



# **Polio and Haemophilus influenzae type b Vaccines**

**Pink Book Web-on-Demand Series**  
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# Learning Objectives

- Describe the Advisory Committee on Immunization Practices General Best Practice Guidelines on Immunization.
- Describe an emerging immunization issue.
- For each vaccine-preventable disease, identify those for whom routine immunization is recommended.
- For each vaccine-preventable disease, describe characteristics of the vaccine used to prevent the disease.
- Locate current immunization resources to increase knowledge of team's role in program implementation for improved team performance.
- Implement disease detection and prevention health care services (e.g., smoking cessation, weight reduction, diabetes screening, blood pressure screening, immunization services) to prevent health problems and maintain health.

# Continuing Education Information

- CE credit, go to: <https://tceols.cdc.gov/>
- Search course number: **WD4564-090622**
- CE credit expires: **July 1, 2024**
- CE instructions are available on the **Pink Book Web-on-Demand Series** web page
- Questions and additional help with the online CE system, e-mail [CE@cdc.gov](mailto:CE@cdc.gov)

The screenshot shows the TCEO website interface. At the top, there is a blue header with the text "Training and Continuing Education Online (TCEO)". Below this is the TCEO logo, which consists of the letters "TCEO" in a bold, blue font, with a green circular arrow icon to the right. Underneath the logo, the text "TRAINING AND CONTINUING EDUCATION ONLINE" is displayed in a smaller, blue font. To the left of the main content area, there is a vertical navigation menu with several blue buttons: "TCEO Home", "Search Courses", "Create Account", "9 Simple Steps to Earn CE", "Frequently Asked Questions", and "Contact TCEO". The main content area has a white background and contains several sections. The first section is titled "New to TCEO?" and includes the text: "Visit [Create Account](#). Once your account has been created, you will be able to search for courses and complete requirements to receive CE." The second section is titled "Already have a TCEO account from the previous system?" and includes the text: "To move your account to the new system please sign in above using your existing TCEO username and password. Once signed in, follow the prompts to verify and update your account. After your account forward you will use this email address and password to sign in." The third section is titled "Not sure how to get started?" and includes the text: "Follow these [9 Simple Steps](#) to earn continuing education for the courses you have taken or conferences you have attended!". Below these sections is a row of four small images: a woman in scrubs talking to a child, a man in a suit looking at a screen, a doctor in a white coat holding a dog, and a woman sitting at a desk with a laptop. At the bottom of the page, there is a "Welcome to TCEO" message and a short paragraph: "Training and Continuing Education Online (TCEO) is a system that provides access to CDC educational activities for continuing education (CE). Use TCEO to search for CE opportunities, complete course e..."

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# Disclosure Statements

**The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.**

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**Polio  
Disease**

# Poliomyelitis Disease

- Epidemics starting in the late 19<sup>th</sup> century
- Polio epidemics were reported each summer and fall
- More than 21,000 paralytic cases reported in the U.S. in 1952
- Vaccine introduction in 1955; polio incidence declined rapidly

# Poliovirus

- **Three serotypes of wild poliovirus:**
  - WPV1
  - WPV2
  - WPV3
- **Minimal heterotypic immunity between serotypes**
- **Rapidly inactivated by heat, chlorine, formaldehyde, and ultraviolet light**



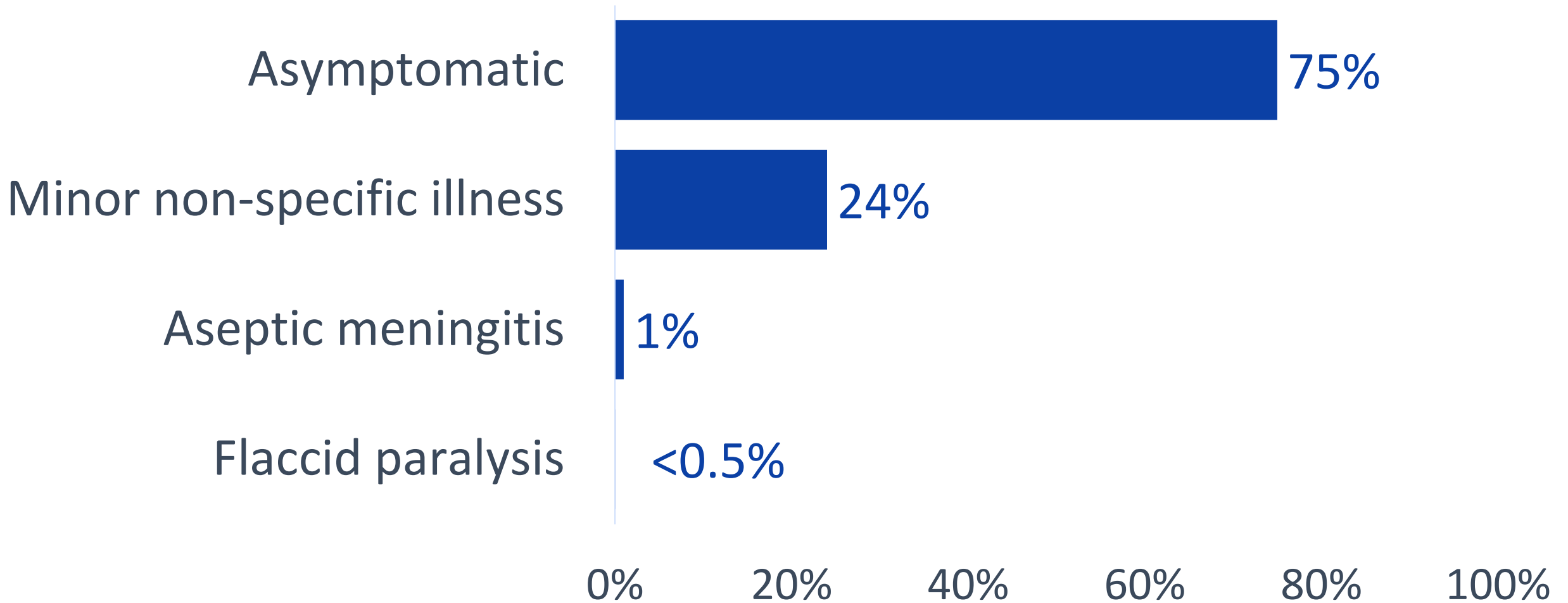
# Poliomyelitis Pathogenesis

- Enters mouth
- **Replicates in pharynx and GI tract**
  - Invades local lymphoid tissue, may enter bloodstream then infect cells of the central nervous system
- **Viral spread along nerve fibers**
- **Destruction of motor neurons**

