immediately; highly contagious until 24 hours post antibiotic treatment.

Prophylaxis

- Invasive Hib (Type B)
  - Prophylactic vaccines—variety of vaccines, most are administered before 18 months.
  - Prophylaxis (rifampin) should be initiated within 2 weeks of the onset of disease of the index case (see below for who should receive prophylaxis).
- Invasive Hia (Type A)
  - While not recommended for the general population, clinicians may consider chemoprophylaxis for household contacts of index cases of invasive Hia disease in households with a child younger than 4 years in high risk communities or with an immunocompromised child. For these individuals and contacts, chemoprophylaxis recommendations for Hib may be followed; however, because there is not a licensed vaccine for Hia the criteria regarding vaccination do not apply.

Contact management

Isolation of case

- Hospitalized cases of *H. influenzae* type B should be isolated until 24 hours after antibiotic treatment starts.

Quarantine of contacts (Type B only)

- Observe for signs of illness (*H. influenzae*); treat with appropriate antimicrobial when indicated.

Infection control procedures

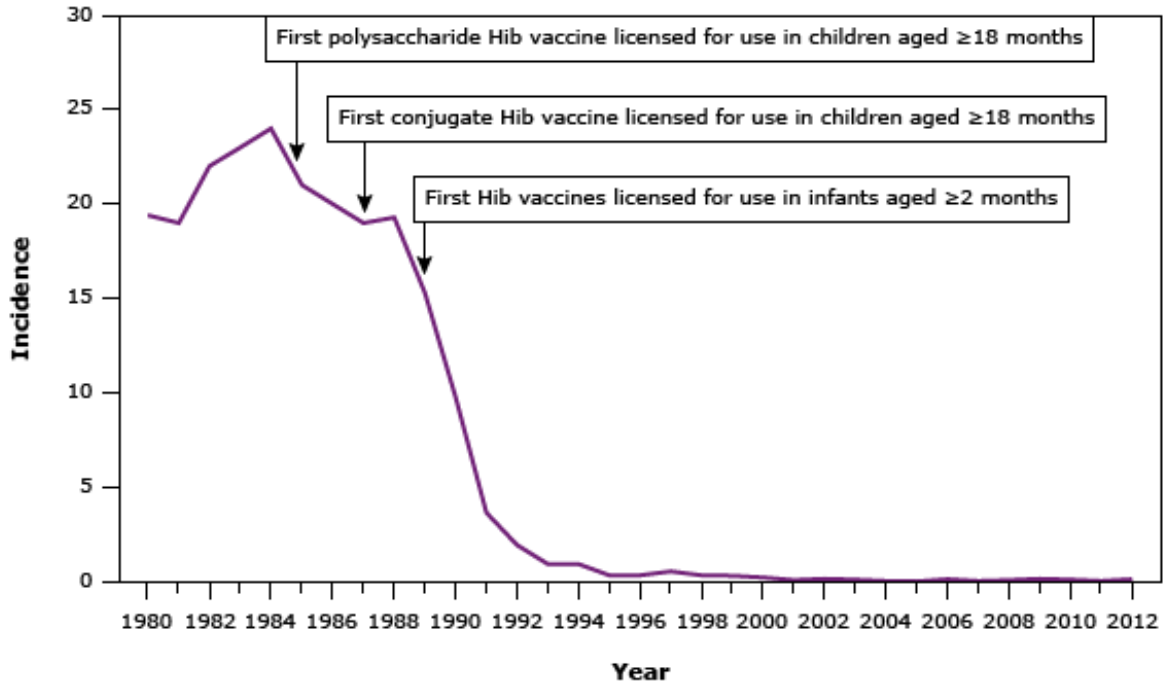
- Standard precautions

Why is *Haemophilus influenzae* important to public health?

Haemophilus influenzae (*H. influenzae*) causes a bacterial infection which is often severe, particularly among infants. Since the introduction of Hib polysaccharide and conjugate vaccines in 1985 and 1990, the incidence of invasive Hib disease in children younger than 5 years of age has decreased by 99%, to fewer than 1 case per 100,000. Continued monitoring of invasive *H. influenzae* disease through Active Bacterial Core surveillance sites (ABCs), which includes serotype information on all invasive *H. influenzae* isolates, has demonstrated low rates of invasive Hib in children younger than 5 years of age; between 2010 and 2014, the average incidence was 0.15 cases per 100,000, which is below the Healthy People 2020 goal of 0.27/100,000.

