Poliomyelitis eradication in four stages

A erradicação da poliomielite em quatro tempos

La erradicación de la poliomielitis en cuatro tiempos

ARTIGO ARTICLE

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Abstract

This article's objective is to review the "state of the art" in the progress, obstacles, and strategies for achieving global polio eradication. Poliomyelitis control measures began in the 1960s with the advent of two vaccines, the oral polio vaccine (OPV) and the inactivated polio vaccine (IPV). From 1985 to 2020, strategies were implemented to reach the goal of eradication of wild poliovirus (WPV). Following the success with the interruption of indigenous WPV transmission in the Americas, the goal of global eradication was launched. We describe the process of eradication in four historical stages: (1) The advent of the inactivated and oral polio vaccines launched the age of poliomyelitis control; (2) The massive and simultaneous use of OPV had a significant impact on WPV transmission in the late 1970s in Brazil; (3) Domestic and international public policies set the goal of eradication of indigenous WPV transmission in the Americas and defined the epidemiological strategies to interrupt transmission; and (4) The implementation of eradication strategies interrupted indigenous WPV transmission in nearly all regions of the world except Pakistan and Afghanistan, where in 2020 the WPV1 transmission chains have challenged the strategies for containment of the virus. Meanwhile, the persistence and dissemination of circulation of OPV-derived poliovirus in countries with low vaccination coverage, plus the difficulties in replacing OPV with IPV, are currently the obstacles to eradication in the short term. Finally, we discuss the strategies for overcoming the obstacles and challenges in the post-eradication era.

Poliomyelitis; Vaccines; Epidemiologic Surveillance; Disease Eradication

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Introduction

Poliomyelitis control activities began in the 1960s with the advent of two vaccines, the oral polio vaccine (OPV) and the inactivated polio vaccine (IPV). From 1985 to 2020, control measures focused on reaching the goal of eradication of wild poliovirus (WPV). Following the success with the interruption of autochthonous WPV transmission in the Americas, the goal of global polio eradication was launched. Coordinated by the Global Poliomyelitis Eradication Initiative (GPEI), the narrative of eradication was one of successes and obstacles, of consensuses and controversies. We chose to adopt a historical narrative to situate readers in the process of eradication, describing the different milestones in four historical periods: (1) Demonstration of viral cytopathogenesis by Enders, Weller, and Robbins, opening the way for the development of the Salk and Sabin polio vaccines; (2) Massive and simultaneous use of the Sabin vaccine (OPV) had a definitive impact on the transmission of wild poliovirus in the late 1970s in Brazil, resulting in a drastic reduction in cases of paralytic poliomyelitis; (3) Domestic and international public policies set the goal of eradication of indigenous transmission of wild poliovirus in the Americas, defining the epidemiological strategies to interrupt transmission; and (4) Implementation of eradication strategies starting in 1985 in the Americas and since 1988 worldwide interrupted autochthonous WPV transmission in nearly all regions of the world, with the last transmission chains persisting in Afghanistan and Pakistan in 2020. Nevertheless, as the consequence of use of OPV, cases and outbreaks associated with vaccine-derived poliovirus (cVDPV) have become frequent and widespread in various countries, requiring new strategies to achieve final eradication. This article's objective is to review the "state of the art" in the progress and obstacles from 1985 to 2020 for achieving polio eradication.

Stage 1

"The golden age in the development of vaccines began in 1949 with the discovery of the virus' propagation in cell cultures (...). Although much had been learned about poliomyelitis and the virus that caused it, until 1949 there was no major expectation of possible development of prevention with the techniques available at the time. The article by Enders (1949) and colleagues in Science, describing poliovirus culture in human tissue, made the breakthrough with the finding anxiously awaited by scientists who were searching for a vaccine against poliomyelitis" 1 (p. 583).

