Increasing polio coverage with safer vaccines: a pressing need in Latin America

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Resumen

Ante el riesgo real de ocurrencia de brotes de parálisis fláccida aguda en la región debidos a poliovirus derivado de la vacuna Sabin o a la importación de poliovirus salvaje, la Sociedad Latinoamericana de Infectología Pediátrica comisionó a un grupo *ad hoc* de expertos integrantes del Comité de Vacunas y Biológicos de la institución, para redactar un documento oficial de posición sobre la necesidad imperiosa de incrementar los niveles de inmunización contra la enfermedad en la región e incorporar definitivamente en forma exclusiva la vacuna de polio inactivada en todos los esquemas nacionales de vacunación. La presente publicación discute las principales conclusiones y recomendaciones generadas como resultado de esta actividad.

Palabras clave: poliomielitis; polio; VPI; VPO; América Latina; SLIPE; cobertura vacunal; riesgos.

Abstract

Given the actual risk of poliomyelitis outbreaks in the region due to poliovirus derived from the Sabin vaccine or the importation of wild poliovirus, the Latin American Society of Pediatric Infectious Diseases commissioned an *ad hoc* group of experts from the institution's Vaccines and Biologicals Committee, to draft an official position paper on the urgent need to increase immunization levels against the disease in the region and incorporate inactivated polio vaccine exclusive schedules in all national immunization programs. This publication discusses the main conclusions and recommendations generated as a result of such activity.

Keywords: poliomyelitis; polio; IPV; OPV; Latin America; SLIPE; vaccine coverage; risks.

Introduction

Poliomyelitis or polio, is a highly contagious disease caused by an enterovirus. The vast majority of infections are asymptomatic or cause very mild flu-like symptoms. Viral meningitis (nonparalytic poliomyelitis), sometimes accompanied by paresthesia, occurs in 1% to 5% of patients within a few days after the initial minor illness has resolved. Rapid onset of asymmetric acute flaccid paralysis with areflexia of the affected limb (paralytic poliomyelitis) occurs in less than 1% of symptomatic infections, with neurological sequelae developing in approximately two-thirds of such patients[1].

Adults who contracted paralytic polio during childhood may develop the non-infectious post-polio syndrome 15 to 40 years later, characterized by a slow and irreversible exacerbation of weakness of the muscle groups affected during the original infection. The estimated incidence of post-polio syndrome in disease survivors is 25% to 40%[2].

Despite undeniable advances in the control and elimination of poliomyelitis worldwide, occasional outbreaks of infection by wild

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poliovirus (WPV) type 1, and more frequently, by circulating attenuated oral vaccine-derived poliovirus (cVDPV), continue to occur, which could lead to a reemergence of the disease or an increase in the number of cases of acute flaccid paralysis (AFP) associated with cVDPV strains[3,4].

In a publication two years ago, the Latin American Society of Pediatric Infectious Diseases (SLIPE) drew attention to various factors that increase the risk of poliomyelitis outbreaks in the region, such as the continued use of the attenuated oral vaccine (OPV), low rates of immunization in most of the countries and the poor epidemiological surveillance of AFP cases[5]. This situation continues to be worrisome and for this reason, SLIPE considered it a priority to issue the current document stating its position on the urgent need to increase the rates of vaccine coverage against the disease and incorporate inactivated polio vaccine (IPV) exclusive schedules into all national immunization programs.

Brief historical summary of the polio eradication process until 2016

Since the launching of Global Polio Eradication Initiative (GPEI) by the World Health Organization (WHO) in 1988, the number of reported cases of the disease worldwide has decreased by approximately 99.99%. WHO's Expanded Program on Immunizations, adopted by the Pan American Health Organization (PAHO) in 1979, marked a before and after in the fight against polio, allowing for a remarkable increase of vaccine coverage over a 40 years period, from 10% to more than 80%. In 2004, the renowned epidemiologist Ciro de Quadros summarized the achievements of vaccination, highlighting the advances of polio control in the region[6].

The WHO Region of the Americas was the first to be declared a WPV-free zone in 1994, after reporting its last case of WPV infection in 1991[6]. However, a historic event occurred in Haiti and the Dominican Republic in 2000, when an outbreak of cVDPV associated with a Sabin type 1 strain was documented, in a context of very low vaccination coverage. This situation generated an alert, not only due to the aforementioned cases, but because of the potential occurrence of similar episodes in the region, also[7].