In the post–Hib vaccine era, the epidemiology of invasive *H. influenzae* disease in the United States has changed. The majority of invasive *H. influenzae* disease in all age groups is now caused by non-typeable *H. influenzae*.

Figure 1. Incidence of Hib disease in relation to licensing of Hib vaccines



Note. From "Hib Vaccines: Their impact on *Haemophilus influenzae* type b disease," by J. R. Gilsdorf, 2021, *The Journal of Infectious Diseases*, *224*(12 Suppl 2), p.S325 (https://doi.org/10.1093%2Finfdis%2Fjiaa537). Copyright 2021 by J. R. Gilsdorf.

Disease and epidemiology

Clinical description

Invasive disease due to *H. influenzae* may produce various clinical syndromes including meningitis, bacteremia or sepsis, epiglottitis, pneumonia, septic arthritis, empyema, cellulitis, or, pericarditis; less common manifestations include endocarditis and osteomyelitis. Mucosal infections, such as bronchitis, sinusitis and conjunctivitis, and otitis media, can also be caused by *H. influenzae,* but are considered to be noninvasive disease.

Causative agent

H. influenzae is a small gram-negative coccobacillus which may be either encapsulated (types a–f) or unencapsulated (non-typeable). Non-typeable strains are thought to be less virulent than encapsulated strains. *H. influenzae* type b (Hib) is the serotype which requires control measures.

Beta-lactamase-negative, ampicillin-resistant (BLNAR) H. *influenzae* is an emerging pathogen. The prevalence of BLNAR *H. influenzae* strains have increased in some countries (Japan and Spain), although their prevalence in the United States and elsewhere remains low (approximately 3%). Possible explanations for this observation include inadequate vaccination against *H. influenzae* type b in some regions, increasingly frequent use of cephalosporins, and under-dosing of oral ampicillin. There are no significant differences in clinical presentation of pneumonia due to BLNAR *H. influenzae* compared to pneumonia due to ampicillin-susceptible *H. influenzae* strains. These pathogens appear to have in vitro susceptibility to ceftriaxone. Depending on local susceptibility findings, ceftriaxone may be an appropriate choice for treatment of clinical infections due to BLNAR *H. influenzae* pending further study of clinical infections with this pathogen.

H. influenzae serotype a (Hia) can cause invasive disease similar to Hib. Invasive Hia infections from Hia have been reported with increasing frequency, especially among people who are American Indian and Alaska Native (AI/AN) and clinical syndromes are frequently severe.

Differential diagnosis

Invasive *H. influenzae* can cause pneumonia, bacteremia, or meningitis. The presentation of these diseases is similar to other invasive bacterial diseases such as Streptococcus pneumoniae or Streptococcus pyogenes. As with other causes of bacterial meningitis, characteristic symptoms of *H. influenzae* meningitis are fever, decreased mental status, and stiff neck.

Laboratory identification

The Gram stain is useful for preliminary identification of likely *H*. *influenzae*, though is not a confirmatory test and cannot distinguish among *H*. *influenzae* serotypes. Confirming a case of Hib disease requires isolating *H*. *influenzae* or detecting *H*. *influenzae* DNA from a normally sterile body site. Normally, sterile sites for isolation of invasive *H*. infl*u*enzae typically include CSF, blood, joint fluid, pleural fluid, pericardial fluid, joint fluid, peritoneal fluid, subcutaneous tissue fluid, placenta, and amniotic fluid - a complete list of normally sterile sites can be found here. All *H*. *influenzae* isolates from normally sterile sites are required to be sent to the Utah Public Health Laboratory (UPHL) for serotyping. Laboratories occasionally use antigen detection methods, but these are not considered confirmatory in the absence of culture positivity. Primary Children's Hospital (PCH) can test for type B, however, the test done by PCH is a IgG antibody test, which is sentout and performed by ARUP. The isolate is still required to be sent to the Utah Public Health Laboratory (UPHL) for serotyping.

> **UPHL:** The UPHL serotypes all isolates of *H. influenza*e from clinical laboratories.

Treatment

Most infections caused by *H. influenzae* are treated empirically. In general, empiric regimens are designed to include an antibiotic that treats *H*. *influenzae*. Antibiotics that have activity against *H*. *influenzae* include beta-lactams (eg, amoxicillin, amoxicillin-clavulanate, or second- and third-generation cephalosporins), fluoroquinolones, macrolides, and tetracyclines.