The demonstration of viral cytopathogenesis by Enders et al. ² in 1949 allowed the development of safe and effective vaccines against poliomyelitis. The licensing and large-scale production of the Sabin live attenuated virus vaccine (OPV) 3,4,5, covering the three types of virus, poliovirus types 1, 2, and 3, and the Salk inactivated polio vaccine (IPV), also trivalent, in the 1950s launched the era of control of paralytic poliomyelitis. Soon after licensing of the OPV, further research identified the problem of genetic instability of the live attenuated virus contained in the vaccine. The OPV virus is capable of recovering its neurovirulence in the presence of certain immune conditions in some recipients of the first dose of the vaccine or their contacts, and the use of OPV can produce isolated cases of vaccineassociated paralytic poliomyelitis (VAPP). A retrospective study in Brazil estimated the occurrence of one case of VAPP per 2.39 million first doses and one case per 13.03 million total doses administered 6. In the world, there are an estimated 2 to 4 cases associated with type 3 vaccine virus per 1 million liveborn infants vaccinated with OPV 4.5. In Brazil, the use of trivalent OPV was already established practice 1,7 in the 1960s, while some pediatricians in various Brazilian cities were using IPV 1,7. However, non-systematic vaccination did not alter the epidemiological scenario of poliomyelitis, which was occurring endemically all across the country in the absence of epidemiological surveillance. The advent of the National Immunization Program (PNI) in 1973 inaugurated a new era for the control of vaccine-preventable diseases in Brazil. A major polio outbreak occurred in the states of Paraná and Santa Catarina in 1979 and changed the political conditions for implementing more effective polio control measures 1,7,8. The activities featured the organization of National Vaccination Days in 1980, consisting of mass and simultaneous vaccination of under-five children with trivalent OPV throughout the country, twice a year, at two-month intervals. The result was a 90% reduction, from 1,210 cases in 1980 to 120 cases in 1981 1.7.8. In the absence of effective epidemiological surveillance, it is reasonable

to assume an even greater impact from the National Vaccination Days on the occurrence of polio cases. The development of health policies and the conditions that allowed for a more effective polio control plan in Brazil is described in detail with extensive references in the studies by Nascimento ^{1,7} and Risi Junior ⁸. These studies systematically portray the history of polio eradication in Brazil and report in detail on the strategies adopted in the various phases of eradication. In the subsequent years of the 1980s, the reduction in the number of paralytic polio cases remained constant, now corroborated by an epidemiological surveillance system implemented in all states of Brazil. The polio surveillance system included a laboratory network for viral diagnosis and surveillance, together with other measures in the set of eradication strategies. Importantly, a large share of the strategies developed in Brazil later shaped the strategies adopted for global polio eradication. In 1985, the Pan American Health Organization (PAHO) proposed to the countries of the Americas the eradication of indigenous transmission of wild polioviruses ^{1,7,8}, laying out the strategies and actions to be developed at the continental level.

Stage 2

Given the impact on the occurrence of polio cases in Brazil, the OPV used on National Vaccination Days was chosen as the "silver bullet" and adopted as the main strategy for eradicating indigenous WPV transmission in the Americas. OPV is capable of interrupting WPV transmission by containing the live attenuated viruses excreted abundantly after vaccination. Circulation of the vaccine viruses in the environment for 1 to 2 months after mass vaccination campaigns in children under five years allowed indirect immunization of susceptible individuals that are not reached by vaccination. Other characteristics of the OPV that elected it as the vaccine of choice for eradication were its low cost, easy administration, and induction of mucosal and humoral immunity. By repeatedly and homogenously reaching more than 95% of the target group, that is, without leaving important pockets of susceptible individuals, circulation of the wild viruses became increasingly difficult, interrupting the transmission chains and the occurrence of cases of paralytic polio. The organization of Brazil's National Vaccination Days requires complex operational linkage by health services, expanding the vaccination capacity to cover the entire target group in the shortest possible time, normally on two days a year. In Brazil, the vaccination network reached more than 115,000 posts ^{7,8}, including permanent health units. All the logistics of the cold chain for maintenance of the vaccines and vaccination operations are performed by health professionals or under their supervision. However, the target public's appearance is what decides the undertaking's success or failure. The more effective the social mobilization, the higher the odds of success. This involves engaging the widest possible sectors of societies, such as public and private schools, churches, service clubs, and some sectors of commerce and industry. Polio eradication launched an unprecedented experience in public health, a public-private partnership with service clubs associated with Rotary International. Since the beginning of eradication in the Americas, Rotary International through its PolioPlus Program has financed vaccination activities, donation of vaccines, hiring of professionals for epidemiological surveillance, and direct participation in vaccination operations through mobilization of private sectors 9,10.