# Poliomyelitis Clinical Features

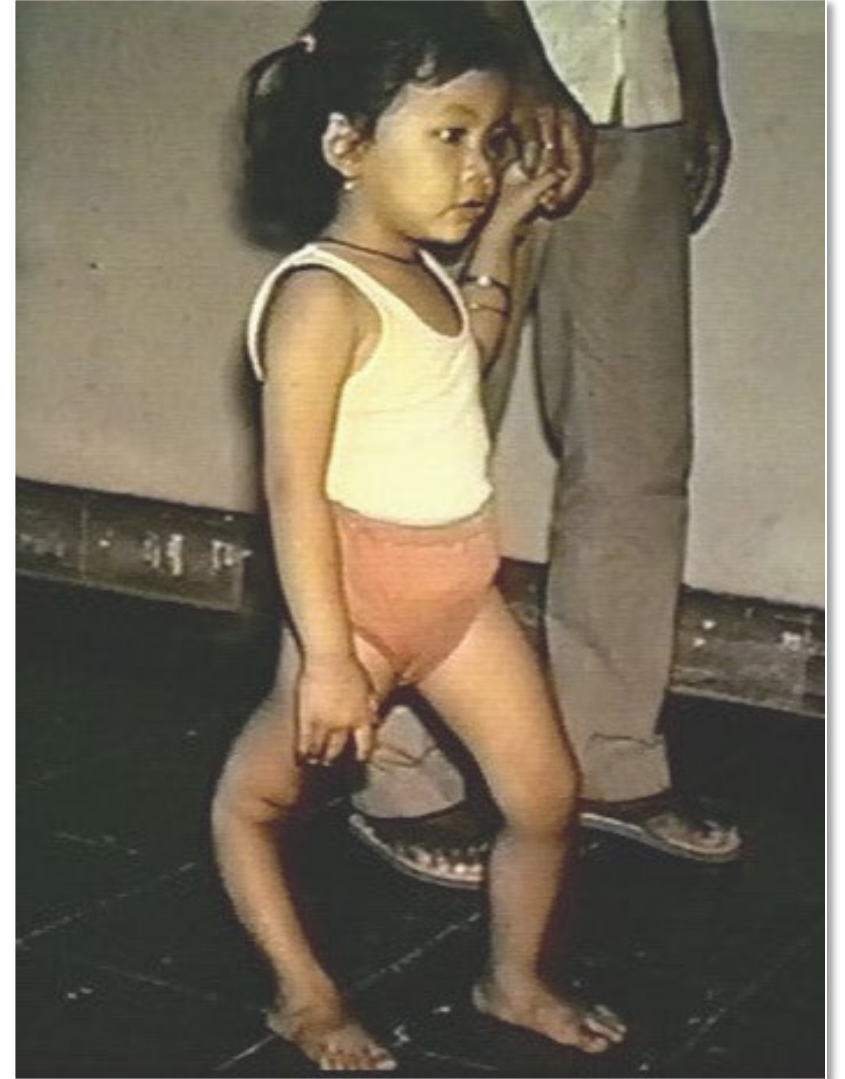
- **Incubation period**
  - 3 to 6 days for nonparalytic poliomyelitis
  - 7 to 21 days for onset of paralysis in paralytic poliomyelitis
- **Risk of severe disease increases with age**

# Outcomes of Poliovirus Infection



# Types of Paralytic Polio

- **Spinal polio: Asymmetric paralysis that most often involves the legs.**
- **Bulbar polio: Weakness of facial, oropharyngeal, and respiratory muscles innervated by cranial nerves**
- **Bulbospinal polio: Combination of bulbar and spinal paralysis**



Asymmetric paralysis

# Poliovirus Epidemiology

## Epidemiology

### Reservoir

Human

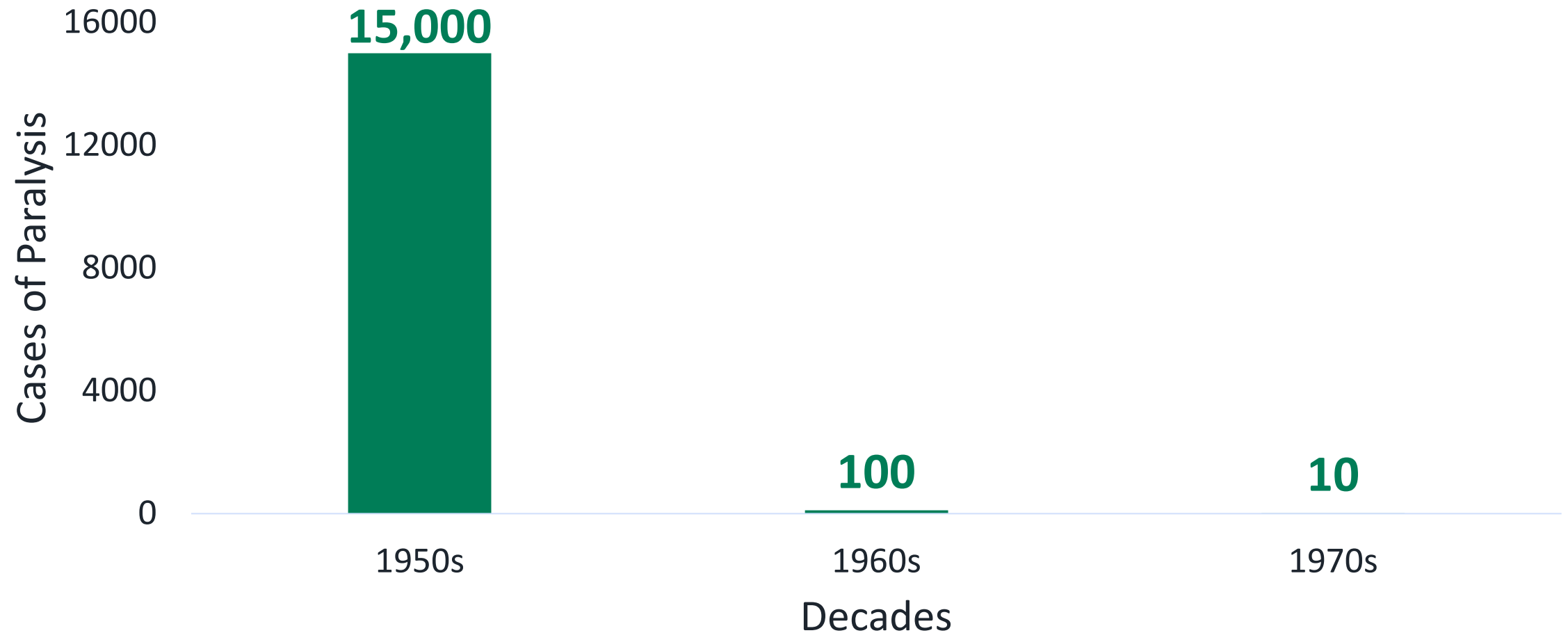
### Transmission

Fecal-oral  
Oral-oral possible

### Communicability

Most infectious: 7–10 days before onset  
Virus present in stool 3–6 weeks

# Cases of Polio Paralysis in the US Before and After Vaccine Introduction



# Poliomyelitis in the US

- **1980-1999: 162 confirmed cases of paralytic polio reported**
  - 6 cases wild poliovirus acquired outside the US
  - 2 cases imported and classified as indeterminate
  - 154 cases vaccine-associated paralytic polio
- **2005: Asymptomatic infections with a circulating vaccine-derived poliovirus**
- **2009: Vaccine-derived poliovirus reported in an immunocompromised person likely infected years ago**