Beta-lactams are generally preferred. Amoxicillin-clavulanate is a commonly used empiric treatment option for localized and non-life-threatening infections, such as otitis media, sinusitis, and acute exacerbations of chronic obstructive pulmonary disease. In patients with systemic infections, such as bacteremia or meningitis, ceftriaxone is the treatment of choice.

For patients with mild to moderate infections treated in the outpatient setting (eg, chronic obstructive pulmonary disease exacerbations, pneumonia), use an oral beta-lactam (such as amoxicillin-clavulanate) or an oral second- or third-generation cephalosporin (such as cefuroxime, cefdinir, cefixime, or cefpodoxime).

For patients with severe infections (eg, meningitis, epiglottitis, bacteremia, or other respiratory tract infections requiring hospitalization), use an intravenous third-generation cephalosporin such as ceftriaxone or cefotaxime.

Alternative options to cephalosporins include fluoroquinolones, tetracyclines, and carbapenems.

Once identified, the patient should be isolated until 24 hours after initiation of appropriate antimicrobial treatment to eliminate carriage. Also, note Hib disease does not necessarily confer immunity to subsequent disease. For additional guidelines on treatment and chemoprophylaxis for invasive Hib disease, see the Red Book.

Immunize as follows:

a. Children with invasive Hib disease at <24 months of age: immunize according to the age-appropriate schedule for unvaccinated children and as if they had received no prior doses, as disease in this age group does not reliably result in a protective immune response. Begin 1 month after onset of disease or as soon as possible thereafter.
b. Children with invasive Hib disease at ≥24 months of age: no Hib immunization is necessary, regardless of previous immunization status, because the disease probably induces a protective immune response and second episodes in children this age are rare. However, Hib vaccination is not contraindicated and can be given as a single antigen or as part of a combination vaccine.

Morbidity/mortality

Invasive infections due to *H. influenzae* are serious and can rapidly be fatal. Hearing impairment or other neurologic sequelae occur in 15–30% of Hib meningitis survivors, and the case-fatality rate is 3–6%, despite appropriate antimicrobial therapy.

Reservoir

Humans (asymptomatic and symptomatic carriers) are the only known host as the bacterium does not survive in the environment on inanimate surfaces.

Transmission

H. influenzae infection is transmitted from person-to-person by droplet or direct contact with nasopharyngeal secretions of an infected person. The most common portal of entry is the nasopharynx. Newborns can become infected by inhalation of amniotic fluid or genital tract secretions containing the organism.

Susceptibility

The vaccine only confers immunity to one strain: type b. Disease before the age of 2 years does not confer immunity; a vaccine is still required. The genetic constitution of the host may be important in susceptibility to infection with Hib. Risk for Hib disease has been associated with a number of genetic markers, but the mechanism of these associations is unknown. No single

genetic relationship regulating susceptibility or immune responses to polysaccharide antigens has yet been convincingly demonstrated.

Incubation period

The incubation period is unknown, but for invasive disease it may be as short as 2–4 days.

Period of communicability

If a person is not on antibiotic therapy, disease is communicable as long as organisms are present in the upper respiratory tract, which may be for a prolonged period, even without nasal discharge.

The contagious potential of invasive *H. influenzae* disease is considered to be limited. However, certain circumstances, particularly close contact with a case (e.g., in a household, child care center, or institutional setting), can lead to outbreaks of Hib or direct secondary transmission of the disease. Asymptomatic carriage is known to occur.

Epidemiology

H. influenzae type b (Hib) is the only type for which there is a vaccine and for which control measures are considered necessary.

Before the widespread use of Hib conjugate vaccines, Hib was a leading cause of bacterial meningitis in the United States among children younger than 5 years of age and a major cause of other life-threatening invasive bacterial disease in this age group. The introduction of Hib vaccine in 1988 resulted in a 99% decrease in invasive Hib disease in children younger than 5 years of age. During 2010-2011, 33% of children younger than 5 years of age with confirmed invasive Hib disease were younger than 6 months of age and too young to have completed a 3-dose primary vaccination series. Of these age-eligible children, 64% were either unvaccinated, incompletely vaccinated (received fewer than 3 doses), or their vaccination status was unknown.