The main strategy of National Vaccination Days with OPV was added to the strategy of identifying suspected polio cases – epidemiological surveillance of acute flaccid paralysis (AFP) – and the containment strategy – outbreak control vaccination – to interrupt poliovirus transmission chains in the community. The definition of a suspected polio case was introduced in the epidemiological surveillance system: any case of AFP in children under 15 years, to be investigated within 24 hours of notification, with two fecal samples collected at 48-hour intervals for laboratory tests. At the onset of paralysis, when viral excretion is more intense, the probability of capturing genetic material from the virus is higher. Molecular biology methods became part of the daily routine in reference laboratories for polio diagnosis, by viral isolation and polymerase chain reaction (PCR), processing the differentiation between viral types and allowing molecular epidemiology to establish a genetic relationship between viruses, orienting the outbreak containment measures. The effectiveness of AFP surveillance is assessed with two indicators. The first is the annual detection rate of non-polio AFPs, of > 1 case per 100,000 inhabitants < 15 years of age in countries that have been certified polio-free, and that should maintain surveillance until global certification of eradication, and of > 2 cases in endemic countries. This indicator has been considered sensitive enough to detect polio cases. The second indicator is the percentage of fecal samples from AFP cases that reached the laboratory within 14 days from the onset of paralysis and in proper conditions of temperature and packing/storage. This indicator should be greater than 80% of the notified and investigated AFP cases. All suspected cases with or without laboratory confirmation should be revisited 60 days later for confirmation of paralysis, an irreversible sequela in poliomyelitis. Some cases remain in the probable category, when the clinical examination is suggestive of polio but the laboratory tests come back negative for poliovirus. Other cases are considered consistent with polio, without laboratory samples for logistic reasons - difficulty in conserving samples at the adequate temperature, contamination of the samples, losses, or impossibility of collecting samples in adequate time. Cases classified as consistent with polio or probable cases are reexamined and analyzed clinically by a committee of clinical specialists in neurology, pediatrics, and epidemiology, aimed at the final classification of each case. In order to contain the viral transmission chain around a suspected or confirmed case, outbreak containment vaccination/mop-up operations are introduced. Based on confirmation of a suspected case, outbreak containment measures are triggered, such as containment vaccination around the case, with vaccination/revaccination of children under five years, independently of the child's vaccination history, in a radius of 2 to 5 km. In urban areas, due to the difficulty in demarcating the viral circulation perimeter, it is common to vaccinate an entire neighborhood or even the entire city. In endemic areas with persistent pockets of susceptible individuals, vaccination is organized in the house-to-house modality.

Environmental virological surveillance was introduced into the eradication program to complement AFP surveillance and expand the monitoring of viral circulation in the communities; conducted in urban sewage systems, monitoring has been an important tool for revealing the extent of viral circulation in the environment. Waste water capture involves a simple collection technique, using ultracentrifugation and RT-PCR, and has proven effective for surveillance, especially in countries with large populations like India, whose certification of eradication included evidence of the absence of circulation of wild poliovirus, produced by environmental surveillance. Environmental surveillance has been used for more than 30 years to monitor the virus ^{11,12}. Environmental surveillance has gained growing importance in post-polio eradication strategies and as a complementary tool in other disease control programs.

Over the years, eradication strategies achieved important results, with a large reduction in polio cases associated with WPV. Considering the success in the Americas, the World Health Assembly in May 1988 adopted the resolution for global eradication of indigenous transmission of wild poliovirus by the year 2000 ¹³. The GPEI was launched, a partnership between the World Health Organization (WHO), the United Nations Children Fund (UNICEF), U.S. Centers for Disease Control and Prevention, Bill & Melinda Gates Foundation, and Rotary International. The GPEI has the role, among others, of coordinating and executing eradication activities together with local governments.