Almost two decades ago, Daniel Tarantola, at the time Director of PAHO's Department of Vaccines and Biological Substances, stated: *"However, the emergence of the vaccine-derived poliovirus (VDPV)... serves to remind us that as long as we have polio in the world and we use the oral polio vaccine (OPV), there will always be a risk of reappearance of poliovirus." "There are places that continue to be a cause for concern. ... where poor surveillance, coupled with a low vaccination rate, greatly increases the possibility of an emerging situation, such as a vaccine-derived poliovirus (VDPV) outbreak"*[8].

As of 1991, with the elimination of WPV circulation in the region of The Americas, the isolated cases of AFP reported were classified as: a) "Vaccine-associated paralytic polio" (VAPP), and b) Paralytic polio caused by a vaccine-derived poliovirus (VDPV).

The occurrence of VAPP motivated some countries to adopt schedules with the exclusive use of IPV: i.e., Canada since 1996; USA sequentially at first in 1998, and exclusive IPV since 2000. After the alert triggered by the outbreak on Hispaniola island, the persistent circulation of VDPV prompted other countries to switch to the use of IPV either alone ("stand-alone") or combined in the first doses, or else, as an exclusive schedule[9]. This was the case of Mexico in 2007, Costa Rica in 2010, Uruguay and Brazil in 2012[9].

Since April 2016, with the suspension of the trivalent oral attenuated vaccine (tOPV) due to the eradication of WP type 2, some countries in the region introduced a sequential schedule with 1 or 2 doses of IPV, followed by bivalent oral polio (bOPV), either in the official immunization schedule or as part of campaigns during national immunization days. Nevertheless, other countries opted for the exclusive use of IPV: i.e., Panama adopted an IPV combined schedule in 2016, followed by an exclusive one in 2022; Chile IPV combined in 2017, and exclusive in 2019; Argentina IPV exclusive in 2020; and Colombia IPV stand-alone, with two bOPV boosters, in 2022[9,10].

Characteristics and current epidemiology of polioviruses

The following viruses are known to cause polio: WPV (serotypes 1, 2, and 3), VAPP-causing vaccine-associated viruses (serotypes 1, 2, and 3), and VDPV (serotypes 1, 2, and 3). The use of OPV, for different reasons, may associate with serious adverse effects, such as VAPP and paralytic polio caused by VDPV, in individuals who are recipients of the vaccine, as well as in contacts whether close or not. In the Region of the Americas, the estimated risk of VAPP was (before the switch of tOPV to bOPV) 1 case per 7.68 million doses administered. (CI = 1 case per 6.73-8.95 million doses administered)[5-9,11].

The viruses that cause VAPP and the VDPV are schematically classified according to their genetic characteristics. The polioviruses types 1 and 3 associated with VAPP have a genetic divergence (GD) from the Sabin strain in the nucleotide sequence of the VP1 protein region of the capsid of less than 1%, while for poliovirus serotype 2 this is less than 0.6%. On the other hand, VDPVs types 1 and 3 have a GD equal to or greater than 1%, whereas type 2 has

a GD equal to or greater than 0.6%. Both the polioviruses causing VAPP, and VDPV (regardless of serotype), may all produce disease with the same symptoms, severity, and lethality as WPV[5-9,11].

The cVDPV undergo mutations as they circulate, and a mutation rate of about 1% per year is thought to occur spontaneously; for this reason, the replication time can be inferred according to the degree of GD. The VDPV that remain replicating in individuals with primary immunodeficiency for an indeterminate period are called iVDPV, while those isolated from immunocompetent individuals in the absence of circulation in a community or recovered from wastewater and environmental sampling, whose source is unknown, are called ambiguos (aVDPV)[5-9,11].

As long as polio remained endemic, the true impact of VAPP and VDPV was not apparent. However, once the disease was being eliminated in various regions of the world, the cases of VAPP progressively surpassed the cases of WPV infection, turning this situation into a public health concern[12].

VAPP cases are more frequent after the first dose of OPV, although they may also occur after the second dose. Its incidence is 3,000 to 6,000 times higher in people with immunosuppression when the oral polio vaccine is used as the first dose. Currently, VAPP and VDPV illness far outnumber reported cases of wild polio[12].