Unimmunized children, particularly those younger than 4 years of age, who are in prolonged close contact (such as in a household setting) with a child with invasive Hib disease, are at increased risk for invasive Hib disease. Other factors causing predisposition to invasive disease include sickle cell disease, asplenia, HIV infection, certain immunodeficiency syndromes, and malignant neoplasms. In adults, underlying conditions such as chronic pulmonary disease, smoking, HIV, alcoholism, pregnancy, and older age increase the risk of *H. influenzae* disease.

Risk factors for Hib disease include exposure factors and host factors which increase the likelihood of exposure to Hib, including being unvaccinated against Hib, household crowding, large household size, childcare attendance, low socioeconomic status, low parental education levels,

and school-aged siblings. Historically, invasive Hib was more common in boys; children who are African American, Alaska Native, Apache and Navajo; childcare attendees; children who live in crowded conditions; and children who were not breastfed.

Since the introduction of Hib vaccine, the incidence of all infections due to the encapsulated and non-typeable strains of *H. influenza* combined has decreased. However, *H. influenzae* type f has become the most common serotype causing invasive infection in the United States. With the reduction of invasive disease due to Hib, the remaining disease is now distributed among all age groups. In Utah, invasive disease due to non-typeable strains predominates, and is seen in all age groups.

Among children in high risk communities, there are also concerns that non-type b strains of *H. influenzae* may emerge as more prevalent causes of invasive disease. *H. influenzae* serotype a (Hia) can cause invasive disease and the clinical presentation of Hia is similar to that of Hib disease in the prevaccine era. Incidence of invasive Hia disease has increased since 2008, with the highest burden among children who are AI/AN. In population-based studies, clinical syndromes were frequently severe. Hia surveillance data can inform prevention strategies, including Hia vaccine development that could prevent significant morbidity and mortality in affected populations.

Public health control measures

Public health responsibility

- Investigate all suspect cases of disease; complete and submit appropriate disease investigation forms.
- Ensure isolate submission to UPHL for serotyping.
- Provide education to the general public, clinicians, and first responders regarding disease transmission and prevention.
- Identify clusters or outbreaks of this disease.
- Identify sources of exposure to minimize further transmission.
- Ensure surveillance is maintained to identify the emergence of other *H. influenzae* types as causes of invasive disease, and to monitor Hib vaccine effectiveness and assess progress toward disease elimination.

Prevention

Routine childhood vaccination is the best preventive measure against Hib disease. Good personal hygiene (proper hand washing, disposal of used tissues, not sharing eating utensils, etc.) is also important.

Chemoprophylaxis

The following are chemoprophylaxis recommendations. They may be used at the discretion of the local health jurisdiction as deemed necessary. Chemoprophylaxis is typically **only** indicated for contacts to *H. influenzae* type b (Hib) disease. Identification of young children who are household or childcare contacts of patients with Hib invasive disease and assessment of their vaccination status may help identify persons who should receive antimicrobial prophylaxis or who need to be immunized.

Clinicians can consider chemoprophylaxis of household contacts of index cases of invasive Hia disease in high risk communities. While prophylaxis after a Hia case is not generally recommended it can be considered for children younger than 4 years who live in crowded conditions, are part of an underserved community, or are immunocompromised. In these cases chemoprophylaxis recommendations for Hib may be followed; however, because there is not a licensed vaccine for Hia the criteria regarding vaccination do not apply.

Figure 2. Indications and guidelines for rifampin chemoprophylaxis for contacts of index cases of invasive *Haemophilus influenzae* type b (Hib) disease

Recommended chemoprophylaxis

Chemoprophylaxis may be indicated for household (or close) contacts of a child with invasive Hib disease, childcare or preschool contacts, and the index patient, depending upon individual circumstances as described below.

Chemoprophylaxis for index patient

If the index patient was treated with an agent other than cefotaxime or ceftriaxone, antimicrobial therapy to eradicate nasopharyngeal carriage is recommended if either of the following is also true for the index patient:

- The index patient is younger than 2 years of age, or
- The index patient lives in a household with a child younger than 4 years of age who has not received an age-appropriate number of doses of Hib conjugate vaccine, or an immunocompromised child.

Chemoprophylaxis for household contacts

Chemoprophylaxis is recommended for all household contacts[1] (including the index case) in the following circumstances:

- Household with at least 1 contact younger than 4 years of age who has not received an age-appropriate number of doses of Hib conjugate vaccine.[2]
- The susceptible child(ren) should receive a dose of Hib conjugate vaccine and be scheduled for completion of Hib immunization if additional doses are necessary to complete immunization.
- Household with a contact who is an immunocompromised child, regardless of that child's Hib immunization status.

