



Advancing Public Health Through Oral and Inactivated Poliovirus Vaccination Programs

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DESCRIPTION

Poliomyelitis once stood among the most feared infectious diseases in the world, particularly during the early and mid-twentieth century. The virus spreads primarily through contaminated water and food and can invade the nervous system, leading to paralysis and sometimes death. Children were especially vulnerable and communities lived in fear during seasonal outbreaks that left thousands with permanent disabilities. The development of effective polio vaccines transformed this bleak reality into one of the most inspiring achievements in public health history. Poliovirus enters the body through the mouth and multiplies in the intestine. In most infected individuals, symptoms are mild or even absent. However, in a small percentage of cases, the virus crosses into the bloodstream and attacks motor neurons in the spinal cord. This damage can result in irreversible paralysis, typically affecting the legs but sometimes impairing breathing muscles. Before vaccines became available, hospitals frequently relied on mechanical ventilators to support patients who lost the ability to breathe independently. The first major breakthrough in prevention came in the nineteen fifties with the development of an inactivated polio vaccine. This vaccine was created by cultivating poliovirus and then inactivating it so that it could not cause disease. When administered by injection, the inactivated vaccine stimulated the immune system to produce protective antibodies. Large scale vaccination campaigns soon followed in many countries, dramatically reducing the number of new cases.

A few years later, an oral polio vaccine was introduced. This formulation used a weakened form of the virus that could replicate in the intestine without causing paralysis in healthy individuals. The oral vaccine offered several advantages. It was easy to administer, especially during mass immunization campaigns and it induced strong intestinal immunity. By replicating in the gut, the weakened virus stimulated local immune responses that limited viral transmission within communities. As a result, the oral vaccine became a powerful tool in interrupting outbreaks and protecting populations in

regions with limited healthcare infrastructure. The combined use of inactivated and oral vaccines has played an important role in reducing global polio cases by more than ninety-nine percent compared with peak epidemic years. Many countries have achieved complete elimination of indigenous poliovirus transmission. This remarkable progress is the result of sustained international collaboration, strong political commitment and dedicated health workers who have delivered vaccines to even the most remote areas. Despite these achievements, the journey toward total eradication has not been without challenges. In rare instances, the weakened virus used in the oral vaccine can mutate and regain the ability to cause paralysis. Such cases are uncommon but highlight the importance of maintaining high immunization coverage. When vaccination rates decline, communities become vulnerable to both wild poliovirus and vaccine derived strains. Continuous surveillance and rapid response to detected cases are therefore essential components of eradication efforts.

The inactivated vaccine offers a high level of safety because it contains killed virus that cannot replicate. Many countries have shifted toward exclusive use of the inactivated formulation as the global incidence of wild poliovirus has decreased. However, in areas where transmission risk remains, the oral vaccine continues to be valuable due to its ability to induce strong community level immunity. Public health authorities carefully assess regional needs to determine the most appropriate vaccination strategy. Community engagement has been fundamental to the success of polio immunization programs. Building trust among families, addressing misinformation and ensuring equitable access are critical for maintaining high coverage rates. Health education campaigns emphasize the safety and effectiveness of vaccines, helping parents understand that immunization protects not only their own children but also the broader community. Logistical considerations also play a significant role. Vaccines must be stored at appropriate temperatures and transported across diverse terrains. In some regions affected by conflict or natural disasters, delivering vaccines safely can be extremely challenging. Nevertheless, global

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partnerships among governments, international organizations and local communities have enabled remarkable progress even under difficult circumstances.

In conclusion, polio vaccines represent one of the most significant achievements in modern medicine. Through the development of both inactivated and oral formulations, scientists and public health leaders transformed a devastating

epidemic into a largely preventable disease. Although challenges remain in achieving complete global eradication, the dramatic reduction in cases demonstrates the power of vaccination combined with international cooperation. Sustained commitment, vigilant surveillance and community engagement will be essential to ensure that future generations live in a world permanently free from poliomyelitis.