The WPV serotype 2 has been considered eradicated in the world since 2015, but in recent years polio outbreaks caused by cVDPV type 2 have spread widely. When vaccination coverage is low, heterogeneous and insufficient, the number of susceptible children increases. Viruses that are eliminated through bowel movements and remain circulating in the environment (cVDPV) tend to develop mutations and in a variable period, estimated between 12 and 18 months on average, are capable of reacquiring neurovirulence. This circulation is more frequent when basic sanitation is inadequate. One of the most important initiatives of the strategic plan for the eradication of polio in its final phase 2013-2018, was the coordinated global withdrawal of the type 2 component of tOPV vaccine in April 2016, since the largest portion of VDPV cases were caused by this serotype[13].

The WHO recommended transition from OPV to IPV since 2016, in an attempt to avoid the risks of mutation of Sabin poliovirus strains generating VDPV. In principle, it proposed that all countries using OPV should introduce at least one dose of IPV, accompanied by the substitution of tOPV with a bOPV containing only polioviruses 1 and 3[12,13]. The aim was to promote the entire withdrawal of the OPV2 component, which is the main cause of VAPP and may also interfere with the immune response to poliovirus 1 and 3 in the tOPV vaccine. Therefore, the first step for the countries that used OPV was the incorporation of IPV, with the subsequent change to a complete schedule with this vaccine (i.e. exclusive IPV, used in stand-alone mode or combined with other antigens)[12,13].

However, after the switch from tOPV to bOPV, the number of cVDPV2 cases increased exponentially. Indeed, in 2016 only 2 cases of cVDPV2 had been reported worldwide, whereas 366 cases of cVDPV2 were reported in 2019, compared to 1,082 in 2020. The wide global circulation of cVDPV2 is illustrated by its occasional isolation from environmental samples. This year in London, England and then in New York, USA, where polio had not been a cause for concern for many years, active environmental surveillance demonstrated the presence of cVDPV2 in wastewater samples, causing alarm and great concern in view of the current inadequate immunization coverage rates. In the latter city, an additional case of AFP due to cVDPV2 was also reported. For cVDPV1, 12 cases were reported in 2019 and 34 cases in 2020. There were no reported cases of VDPV3 in the same period[14].

The WHO Strategic Advisory Group of Experts on Immunization (SAGE) has expressed serious concerns about the threat to the global eradication effort posed by cVDPV, and the spread of WPV1 in Afghanistan and Pakistan into previously polio-free areas in these countries, as well as the inability of the program to effectively control cVDPV outbreaks in Africa[15].

It should be noted that the November 2021 confirmation of a WPV1 AFP case in an unvaccinated 3-year-old boy from Lilongwe, the capital of Malawi, represents the first detection of WPV1 in the WHO African Region since 2016, when four cases occurred due to endemic transmission in Nigeria[16]. The WPV1 isolate in Malawi was genetically related to the virus detected in Pakistan in 2020. This long-distance international spread of polio, presumed to have been by sea or air traffic, is the first such spread recorded since the introduction of WPV1 in 2013 in Syria and Israel.

According to the conclusions of the recent thirty-second meeting of the Emergency Committee on the International Spread of Poliovirus, held on June 24, 2022, the WPV1 outbreak in southeastern Africa serves as a reminder to all countries of the risk of undetected import and subsequent propagation[16].

Another case of WP1 occurred on March 25, 2022 in Mozambique, a country very close to Malawi. Sequencing of the virus confirmed that it was similar to the imported WPV1 case confirmed in Malawi in February of the same year[17].

At the end of June 2022, the world had registered 12 cases of WPV1, in two endemic countries, Pakistan and Afghanistan, in addition to the already mentioned cases of WPV1 in Malawi (end of 2021) and Mozambique (2022)[18].

cVDPV outbreaks

Recent outbreaks of cVDPV in previously polio-free countries include the following:

cVDPV2

Tajikistan reported 33 cases in 2021; Nigeria 415 cases in 2021 and 26 cases in 2022; Yemen 66 cases in 2021 and 40 in 2022, Democratic Republic of the Congo 48 cases in 2022 and Ukraine 2 cases and 6 contacts, at the end of 2021 and 2022, respectively. The confirmation in the latter country of a case of polio caused by VDPV2 in a 17-month-old girl from the northwestern province of Rivne, and six healthy contacts (siblings of the girl), had strong repercussions[19]. In view of the massive population displacements and refugees generated during the current war conflict, there is much concern among international health authorities and recipient countries, due to this notification[19].

cVDPV 1

Madagascar reported 13 cases in 2021 and 5 in 2022[18].

cVDPV3

On March 7, 2022, a case of cVDPV3 was confirmed in an unvaccinated Israeli girl aged 3 years and 9 months, as well as in 6 close contacts. The girl developed AFP, and her stool tested positive for poliovirus. Of the seven children infected, only one was incompletely immunized, while the other six were unvaccinated[20,21]. Further testing revealed genetic similarities between the girl's isolate and VDPV3 strains detected in environmental samples collected from Israel and the Palestinian occupied territories between September 2021 and January 2022. These isolates, previously classified as VDPV3 of ambiguous origin (aVDPV3), were later reclassified as cVDPV3[21].

