Current status of poliomyelitis in Latin America

Estado actual de la poliomielitis en Latinoamérica

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Resumen

La vacuna oral contra el poliovirus (OPV) ha sido fundamental en controlar la epidemia de poliomielitis, y destaca por su seguridad, eficacia, facilidad de administración oral y bajo costo. Sin embargo, a pesar de estas ventajas, al tratarse de una vacuna con virus vivos atenuados, existe la posibilidad de mutaciones que confieran neurovirulencia. Por ende, es importante la vigilancia de parálisis flácida aguda (PFA), ya sea asociada a las vacunas atenuadas (VAPP) o a los virus derivados de vacunas (VDPV). En esta revisión presentamos datos importantes de Latinoamérica en los últimos años, donde se revisan los datos de VDPV de transmisión comunitaria, de origen ambiguo y asociadas con inmunodeficiencias. Debido a la presencia de VDPV, es importante fortalecer el sistema de vigilancia epidemiológica por PFA, con datos muy inferiores a los recomendados en estos últimos años en las Américas. Adicionalmente, es fundamental mejorar las coberturas vacunales para reducir la cantidad de lactantes en riesgo de adquirir poliomielitis. En consecuencia, presentamos las tasas de cobertura vacunal con la vacuna inactivada contra el poliovirus (IPV) en la región y analizamos los programas de vacunación contra la poliomielitis en concordancia con las recomendaciones de la Sociedad Latinoamericana de Infectología Pediátrica (SLIPE; mínimo 3 dosis de IPV) y del Grupo de Expertos en Asesoramiento Estratégico (SAGE) sobre Inmunización de la OMS (mínimo 2 dosis de IPV). El estudio concluye con recomendaciones de los autores para el cambio de OPV a uso exclusivo de IPV, para aumentar las coberturas vacunales y para reforzar la vigilancia por PFA en la región.

Palabras clave: poliovirus; vacunación; Latinoamérica; recomendaciones.

Abstract

Oral poliovirus vaccine (OPV) has been instrumental in controlling the polio epidemic, and stands out for its safety, efficacy, ease of oral administration, and low cost. However, despite these advantages, as it is a live attenuated virus vaccine, there is the possibility of mutations that confer neurovirulence. Therefore, surveillance for acute flaccid paralysis (AFP) is important, whether associated with live vaccines (VAPP) or vaccine-derived viruses (VDPV). In this review we present important data from Latin America in recent years, where data on VDPV of community transmission, of ambiguous origin and associated with immunodeficiencies are reviewed. Due to the presence of VDPV, it is important to strengthen the epidemiological surveillance system for AFP, with data much lower than those recommended in recent years in the Americas. Additionally, it is essential to improve vaccination coverage to reduce the number of infants at risk of acquiring poliomyelitis. Consequently, we present the vaccination coverage rates with the inactivated vaccine against poliovirus (IPV) in the region and analyze the vaccination programs against poliomyelitis in accordance with the recommendations of the Latin American Society of Pediatric Infectious Diseases (SLIPE; minimum 3 dosis of IPV) and the WHO Strategic Advisory Expert Group (SAGE) on Immunization (minimum 2 doses of IPV). The study concludes with recommendations from the authors for the change from OPV to exclusive use of IPV, to increase vaccination coverage and to strengthen surveillance for AFP in the region.

Keywords: poliovirus; vaccination; Latin America; recommendations.

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Abbreviations

International nomenclature.

AFP	Acute flaccid paralysis
aVDPV	Ambiguous vaccine derived poliovirus
bOPV	Bivalent OPV (serotypes 1 and 3)
CoNaIn	Comisión Nacional de Inmunizaciones (Argentina)
COVID-19	Coronavirus Disease 2019
cVDPV	Community vaccine derived poliovirus
iVDPV	Inmunodeficient vaccine derived poliovirus
mOPV	Monovalent OPV
nOPV	New formulation for OPV-2
OPV	Oral poliovirus vaccine
PAHO	Panamerican Health Organization
SAGE	Strategic Advisory Group of Experts on Immunization
SARS-CoV-2	Severe Acute Respiratory Syndrome caused by coronavirus type 2
SLIPE	Sociedad Latinoamericana de Infectología Pediátrica
tOPV	Trivalent OPV
UNICEF	United Nations International Children's Emergency Fund
VAPP	Vaccine associated paralytic poliomyelitis
VDPV	Vaccine derived polioviruses
WHO	World Health Organization
wPV	Wild poliovirus