Stage 3

A milestone in the eradication process was reached in 1991 in Junín, Peru, when the last case of paralysis associated with wild poliovirus in the Americas occurred. In 1994, the Global Commission for the Certification of the Eradication of Poliomyelitis in the Americas, consisting of independent members of the scientific community, certified the eradication of wild poliovirus transmission. When WHO launched the goal of global eradication, it estimated an incidence of 350,000 cases of paralysis associated with the 3 types of WPV in 125 countries 7. In 2003, the goal of global eradication by 2000 had not been reached, but the number of endemic countries had been reduced from 125 to 7. There had been a 99% reduction in cases in the world with the interruption of indigenous transmission of the 3 types of wild poliovirus in the Americas (1994), Western Pacific (2000), and Europe (2002), regions which had the eradication certified by independent international commissions. Despite such progress, low vaccination coverage with OPV still prevailed in politically disrupted areas, in areas showing "fatigue" with the National Vaccination Days that had gone years without polio, and in other areas where anti-vaccines movements emerged. Such conditions created a favorable environment for the frequent and widespread occurrence of cases/outbreaks associated with vaccine-derived

poliovirus (cVDPV), predominantly type 2. The live viruses contained in OPV have the potential to recover their neurovirulence and cause cases of paralysis clinically similar to those caused by the wild virus 14. The first outbreaks associated with vaccine-derived poliovirus (cVDPV) dated to 1988 in Egypt 14. Revealed retrospectively after the investigation of similar cases in the Caribbean, the outbreaks in Egypt lasted for four years until interruption of the transmission. In 2000-2001, for the first time, an outbreak associated with type 1 vaccine-derived poliovirus (cVDPV1) was detected on the island of Hispaniola (Haiti and Dominican Republic)¹⁴. All the cases were in unvaccinated children, and they all occurred in communities with vaccination coverage between 7% and 40%. There were 13 cases in the Dominican Republic and eight cases in Haiti, including two fatal cases. Type 1 vaccine-derived poliovirus (cVDPV1), which circulates in the environment, has biological properties that are indistinguishable from wild poliovirus and possibly originated from a dose of OPV administered between 1998 and 1999. PAHO declared the outbreak in Hispaniola a regional emergency, and National Vaccination Days were promptly held in both countries. The results of the vaccination, reaching homogeneous coverage rates greater than 95%, repeated for three years, controlled the epidemic, but other outbreaks appeared in all regions of the world during the next two decades in relation to the increase in the use of trivalent OPV and thus greater circulation of the vaccine virus in the environment 15.

Stage 4

The eradication strategies, especially the use of OPV, were redefined and adjusted to respond to the new epidemiological scenarios with the occurrence of cases of paralytic poliomyelitis associated with the vaccine-derived polioviruses (cVDPV). In a scenario of absence of circulation of type 2 wild poliovirus (WPV2), the global eradication of which was certified in 2015, OPV had its formulation altered to contain only the type 1 and type 3 viruses. Type 3 virus (WPV3), absent since 2012, had its eradication certified in 2019. With the eradication of WPV3, the OPV was modified to contain only the type 1 virus. In this new formulation, monovalent OPV for type 1 has been used in the endemic areas of Pakistan and Afghanistan, the last reservoirs of WPV1 in the world.

Given the operational, political, and economic difficulties for executing the recommended actions to contain the outbreaks of cVDPV, disseminated in various countries, the goal of global eradication was once again postponed, this time until 2012. One more time, the goal was not reached. With the circulation of cVDPV in expansion, there was an increase in the use of monovalent type 2 OPV, generating more outbreaks. To respond to the growing challenges for reaching the goal of global eradication, the GPEI developed an endgame plan for 2013-2018, focusing on the final stage of eradication and the post-eradication era. The plan identifies priority countries for eradication and actions corresponding to the epidemiological situation. In 2013, WHO declared polio eradication an international emergency according to the International Health Regulations (IHR), establishing an emergency committee to monitor the situation and advise the GPEI in the process of global eradication, now without a defined target date. The development of a third surveillance system was introduced in 2015, aimed at identifying and controlling individuals with immunodeficiency, another source of spread of vaccine-derived virus, by prolonged excretion of immunodeficiency-related vaccinederived poliovirus (iVDPV) ^{16,17}. Although the magnitude of the problem is not entirely known, the trend is towards reduction in the number of individuals in this condition that excrete the poliovirus, through treatment with antivirals and early mortality of part of the immunodeficient individuals over the course of childhood 17. Poliovirus excretors are rare cases among immunodeficient individuals, who normally do not excrete poliovirus for long periods; a small proportion of these individuals can excrete the poliovirus for longer periods, for more than six months. A study in seven middle- and low-income countries in 2008-2013 investigated 562 immunodeficient individuals 18. Of these, only one excreted poliovirus for more than six months (the cutoff point in the study to define long-term excretors). A more recent study 19 analyzed all the cases (n = 101) of iVDPV from 1962 to 2016 in the registry of immunodeficient individuals maintained by WHO. Median excretion period was 1.3 years, and 90% of the individuals stopped excreting after 3.7 years. A change was observed in the occurrence of cases, from high-income countries to middle-income countries over the course of the

