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### RESEARCH ARTICLE

## VACCINATION AND THE BATTLE AGAINST POLIO: A PUBLIC HEALTH TRIUMPH

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### Abstract

Polio, once a devastating global disease-causing paralysis and death, has been largely controlled through widespread vaccination efforts. This article highlights the critical role of immunization in public health, focusing on India's remarkable journey toward polio eradication. From the introduction of the Oral Polio Vaccine (OPV) in 1978 to the nationwide Pulse Polio campaign in 1995, India's dedicated efforts culminated in being declared polio-free by the WHO in 2014. The piece also outlines the virology, transmission, diagnosis, and lack of cure for poliovirus, emphasizing prevention through vaccination. Despite global progress, poliovirus remains a threat in regions like Afghanistan and Pakistan, underscoring the need for continued vigilance and immunization to prevent resurgence and ensure a polio-free future. One of the most poignant tools in public health is vaccination, which involves administering a vaccine to help the body develop immunity against specific contagious conditions. Vaccines contain inactivated or weakened forms of a contagion or bacteria (antigens), which spark the vulnerable system to respond without causing the factual illness. This process equips the body to defend itself if exposed to the complaint in the future, thereby precluding illness, complications, and indeed death. Historically, vaccines have played a vital part in controlling and barring deadly conditions similar as measles, tuberculosis, smallpox, and polio. Wide immunization not only protects individualities but also helps communities through herd immunity, where enough people are vaccinated to limit the spread of a complaint. This has led to significant advancements in public health issues, including increased life expectation and a decline in complaint frequency. Also it is cited in Obregón R, Chitnis K, Morry C, Feek W, Bates J, Galway M, Ogden E. Achieving polio eradication: a review of health communication evidence and lessons learned in India and Pakistan. Bull World Health Organ. 2009 Aug;87(8):624-30. doi:10.2471/blt.08.060863. PMID: 19705014; PMCID: PMC2733260.

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### Introduction:-

#### India's Journey Toward Polio Eradication

India's sweats to exclude polio involved several mileposts and major challenges. The process began in the 1970s with early vaccination sweats and moved forward with the launch of the Universal Immunization Programme (UIP)

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in 1985. A turning point came with the polio immunization (PPI) crusade, initiated in 1995, which aimed to administer the Oral Polio Vaccine (OPV) to all children under the age of five, regardless of their previous vaccination status. The last case of wild poliovirus in India was reported in West Bengal in 2011. Following this, in 2014, the World Health Organization (WHO) declared India officially polio-free. This achievement was the result of an extraordinary public crusade involving door-to-door vaccination drives and special immunization days known as “Polio Sundays”, ensuring that no child was left vulnerable. India’s polio elimination is regarded as one of the topmost public health successes encyclopedically.

### A Brief History of Polio and Its Vaccines

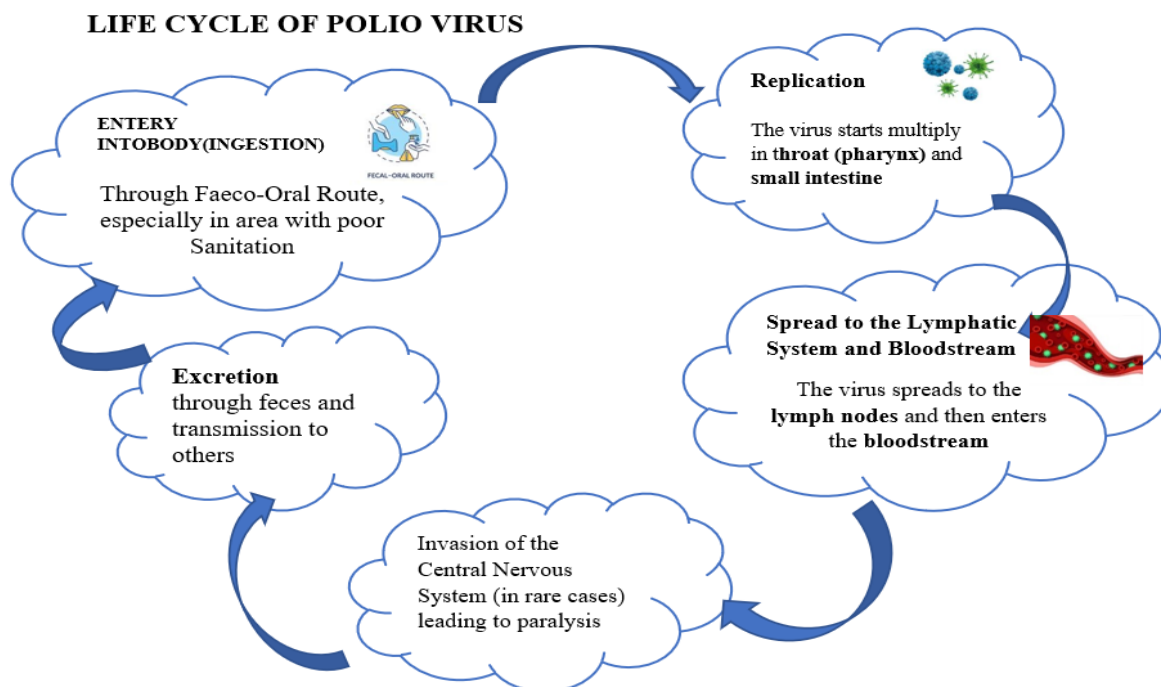
Poliomyelitis, or polio, was once among the most feared diseases worldwide, especially for children. It caused paralysis, disability, and in severe cases, death. In the 1940s and early 1950s, countries like the United States experienced devastating outbreaks. Hospitals were overwhelmed, and the “iron lung”—a mechanical ventilator used to assist breathing—became a symbol of the crisis.