Introduction

Poliovirus is an enterovirus of the *Picornaviridae* family. There are three types of poliovirus that differ slightly in capsid protein, and thus in receptor specificity and antigenicity. Wild serotype 1 (wPV-1) is currently only found in two endemic countries (Pakistan and Afghanistan), while serotypes 2 and 3 (wPV-2 and wPV-3, respectively) have been eradicated. The last case of wPV-2 was detected in 1999 and was declared eradicated in the world in September 2015. The last case of wPV-3 was detected in 2012 and it was declared eradicated in October 2019[1].

The history of polio developed in three, well-defined periods. The first period was endemic, occurring until the 19th century, in which wPV infection determined the severity of the disease. Subsequently, the epidemic period occurred in the 20th century with urbanization, until the pandemic of 1955-1957, in which the iron lungs improved survival rates, but survivors had serious sequelae. With the distribution of the oral poliovirus vaccine (OPV) in 1955, the post-vaccination period began, which managed to eradicate two of the three wPV serotypes.

In 1988, the World Health Organization (WHO) launched the polio eradication initiative. This initiative involved mass vaccination campaigns that achieved a significant reduction in the circulation of wPV. At the beginning of the campaign, approximately 350,000 cases of paralysis were estimated in more than 125 countries, due to the three wPV serotypes. As of September 22, 2020, the WHO has reported 120 cases of wPV-1[2]. Although this serotype has not been eradicated, the progress of the campaign continues to be remarkable, achieving a reduction in cases due to the three serotypes of poliovirus greater than 99.9%. However, there is still a long and difficult road ahead to achieve wPV eradication.

Figure 1 presents the global evolution of poliomyelitis cases and the main events that have occurred over time. With the recognized leadership of Dr. Ciro de Quadros[3], the American continent was the first to obtain the eradication certification of the three wPV serotypes in 1994, after the last case was reported in Peru in 1991. Other regions achieved the disease eradication more than a decade later: Western Pacific (2000), Europe (2002), Southeast Asia (2014) and, more recently, Africa[4] (2020). To date, wPV is only endemic in Afghanistan and Pakistan, as it was already mentioned.

In April 2016, the WHO recommended the global transition from trivalent OPV (tOPV) to a bivalent vaccine (bOPV) that excluded serotype 2. This strategy aimed at reducing the circulation of vaccine-derived poliovirus 2 (VDPV-2). In addition, during the same period, it was recommended to start the sequential scheme with at least one dose of IPV –preferably the first dose– which has already been implemented in all the countries of the Americas region[5]. Vaccination schedules differ in terms of dates of administration and incorporate the IPV, either in the primary series between 1 and 6 months of age in addition to a booster, or, between 7 and 24 months (eg, Costa Rica) and between 4 and 7 years (eg, Uruguay).

As an example, the last case of polio due to wPV in Argentina was registered in 1984. In response to recommendations by the WHO[6], the Latin American Society of Pediatric Infectious Diseases (SLIPE)[7,8], and national experts, Argentina's National Immunization Commission (CoNaIn) introduced the poliovirus containment plan through the use of bOPV as of May 2, 2016 with use of IPV at 2 and 4 months, in a sequential schedule[9]. Through Ministerial Resolution 814/2020, the exclusive use of IPV was implemented in the primary series in 2020, with a reinforcement at 5-6 years before school entry, as of June 1, 2020.

Oral polio vaccine (OPV)

OPV contains live attenuated viruses and is safe and effective in most children. It is estimated that more than one billion children have received OPV and that this has

