

**Centers for Disease Control and Prevention**  
National Center for Immunization and Respiratory Diseases



## Polio and Polio Vaccine

Chapter 18  
September 2018

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### Poliomyelitis Disease

- First outbreak described in the U.S. in 1843
- Polio epidemics were reported each summer and fall
- More than 21,000 paralytic cases reported in the U.S. in 1952



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### Poliovirus

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

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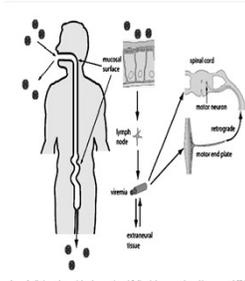
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### Poliomyelitis Pathogenesis

- Enters into mouth
- Replicates in pharynx and GI tract
- Hematologic spread to lymphatics and central nervous system
- Viral spread along nerve fibers
- Destruction of motor neurons



Racaniello VR. One hundred years of poliovirus pathogenesis. Virology 2006;344:9-16

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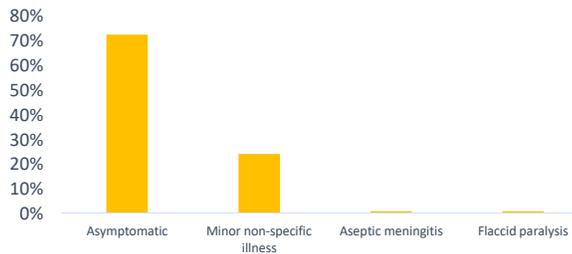
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### Outcomes of Poliovirus Infection




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**Asymmetric paralysis**

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### Poliovirus Epidemiology

<b>Reservoir</b>	Human
<b>Transmission</b>	Fecal-oral Oral-oral possible
<b>Communicability</b>	Most infectious: 7–10 days before onset Virus present in stool 3–6 weeks

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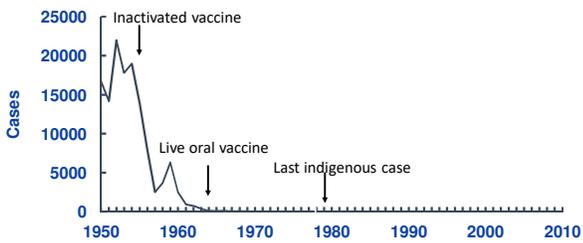
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### Poliomyelitis—United States, 1950–2011




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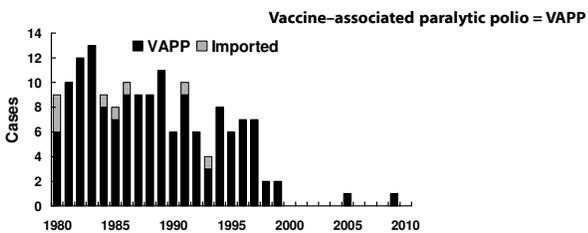
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### Poliomyelitis—United States, 1980–2010




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### Poliovirus Vaccines

- 1955–Inactivated vaccine
- 1963–Live, attenuated vaccine (OPV)
- 1987–Enhanced-potency, inactivated vaccine (IPV)




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### Enhanced Inactivated Polio Vaccine

- Highly effective in producing immunity to poliovirus
  - ≥90% of recipients immune after 2 doses
  - ≥99% of recipients immune after 3 doses
- Duration of immunity not known with certainty

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### Polio-Containing Vaccine Products

Product ACIP Abbreviation	Age Indications	IPV Series
IPOL IPV	6 weeks and older	Any dose in the series
Pediarix DTaP-IPV-HepB	6 weeks through 6 years	Doses 1 through 3
Pentacel DTaP-IPV/Hib	6 weeks through 4 years	Doses 1 through 4
Kinrix DTaP-IPV	4 through 6 years	Dose 4
Quadracel DTaP-IPV	4 through 6 years	Dose 4 or 5

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**ACIP Polio Immunization Recommendations  
Routine Schedule**

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

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**ACIP Polio Immunization Recommendations  
Catch-Up Schedule**