In addition to receiving antimicrobial prophylaxis, exposed unimmunized or incompletely immunized children who are household contacts of patients with invasive Hib disease must be carefully observed for signs of illness. Exposed children in whom febrile illness develops should receive prompt medical attention.

Chemoprophylaxis for childcare or preschool contacts

Chemoprophylaxis is recommended for childcare or preschool contacts, when unimmunized or incompletely immunized children attend the facility and 2 or more cases of Hib invasive disease have occurred among attendees within 60 days.[3,4]

Exposed unimmunized or incompletely immunized children who are child care or preschool contacts of patients with invasive Hib disease must be carefully observed for signs of illness. Exposed children who develop febrile illness should receive prompt medical attention.

Recommended regimen

Prophylaxis should be initiated as soon as possible in contacts. In the index case, it should be initiated within 2 weeks of the onset of disease, and may be initiated in conjunction with treatment.

- **Rifampin** is the drug of choice for chemoprophylaxis. The regimen is as follows—rifampin 20mg/kg (maximum dose 600 mg) once per day for 4 days.
- The dose of rifampin for infants younger than 1 month of age has not been established. Some experts recommend lowering the dose to 10mg/kg.
- Consultation with an expert in infectious disease is recommended for contacts in whom rifampin is contraindicated.

Chemoprophylaxis not recommended for:

- Contacts of people with invasive disease caused by non-type b strains of *H. influenzae*
- Occupants of households with no children younger than 4 years of age other than the index patient
- Occupants of households when all household contacts 12 to 48 months of age have completed their Hib immunization series;[5] and when all household contacts younger than 12 months of age have completed their primary series of Hib immunizations.
- Nursery school and childcare contacts of 1 index case, especially people older than 2 years of age
- Pregnant women

[1]Close (household) contact is defined as a person who resides with the index patient or who spent ≥4 hours with the index patient for at least 5 of the 7 days before the day of hospital admission of the index case.
[2]The primary series of Hib conjugate vaccine consists of 2–3 doses, depending on the Hib vaccine formulation. See Table 2 for more details.
[3]Only children who are age-appropriately immunized and on rifampin should be permitted to enter the childcare group during the time prophylaxis is given. Children enrolling in a childcare center or other setting during the time prophylaxis is given should also receive rifampin, as should supervisory personnel.

[4]When a single case has occurred, the advisability of rifampin prophylaxis in exposed childcare groups with unimmunized or incompletely immunized children is controversial, but many experts recommend no prophylaxis.
[5]Complete immunization is defined as having had ≥1 dose of conjugate vaccine at ≥15 months of age; 2 doses between 12 and 14 months of age; or a 2- or 3-dose primary series (number of doses required depends on vaccine type and age at initiation) when <12 months with a booster dose at ≥12 months of age.

Vaccine

Table 1 lists the Hib conjugate vaccines currently available in the United States. The combination vaccines that include the Hib conjugate vaccine have been licensed by the U.S. Food and Drug Administration (FDA) following immunogenicity and safety studies. These combination vaccines decrease the number of injections needed for protection against vaccine-preventable diseases. HbOC (HibTiter) is no longer available in the United States.

TABLE 1. *Haemophilus influenzae* type b (Hib) conjugate vaccines licensed and available in the United States

Vaccine product	Manufacturer	Trade name	Components	Primary series	Booster dose
Monovalent vaccine					
PRP-OMP*,†	Merck & Co, Inc	PedvaxHIB	PRP conjugated to OMP	2, 4 months	12–15 months
PRP-T	Sanofi Pasteur	ActHIB	PRP conjugated to tetanus toxoid	2, 4, 6 months	12–15 months
PRP-T	GlaxoSmithKline	Hiberix	PRP conjugated to tetanus toxoid	Not licensed for primary series	12–15 months§
Combination vaccine					
PRP-OMP-HepB*,†	Merck & Co, Inc	Comvax	PRP-OMP + hepatitis B vaccine	2, 4 months	12–15 months
DTaP-IPV/Hib	Sanofi Pasteur	Pentacel	DTaP-IPV + PRP-T	2, 4, 6 months	15–18 months¶
MenCY/PRP-T**	GlaxoSmithKline	MenHibRix	MenCY + PRP-T	2, 4, 6 months	12–15 months
DTaP-IPV-Hib-HepB	Sanofi Pasteur	Vaxelis	DTaP-IPV-Hib-HepB	2, 4, 6 months	Not Indicated