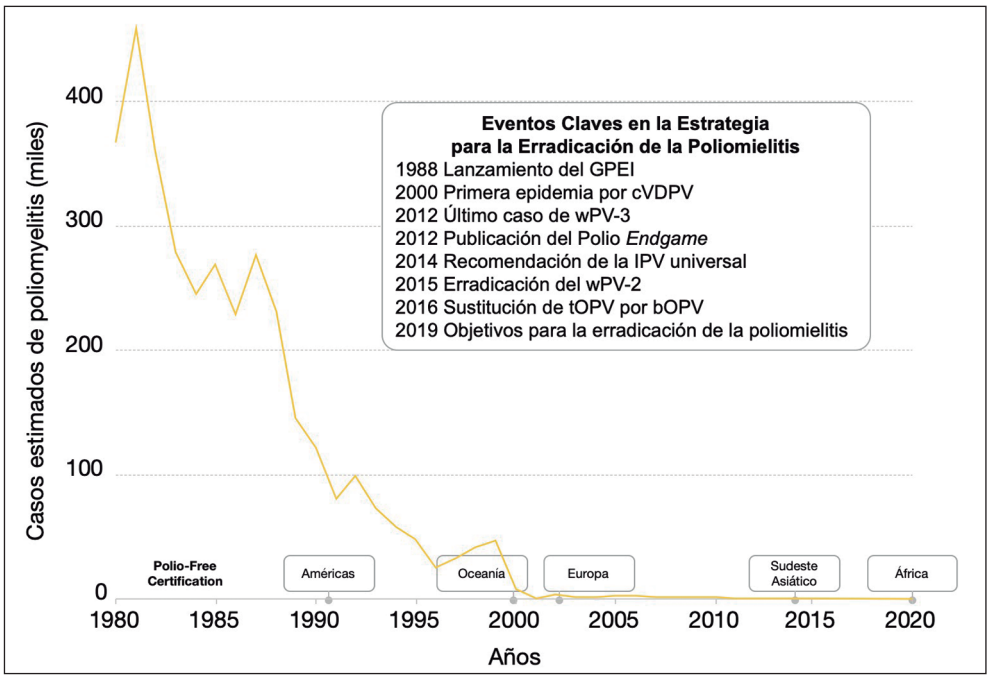

Figure 1. Global evolution of the frequency of poliomyelitis cases 1980-2020 and milestones in the eradication strategy. cVDPV: community circulating vaccine derived poliovirus; GPEI: Global Strategy for Poliomyelitis Eradication; bOPV: bivalent oral polio vaccine; WHO: World Health Organization; tOPV: trivalent oral polio vaccine; wP-2: wild poliovirus type 2; wP-3: wild poliovirus type 3. Source: prepared by the authors with data from https://ourworldindata.org/polio and from WHO (2020).

prevented more than 650,000 cases of polio in the world since 2010. Without a doubt, this vaccine was extremely important in the process of reducing polio worldwide. Its advantages include the ease of oral administration and low cost, which contributed to its extremely practical implementation.

Despite its safety and efficacy, OPV has some disadvantages. For example, infants require multiple doses to achieve reasonable protection. Furthermore, as it is a live attenuated virus vaccine, they are susceptible to mutations and re-acquire neurovirulence. Poliomyelitis due to VDPVs is indistinguishable from poliomyelitis due to wPV. Vaccine viruses are also excreted in the fecal route for over than two months and may infect other people in the community.

Depending on the intensity of the genetic divergence, mutant polioviruses can cause two types of acute flaccid paralysis (AFP) phenomena, namely:

- Vaccine-associated paralytic poliomyelitis (VAPP).
- Paralytic poliomyelitis by vaccine-derived poliovirus (VDPV).

Mutations and recombinations are practically out of the control of health systems because these mechanisms are spontaneous in circulating viruses[10]. Regardless of the degree of genetic divergence, VAPP and VDPV may cause poliomyelitis with the same symptoms, intensity and severity than wPV. The only proven way to avoid VAPP and VDPV cases is to exclusively use IPV, which does not contain live viruses and therefore has no potential for mutations.

Vaccine-associated paralytic poliomyelitis (VAPP)

VAPP cases are rare, and in the late 1980s, one case of VAPP was reported for every 0.5 to 2.2 million doses administered. All three types of Sabin viruses can cause VAPP and the risk is higher after the first dose of OPV and very high in immunocompromised people. Figure 2 presents VAPP cases by number of OPV doses applied. Data from Brazil, where the last case of wP paralysis was identified in 1989, show that in the period between 2005 and 2014, 94 cases of VAPP were identified in children under 5 years of age, caused by the Sabin type vaccine serotypes. 1 (19%), type 2 (14%), type 3 (31%) and the remaining isolates of more than one Sabin serotype[11].