- Infants 6 months of age and younger, follow the recommended schedule intervals
- 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	-----

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**ACIP Polio Immunization Recommendations  
4<sup>th</sup> Dose and the Catch-Up Schedule**

- A 4<sup>th</sup> dose is not necessary if the 3<sup>rd</sup> 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

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**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 the last dose of OPV and the IPV dose

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**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 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

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**ACIP Polio Immunization Recommendations  
Adolescents**

- Routine vaccination of U.S. residents 18 years of age or older is not necessary or recommended
- May consider vaccination of travelers to polio-endemic countries and selected lab workers

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**Contraindications and Precautions**

- Severe allergic reaction to a vaccine component or following a prior dose of vaccine
  
- Moderate to severe acute illness

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**Vaccine Administration**

- **Route: IM injection**
  - IPV, DTaP-IPV/Hib, DTaP-IPV-HepB, DTaP-IPV
  - Needle gauge: 22 – 25 gauge
  - Needle length\*: 1 – 1.5 inch depending on the patient’s age and/or weight
  
- **IM injection site\***:
  - 6 weeks–11 months: Vastus lateralis muscle is recommended
  - 1–3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 3 years and older: Deltoid muscle is preferred; vastus lateralis muscle may also be used
  
- **Note: IPV single component may also be Subcut injection in the anterolateral thigh or upper outer triceps area of the arm**

\*Professional judgement should be used to determine the proper needle length and site. Influencing factors include injection technique, local reaction, number of vaccines to be administered, patient age, size and muscle mass

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**IPV Adverse Reactions**

- **Local reactions**                    **2.8% (pain, redness, swelling)**
  
- **Severe reactions**                **rare**

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**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 through 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**

- Store all IPV-containing vaccines in a refrigerator between 2°C and 8°C (36°F and 46°F)
- Store in original packaging with lids closed
- Store DTaP-IPV/Hib (Pentacel) diluent in the refrigerator and lyophilized Hib vaccine
- Do not freeze vaccine or diluent

**IPV**

**Ages:** 6 weeks and older

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

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

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**Polio Eradication**

- Last case in the United States in 1979
- Western Hemisphere certified polio-free in 1994
- Last isolate of WPV2 was in India in October 1999
- Global eradication goal

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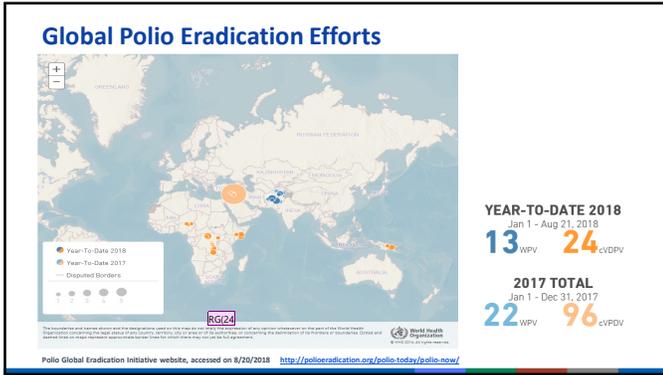
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- ### Clinical Considerations for IPV-Containing Vaccines
- **Storage:** Refrigerate between 2°C and 8°C (36°F and 46°F)
  - **Preparation: Prepare the vaccine just prior to administration**
    - Pentacel requires reconstitution
    - Reconstitute the lyophilized vaccine with the DTaP-IPV liquid diluent supplied by the manufacturer. Do NOT use Kinrix or Quadacel
  - **Route: IM injection\***
  - **Site:**
    - 11 months and younger: Anterolateral thigh muscle
    - 12 months and older: Anterolateral thigh muscle or deltoid muscle of arm
  - **Needle:**
    - Children: 22–25 gauge, 1-inch needle
    - Adults: 22–25 gauge, length varies by weight
- \*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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## Slide 25

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**RG(24** I would change the colon to a comma and lowercase "accessed."

Redmon, Ginger (CDC/OID/NCIRD), 8/20/2018