Source: Adapted from American Academy of Pediatrics. *Haemophilus influenzae* infections. Pickering L, Baker C, Kimberlin D, Long S, eds. Red book: 2012 report of the Committee on Infectious Diseases. Elk Grove Village, IL: American Academy of Pediatrics; 2012:345–52.
*If a PRP-OMP vaccine is not administered as both doses in the primary series, or if there is uncertainty about which products were administered previously, a third dose of Hib conjugate vaccine is needed to complete the primary series.
†Preferred vaccine for children who are American Indian/Alaska Native.
§To facilitate timely booster vaccination, Hiberix can be administered as early as age 12 months, in accordance with Hib vaccination schedules for routine and catch-up immunization (CDC. Licensure of a *Haemophilus influenzae* type b [Hib] vaccine [Hiberix] and updated recommendations for use of Hib vaccine. MMWR 2009;58:1008–9).
¶The booster dose may be administered as early as age 12 months, provided at least 6 months have elapsed since the third dose.
**Recommendations for the MenCY component of MenCY/PRP-T have been published previously (CDC. Infant meningococcal vaccination: Advisory Committee on Immunization Practices (ACIP) recommendations and rationale.

Hib conjugate vaccine schedules (table 2)

In the United States, the primary series of Hib conjugate vaccine, which is administered before 7 months of age, requires 2 or 3 doses, depending upon the vaccine preparation. The minimum age for the first dose is 6 weeks. Hib conjugate vaccines can be administered at the same visit as other routine immunizations.

It is ideal to use the same Hib conjugate vaccine to complete the primary series. However, if it is unknown which vaccine was previously administered, or if the same vaccine is not available, the vaccines can be interchanged. If 2 different preparations are used, a 3-dose primary series is required.

In the United States, a booster dose is required at 12–15 months of age (or as soon thereafter as possible); 12 months is the minimum age for the final dose. Any of the Hib conjugate vaccines may be used for the booster dose; the vaccine need not be the same as the one used for the primary series.

Table 2: *Haemophilus influenzae* type b vaccine detailed schedule for unvaccinated children

Vaccine	Age at 1st dose (months)	Primary series	Booster
PRP-T*	2–6	3 doses, 8 weeks apart	12–15 months
	7–11	2 doses, 4 weeks apart	12–15 months
	12–14	1 dose	2 months later
	15–59†	1 dose	--
PRP-OMP	2–6	2 doses, 8 weeks apart	12–15 months

	7–11	2 doses, 4 weeks apart	12–15 months
	12–14	1 dose	2 months later
	15–59	1 dose	--

*Hiberix brand PRP-T vaccine is approved only for the last dose of the Hib series among children 12 months of age and older.

†MenHibrix brand PRP-T vaccine is not recommended for children 19 months of age or older.

Hib conjugate vaccine recommendations for children not up-to-date

Catch-up schedule: The catch up schedule for Hib conjugate vaccine depends upon the age at which the series is initiated and the number of doses previously received:

- Children younger than 6 months of age at initiation of vaccination should receive 3 doses of the Hib conjugate vaccine at 4 to 8 week intervals, and a booster (single dose) 8 weeks from the last dose for children 12–15 months of age.
- Children who are 7–11 months of age at initiation of vaccination should receive 2 doses of Hib conjugate vaccine at 4 to 8 week intervals up to 12 months of age, and a booster (single dose) 8 weeks from the last dose for children 12 months of age to 5 years.
- Children who have received ≤1 dose of Hib conjugate vaccine before 1 year of age and are now 12–14 months of age should receive 2 doses of Hib conjugate vaccine eight weeks apart, up to 5 years of age.
- Children with an incomplete series of Hib conjugate vaccination who are now 15–59 months old should receive a single dose of Hib conjugate vaccine.

Impaired host defense

Certain children may be at increased risk of invasive Hib disease because of immune deficiency, or other host defense abnormalities (e.g., sickle cell disease, functional or anatomic asplenia). These children should receive Hib conjugate vaccine as recommended for all infants. Any children younger than 59 months of age with these risk factors who have an incomplete vaccination history should be vaccinated according to the catch-up schedule. For unimmunized children at increased risk of Hib disease who are older than 59 months of age, the following is recommended:

- Unimmunized children older than 59 months who have sickle cell disease or asplenia should receive a single dose of Hib conjugate vaccine.
- Unimmunized children older than 59 months who have human immunodeficiency virus, IgG2 subclass deficiency, bone marrow transplant, or malignancy should receive 2 doses of Hib conjugate vaccine, separated by 4 to 8 weeks.