period, calling attention to the increased risk of transmission of poliovirus in these countries after stopping the use of OPV. In the study, the variables immunodeficiency syndrome and residence in high-income countries were the risk factors for long-term excretion. The endgame plan was revised and gained a new and updated version, currently in effect for 2019-2023 19. With evidence of the persistent circulation of cVDPV and the need to reduce the use of OPV, the strategy was introduced to replace OPV with IPV throughout the world ^{20,21,22}. The "shift", as the strategy is known, was supposed to have been completed in 2014 and 2015, when all the countries would have introduced two doses of IPV in their basic vaccination calendars, at four months and six months of age. The introduction of IPV in routine vaccination aimed to guarantee immunity against type 2 poliovirus and allow total replacement of trivalent OPV with bivalent against type 1 and type 3, which occurred globally in 2016 in routine immunization and campaigns ²³. The strategy to allow the stepwise substitution took into consideration the global IPV production capacity, the costs, training of personnel, and readjustment of the cold chain network. The introduction of IPV began a year before interruption of the use of trivalent OPV, to allow increasing the production and reducing the vaccine's price. Even today the production and availability of IPV are lower than the demand, and given the high cost, various countries have experienced difficulty in obtaining IPV. In 2016, the WHO set priorities for guaranteeing that there would be no shortage of IPV for high-risk countries ²⁴. Although all countries made the transition from OPV3 to OPV2, 35 lower-risk countries either did not introduce IPV in the scheduled timeframe or had to suspender vaccination with IPV after starting it. Another 14 countries only introduced IPV in routine infant immunization in 2018 and two other countries only introduced it in 2019. In late 2019, there was still a cohort of approximately 43 million children unvaccinated with IPV and thus without immunity to type 2 poliovirus ²⁵. Complementing the programs' routine immunization strategy, the third dose with bivalent OPV was maintained. Countries with more favorable economic conditions, such as high-income countries, totally replaced OPV with IPV years before. Brazil and 31 other countries of the Americas still use bivalent OPV in the booster doses at 15 months and 4 years ²⁶. The difficulty in obtaining IPV is still the biggest challenge for the post-eradication era, even though various countries are using the vaccine with fractioned doses. The possibility of using fractionated doses of IPV 26,27,28 should increase the vaccination coverage and result in the reduction of individuals susceptible to the poliovirus. The use of IPV in fractionated doses (0.1mL rather than 0.5mL) assumes changes in the vaccination calendar – 6 and 14 weeks – and in the administration procedure (intradermal rather than intramuscular) ²⁸. But the problem of cVDPV2 circulation is still unsolved. On the one hand, while IPV is highly effective in conferring immunity without the risk of producing vaccine-derived viruses, on the other it does not confer the same type of immunity as OPV, which prevents person-to-person transmission, necessary to contain outbreaks of cVDPV. Thus, simultaneously with the expanded use of IPV and seeking to respond quickly (from 2020 to 2021) to the outbreaks in countries of Africa, Asia, and the Middle East, the GPEI invested in the development of two new live vaccines, nOPV, the result of genetic techniques that reduce the reversal of the virus to neurovirulence ²⁹. The positive results of phase I trials with the two candidate vaccines were encouraging, and phase II trials began in 2018. If positive, the results are expected to accelerate the licensing and use of nOPV2 before late 2020 30,31.