Paralytic poliomyelitis by vaccine-derived poliovirus (VDPV)

VDPVs affect non- or under-immunized populations living in areas with inadequate basic sanitation. If vaccination coverage against poliovirus remains low in the community and sanitation is inadequate (eg, no provision of safe water or sanitary disposal of excreta),

VDPV isolated from the environment can be transmitted to susceptible populations, leading to emergencies. of the three types of VDPV.

Community-circulating VDPVs (cVDPVs)

cVDPVs are defined as isolates of VDPV for which there is evidence of person-to-person transmission in the community. All three types of Sabin viruses can mutate and cause paralysis; however, until 2016, the majority of cVDPV cases reported were serotype 2 (cVDPV-2)[15]. As already mentioned, in 2016 the transition from tOPV to bOPV was proposed. Two facts supported this decision: wPV-2 had already been eradicated and cVDPV-2 was the most frequent. This measure was expected to reduce the circulation of VDPV. Furthermore, PV-2 interferes with the immune response to PV-1 and PV-3.

After the switch to bOPV between 2016 and 2018, one case of VAPP was reported for every 15.5 million doses administered, but this reduction was expected to be more relevant, as had occurred in the United States of America in the second half of the 90s. On the other hand, the total elimination of cVPDV-2 was expected. In contrast, a dramatic increase in cVDPV-2 outbreaks was documented in several non-endemic countries. As of September 29, 2020, 409 cases were reported for cVDPV-2 and 15 cases for cVDPV-1[16]. Although only two countries currently have endemic wPV (Afghanistan and Pakistan), more than 20 non-endemic countries had outbreaks of cVDPV-2 and some also recorded outbreaks of cVDPV-1 during 2020.

In 2018 there was an outbreak of 26 cases of cVDPV-1 in Papua New Guinea[17], which cost more than 30 million US dollars (USD) to control and, in 2020, there is great concern about an outbreak of cVPDV-1 in Yemen[18]. Most of the epidemics with cVPDV-2 are reported in Africa and affect children who have not been vaccinated against serotype 2. Paradoxically, with the implementation of the monovalent vaccine (mOPV2), in an attempt to control outbreaks, the number of cVPDV outbreaks increased, both in countries that implemented mOPV-2 and in those where this vaccine was not used[19].

Despite the exclusion of the Sabin 2 virus from tOPV, the cases of cVDPV-2 increased dramatically: 2 during 2016 and more than 500 until October 27, 2020[16]. Therefore, approval is sought in record time of a new oral vaccine (nOPV), more stable than Sabin serotypes, and with a low probability of reverting to neurovirulence[20]. It should be noted that although the probability of reversion is low, it cannot be guaranteed that it will be null.

VDPVs circulate in the environment in masse after vaccination campaigns with the OPV-2 vaccine, either as a component of tOPV or as mOPV-2. For example, in Mexico, it was shown that cVDPVs circulated after a national vaccination campaign and were isolated up to 8 months afterwards[21-23].