Consult the chapter on *H. influenzae* in the *Red Book* of the American Academy of Pediatrics (AAP) for a full discussion of vaccines, immunization schedules, and special circumstances. For example,

children, including those older than 5 years of age, with underlying conditions predisposing them to Hib disease may need additional doses.

Isolation and quarantine requirements

Isolation: Hospitalized cases of invasive *H. influenzae* type B disease should be isolated until 24 hours after initiating appropriate antimicrobial treatment.

Quarantine: Personal surveillance and prophylaxis with an appropriate antimicrobial when indicated by clinical situation of the contact, or potential for future transmission. Otherwise, there are no restrictions.

Case investigation

Reporting

All cases of *H. influenzae* recovered from a normally sterile site (e.g., CSF, blood, joint fluid, pleural effusion, pericardial fluid, peritoneal fluid, subcutaneous tissue fluid, placenta, amniotic fluid) should be reported to public health.

Table 3. Criteria to determine whether a case should be reported (CSTE)

Criterion	Reporting	
Clinical evidence		
Meningitis	N	
Epiglottitis		S
Healthcare record indicates a diagnosis of disease caused by *H. influenzae*		S
Death certificate indicates disease caused by *H. influenzae* as a cause of death or a significant condition contributing to death		S
Laboratory evidence		
Isolation of *H. influenzae* (any type) from a normally sterile site		S
Detection of *H. influenzae*-specific nucleic acid in a normally sterile body site using a validated polymerase chain reaction (PCR) assay		S
Detection of *H. influenzae* type b (Hib) antigen in CSF	N	

Notes:
S = This criterion alone is sufficient to identify a case for reporting.
N = All "N" criteria in the same column are necessary to identify a case for reporting.

Case definition

Haemophilus influenzae (2015)

The following case definition for invasive *H. influenzae* disease has been approved by the Council of State and Territorial Epidemiologists (CSTE) and was published in 2015.

Description of criteria to determine how a case should be classified

Probable:

- Meningitis **with** detection of *H*. *influenzae* type b antigen in cerebrospinal fluid (CSF).

Confirmed:

- Isolation of *H*. *influenzae* from a normally sterile body site (e.g., cerebrospinal fluid [CSF], blood, joint fluid, pleural fluid, pericardial fluid, peritoneal fluid, subcutaneous tissue fluid, placenta, or amniotic fluid), **or**
- Detection of *H*. *influenzae*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., cerebrospinal fluid [CSF], blood, joint fluid, pleural fluid, pericardial fluid, peritoneal fluid, subcutaneous tissue fluid, placenta, or amniotic fluid), using a validated polymerase chain reaction (PCR) assay.

Comment(s): Positive antigen test results from urine or serum samples are unreliable for diagnosis of *H. influenzae* disease and should not be used as a basis for case classification. Isolates of *H. influenzae* are important for antimicrobial susceptibility testing.

Clinical criteria

Invasive disease may manifest as pneumonia, bacteremia, meningitis, epiglottitis, septic arthritis, cellulitis, or purulent pericarditis; less common infections include endocarditis and osteomyelitis.

Laboratory criteria

- Detection of *H. influenza*e type b antigen in cerebrospinal fluid (CSF)
- Detection of *H. influenzae*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., cerebrospinal fluid [CSF], blood, joint fluid, pleural fluid, pericardial fluid, peritoneal fluid, subcutaneous tissue fluid, placenta, or amniotic fluid), using a validated polymerase chain reaction (PCR) assay; **or**
- Isolation of *H. influenzae* from a normally sterile body site (e.g., cerebrospinal fluid [CSF], blood, joint fluid, pleural fluid, pericardial fluid, peritoneal fluid, subcutaneous tissue fluid, placenta, or amniotic fluid).

Epidemiologic linkage

Not applicable for case classification.

