

Overview of Polio

0.25 CREDIT HOURS



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PHARMACIST OBJECTIVES

1. List the transmission route and vaccination type associated with the poliovirus

PHARMACY TECHNICIAN OBJECTIVES

1. List the transmission route and vaccination type associated with the poliovirus

OVERVIEW

Micro-learning opportunities were created in response to evidence that learning is maximized when delivered in short and focused 'bursts.' In this session, polio's history, historical impact, transmission, and vaccine are explored, including some interesting facts about our previous education on the subject.

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TARGET AUDIENCE

Pharmacist, Pharmacy Technician

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I wonder what will be written about COVID, vaccines, and masking in the next 50 to 100 years! All of us students of history remember learning that Franklin Delano Roosevelt was a polio victim. His efforts with the March of Dimes provided much needed research dollars to fund Dr. Salk's work in developing a polio vaccine.

The History of the Vaccine

Polio is another vaccine-preventable disease that many in my parents' generation grew to fear. Polio was probably the first disease where science and research, and not just serendipity (like smallpox), brought a dreaded disease under control.

Jonas Salk

- Jonas Edward Salk was born October 28, 1914 in New York City
 - The eldest of three sons born to Russian-Jewish immigrants
- In 1942, Salk went to the University of Michigan on a research fellowship to develop an influenza vaccine
- In 1947, Salk was appointed director of the Virus Research Laboratory at the University of Pittsburgh School of Medicine
 - Created his inactivated polio vaccine (IPV) between 1952 and 1953
 - The vaccine contained wild polioviruses of all 3 serotypes that had been killed by means of formaldehyde
 - When injected intramuscularly, the vaccine elicited the production of antibodies, rendering recipients immune to the disease
 - In 1954, Dr. Salk began a placebo-controlled study on 1.3 million children
 - By 1955, Dr. Salk announced that the vaccine was safe and effective, and a nationwide campaign began to inoculate the nation
 - On April 12, 1955, it was proclaimed that the battle against poliomyelitis had potentially been won thanks to Salk's vaccine
 - When asked about the patent for his vaccine Dr Salk responded: "Who owns this patent? Well, the people, I would say. There is no patent. Could you patent the sun?"
- In 1963, he founded the Salk Institute for Biological Studies in La Jolla, California, thanks to support from the March of Dimes
- He spent his last years searching for a vaccine against AIDS
- Died at the age of 80 on June 23, 1995 in La Jolla, California.

Albert Sabin

- Dr. Sabin was born Abram Saperstein on August 26, 1906, in Bialystok, Poland
- Immigrated to the United States with his parents in 1921 to avoid the persecutions directed against people of Jewish lineage
- Received his M.D. from New York University in 1931 and immediately began research on polio

- During the mid-1930s, Sabin was studying poliovirus at the University of Cincinnati
 - In 1939, he realized that it was not a respiratory virus but an enteric virus that lived and multiplied in the intestine
 - Sabin was able to demonstrate that contagion occurred through both the respiratory route, from coughing and sneezing, and the enteric route, from fecal contamination
- After World War II broke out, he joined the U.S. Army Epidemiological Board's Virus Committee
 - Accepted assignments in Europe, Africa, the Middle East, and the Pacific
 - During this phase of his career, Dr. Sabin developed vaccines for encephalitis (sleeping sickness), sand-fly fever, and dengue fever
- Dr Sabin died March 3, 1993, and is buried in Arlington National Cemetery
- Dr. Sabin did not patent his vaccine because he wanted it to be used as broadly as possible. "It's my gift to all the world's children", he said.
- In the late 1950s, the mass-vaccination campaign in the Soviet Union demonstrated high vaccine effectiveness and resulted in licensure of the oral polio vaccine (OPV) in the United States in 1961
 - Subsequently, OPV rapidly replaced IPV as the vaccine of choice in the US
 - OPV was preferred over IPV because it induced both systemic and intestinal immunity, was easier to administer, and was less expensive than IPV
 - The main drawback of OPV is that, very rarely (in 1 case out of $\approx 750,000$), Sabin viruses can mutate back to a more neurovirulent form and cause vaccine-associated paralytic polio

Cutter Incident

- A defective polio vaccine that was manufactured by Cutter Labs in Berkeley California was used in the Western and Midwestern United States
- Over 200,000 kids were injected
- Because of this defective vaccine, thousands of cases were reported, 192 kids were left severely paralyzed, and 11 kids died
- The government temporarily suspended the vaccination program until it was determined that Cutter vaccine should be permanently withdrawn and IPV from other manufacturers could be reinitiated safely
 - A jury found that Cutter was not negligent in producing the vaccine, but had breached an implied warranty that their product was safe
- Dr. Paul A. Offit, MD, is the Director of the Vaccine Education Center and an attending physician in the Division of Infectious Diseases at Children's Hospital of Philadelphia
 - He wrote a book that outlines a series of events that contributed to the vaccine that contained live virus to be released from Cutter Laboratories
 - These included the use of a highly virulent strain (Mahoney), deficiencies in the inactivation of vaccine virus, inadequate safety tests, and poor communication with other scientists and the government (Carapetis J, 2006)
- The Cutter Incident still impacts vaccine administration 60 years later, according to Dr. Offit's book "The Cutter Incident: How America's First Polio Vaccine Led to Today's Growing Vaccine Crisis" (Yale University Press, 2005)

SV40

- Some of the polio vaccines administered from 1955–1963 were contaminated with a virus called simian virus 40 (SV40)
- The virus came from the monkey kidney cell cultures used to produce the vaccine
- Most, but not all, of the contamination was in the inactivated polio vaccine (IPV)
- SV40 has biological properties consistent with a cancer-causing virus, however, there were no increases in cancers when the age group that received the IPV between 1955-63 was studied