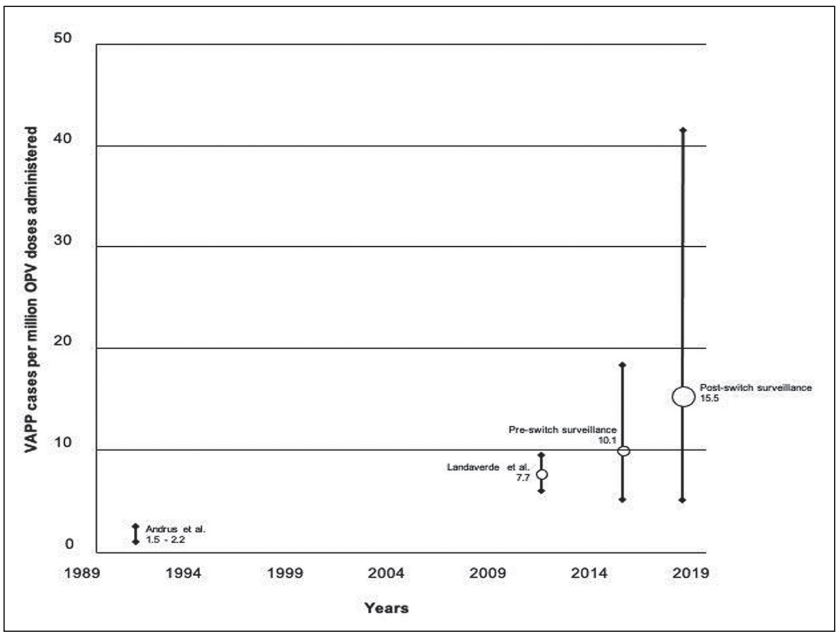

Figure 2. Trend of VAPP cases in the Latin American and Caribbean Subregion, 1992-2018. bOPV: bivalent OPV (serotypes 1 and 3); WHO: World Health Organization; OPV: oral poliovirus vaccine; tOPV: trivalent OPV; VAPP: paralytic poliomyelitis associated with vaccination. Source: Modified by the author (LHFA) based on references 12-14 and WHO surveillance data before and after the switch from tOPV to bOPV.

In Brazil, for 3 years in a row (2013-2015), environmental surveillance conducted in some sites in the city of São Paulo revealed the presence of Sabin virus types 1, 2, and 3 after the national vaccination campaigns and before the introduction of bOPV[24]. In Argentina[25] and Brazil[26], Sabin strains were detected in environmental waters, with mutations in the genetic region associated with neurovirulence. However, there are no reports of cVPDV cases in our region.

Ambiguous origin VDPVs (aVDPVs)

aVDPVs are isolates of VDPVs in individuals or environmental samples, with no evidence of community circulation or in individuals without documented immunodeficiencies[15]. As of October 20, 2020, 268 isolates of aVDPV-2 and 8 isolates of aVDPV-1 have been documented[16]. Table 1 presents the cases of cVDPV and aVDPV reported in the world between January 1, 2016 and October 20, 2020.

VDPVs in immunosuppressed patients (iVPDVs)

iVDPV cases are very rare, but it is estimated that they are underreported, as most were reported in high-income countries, with good conditions for surveillance and case investigation. Also, not all cases of iVPDV present with AFP, so they can escape surveillance systems.

Table 1. Cases of cVPDV and aVDPV (types 1, 2, and 3) reported worldwide between January 1, 2016 and October 20, 2020

Virus	2016	2017	2018	2019	2020[a]
cVDPV-1	3	0	27	12	17
cVDPV-2	2	96	65	366	531
cVDPV-3	-	-	7	-	-
aVDPV-1	-	-	7	26	8
aVDPV-2	5	2	65	196	268
aVDPV-3	-	-	11	-	-

aVDPV: Vaccine-derived poliovirus of ambiguous origin; cVDPV: community circulating vaccine-derived poliovirus; Source: Reference 16 ([a]as of October 20, 2020).

In an analysis of 107 cases compatible with iVDPV as of November 30, 2016, 74 (70%) presented with VAPP. The mean age was 1.04 years, which implies that more than half of the cases occurred in children over 1 year of age. Most of the cases were registered in developed countries and in 59% of the cases, the paralysis was diagnosed before the primary immunodeficiency[27].

Subsequent analyzes of other series of iVDPV cases coincided in this epidemiological behavior[28,29]. Of the 141 iVDPV cases analyzed, 58% occurred in infants under one year of age, 58% in men, and almost half were reported in countries of the middle-high income (47.5%). Most of these were due to iVDPV-2 (58%) and iVDPV-3 (20%)[28,29]. Before the switch to IPV, 62% of cases were associated with iVDPV-2 (alone or in combination) and, as of 2017, by iVDPV-1 and iVDPV-3[28].

In another series of 149 cases of iVDPV documented between the years 1961 and 2019, it was found that 66% of the cases were diagnosed between 2010-2019, 59% in infants younger than 1 year old, 28% in 1-5 year-olds, 13% in > 5-year-olds, 60% in men, 64% with VAPP as presenting symptom and 56% caused by iVDPV-2, 23% by iVDPV-3 and 17% by iVDPV-1)[30]. The study also stands out that 4% presented heterotypic combinations: iVDPV-2 with iVDPV-1 or with iVDPV-3[30]. Of the 149 cases in this series, 18 (12%) cases were reported in the Americas. It is important to note the detection of five cases of iVDPV in Argentina by the three serotypes: iVDPV-1 (n = 3), iVDPV-2 (n = 1) and iVDPV-3 (n = 1)[12,13,31].