OPV Vaccine Considerations

At its April 2022 meeting, the WHO SAGE endorsed calls for an intensified effort to "Cessation of the Use of Oral Polio Vaccine (OPV) ", with the creation of specialized task forces aimed to enable a more efficient planning and implementation of global elimination of OPV in routine immunization programs, one year after certification of WPV eradication[22].

The epidemiology of WPV1 continues to be favorable, with very low numbers of wild polio cases reported in a 12-month period. However, SAGE expressed serious concern about the recent detection of WPV in Malawi, where transmission had been interrupted, as well as the ongoing transmission of cVDPV2, particularly in Africa, where Nigeria is still facing cVDPV2 outbreaks[22].

Main pillars of eradication

The main pillars to achieve polio eradication are:

- Adequate vaccination coverage.
- Timely epidemiological surveillance.
- Integration of national and regional polio control and immunization programs, both operationally and at the health policy level.

The greatest risk for the Americas at this time is the possibility of receiving imported cases of WPV or VDPV, in addition to the occurrence of autochthonous VDPV1 and VDPV3 infections, since several Latin American countries continue to use bOPV.

To lower such risk, it is critical to work on the following three aspects:

1. Reduce the probability of receiving imported WPV or VDPV as a result of exposure to travelers from other parts of the world where cases or outbreaks occur. Globalization implies significant risks of receiving an imported case in a matter of a few hours.
2. Increase the probability of detecting the aforementioned importation in due time (good quality of epidemiological surveillance), or identifying a VDPV1 or VDPV3 within the country itself. In this respect, it is necessary to comply with surveillance indicators and improve their performance, in order to avoid missing cases of AFP caused by poliovirus. Successful eradication activities require that all AFP cases in individuals < 15 years of age be investigated and possible poliovirus etiology excluded.
3. Achieve high and homogeneous vaccination coverage both at the national and regional levels, to prevent a possible outbreak after importation of WPV or VDPV.

For surveillance purposes, the following case definitions have been adopted[23]:

- Suspected case: any person < 15 years of age presenting with AFP for any reason, except severe trauma, or any person of any age with suspected poliomyelitis.
- Confirmed case: AFP associated with the isolation of WPV, with or without residual paralysis.
- Polio-compatible case: AFP with residual polio-like paralysis at 60 days, lack of follow-up, or death, in which a stool sample was not obtained within 15 days of onset of paralysis.
- VAPP case: AFP with onset of paralysis 4 to 40 days after administration of OPV (mainly following the first dose), presenting with typical polio clinical picture, including neurological sequelae at 60 days, and a Sabin virus isolated from feces showing limited GD in the nucleotide sequence of the VP1 capsid protein relative to the parent Sabin vaccine.

- VDPV-associated case: the sequenced virus corresponds to a VDPV.
- Discarded case (not polio): AFP for which one adequate stool specimen was obtained within 2 weeks after onset of paralysis and was negative for poliovirus.

The epidemiological indicators to monitor are as follows[24]:

- Coverage with 3 doses of polio vaccine: it must be ≥ 95%.
- Percentage of reporting units: at least 80% of regional divisions must submit weekly reports, even if no PFA case has occurred (negative reporting).
- AFP notification rate: at least one annual case of AFP should be detected per 100,000 people < 15 years of age.
- Investigation of cases within 48 hours of notification: this indicator must exceed 80%.
- Sampling of fecal material from the case within 14 days of the onset of the clinical picture: this indicator must be greater than 80%.
- Percentage of viral isolation: expected percentage is at least 10% of the samples received.

It is essential to consider the implementation of strategies to promote the notification of AFP cases, which are managed in hospitals or high complexity centers, according to the type of patient detected.

In 2020, the AFP rate in the Americas Region was 0.82, up to 85% of cases were investigated in < 48 hours, and 75% of cases had one adequate stool sample. The number of reported AFP cases decreased 39% in 2020 compared to 2019 (AFP rate of 1.33), and for the first time since 2006, the region did not meet the standard for AFP rate[25].