# Polio -- 2022

- **July 21, 2022: CDC is aware of a case of polio in an unvaccinated individual from Rockland County, New York, and is consulting with the New York State Department of Health on their investigation. Public health experts are working to understand how and where the individual was infected and provide protective measures, such as vaccination services to the community to prevent the spread of polio to under- and unvaccinated individuals. There is no cure for polio, but it is preventable through safe and effective vaccination.**



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**Polio  
Vaccine**

# Poliovirus Vaccines

- **1955–Inactivated vaccine**
- **Early 1960s–Live, attenuated vaccine (OPV)**
- **1987–Enhanced-potency, inactivated vaccine (IPV)**



# Polio-Containing Vaccine Products

Vaccine name	Vaccine components	Age indication	Dose in polio series	Injection route
<b>Ipol (SP)</b>	IPV	6 weeks and older	Any	IM or SC
<b>Pentacel (SP)</b>	DTaP-IPV/Hib	6 wks–4 yrs	1, 2, 3, 4	IM
<b>Kinrix (GSK)</b>	DTaP-IPV	4–6 yrs	4	IM
<b>Quadracel (SP)</b>	DTaP-IPV	4–6 yrs	4, 5	IM
<b>Vaxelis (Merck)</b>	DTap-IPV-Hib-HepB	6 wks–4 yrs	1, 2, 3	IM
<b>Pediarix (GSK)</b>	DTaP-HepB-IPV	6 wks–6 yrs	1, 2, 3	IM

IM = Intramuscular; SC = Subcutaneous; All vaccines in the table above are non-live

# Enhanced Inactivated Polio Vaccine

- **IPV highly effective in producing immunity to poliovirus**
  - 90% of recipients are immune after 2 doses
  - 99% of recipients are immune after 3 doses
- **Duration of immunity not known with certainty**

# Preparation and Administration for IPV-Containing Vaccines

- **Preparation: prepare the vaccine just prior to administration**
  - Pentacel requires reconstitution
  - Reconstitute the lyophilized vaccine with the DTaP-IPV liquid diluent supplied by the manufacturer. Do NOT use Kinrix or Quadracel.
- **Route: IM injection\***

\*IPV may be administered by subcutaneous injection using a 5/8-inch needle given in the fatty tissue over the upper, outer triceps or anterolateral thigh

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**Clinical  
Considerations**

# ACIP Polio Vaccine Recommendations

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Inactivated poliovirus (IPV <18 yrs)			1 <sup>st</sup> dose	2 <sup>nd</sup> dose	←----- 3 <sup>rd</sup> dose -----→							4 <sup>th</sup> dose					

# ACIP Polio Immunization Recommendations

## Routine Childhood Schedule

IPV Dose	Routinely Recommended Age
1	2 months
2	4 months
3	6–18 months
4	4–6 years



# Polio Schedule and Combination Vaccines

- **A dose of IPV on or after age 4 years (i.e., minimum age) is recommended regardless of the number of previous doses.**
- **When DTaP-IPV/Hib (Pentacel) is used, following the schedule for DTaP, 4 doses are given by age 18 months.**
- **A final IPV-containing dose should be administered at 4-6 years; resulting in a 5-dose series.**

# ACIP Polio Immunization Recommendations

## Catch-Up Schedule

- Infants ages 6 months and younger, follow the recommended schedule
- If accelerated protection is needed (e.g., travel to polio-endemic area), minimum age and intervals may be followed

Dose	Minimum Age	Minimum Interval to the Next Dose
Dose 1	6 weeks	4 weeks
Dose 2	10 weeks	4 weeks
Dose 3	14 weeks	6 months
Dose 4	4 years	-----

# ACIP Polio Immunization Recommendations

## 4<sup>th</sup> Dose and the Catch-Up Schedule

- **A 4th dose is not necessary if the 3rd dose was administered:**
  - At age 4 years or older AND
  - At least 6 months after the previous dose
- **Children who have received 4 doses (or more) before 4 years of age need an additional dose.**
  - There should be at least 6 months between last and next-to-last dose
- **Children turning 4 in less than 4 weeks who have only had 2 doses should receive a final dose in 6 months**

# Schedules that Include Both IPV and OPV

- **Mixed-product series containing both OPV and IPV is acceptable**
  - Only trivalent OPV (tOPV) counts toward completing the series
- **Children with an incomplete series:**
  - Administer IPV to complete a series that includes doses of OPV
  - Ensure doses met minimum ages and intervals
- **Administer 1 dose of IPV to children who received 4 doses of OPV (or more) before 4 years of age.**
  - There should be at least 6 months between the last dose of OPV and the IPV dose

# OPV Administered Outside the U.S.

- **Use the date of administration to make a presumptive determination of what type of OPV was received.**
- **Trivalent OPV was used throughout the world prior to April 1, 2016.**
- **Persons 18 years of age and younger with doses of OPV that do not count towards the U.S. vaccination requirements should receive IPV.**

# ACIP Polio Immunization Adult Recommendations

- **Routine vaccination of U.S. residents 18 years of age or older was not previously recommended; however, all adults who are unvaccinated or have incomplete vaccination for poliovirus should catch up.**

# ACIP Polio Immunization Adult Recommendations

- **Adults who have never been vaccinated against polio should receive three doses of IPV:**
  - The first dose at any time
  - The second dose 1 to 2 months later
  - The third dose 6 to 12 months after the second
  - Adults who have had one or two doses of polio vaccine in the past should receive the remaining one or two doses.

# ACIP Polio Immunization Adult Recommendations

## ■ Adults at increased risk of exposure

- Laboratory workers handling specimens that may contain polioviruses
- Healthcare personnel treating patients who could have polio or have close contact with a person who could be infected with poliovirus
- Travelers to areas where poliomyelitis is endemic or epidemic.