Surveillance for acute flaccid paralysis (AFP)

Surveillance for AFP is the primary way to detect poliovirus disease. The quality of such surveillance is critical to achieving polio eradication. Unfortunately, underreporting of cases has been documented in the surveillance systems in the countries of the region, both in the notification of AFP, and in the collection and delivery of samples in the recommended time, with the forms properly filled out and follow-up of the cases, according to the recommendations. PFA surveillance should be supplemented by environmental surveillance, thus ensuring that surveillance sources of VDPV and potentially imported wPV are covered. The improvement in the sensitivity of surveillance activities is based on five pillars: effective detection, investigation, notification, monitoring and supervision of cases[31].

Since it was demonstrated that it was possible to eradicate the disease, notification of AFP has remained below the expected cases in most Latin American countries. Figure 3 presents the notification rates of AFP cases in the Americas between 2019 and 2020. For this period, a total of 1424 AFP cases were reported[32].

AFP notification rates do not reach the recommended minimum (1 per 100,000 population < 15 years) in most countries on the continent[32]. Only 4 countries (Mexico, Honduras, Costa Rica and Cuba; Figure 3, green bars) report rates higher than 1, while other 6 countries (Panama, Colombia, El Salvador, Paraguay, Nicaragua, Venezuela; Figure 3, yellow bars) approximate this rate, with values higher than 0.80. Nine countries and the Caribbean region report rates below 0.80 (Figure 3, red bars). Similarly, the recommended minimum number of samples is not achieved during the first 48 hours (80%) after notification[32]. In itself, this situation is worrisome, and it is aggravated by the pandemic of the disease caused by SARS- CoV-2, which has suspended and redirected numerous essential health services in Latin America and the Caribbean. In addition, when the borders are reopened, there is the possibility of re-introduction of wPV and/or cVDPV, especially with the suboptimal pre-pandemic vaccine coverage, which has been aggravated by the pandemic.

Some poliovirus environmental surveillance studies in the Americas show the effectiveness of switching from OPV to IPV in reducing the circulation of polioviruses. Between 2003 and 2005, the province of Córdoba, Argentina, implemented the change from OPV to IPV. Analysis at the end of the implementation cycle revealed that VDPV represented 19% of the positive environmental samples. Upon returning to the use of OPV the following two months, the percentage of VDPV in the environmental samples increased to 100%[25]. Another study of 31 environmental samples in Rio de Janeiro, Brazil, between 2011 and 2012 found enterovirus in 27 samples, of which 8 were found to be Sabin type (type 1 = 1; type 2 = 5; type 3 = 2), with no evidence of VDPV or recombinations[26]. More recently, between 2016 and 2017 in Port-au-Prince and Gonaïves, Haiti, non-polio enterovirus and Sabin poliovirus type 1 and 2 were found, but no strains of VPDV or wPV were detected[33].

