

The Eradication of Polio Virus, What We Have Achieved Until Now

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Polioviruses are members of Enterovirus's family. They cause a systemic viral infection primary affects the central nervous system called poliomyelitis which causes paralysis. Only three serotypes exist 1,2,3, and getting infect with each gives serotype-specific, lifelong immunity to disease but little or no immunity to infection or disease caused by other serotypes. Before we discovered poliovirus vaccines, most paralytic disease was caused by serotype "1". Wild-type polioviruses, circulated virulent polioviruses derived from OPV strains (cVDPV), and live-attenuated OPV viruses, may circulate in different populations. It depends on whether OPV is used, on the vaccine-induced immunity rates in the population, and on whether elimination of endemic transmission of wild-type polioviruses has been done.

The appearance of symptoms within the infection by polioviruses range from unapparent symptoms to severe paralysis and death. At least 95% of infections are asymptomatic or unapparent and can be recognized only by the isolation of poliovirus from faeces or oropharynx or by a rise in antibody titer. *Abortive poliomyelitis* occurs in 4-8% of infections, and characterized by a 2-3 days period of fever, which may be presented with headache, sore throat, anorexia, vomiting, listlessness, or abdominal pain. Abortive poliomyelitis cannot be distinguished from other viral infections because the neurologic examination is normal, and can be clinically suspected only during an epidemic. Nonparalytic poliomyelitis differs from abortive poliomyelitis by the presence of signs of meningeal irritation. The disease is identical to meningitis caused by other enteroviruses. The systemic manifestations of nonparalytic poliomyelitis are generally more severe than in abortive poliomyelitis.

There are three types of vaccines: Inactivated Poliovirus Vaccine (IPV), Live-Attenuated Poliovirus Vaccine, and Monovalent and Bivalent Oral Poliovirus Vaccines (OPV). Even after the discovery of polio vaccines, poliomyelitis was ignored in developing countries and was regarded as an epidemic disease of wealthier nations. The WHO founded the Expanded Program on Immunization in 1974, which provided monetary and technical support for basic immunization against polio. Many children still can't get vaccines because of interrupted supplies, civil strife, disruptions in the cold chain necessary to maintain the potency of OPV, and poor political support. To control and fully eradicate polio the WHO Global Poliomyelitis Eradication Initiative uses many major strategies including improvement of laboratory capabilities, encouragement of routine childhood immunization, supplementary immunization activities (SIAs), intensified surveillance, and rapid response to identified outbreaks. Because of the spread of OPV virus, seroconversion rates during these mass campaigns are higher than for routine immunization, or when diarrheal disease is less common, because they are performed during the dry season. Number of unanticipated events like a temporary suspension of all immunization in northern Nigeria during 2003 and 2004 which resulted in importation of polio to 27 previously polio-free nations, incapability to prevent transmission in some northern Indian states in spite of high trivalent OPV coverage, civil disturbance in some locations, and the emergence of cVDPV in numerous regions. In 2012, renewed efforts and newly available resources have produced a marked reduction in global paralytic poliomyelitis cases to 223 cases, including the complete vanishing of all cases caused by wild-type 2 poliovirus. In 2011 major success in interruption of poliovirus type 1 circulation in India. Paralytic polio cases continue to be reported from three endemic countries (Pakistan, Afghanistan, Nigeria) and another five countries which previously have been free of Polio virus (Equatorial Guinea, Iraq, Cameroon, Syria, Ethiopia). The biggest challenges we face

that the global eradication remain in endemic countries and which participate more than 97% of the world’s cases. The WHO introduced the Polio Eradication and Endgame Strategic Plan 2013-2018 in 2013, a plan extend for 6 years to achieve fully eradication of polio (see figure below).

WHO Polio Eradication and Endgame Strategic Plan 2013-2018	
OBJECTIVE	PRIMARY GOAL
Poliovirus detection and interruption of its transmission	Stop all wild-type poliovirus transmission by the end of 2014
Strengthening of routine immunization programs and the withdrawal of OPV	Withdrawal of the type 2 component of OPV in all routine immunization programs by mid-2016 and use of bivalent OPV in 2019 to 2020
Containment and certification	Certification of all six WHO regions as having eradicated wild-type polioviruses by the end of 2018
Legacy planning	Have a strategy in place by the end of 2015 to ensure that the world remains permanently free of polio as well as to transition the lessons learned, with assets and infrastructure built to support this effort so that they may benefit other development goals and global health priorities