# ACIP Polio Immunization Adult Recommendations

- **Use routine IPV schedule if possible**
  - 0, 1 through 2 months, 6 through 12 months intervals
- **If accelerated protection is needed (e.g., travel to polio-endemic area), use the minimum intervals.**

Dose	Minimum Intervals to the Next Dose
Dose 1	4 weeks
Dose 2	6 months
Dose 3	-----

# ACIP Polio Immunization Adult Recommendations

## ■ **Previously completed series**

- Administer 1 dose of IPV to those at risk

## ■ **Incomplete series**

- Administer remaining doses in series based on immunization history
- No need to restart a valid, documented series
  - Valid = minimum intervals met

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**Safety**

# Contraindications

## Polio

Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component

# Precautions

## Polio

Pregnancy

Moderate or severe acute illness with or without fever

# IPV Adverse Reactions

## Polio

**Local reactions (pain, redness, swelling)**

**3.2-18%**

**Severe reactions**

**rare**

# Polio: Vaccine Administration Errors

- **Schedule errors: Dose 4 administered too soon**
  - Doses administered 5 or more days before the minimum age and/or interval do not count and should be repeated when age-appropriate .
  - Wait the minimum interval from the invalid dose before giving the repeat dose.
  - Minimum age/interval: at/after age 4 AND 6 months after dose 3
- **Age/dose errors: Kinrix or Quadracel for doses 1–3**
  - If the minimum age and interval from the last dose of polio vaccine has been met, the dose can count and does not need to be repeated.
- **Preparation errors: wrong diluent to reconstitute DTaP-IPV/Hib (Pentacel)**
  - Do not use Kinrix or Quadracel to reconstitute Pentacel

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## **Storage and Handling**



# Polio Vaccine Storage and Handling

- **Store in the refrigerator between 2°C and 8°C (36°F and 46°F)**
  - Should not be frozen
  - Refrigerate on arrival

## **IPV**

**Ages:** 6 weeks and older

**Use for:** Any dose in the series

**Route:** Intramuscular (IM) injection OR  
Subcutaneous (subcut) injection

# Knowledge Check

- When DTaP-IPV/Hib (Pentacel) is used, 4 doses of IPV are given at ages 2, 4, 6, and 15-18 months. This results in 4 doses of IPV by the age of 18 months. The series is complete at 18 months.
- A. True
- B. False



## Answer

- When DTaP-IPV/Hib (Pentacel) is used, 4 doses of IPV are given at ages 2, 4, 6, and 15-18 months. This results in 4 doses of IPV by the age of 18 months. The series is complete at 18 months.

B. False



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**Hib  
Disease**

# ***Haemophilus influenzae* type b**

- **Severe bacterial infection, particularly among infants**
- **First described in 1892 during an influenza outbreak**
- **Established *H. influenzae* did not cause influenza in 1933**

# **Impact of *Haemophilus influenzae* type b Disease: Prevaccine**

- **Formerly the leading cause of bacterial meningitis among children younger than 5 years of age**
- **Approximately 1 in 200 children developed invasive Hib disease**
- **Almost all infections among children younger than 5 years**

# *Haemophilus influenzae* type b

- **Aerobic gram-negative bacteria**
- **Polysaccharide capsule**
- **6 different serotypes (a through f) of polysaccharide capsule**
- **95% of invasive disease caused by type b (prevaccine era)**

# Hib Pathogenesis

- **Enters body through nasopharynx**
- **Invasive infection: Bacteria spread in bloodstream to distant sites in the body**



# *Haemophilus influenzae* type b

## Clinical Manifestations

- **Can affect many organ systems; most common types of disease:**
  - Meningitis
  - Bacteremia
  - Epiglottitis
  - Pneumonia
  - Arthritis
  - Cellulitis
- **Meningitis most common clinical manifestation**



**Facial cellulitis or infection of the soft tissues of the face, caused by Hib**

# *Haemophilus influenzae* type b Epidemiology

## Epidemiology

### Reservoir

Human asymptomatic carriers

### Transmission

Airborne respiratory droplets or direct contact with respiratory secretions

### Temporal pattern

Prevaccine peak in Sept. through Dec. and March through May

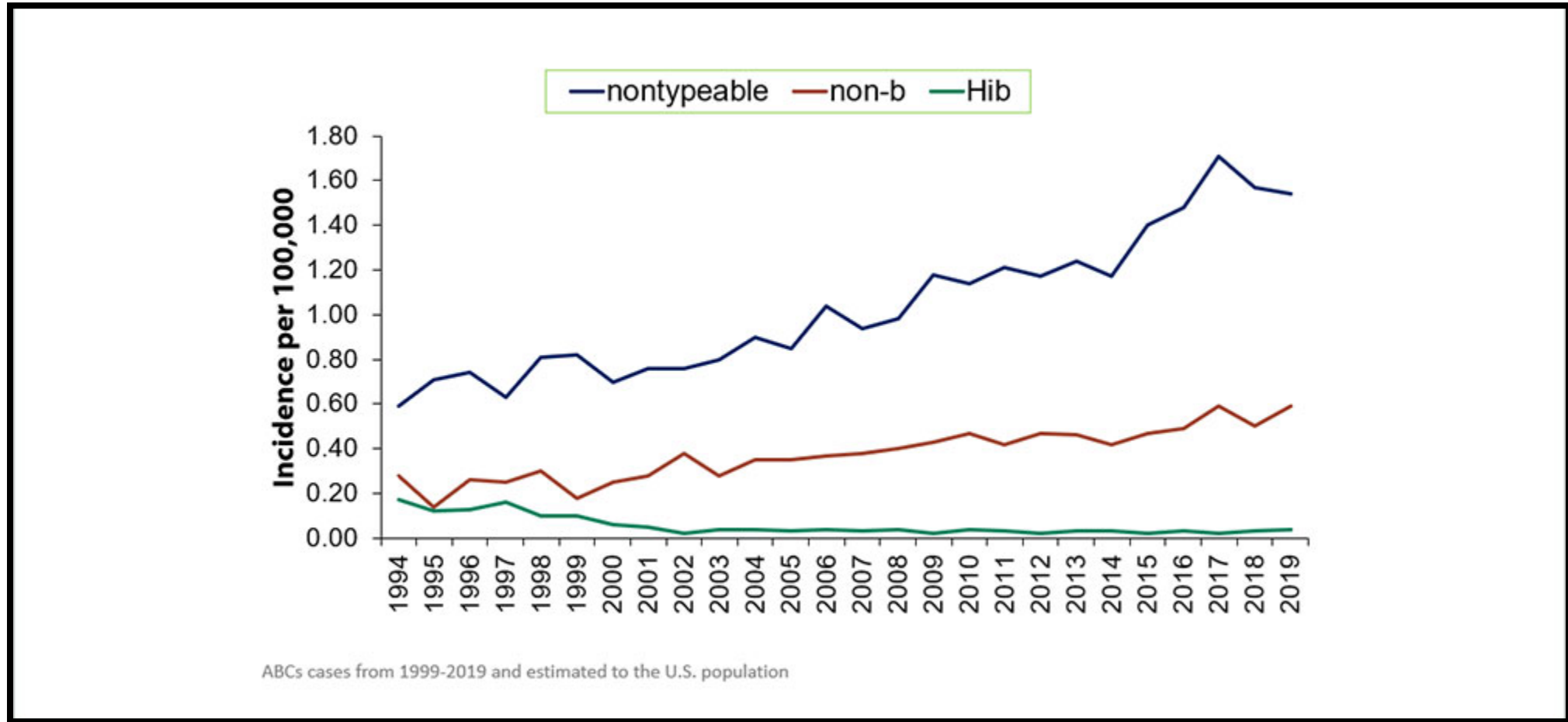
### Communicability

Generally limited but higher in some circumstances (e.g., household, childcare)