Table 4. Criteria to determine case classification (CSTE)

Criterion	Case definition	
Clinical evidence	**Probable**	**Confirmed**
Meningitis	N	
Laboratory evidence		
Isolation of *H. influenzae* (any type) from a normally sterile site		S
Detection of *H. influenzae*-specific nucleic acid in a normally sterile body site using a validated polymerase chain reaction (PCR) assay		S
Detection of *H. influenzae* type b (Hib) antigen in CSF	N	

Notes:

S = This criterion alone is sufficient to classify a case

N = All "N" criteria in the same column are necessary to classify a case

Case investigation process

- Public health should immediately determine whether a reported case is due to serotype b:
  - Identify the laboratory where the initial testing occurred.
  - Call the laboratory to ensure the isolate is immediately sent to UPHL for serotyping.
  - Call UPHL to notify them an *H. influenzae* strain is coming and serotyping needs to occur as soon as possible.
- Cases due to *H. influenzae* type b should be immediately investigated:
  - Identify all close contacts (view chemoprophylaxis section for details).
  - Ensure contacts are provided with chemoprophylaxis and vaccine within 7 days of hospitalization of the index case.

Outbreaks

An outbreak is defined as:

- 2 or more cases in a closed population in a 30-day period; or
- 2 or more cases with direct epidemiological linkage.

Identifying case contacts

See chemoprophylaxis for definition of case contacts.

Case contact management (Hib only)

- Ensure contacts receive chemoprophylaxis.
- Ensure appropriate immunization of contacts. The number of doses required is determined by the current age of the child and the number, timing, and type of Hib vaccine doses previously received.
    - Unvaccinated and incompletely vaccinated children younger than 5 years of age should be scheduled for completion of the recommended, age-specific immunization schedule.
    - Infants should be placed on an accelerated schedule using minimum intervals between doses.
    - Unvaccinated high-risk individuals older than 5 years of age should receive 1 dose.
- Conduct surveillance. Careful observation of exposed contacts, especially children younger than 4 years of age, is essential. Those who develop a febrile illness should receive prompt medical attention, regardless of Hib vaccination status.

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Version control

V.06.15: Changes to layout and format of overall document. Addition of Why is *Haemophilus influenzae* important to public health? section. Updates and revision to vaccinations and schedule. Edits to Case fatality section. Updates on sources of reference. Addition of UT-NEDSS minimum/required fields by tab section.

V.03.17: Added Critical clinician information section. Updated cased definition and references section.

V.10.17: Updated normally sterile-site definition to include peritoneal fluid, subcutaneous tissue fluid, placenta, and amniotic fluid as outlined in the CDC Manual for the Surveillance of Vaccine-Preventable Diseases; updated references.

V.9.18: Added Rules for entering laboratory test results section.

V.12.18: Updated Critical clinician information, Disease and epidemiology, Public health control measures, and Case investigation sections to reflect changes from EAG.

V.04.22: Updated UT-NEDSS minimum/required fields by tab, Vaccine, and Epidemiology sections.

V.06.22: Information added throughout the document about Hia. Updated formatting and writing style to match new department guidelines. Updated references to conform to APA 7th edition citation style.

UT-NEDSS minimum/required fields by tab

Demographic

- First name
- Last name
- Birth sex
- Race
- Ethnicity
- Address at diagnosis state
- Address at diagnosis county
- Date of birth

Clinical

- Disease
- Date diagnosed
-
- Onset date
- Syndrome:
    - Please specify:
- Died
- Date of death
- Has the patient been vaccinated with HIB vaccine?
    - If yes, name and date of HIB vaccine(s) (up to four doses)

Laboratory

- Organism
- Specimen source
- Test result
-
- Test type
- Serotype

Epidemiological

- Childcare associated
- Is this case epi-linked to a laboratory-confirmed case?

Reporting

- Date first reported to public health

Administrative

- Outbreak name
- State case status
- Outbreak associated

Rules for entering laboratory test results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

Test-specific rules

Test specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS.

Test type	Test result	Create a new event	Update an existing event
PCR/amplification	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal/other	Yes	Yes
Culture	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal/other	Yes	Yes
Typing/identification	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal/other	Yes	Yes

Whitelist rules

Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.

***Haemophilus influenzae* morbidity whitelist rule:** If the specimen collection date of the laboratory result 60 days or less after the event date of the last positive laboratory result, the laboratory result should be added to the morbidity event.

***Haemophilus influenzae* contact whitelist rule:** If the specimen collection date of the laboratory result is 21 days or less after the event date of the contact event, the laboratory result should be added to the contact event.

Graylist rule

We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.

***Haemophilus influenzae* graylist rule:** If the specimen collection date of the laboratory result is 30 days before to 7 days after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Other electronic laboratory processing rules

- If an existing event has a state case status of "not a case," ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.