The recent performance in the region of three key indicators of AFP surveillance programs (investigation of diagnostic samples within the first 48 hours, collecting an adequate sample, and estimation of the AFP rate), are depicted in Figure 1.

In general, polio vaccination coverage must be higher than 95% and homogeneous. Countries should track unvaccinated or incompletely vaccinated children and ensure that they are covered by the vaccination program. Additionally, it is essential to accomplish effective vaccination campaigns, recover and complete immunization schedules if necessary, and work with scientific societies to improve the effectiveness of eradication programs.

Use of technological tools similar to those that allowed a successful massification of vaccination against COVID-19, and their incorporation to the strategies of National Immunization Programs, might also prove beneficial for polio eradication efforts[26].

Environmental surveillance is an excellent complement to the national surveillance system. However, given its high cost, countries should consider implementing environmental monitoring once the sensitivity of the PFA monitoring system has improved[27].

The accumulation of susceptible individuals due to low vaccination coverage and weak surveillance systems represent a challenge to sustained polio eradication in the

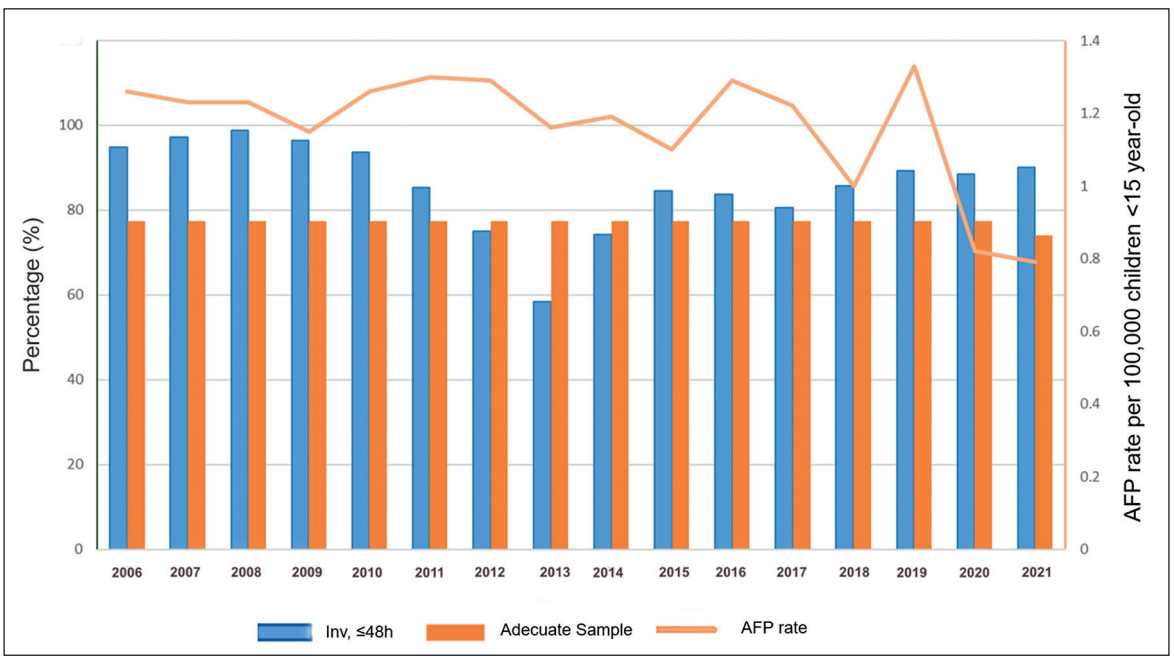

Figure 1. Indicators of acute flaccid paralysis surveillance performance in the Region of The Americas from 2006 to 2021. Source: Polio Surveillance System and Country Reports to FPL-IM/PAHO.