# Hib Disease Burden

- **1980s: ~20,000 cases, or 40 to 50 cases per 100,000 (age <5 years)**
- **Incidence declined more than 99% since prevaccine era**
- **2019: Rate of Hib infections 0.04 per 100,000 (all ages)**

# Incidence of invasive Hib disease, United States, 1999-2019



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**Hib  
Vaccine**

## ***Haemophilus influenzae* type b Polysaccharide Vaccine**

- Available 1985 until 1988
- Not effective in children younger than 18 months of age
- Efficacy in older children varied
- Age-dependent immune response
- No booster response

# *Haemophilus influenzae* Type b Conjugate Vaccines

- **First conjugate vaccine licensed in 1987**
- **Conjugation improves immunogenicity**
  - Immune response with booster doses
- **3 single-component conjugate Hib vaccine products**
- **2 combination vaccine products available that contain Hib conjugate vaccine**



# Hib-Containing Vaccine Products

Vaccine Product	Age Indications	Dose in series
<b>PRP-T (polysaccharide, tetanus toxoid)</b>		
ActHIB	2, 4, and 6 months	1, 2, 3, booster
Pentacel (SP)	6 weeks–4 years	1, 2, 3, booster
Hiberix (GSK)	2, 4, and 6 months	1, 2, 3, booster
<b>PRP-OMP (polysaccharide, outer membrane protein)</b>		
PedvaxHIB	2 and 4 months	1, 2, booster
Vaxelis (Merck)	6 weeks–4 years	1, 2, 3

# Preparation and Administration of Hib-Containing Vaccine

- **Preparation: prepare vaccine just prior to administration**
  - ActHIB, Pentacel, and Hiberix require reconstitution
  - Reconstitute the lyophilized vaccine with the diluent supplied by the manufacturer.
- **Route: IM injection**

## Vaccines with Diluents: How to Use Them

Be sure to reconstitute the following vaccines correctly before administering them! Reconstitution means that the lyophilized (freeze-dried) vaccine powder or wafer in one vial must be reconstituted (mixed) with the diluent (liquid) in another.

- Only use the diluent provided by the manufacturer for that vaccine as indicated on the chart.
- ALWAYS check the expiration date on the diluent and vaccine.
- NEVER use expired diluent or vaccine.

Vaccine product name	Manufacturer	Lyophilized vaccine (powder)	Liquid diluent (may contain vaccine)	Time allowed between reconstitution and use, as stated in package insert*	Diluent storage environment
ActHIB (Hib)	Sanofi Pasteur	Hib	0.4% sodium chloride	24 hrs	Refrigerator
Hiberix (Hib)	GlaxoSmithKline	Hib	0.9% sodium chloride	24 hrs	Refrigerator or room temp
Imovax (RAB <sub>HDcv</sub> )	Sanofi Pasteur	Rabies virus	Sterile water	Immediately†	Refrigerator
M-M-R II (MMR)	Merck	MMR	Sterile water	8 hrs	Refrigerator or room temp
Menveo (MenACWY)	GlaxoSmithKline	MenA	MenCWY	8 hrs	Refrigerator
Pentacel (DTaP-IPV/Hib)	Sanofi Pasteur	Hib	DTaP-IPV	Immediately†	Refrigerator
ProQuad (MMRV)	Merck	MMRV	Sterile water	30 min	Refrigerator or room temp
RabAvert (RAB <sub>PROV</sub> )	GlaxoSmithKline	Rabies virus	Sterile water	Immediately†	Refrigerator
Rotarix (RV1)‡	GlaxoSmithKline	RV1	Sterile water, calcium carbonate, and xanthan	24 hrs	Refrigerator or room temp
Shingrix (RZV)	GlaxoSmithKline	RZV	AS01g <sup>§</sup> adjuvant suspension	6 hrs	Refrigerator
Varivax (VAR)	Merck	VAR	Sterile water	30 min	Refrigerator or room temp
YF-VAX (YF)	Sanofi Pasteur	YF	0.9% sodium chloride	60 min	Refrigerator or room temp
Zostavax (ZVL)	Merck	LZV	Sterile water	30 min	Refrigerator or room temp

Always refer to package inserts for detailed instructions on reconstituting specific vaccines. In general, follow the steps below.

- 1 For single-dose vaccine products (exception is Rotarix<sup>®</sup>), select a syringe and needle of proper length to be used for both reconstitution and administration of the vaccine. For Rotarix, see the package insert.<sup>1</sup>
- 2 Before reconstituting, check labels on both the lyophilized vaccine vial and the diluent to verify that
  - they are the correct two products to mix together,
  - the diluent is the correct volume, and
  - neither the vaccine nor the diluent has expired.
- 3 Reconstitute (i.e., mix) vaccine just prior to use by:
  - removing the protective cap and wiping each stopper with an alcohol swab,
  - inserting needle of syringe into diluent vial and withdrawing entire contents, and
  - injecting diluent into lyophilized vaccine vial and rotating or agitating to thoroughly dissolve the lyophilized powder.
- 4 Check the appearance of the reconstituted vaccine.
  - Reconstituted vaccine may be used if the color and appearance match the description on the package insert.
  - If there is discoloration, extraneous particulate matter, obvious lack of reuspension, or the vaccine cannot be thoroughly mixed, mark the vial as "DO NOT USE," return it to proper storage conditions, and contact your state or local health department immunization program or the vaccine manufacturer.
- 5 If reconstituted vaccine is not used immediately or comes in a multidose vial, be sure to
  - clearly mark the vial with the date and time the vaccine was reconstituted,
  - maintain the product at 2°-8°C (36°-46°F); do not freeze, and
  - use only within the time indicated on chart above.

\*If the reconstituted vaccine is not used within this time period, it must be discarded.

†For purposes of this guidance, IAC defines "immediately" as within 30 minutes or less.