Economic benefits of eradication vs. control

The economic aspect of eradication should be addressed. In 2013, the GPEI in its first version of the endgame 2013-2018 estimated that to implement the plan would require an additional USD 5 billion, in addition to the USD 9 billion spent on eradication since 1988. The benefits of eradicating polio may extend beyond the health area. Some modellings work with projections of expenses that are avoided with eradication, such as vaccine production, vaccination and surveillance activities, including laboratories and the social cost of individuals with paralysis. Based on projections by Tebbens et al. ³², the GPEI estimates that eradication will mean a savings of USD 40-50 billion by 2035, considering that the expenses in the initial years were higher with eradication, but that over time they would tend to be progressively lower than the control strategy.

Principal challenges for the final eradication of polio

In 2020, as provided in the endgame plan, the GPEI assessed the current stage of poliovirus surveillance in 40 countries that are considered priorities for achieving final eradication ³³. The plan for 2019-2023 provides the selection criteria and list of priority countries ²⁰. The plan analyzed the performance quality indicators for the surveillance of non-polio AFP, in individuals < 15 years (> 2/100,000), and the proportion of cases (> 80%) with adequate samples (2 samples with a 24-hour interval and collected within 14 days from the onset of paralysis) sent to the reference laboratory. The results indicate that in general, the countries showed a decline in the surveillance indicators from 2018 to 2019. There was a decline in the proportion of countries that met the two indicators, from 83% in 2018 to 63% in 2019. In 2019, the numbers of cases associated with WPV1 and cVDPV2 increased, respectively, to 176 and 368, with > 40 outbreaks of cVDPV in Africa and Asia. In 2020, as of August 5, a total of 85 cases of paralytical polio from WPV1 had been notified in two countries (Afghanistan and Pakistan) and 210 cases of cVDPV in 15 countries of Africa, Asia, and Western Pacific. The emergency committee of the International Health Regulations for polio, in its most recent meeting in June 2020³¹, considering the COVID-19 pandemic, issued a warning on the high risk of importing/exporting polioviruses, both WPV and cVDPV, due to the reduction in viral containment measures and the decrease in routine vaccinations. It is important to note that various countries have decreased their routine vaccination coverage rates, not only for polio but for the entire basic childhood vaccination scheme, in the last five years. Low vaccination coverage favored the reintroduction of measles in the Americas in 2018 and the expanded circulation of cVDPV in countries that have historically experienced difficulty in achieving adequate coverage rates. However, the possibility of using nOPV to contain the outbreaks of cVDPV, combined with the increase in coverage rates with IPV, point to promising avenues for interrupting the transmission of WPV1 and cVDPV. After the interruption of WPV transmission, the replacement of OPV with IPV should be completed in the medium term. In the absence of poliovirus circulation, in the post-certification phase of eradication, the containment of all polioviruses in laboratories will be essential for eliminating the possibility of accidental reintroduction of the virus in the community ^{20,26}. In this sense, in 2015, the countries of the Americas launched the destruction of all WPV, cVDPV, and Sabin type 2 viruses according to the Regional Plan for containment of the virus in the posteradication era 26. In this scenario of difficulties for interrupting the WPV1 transmission chains and containing the circulation of cVDPV (difficulties that are circumstantial but which may persist in the medium term), the old controversy of polio eradication versus polio control reemerges ³⁴. The debate that started in the 1990s ^{35,36} argued the following: on the one hand, that eradication as a vertical program would siphon off resources that should be invested in the development of primary care systems, and particularly from the immunization program in the less economically privileged countries, and on the other, evidence was produced that corroborated the positive impact of structuring both primary care and immunization programs. Polio eradication in the Americas played a structuring role in primary care, organizing the services and spearheading other public health actions, according to a report produced by an independent commission ³⁷. The report is cautious by acknowledging that the impact of eradication was positive in the specific context of health structure in Latin America and could not be extrapolated to regions with less developed health systems. More recently, similar studies were conducted on other continents, and their results corroborated those of the Taylor Commission in the Americas, but were not sufficiently striking to put the controversy to rest 37,38.

The choice of OPV in immunization programs and eradication has been the object of controversy over the decades. The potential to produce cases of VAPP and to be a source of widespread circulation of cVDPV takes the debate on the vaccine to the field of medical ethics, by considering that any case of paralysis produced by the vaccine is not ethically acceptable ²². The introduction of nOPV should interrupt the circulation of cVDPV2 and the progressive replacement of OPV with IPV, which even if fractionated should solve the problem of individual immunity to the poliovirus. These two strategies have the potential to contain, besides the poliovirus, the ethical debate that accompanies the trajectory with the use of OPV and the proposal for eradication. The ultimate achievement of poliomyelitis eradication may be revitalizing for health systems, particularly in the less favored countries. The positive impact of the success of eradication may extend to immunization programs as a whole, primary care, and other public health actions.