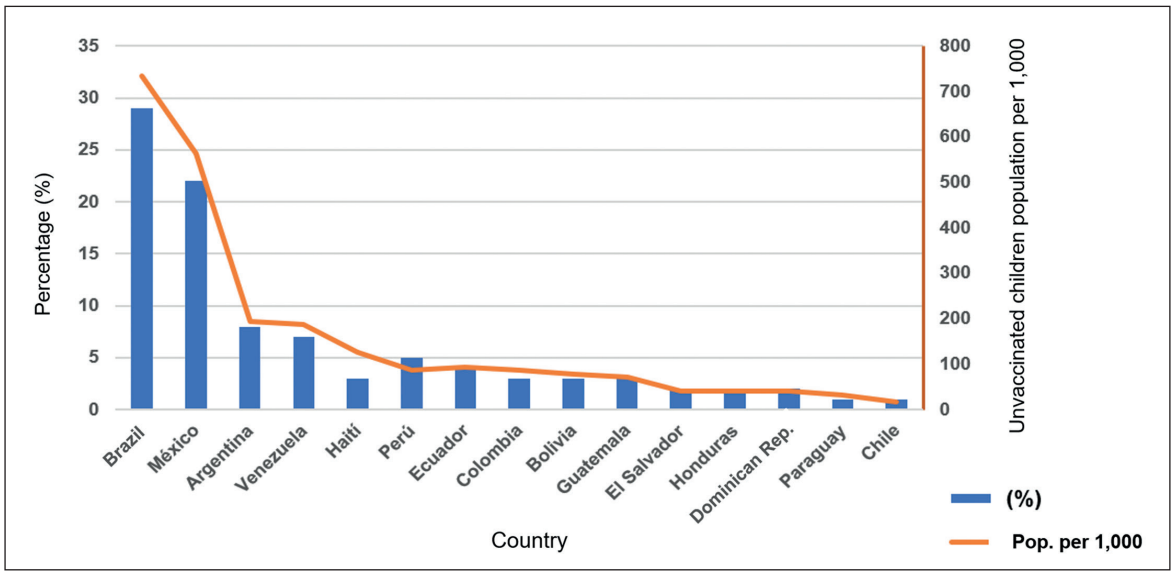

Figure 2. Population of children unvaccinated with 3 doses of polio vaccine (POL3), according to percentage contributed by each country. Region of The Americas, 2020. Source: Wuenic 2020, immunization coverage by antigen. Updated October 21, 2021 https://data.unicef.org/resources/immunization-coverage-estimates-data-visualization/

Americas. The available data shows a negative impact of the SARS-Cov-2 pandemic on vaccination coverage in the continent for the year 2020 and the risk of a decrease in coverage (See Figures 2 and 3).

Integration is considered one of the three foundations of the Polio Endgame Strategy 2019-2023 and is a strategic priority in the Immunization Agenda 2030 (IA2030) and the Gavi Plan 5.0 Strategy[26]. Sustained integration between polio control programs and national immunization programs would generate significant mutual benefits. In the case of polio, integration can help achieve eradication and address community fatigue in endemic countries. Similarly, the expertise and institutional presence generated by polio eradication campaigns can help reach and protect those children who have never received any doses of vaccine[26].

Polio vaccines currently available in Latin America

Inactivated Polio Vaccine (IPV)

IPV was developed by Jonas Salk at the beginning of the 50s of the last Century in the United States and since then, it has been widely used with great success for disease prevention throughout the world. It consists of inactivated (killed) viruses with strains of all three poliovirus serotypes (PV1, PV2, PV3). Since 1987, the composition of IPV was increased in its quantity of antigens, with high efficacy and effectiveness (eIPV, currently known as IPV), which is routinely used today[28].

It is administered by the IM route and induces the production of neutralizing antibodies in the blood that protect against all forms of polio disease caused by any of the three serotypes of WPV, or by VDPV of OPV[28.29].

The primary schedule of 3 doses (usually at 2-4-6 months) in the first year of life, stimulates a response that can reach 100% against the three serotypes of poliovirus in the vast majority of those vaccinated, offering a long-term protection. However, it induces very low levels of immunity in the intestine, which are insufficient to prevent WPV replication in the guts of infected persons[30]. It can be administered in combination with other antigens, therefore