‡Rotarix vaccine is administered by mouth using the applicator that contains the diluent. It is not administered as an injection.

§AS01g is composed of 3-O-Desacyl-1'-monophosphoryl lipid A (MPL) from *Salmonella minnesota* and QS-21, a saponin purified from plant extract *Quillaja agaveoides* Molina, combined in a liposomal formulation. The liposomes are composed of dioleoyl phosphatidylcholine (DOPC) and cholesterol in phosphate-buffered saline solution containing disodium phosphate anhydrous, potassium dihydrogen phosphate, sodium chloride, and water for injection.

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**Clinical  
Considerations**

# HIB Vaccine Recommendations

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
<i>Haemophilus influenzae</i> type b (Hib)			1 <sup>st</sup> dose	2 <sup>nd</sup> dose	See Notes		← 3 <sup>rd</sup> or 4 <sup>th</sup> dose, See Notes →										

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
<i>Haemophilus influenzae</i> type b (Hib)	1 or 3 doses depending on indication			

# ACIP Hib Immunization Recommendations

## Routine Schedule

- **Routinely recommended for all infants beginning at 2 months of age\***
- **Schedule varies based on the product used**
  - ActHib, Pentacel, Hiberix, Vaxelis: follow the 4-dose schedule at 2, 4, 6, and 12–15 months of age (3-dose primary series, 1 booster dose)
  - PedvaxHIB: follow the 3-dose schedule at 2, 4, and 12–15 months of age (2-dose primary series, 1 booster dose)
- **If any dose in the series is ActHIB, Pentacel, Hiberix or the product is not known, follow the 4-dose schedule.**

\*Minimum age for the 1<sup>st</sup> dose is 6 weeks

# Unvaccinated Healthy Children 7 months of Age and Older

- Children starting late may not need entire 3- or 4-dose series
- Number of doses child requires depends on current age
- Resources:
  - Catch-up guidance for healthy children
  - Detailed schedule p. 128 of Pink Book

Catch-Up Guidance for Healthy<sup>1</sup> Children  
4 Months through 4 Years of Age  
*Haemophilus influenzae* type b-Containing Vaccine  
Products: ActHIB, Pentacel, Hiberix, or Unknown

Catch-Up Guidance for Healthy<sup>1</sup> Children  
4 Months through 4 Years of Age  
*Haemophilus influenzae* type b-Containing Vaccine  
Products: ActHIB, Pentacel, Hiberix, or Unknown

Catch-Up Guidance for Healthy<sup>1</sup> Children  
4 Months through 4 Years of Age  
*Haemophilus influenzae* type b-Containing Vaccine  
Products: ActHIB, Pentacel, Hiberix, or Unknown

The table below provides guidance for children whose vaccinations have been delayed. Start with the child's age and information on previous doses (previous doses must be documented and must meet minimum age requirements and minimum intervals between doses). Use this table in conjunction with figure 2 of the Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, found at [www.cdc.gov/vaccines/schedules/hcp/child-adolescent.html](http://www.cdc.gov/vaccines/schedules/hcp/child-adolescent.html).

IF current age is	AND # of previous doses is	AND	THEN	Next dose due
4 through 6 months	Unknown or 0	→	Give Dose 1 today	Give Dose 2 at least 4 weeks after Dose 1
	1	It has been at least 4 weeks since Dose 1	Give Dose 2 today	Give Dose 3 at least 4 weeks after Dose 2
		It has not been 4 weeks since Dose 1	No dose today	Give Dose 2 at least 4 weeks after Dose 1
	2	It has been at least 4 weeks since Dose 2	Give Dose 3 today	Give Dose 4 (Final Dose) at 12 months of age or older.
It has not been 4 weeks since Dose 2		No dose today	Give Dose 3 at least 4 weeks after Dose 2	
7 through 11 months	Unknown or 0	→	Give Dose 1 today	Give Dose 2 at least 4 weeks after Dose 1
	1	It has been at least 4 weeks since Dose 1	Give Dose 2 today	IF Dose 1 was given before 7 months of age, give Dose 3 at least 4 weeks after Dose 2 IF Dose 1 was given at 7 months of age or older, give Dose 3 (Final Dose) at least 8 weeks after Dose 2 and no earlier than 12 months of age or older
		It has not been 4 weeks since Dose 1	No dose today	Give Dose 2 at least 4 weeks after Dose 1
	2	Dose 1 was given before 7 months of age	Give Dose 3 today	Give Dose 4 (Final Dose) at least 8 weeks after Dose 3 and at least 12 months of age
Dose 1 was given at 7 months of age or older		No dose today	Give Dose 3 at least 4 weeks after Dose 2	
		→	No dose today	Give Dose 3 (Final Dose) at least 8 weeks after Dose 2, and no earlier than 12 months of age or older

<sup>1</sup>Refer to footnote 4 of the 2018 Recommended Immunization Schedule for Children at increased risk for *Haemophilus influenzae* type b disease.  
Reference: Recommended Immunization Schedule for Persons Aged 18 Years or Younger, 2018. [www.cdc.gov/vaccines/schedules/downloads/child/0-18yr-child-combined-schedule.pdf](http://www.cdc.gov/vaccines/schedules/downloads/child/0-18yr-child-combined-schedule.pdf)

Revised January 2018

Revised January 2018

Revised January 2018

U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention

CS240275-M

# Vaccination of Special Populations

- **Vaccination recommendations for children with conditions that increase the risk of invasive Hib are based on age, vaccination history, and condition.**
  - Functional or anatomic asplenia
  - Immunoglobulin deficiency or early complement component deficiency
  - HIV infection
  - Receipt of chemotherapy or radiation therapy

# Vaccination of Special Populations

- **Children age 12–59 months at increased risk of invasive Hib\***
  - 0 or 1 dose before age 12 months: 2 doses, 8 weeks apart
  - 2 or more doses before age 12 months: 1 dose at least 8 weeks after previous dose

\*Chemotherapy, anatomic or functional asplenia, HIV infection, immunoglobulin deficiency, or early complement component deficiency



# Vaccination of Special Populations

- **Unvaccinated\* persons ages 15 months or older undergoing elective splenectomy: 1 dose (preferably at least 14 days before procedure)**
- **Unvaccinated\* persons ages 5 years or older with anatomic or functional asplenia: 1 dose**
- **Unvaccinated persons ages 5–18 years with HIV infection: 1 dose**
- **Hematopoietic stem cell transplant recipients (any age): 3 doses  $\geq$ 4 weeks apart (beginning 6–12 months post-transplant)**

\*Unvaccinated = Less than routine series (through age 14 months) OR no doses (age 15 months or older)

# Vaccination of Special Populations

- **Children younger than 24 months of age with invasive Hib disease**
  - Administer complete series as recommended for child's age
  - Vaccinate during the convalescent phase of the illness
- **American Indian/Alaska natives**
  - Hib disease peaks earlier in infancy.
  - PedVaxHIB vaccine produces protective antibody after first dose/early protection
  - PedVaxHIB vaccine is preferentially recommended for primary series doses.