OPV, oral polio vaccine; WHO, World Health Organization.
 From World Health Organization. *Poliomyelitis: Intensification of the Global Eradication Initiative. Report by the Secretariat.* Available at http://apps.who.int/gbl/ebwha/pdf_files/WHA66/A66_18-en.pdf. Accessed June 9, 2013; and World Health Organization. *Executive Summary of the Polio Eradication & Endgame Strategic Plan 2013-2018.* Available at http://www.polioeradication.org/Portals/0/Document/Resources/StrategyWork/PEESP_ES_EN_A4.pdf. Accessed June 9, 2013.

Figure

The aim of the Endgame Plan was of course to eradicate polio by 2018. It did not succeed in this aim.

According to semi-annual status report from July to December 2015, there were no new cases of wild poliovirus type 1 (WPV1) in Nigeria and WHO declared Nigeria free from endemic polio on 24 September 2015 after three years with no polio cases. In Pakistan, there was an improvement in the eradication plan. A total of 25 cases had onset of paralysis in the second half of 2015 – a vast improvement on the 206 in the second half of 2014. Furthermore, in the second half of 2015, 14 cases of WPV were reported in Afghanistan with a decrease from the 20 cases reported in Afghanistan during the same period in 2014. Despite this improvement, vaccination gaps persist in many areas like Karachi, Peshawar-Khyber corridor, parts of the Quetta block, and northern areas of Nigeria. On the other hand, in 2018, wild poliovirus (WPV) cases were reported only from two countries: Pakistan and Afghanistan. In Nigeria, the third WPV endemic

country, no WPV has been detected anywhere in the country since 2016. Pakistan's polio eradication effort today is an excellent analogy to the world's eradication effort. Polio paralysed more than 30 000 children all over Pakistan twenty years ago. While from just four districts during 2018, only 12 cases were reported. Africa has not detected any WPV from any source from north-eastern Nigeria since September 2016. And although surveillance gaps in some parts of that area remain, surveillance (and immunity levels) is significantly stronger today than it was in 2016, when the surveillance system did manage to detect the virus.

Africa stands on the cusp of a historic public health success: the potential certification of WPV eradication, which could occur as early as 2020. Circulating vaccine-derived poliovirus (cVDPV) outbreaks are not a new phenomenon, but as the world increasingly approaches being free of WPVs, such outbreaks take on a new importance. Case numbers caused by cVDPVs were in fact lower in 2018 than in previous years but were more "visible" in light of the extremely low levels of WPV transmission remaining in the world. The emergence of cVDPVs in areas of low population immunity underscores the need to strengthen routine immunization levels. Ultimately, however, the only 100%-sure strategy to eliminate the long-term risk of cVDPVs is to stop OPV use. But that can only happen after we have been fully eradicated WPVs. Hence the dual emergency: to stop WPVs as rapidly as possible, not only to eradicate these strains in their own right and prevent their global resurgence, but also to stop them to enable the global cessation of OPV as quickly as possible. In 2018, Nigeria was affected by two genetically distinct circulating vaccine-derived polioviruses type 2 (cVDPV2). Four genetically related viruses were isolated in Sokoto state from environmental samples, which collected between April and May 2018. No new cases of acute flaccid paralysis (AFP) associated with them were detected. In Indonesia, a genetically distinct cVDPV1 outbreak was confirmed in January 2019, in Papua province bordering Papua New Guinea. The virus was isolated from a healthy community contact, as well as from a child with AFP. A response was immediately started following the outbreak's detection, and in high-risk provinces further outbreak response planned. In June 2017, reports emerged of an explosive cVDPV2 outbreak in the eastern part of the Syrian Arab Republic. Confirmation of the outbreak was soon received, and an extraordinary outbreak response was launched, amidst extremely challenging and dangerous circumstances and within the context of a broader humanitarian aid response. The response was successfully implemented throughout the rest of 2017 and 2018, involving a broad range of partners and humanitarian actors, and the outbreak was successfully stopped as no new cases were detected in the country after September 2017.

As we see, we have achieved a lot of progress in the eradication of Polio virus in endemic and previously free of Polio countries. However, until now we can't fully eradicate the virus, but as much as the authorities coordinate with WHO and respond aggressively to any new cases, we can lastly fully eradicate this dangerous disease [1-4].

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