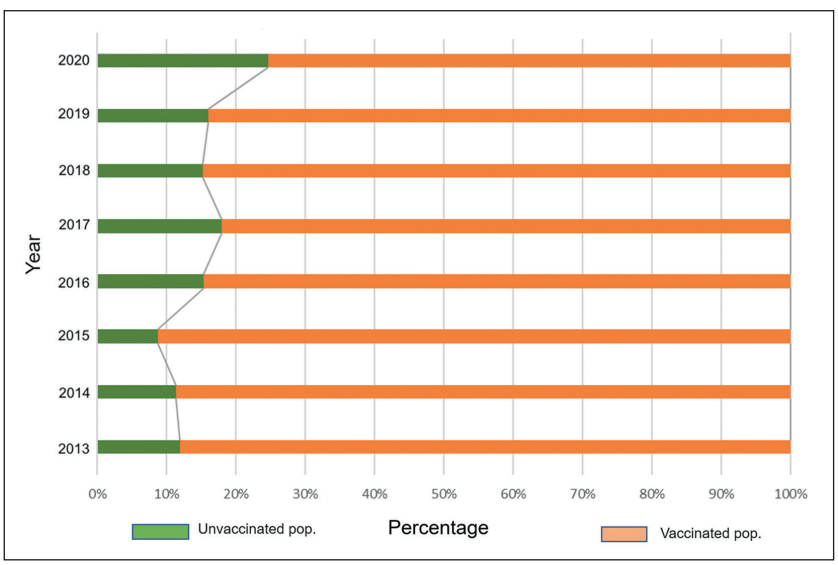

Figura 3. Percentage of populations of children vaccinated and unvaccinated with POL3. Region of The Americas, from 2013 to 2022. Source: Wuenic 2020, immunization coverage by antigen. Updated October 21, 2021 https://data.unicef.org/resources/immunization-coverage-estimates-data-visualization/

increasing adherence and as a consequence, achieving better vaccination coverages.

IPV is one of the safest vaccines available. Does not cause serious adverse events. Since it contains not live virus, there is no risk of causing VAPP or spreading VDPV in the community that might potentially cause polio[28,29].

Recommendation of use

IPV should be the vaccine of choice in all countries, even though timetables of administration may differ from each other. The schedule recommended by SLIPE consists of 3 doses in the primary schedule, with one additional dose (fourth dose) as a booster. There is no contraindication for an individual to receive a fifth or more doses of IPV, for example, prior to traveling to countries that still report cases of wild or attenuated oral vaccine-derived polio.

According to the WHO recommendation, at least the first two doses should always be with IPV, regardless of the calendar used by a country, precisely to prevent VAPP. Countries must prepare for such change and use only the IPV vaccine in their routine immunization against polio[22].

Once WPV is eradicated, only VDPV polio cases will remain circulating. It is for this reason that IPV is the recommended vaccine. The risk of polio disease in its different manifestations, including the paralytic form, will continue to be much greater with the uninterrupted use of the OPV in the vaccination schedules of many countries[22,28].

Due to the above-mentioned, the use of IPV is not recommended for outbreak containment, only for routine vaccination in any country.

From the moment of WPV1 eradication (given that currently, WPV2 and WPV3 are considered eradicated from the world), all OPV vaccination should be discontinued to prevent re-establishment of VDPV spread and transmission.[22]

Fractional-dose IPV (fIPV) for ID (intradermal) application

Due to operational difficulties, obstacles in adapting to the schedules used in Latin America and possible biases in its application, in addition to questionable data on efficacy when used in certain situations, the SLIPE does not recommend inactivated fractionated vaccine doses by ID route. This topic has already been extensively commented on in another publication[31].

Attenuated oral polio vaccine (OPV)

It was developed by Albert Sabin in the middle of last century and consists of a mixture of live attenuated poliovirus strains of each of the three poliovirus serotypes.

Before April 2016, the tOPV vaccine was the vaccine of choice used to prevent the disease and unequivocally contributed to a substantial (> 99%) reduction in the number of cases of wild-type virus disease. It was used in routine immunization throughout the world, especially in developing countries[32].

After the "switch" from tOPV to bOPV, as recommended by the WHO, all countries that choose to continue with the OPV should also use the IPV in their schedules, at least in the first dose, which would provide protection for serotype 2[33,34].

Several countries in the developed world already use only the IPV vaccine in their immunization calendars. However, for various reasons, many countries will still prefer to continue using OPV in a sequential schedule with IPV[32].

OPV has a lower cost as compared to IPV. It is administered in drops orally and thus, easily administered to a large number of people in a short period of time, such as in vaccination campaigns.

OPV is capable of generating a good, long-lasting protective immune response against the three poliovirus serotypes and also stimulates a good immunity of the intestinal mucosa, although this response may vary according to some factors, such as the coexistence of other enteroviruses and parasites. It is the vaccine of choice to contain outbreaks[32].

Monovalent oral vaccine against poliovirus serotype 2 (mOPV2)

After the discontinuation of the tOPV vaccine, there was an explosive increase in polio cases caused by cVDPV2, especially in some regions with low vaccination coverage. In order to control such cVDPV2 outbreaks, the mOPV2, a monovalent oral attenuated vaccine containing only serotype two poliovirus, was designed[35,36].