# Hib Vaccine Interchangeability

- **All single-component conjugate Hib vaccines are interchangeable for primary series and booster dose.**
- **3-dose primary series (4 doses total) if more than one brand of vaccine used at 2 or 4 months of age**
- **Whenever feasible, use same combination vaccine for subsequent doses**
- **If vaccine used for earlier doses is not known or not available, any brand may be used to complete the primary series.**

# Knowledge Check

- **Vaxelis can be used for all 4 recommended doses in the Hib series**
- A. True
- B. False



## Answer

- Vaxelis can be used for all 4 recommended doses in the Hib series

B. False



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**Safety**

# Contraindications

## Hib

Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component

Age younger than 6 weeks

# Precautions

## Hib

Moderate or severe acute illness with or without fever



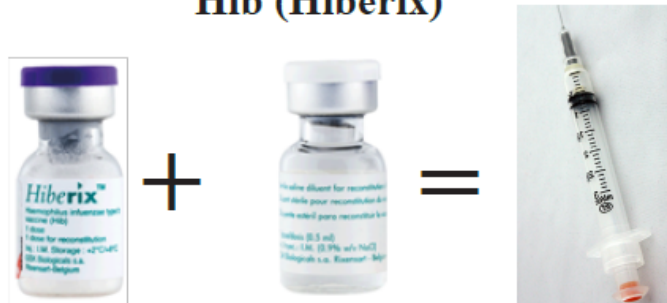
# Hib Vaccine Adverse Reactions

<b>Hib</b>	
<b>Swelling, redness, or pain</b>	5 to 30% of recipients
<b>Fever</b>	31%
<b>Crying</b>	11%
<b>Injection site erythema</b>	11%
<b>Irritability</b>	10%
<b>Rash</b>	9%

# Hib: Vaccine Administration Errors

- Preparation errors: Using the wrong diluent to reconstitute the lyophilized component


**Hib (Hiberix)**



Lyophilized Hib component + Manufacturer's 0.9% sodium chloride diluent = Hiberix vaccine

Beyond Use Time: If not used immediately after reconstitution, store at 2°C to 8°C (36°F to 46°F) and discard if not used within 24 hours. Should be shaken vigorously before injection.

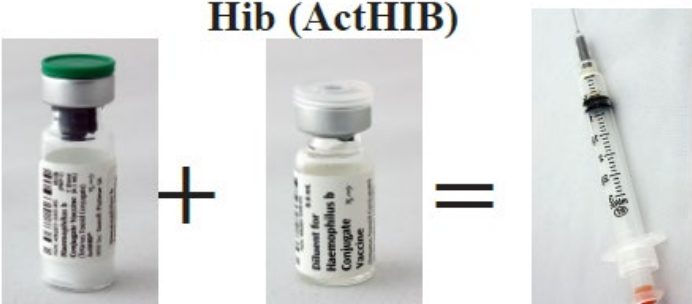
**DTaP-IPV/HIB (Pentacel)**



Lyophilized Hib component + Manufacturer's DTaP-IPV liquid component = Pentacel vaccine

Should be used immediately after reconstitution

**Hib (ActHIB)**



Lyophilized Hib component + Manufacturer's 0.4% sodium chloride diluent = ActHIB vaccine

Beyond Use Time: If not used immediately after reconstitution, store at 2°C to 8°C (36°F to 46°F) and discard if not used within 24 hours. Should be shaken vigorously before injection.

# 10

**Storage and  
Handling**

# Vaccine Storage and Handling

- Store all Hib-containing vaccine refrigerated between 2°C and 8°C (36°F and 46°F)
- Do not freeze vaccine or diluents, or expose to freezing temperatures
- Store Hib vaccine in the original packaging
  - For Hib vaccines that require reconstitution (Pentacel<sup>®</sup>, ActHIB<sup>®</sup>, Hiberix<sup>®</sup>), they should be stored together in the refrigerator

## Hib (ActHIB)

**Ages:** 6 weeks through 4 years

**Use for:** Any dose in the series

**Route:** Intramuscular (IM) injection

**Reconstitute Hib powder ONLY with manufacturer-supplied 0.4% sodium chloride diluent**

**Beyond Use Time:** If not used immediately after reconstitution, store at 2°C to 8°C (36°F to 46°F) and discard if not used within 24 hours. Shake well prior to administration.

## Hib (PedvaxHIB)

**Ages:** 6 weeks through 4 years

**Use for:** Any dose in the series

**Route:** Intramuscular (IM) injection

## Hib (Hiberix)

**Ages:** 6 weeks through 4 years

**Use for:** Any dose in the series

**Route:** Intramuscular (IM) injection

**Reconstitute Hib powder ONLY with manufacturer-supplied 0.9% sodium chloride diluent**

**Beyond Use Time:** If not used immediately after reconstitution, store at 2°C to 8°C (36°F to 46°F) and discard if not used within 24 hours. Shake well prior to administration.

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**Resources**

# Additional Resource

- Provide the polio and Hib vaccine information statement (VIS) when a combination vaccine is administered.
  - There are no VISs specific for Kinrix, Pediarix, Pentacel, or Quadracel .
- Other option: multiple vaccines VIS
  - May be used in place of the individual VISs for DTaP, Hib, hepatitis B, polio, and PCV13 when two or more of these vaccines are administered during the same visit
  - It may be used for infants through children receiving their routine 4- to 6-year vaccines

VACCINE INFORMATION STATEMENT

## Your Child's First Vaccines

*What You Need to Know*

Many Vaccine Information Statements are available in Spanish and other languages. See [www.imzmnize.org/via](http://www.imzmnize.org/via)  
Hojas de información sobre vacunas están disponibles en español y en muchos otros idiomas. Visite [www.imzmnize.org/via](http://www.imzmnize.org/via)

The vaccines covered on this statement are those most likely to be given during infancy and early childhood. Other vaccines (including measles, mumps, and rubella; influenza; and hepatitis A) are also routinely recommended.

Your child will get these vaccines today:

DTaP     Hib     Hepatitis B     Polio

(Provider: Check appropriate boxes.)

VACCINE INFORMATION STATEMENT

## Hib Vaccine

(*Haemophilus influenzae* Type b)

*What You Need to Know*

Many Vaccine Information Statements are available in Spanish and other languages. See [www.imzmnize.org/via](http://www.imzmnize.org/via)  
Hojas de información sobre vacunas están disponibles en español y en muchos otros idiomas. Visite [www.imzmnize.org/via](http://www.imzmnize.org/via)

**1 Why get vaccinated?**

**1 Why get vaccinated?**

Vaccine-preventable diseases that have not gone away. Other diseases still occur are fewer babies get vaccinated. 7 childhood diseases that have not gone away. Other diseases still occur are fewer babies get vaccinated.