The Virus

- Poliovirus, a human enterovirus that belongs to the family *Picornaviridae* in the genus *Enterovirus*, is the causative agent of poliomyelitis
- Single-stranded RNA virus
- Humans are the only natural hosts
 - However, can be transferred to monkeys when it is directly inoculated into the central nervous system (CNS)
- Usually contracted via the fecal-oral route

Signs and symptoms

- 90% of individuals who contract the poliovirus are entirely asymptomatic
- In fewer than 1% of cases, the virus enters the central nervous system, where it preferentially infects and destroys motor neurons
 - Leads to muscle weakness and acute flaccid paralysis

Transmission

- Can occur through direct person-to-person contact
 - Either through the fecal-oral route or via respiratory droplets
 - Polio has an R naught of 5 to 7, meaning that 80-86% of the population would need to be vaccinated before viral spread would stop, according to Infection Control today

The vaccine

- Inactivated polio vaccine (IPV) is the only polio vaccine that has been given in the United States since 2000
 - Given by injection in the arm or leg, depending on the person's age
- Children get four doses of IPV, with one dose at 2, 4, 6-18 months, and 4-6 years
- A single-antigen vaccine called IPOL is licensed in the U.S. for active immunization of infants (as young as 6 weeks of age), children, and adults for the prevention of poliomyelitis caused by poliovirus types 1, 2, and 3
- In unvaccinated adults, two doses of IPV should be administered at intervals of four to eight weeks, and the third dose should be administered within six to 12 months of the second dose

Eradication

- Cases due to wild poliovirus have decreased by over 99% since 1988, from an estimated 350,000 cases then, to just 6 reported cases in 2021 (World Health Organization)

Recent Outbreaks

- An unvaccinated adult suffered paralysis from polio in June of 2022, the first case in New York since 1990
 - Wastewater surveillance later found the virus had been spreading silently in the New York City area for months
 - The origin of the virus is still under investigation, but samples in New York are genetically linked to polioviruses found in London and Jerusalem wastewater
 - First detected in Rockland County, then in neighboring Orange County, New York City, Sullivan County, and later in Nassau County on Long Island
 - In some areas of Rockland, only 37% of kids in this age group are up-to-date on their vaccine

London outbreak

- In London, children aged 1-9 were made eligible for booster doses of a polio vaccine after British health authorities reported finding evidence of the virus spreading in multiple areas
 - No cases found in people
- Britain's Health Security Agency said it detected viruses derived from the oral polio vaccine in the sewage water of eight London boroughs
 - The agency's analysis of the virus samples suggested "transmission has gone beyond a close network of a few individuals"
 - 116 isolates were identified in 19 sewage samples in London between Feb 8 and July 5, 2022

Franklin D. Roosevelt

- We are all aware of the most famous polio victim, Franklin Delano Roosevelt
- Began having symptoms of paralytic illness in 1921, at the age of 39
- Was president of the United States from 1933 to 1945
- In 1938, he founded the National Foundation for Infantile Paralysis, to push for the development of a polio vaccine
 - Later became known as the March of Dimes
- The big question is... *Did Franklin Delano Roosevelt really have polio, or was it Guillain-Barré Syndrome?*
 - Most evidence points to GBS, rather than poliomyelitis
 - Read the entire article here: <https://pubmed.ncbi.nlm.nih.gov/26508622/>
 - The author of this article also published a book called "Prisoners of Time"
 - This book is a case study of how doctors can only diagnose what they know, how millions of people can accept myth as fact, and how new research can correct the historical record

Interesting points about FDR's diagnosis

- The diagnosis of FDR's neurological disease still depends upon documented clinical abnormalities
- His age, prolonged symmetric ascending paralysis, transient numbness, protracted dysesthesia (pain on slight touch), facial paralysis, bladder and bowel dysfunction, and absence of meningismus are typical of Guillain-Barré syndrome and are inconsistent with paralytic poliomyelitis
- FDR's prolonged fever was atypical for both diseases
- Finally, permanent paralysis, though more common in paralytic poliomyelitis, is also frequent in Guillain-Barré syndrome
 - Thus, the clinical findings indicate the most likely diagnosis in FDR's case remains Guillain-Barré syndrome
- Other evidence shows FDR never had a lumbar puncture
- GBS was only mentioned in European literature, and physicians at the time considered he might have either a blood clot, a "heavy cold", or polio
- **For a 9 page dissertation about FDR's diagnosis, check out:**
<https://www.ehdp.com/press/fdr-polio-gbs/jmb-2003-fdr.pdf>

Polio Trivia

- The first disposable syringes were a result of Salk's polio vaccine
 - Becton, Dickinson, and Company (BD) developed the HYPAK syringe (originally made of glass) to administer the polio vaccine
 - The following year, Roehr Products introduced a plastic, disposable hypodermic syringe called the Monoject
 - Because of their low cost, plastic became the standard for disposable syringes
- Mary Poppins' "...just a spoonful of sugar helps the medicine go down!" was a reference to the administration of Sabin's OPV
- In 1946, the dime was changed to have Roosevelt's image because of his connection to the "March of Dimes"

--Have a great day on the bench!!

Activity Test

Overview of Polio

Activity tests must be completed online at www.freeCE.com.

A passing grade of 70 or higher and completion of an online activity evaluation are required to earn credit.

1. What is/are the route(s) of transmission for polio?
 - A. Respiratory droplets
 - B. Fecal-oral
 - C. Neither of these
 - D. Both of these

2. Via what route is the polio vaccine of choice given?
 - A. Oral
 - B. Intramuscular
 - C. Intranasal
 - D. Subcutaneously