New oral polio vaccine type 2 (nOPV2)

The nOPV2 was developed with the goal of controlling outbreaks without the drawbacks of mOPV2. It is a new generation version of the original mOPV2, which clinical trials have shown to be safer and more effective in protecting against type 2 polio while being more genetically stable. The latter, should reduce the probability of the appearance of cVDPV2 in environments with low immunity[34]. Of note, although the risk of ensuing mutations is significantly lower than that observed with traditional OPV, it is not zero.

The nOPV2 is being used under the control of the WHO's Emergency Use Listing procedure (EUL), to enable rapid availability. Rollout of nOPV2 began in March 2021 in an initial group of countries that strictly met criteria for use of the vaccine. As of October 2021, millions of doses of nOPV2 have been administered to contain cVDPV2 outbreaks, especially on the African continent[34,35].

Polio vaccines under study

There are several studies with different vaccination approaches against polio, including the use of other technological platforms such as the Sabin-IPV, in contrast to the already well-known Salk-IPV, and new vaccine preparations with more genetically stable poliovirus 1, 2 and 3[35].

Schedules used in Latin America

By October 2020, thirteen countries and territories in Latin America had not yet introduced the second dose of IPV. Furthermore, Cuba and Ecuador still use the fIPV in different application schedules (Rey G, personal communication. Presented at the 26th Meeting of the Technical Advisory Group TAG, PAHO, July 2021).

As of July 2022, thirteen countries in the region used two doses of IPV IM at 2 and 4 months; 14 countries used 3 doses of IPV IM at 2, 4, and 6 months; 14 countries used IPV IM exclusively; and 34 countries and territories continued to use bOPV in their primary vaccination schedules, or in booster doses. Only one country continues to use bOPV at birth[37]. (Rey G, personal communication. Presented at the 26th Meeting of the TAG Technical Advisory Group, PAHO, July 2021)

SLIPE proposes a schedule with 3 doses of IPV in the basic schedule during the first year of life and a booster (fourth dose) at 18 months or at the age prior to school entry, around five to six years of age. There is no harm in applying a fifth or additional booster doses, as in the case of a previously vaccinated adult traveling to an endemic area of polio or with known circulating VDPV[38,39].

According to the WHO Strategic Plan 2022-2030, the second dose of IPV should currently be prioritized. It is expected that by the end of 2023 the absence of wild poliovirus 1 will have been validated and by 2030 the absence of cVDPV 1, 2 and 3 will be certified; thus, it would be possible to discontinue all use of OPV and initiate the exclusive use of IPV in countries that have not yet done so[29].

Conclusions

- The probability of polio reintroduction in the Americas remains a real threat.
- Factors that facilitate the potential reintroduction of poliovirus in the region are a low and heterogeneous vaccination coverage, as well as lack of compliance with flaccid paralysis surveillance indicators, all of which worsened during the pandemic.
- Regional migratory flows and, indirectly, armed conflicts in other countries, which cause mass international migrations, are also potential reintroduction factors.
- It is essential to maintain in each country a high vaccination coverage (greater than 95%), and it has to be homogeneous.
- In an increasingly globalized world, a real-time epidemiological alert system against the risk of poliovirus reintroduction is crucial.
- Timely detection of imported cases through adequate epidemiological surveillance, including molecular diagnosis, would help to prevent the spread of poliovirus and the consequent epidemic outbreaks. On a global level, a major public health problem is the silent circulation of VDPV, which cause most of recent polio outbreaks.
- It is necessary to emphasize the idea that eradication of poliomyelitis in the world not only implies interruption of WPV circulation, but also of currently prevalent VDPV originated from the OPV, for which we recommend the exclusive use of IPV.
- A greater integration between national and regional poliomyelitis control and immunization programs is required, which would instead help to achieve the goal of polio eradication and minimize the possibility of accumulation of pediatric populations inadequately immunize against the disease.
- All countries in the region should optimize their health surveillance systems to identify high-risk populations with significant groups of zero-dose children, particularly in places where recovery of surveillance activities after the COVID-19 pandemic has been only partial. Countries must also assume polio prevention and surveillance more aggressively, since the already limited available funds are frequently diverted to deal with other emerging public health problems, such as COVID-19 and monkeypox.
- Health authorities need to communicate clear messages about the importance of vaccination, in view of widespread "vaccine fatigue" and skepticism prevailing in many communities.

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