A breakthrough came in 1952 when Dr. Jonas Salk, an American virologist, developed the Inactivated Polio Vaccine (IPV) using killed poliovirus. His vaccine was a major advancement because it did not carry any risk of causing polio. After a historic clinical trial involving over 1.8 million children, the vaccine was declared safe and effective in 1955, leading to mass vaccination efforts.

Later, in the early 1960s, Dr. Albert Sabin introduced the Oral Polio Vaccine (OPV) using a weakened live virus. This version was cheaper, easier to administer, and more effective in halting the spread of the virus by generating immunity in the gut. OPV became the primary vaccine used globally after successful testing in countries such as the Soviet Union and official approval in the U.S. in 1961.

In India, OPV was introduced in 1978 as part of the Expanded Programme on Immunization for children under one year of age. The Universal Immunization Programme in 1985 further strengthened routine vaccination efforts. However, it was the 1995 launch of the Pulse Polio campaign that truly accelerated mass immunization by aiming to reach every child, regardless of previous vaccine history.

### Life Cycle of Polio Virus



Poliovirus (PV) is one of the best-characterized positive-strand RNA viruses that belongs to the Enterovirus genus of the Picornaviridae family. PV is classified within the Enterovirus C species, and there are three wild PV serotypes: WPV1, WPV2 and WPV3 [2]. Enteroviruses are mainly transmitted by the faecal–oral and respiratory routes. They initially replicate in the gastrointestinal or respiratory epithelium and can then spread to other tissues and organs via the lymphatic system and bloodstream [3]. PV can reach the central nervous system (CNS), mainly the spinal cord, destroying motor neurons and causing acute paralytic poliomyelitis in rare cases and then excreted out through feces and transmission to others.

#### Epidemiological Triad for Poliovirus:

*Poliovirus, Infects the gastrointestinal tract; in rare cases, invades the central nervous system and destroys motor neurons, leading to paralysis.*

**AGENT**

*Poor sanitation and contaminated water increase the risk, it survives longer in warm, moist climates.*

**ENVIRONMENT**

**HOST**

*Susceptible Population: Mainly children under 5 years of age, though unvaccinated individuals of any age are at risk.*

#### Polio Diagnosis and Treatment

Healthcare professionals frequently identify polio grounded on symptoms similar as muscle weakness, stiffness in the neck or back, or abnormal revulsions. Laboratory testing of a coprolite sample is the most dependable system to confirm the presence of the poliovirus. Although the contagion can occasionally be set up in throat hearties, this is only possible during the first week of infection, making it a less dependable individual tool. There's presently no cure for polio. The only effective strategy is forestallment through immunization. The polio vaccine, when given in multiple boluses, provides lifelong protection. Since the launch of the Global Polio Eradication Initiative in 1988, it's estimated that over 20 million people have been spared palsy, and roughly 1.5 million nonage deathshave been avoided due to vitamin A supplements handed alongside vaccination. Although polio- convinced palsy is endless, certain curatives can help ameliorate quality of life. These include physical remedy, heat treatment, and muscle relaxants, which help strengthen affected muscles and reduce discomfort, indeed though they can not reverse the damage

#### Global and Regional Threats

Vaccination remains the key defense against the return of polio. If strategic vaccination efforts are not maintained, the virus could resurge. Currently, wild poliovirus still circulates in parts of Afghanistan and Pakistan, posing a threat of reintroduction to polio-free countries like India. Failure to stop polio in these remaining regions could result in up to 200,000 new cases annually worldwide within a decade.

That is why continued vigilance and immunization are essential—to protect future generations and finally eliminate polio forever.

#### Post-Eradication Surveillance: Sustaining Polio-Free Status

A strong, two-pronged strategy is required for post-eradication surveillance, which includes environmental and clinical (AFP) monitoring, reinforced by comprehensive laboratory sequencing and quick response systems.

Maintaining eradication requires strict certification requirements, polio infrastructure integration into larger health systems, and the containment of biological materials.

Digital technologies and creative surveillance techniques increase abilities to detect significantly. The benefits of eradication are maintained through globally coordinated risk assessments, epidemic response assessments, and emergency preparedness, all supported by ongoing funding. Resilience against poliovirus comeback and global health security hinge on these systems' continuous integr

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