**1. Diphtheria (the 'D')**

- **Signs and symptoms:** Sore throat, fever, and a white coating on the back of the throat that can lead to breathing problems.
- **Diphtheria can lead to:** Paralysis and heart failure.
- About 15,000 people die from diphtheria each year.

**2. Tetanus (the 'T' in Lockjaw)**

- **Signs and symptoms:** Stiff muscles, usually in the neck, and difficulty swallowing.
- **Tetanus can lead to:** Paralysis and death.
- Tetanus kills about 10% of people who get it.

**3. Pertussis (the 'P' in Whooping Cough)**

- **Signs and symptoms:** Coughing spells that can make it hard to breathe. These spells can last for weeks.
- **Pertussis can lead to:** Damage to the lungs, or death. In infants, it can be fatal.
- Most pertussis deaths occur in children under 6 months of age.

Your child can get Hib disease by being around other children or adults who may have the bacteria and not know it. The germs spread from person to person. If the germs stay in the child's nose and throat, the child probably will not get sick. But sometimes the germs spread into the lungs or the bloodstream, and then Hib can cause serious problems. This is called invasive Hib disease.

Before Hib vaccine, Hib disease was the leading cause of bacterial meningitis among children under 5 years old in the United States. Meningitis is an infection of the lining of the brain and spinal cord. It can lead to brain damage and deafness. Hib disease can also cause:

- pneumonia
- severe swelling in the throat, making it hard to breathe
- infections of the blood, joints, bones, and covering of the heart
- death

Before Hib vaccine, about 20,000 children in the United States under 5 years old got Hib disease each year, and about 3% - 6% of them died.

Hib vaccine can prevent Hib disease. Since use of Hib vaccine began, the number of cases of invasive Hib disease has decreased by more than 99%. Many more children would get Hib disease if we stopped vaccinating.

**2 Hib vaccine**

Several different brands of Hib vaccine are available. Your child will receive either 3 or 4 doses, depending on which vaccine is used.

Doses of Hib vaccine are usually recommended at these ages:

- First Dose: 2 months of age
- Second Dose: 4 months of age
- Third Dose: 6 months of age (if needed, depending on brand of vaccine)
- Final/Booster Dose: 12-15 months of age

Hib vaccine may be given at the same time as other vaccines.

Hib vaccine may be given as part of a combination vaccine. Combination vaccines are made when two or more types of vaccine are combined together into a single shot, so that one vaccination can protect against more than one disease.

Children over 5 years old and adults usually do not need Hib vaccine. But it may be recommended for older children or adults with asplenia or sickle cell disease, before surgery to remove the spleen, or following a bone marrow transplant. It may also be recommended for people 5 to 18 years old with HIV. Ask your doctor for details.

Your doctor or the person giving you the vaccine can give you more information.

VACCINE INFORMATION STATEMENT

## Polio Vaccine

*What You Need to Know*

Many Vaccine Information Statements are available in Spanish and other languages. See [www.imzmnize.org/via](http://www.imzmnize.org/via)  
Hojas de información sobre vacunas están disponibles en español y en muchos otros idiomas. Visite [www.imzmnize.org/via](http://www.imzmnize.org/via)

**1 Why get vaccinated?**

**Adults**

Most adults do not need IPV because they were already vaccinated against polio as children. But some adults are at higher risk and should consider polio vaccination, including:

- people traveling to certain parts of the world, laboratory workers who might handle polio virus, and health care workers treating patients who could have polio.
- These higher-risk adults may need 1 to 3 doses of IPV, depending on how many doses they have had in the past. There are no known risks to getting IPV at the same time other vaccines.

**3 Some people should not get this vaccine**

All the person who is giving the vaccine:

- If the person getting the vaccine has any severe, life-threatening allergies.
- If you ever had a life-threatening allergic reaction after a dose of IPV, or have a severe allergy to any part of this vaccine, you may be advised not to get vaccinated. Ask your health care provider if you want information about vaccine components.
- If the person getting the vaccine is not feeling well. If you have a mild illness, such as a cold, you can probably get the vaccine today. If you are moderately or severely ill, you should probably wait until you recover. Your doctor can advise you.

**4 Risks of a vaccine reaction**

With any medicine, including vaccines, there is a chance of side effects. These are usually mild and go away on their own, but serious reactions are also possible.

Some people who get IPV get a sore spot where the shot is given. IPV has not been known to cause serious problems, and most people do not have any problems with it.

U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention

# Continuing Education Information

- CE credit, go to: <https://tceols.cdc.gov/>
- Search course number: **WD4564-090622**
- CE credit expires: **July 1, 2024**
- CE instructions are available on the **Pink Book Web-on-Demand Series** web page
- Questions and additional help with the online CE system, e-mail [CE@cdc.gov](mailto:CE@cdc.gov)

The screenshot shows the TCEO website interface. At the top, there is a blue header with the text "Training and Continuing Education Online (TCEO)". Below this is the TCEO logo, which consists of the letters "TCEO" in a bold, blue font with a green circular arrow icon to the right. Underneath the logo, the text "TRAINING AND CONTINUING EDUCATION ONLINE" is displayed in a smaller, blue font. On the left side, there is a vertical navigation menu with several blue buttons: "TCEO Home", "Search Courses", "Create Account", "9 Simple Steps to Earn CE", "Frequently Asked Questions", and "Contact TCEO". The main content area on the right has a blue header with the text "New to TCEO?". Below this, there are three sections of text: "Visit Create Account. Once your account has been created, you will be able to search for courses and complete requirements to receive CE.", "Already have a TCEO account from the previous system? To move your account to the new system please sign in above using your existing TCEO username and password. Once signed in, follow the prompts to verify and update your account. After your account forward you will use this email address and password to sign in.", and "Not sure how to get started? Follow these 9 Simple Steps to earn continuing education for the courses you have taken or conferences you have attended!". At the bottom of the main content area, there is a row of four small images: a woman smiling at a child, a man in a suit looking at a screen, a doctor in a white coat holding a dog, and a woman sitting at a desk with a laptop. Below the images, the text "Welcome to TCEO" is displayed, followed by a small line of text: "Training and Continuing Education Online (TCEO) is a system that provides access to CDC educational activities for continuing education (CE). Use TCEO to search for CE opportunities, complete course e".

# E-mail Your Immunization Questions to Us

- [NIPINFO@cdc.gov](mailto:NIPINFO@cdc.gov)





# Thank You From Atlanta!