Contributors

J. F. S. Verani contributed to the conception, elaboration, and writing. F. Laender contributed to the writing and revision.

Additional informations

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Resumo

O objetivo deste artigo é rever o "estado da arte" dos avanços, obstáculos e estratégias para atingir a erradicação global da pólio. As ações de controle da poliomielite iniciaram na década de 1960 com o advento das duas vacinas antipoliomielíticas, a vacina oral da pólio (VOP) e a vacina inativada da pólio (VIP). No período de 1985 a 2020, são implementadas estratégias para atingir a meta de erradicação do poliovírus selvagem (WPV). Após o sucesso da interrupção da transmissão autóctone do WPV na região da Américas, foi lançada a meta da erradicação global. Descrevemos o processo de erradicação em quatro tempos: (1) O advento das vacinas VIP e VOP iniciou a era do controle da poliomielite; (2) A utilização massiva e simultânea da VOP teve impacto significativo sobre a transmissão do poliovírus selvagem no final da década de 1970 no Brasil; (3) Políticas públicas (nacionais e internacionais) decidem pela erradicação da transmissão autóctone do poliovírus selvagem nas Américas e definem as estratégias epidemiológicas para interromper a transmissão; e (4) A implantação das estratégias de erradicação interrompeu a transmissão autóctone do WPV em quase todas as regiões do mundo, exceto no Paquistão e Afeganistão, onde, em 2020, cadeias de transmissão do WPV1 desafiam as estratégias de contenção do vírus. Por outro lado, a persistência e a disseminação da circulação do poliovírus derivado da VOP, em países com baixa cobertura vacinal, somadas às dificuldades para substituir a VOP pela VIP constituem, atualmente, os obstáculos para a erradicação a curto prazo. Finalmente, discutimos as estratégias para superar os obstáculos e os desafios na era pós-erradicação.

Poliomielite; Vacinas; Vigilância Epidemiológica; Erradicação de Doenças

Resumen

El objetivo de este artículo es revisar el "estado de la cuestión" de los avances, obstáculos y estrategias para alcanzar la erradicación global de la polio. Las acciones de control de la poliomielitis se iniciaron en la década de 1960, con el advenimiento de las dos vacunas antipoliomielíticas, la vacuna oral de la polio (VOP) y la vacuna inactivada de la polio (VIP). En el período de 1985 a 2020, se implementan estrategias para alcanzar la meta de la erradicación del virus de la polio salvaje (WPV). Tras el éxito de la interrupción de la transmisión autóctona del WPV en la región de las Américas, se lanzó la meta de la erradicación global. Describimos el proceso de erradicación en cuatro tiempos: (1) El advenimiento de las vacunas VIP *v* VOP inició la era del control de la poliomielitis; (2) La utilización masiva y simultánea de la VOP tuvo un impacto significativo sobre la transmisión del virus de la polio salvaje, al final de la década de 1970, en Brasil; (3) Políticas públicas (nacionales e internacionales) deciden la erradicación de la transmisión autóctona del virus de la polio salvaje en las Américas y definen las estrategias epidemiológicas para interrumpir la transmisión; y (4) La implantación de las estrategias de erradicación interrumpió la transmisión autóctona del WPV en casi todas las regiones del mundo, excepto en Paquistán y Afganistán, donde, en 2020, cadenas de transmisión del WPV1 desafían las estrategias de contención del virus. Por otro lado, la persistencia y la diseminación de la circulación del virus de la polio, derivado de la VOP, en países con baja cobertura de vacunas, sumadas a las dificultades para substituir la VOP por la VIP constituyen, actualmente, los obstáculos para la erradicación a corto plazo. Finalmente, discutimos las estrategias para superar los obstáculos y los desafíos en la era poserradicación.

Poliomielitis; Vacunas; Vigilancia Epidemiológica; Erradicación de la Enfermedad

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