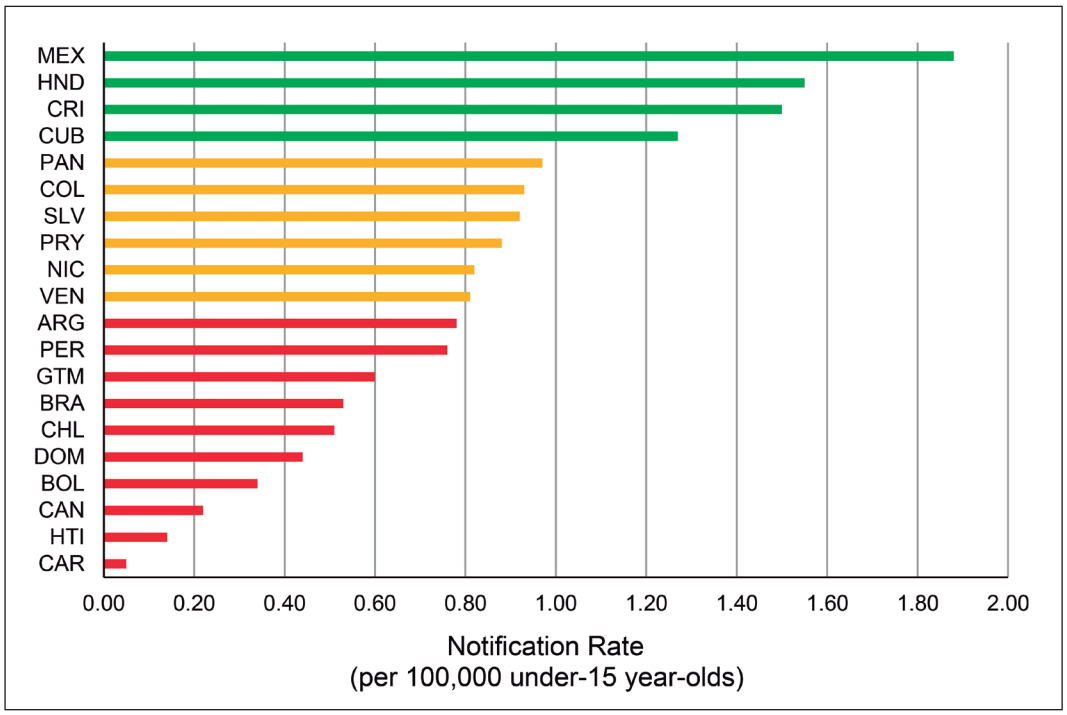

Figura 3. Notification rates (per100.000 under 15 year-olds) of acute placcid paralysis in the Americas by country, 2019-2020. a. From epidemiological week 40 in 2019 to epidemiological week 39 in 2020. Abbreviations correspond to the ISO code of each country; CAR = Caribbean; United States does not report data to the surveillance system; Equador and Uruguay did not submit data for the informed period. Source: Reference 32.

Vaccine coverage in Latin America

According to PAHO, Latin American countries present vaccination coverages that are too low and heterogeneous –between 81% and 95%– which does not allow achieving vaccine efficacy[14]. In practice, these figures result in large populations at risk of a new poliomyelitis outbreak. For example, Ecuador reports that approximately 70% of its children are not vaccinated with the first dose of IPV, which puts more than 100,000 children at risk for wPV-2[35]. Using data from 2019, UNICEF[35] estimated that Venezuela, with 55% coverage with one dose of IPV, has 226,000 children at risk of polio. The same year, the coverage with a dose of IPV from Brazil and Mexico were relatively higher (86% and 84%, respectively) but, due to the population density of these countries, it was estimated that the total number of children at risk of poliomyelitis is 400,000 in Brazil and 348,000 in Mexico[35].

2019-2023 Endgame Strategy for the eradication of poliomyelitis

The Endgame Strategy is based in three objectives during the 2019-2023 period[15]:

- Discontinue circulation of wPV.
- Discontinue transmission of VDPVs within 120 days of detection of an outbreak and eliminate the risk of future re-emergence, and
- Achieve and maintain vaccination coverage above 95%.

Although OPV remains extremely useful in the polio elimination process in the Americas, it is the leading cause of potential silent circulation of VDPVs[20]. Until a vaccine without risk of reversal is available, the Endgame Strategy[15] involves the exclusive use of three or more IPV doses with high vaccination coverage (≥ 95%)[34]. For this reason, SLIPE presented a recommendation of four doses of IPV (3 in the primary series + 1 booster), either as monovalent or polyvalent in combination with other vaccines of the immunization program of each country in the region[7].

To date, all Latin American countries have introduced at least one dose of IPV (Table 2). Five countries (Costa Rica, Mexico, Chile, Uruguay, and Argentina) have implemented the SLIPE recommendation of at least 4 doses of IPV. Except for Mexico, the rest of these countries have stopped using IPV entirely.

In October 2020, the WHO Strategic Advisory Group of Experts (SAGE) on Immunization recommended that all countries in the world using one dose of IPV switch to using two doses of IPV to increase protection against wPV-2[37]. In Latin America, this recommendation affects the vaccination schedules of

Table 2. Polio vaccination schedule in Latin American countries, as of October 1, 2020

IPV doses	Countries	Schedule
5	Costa Rica	Pentavalent aP-IPV vaccine at 2, 4, 6, and 18 months and booster with Tdap-IPV in preschool-age children. Does not use OPV
4	Argentina and Uruguay	Stand-alone IPV at 2, 4, and 6 months and booster at 4-6 years. Does not use OPV
	Chile	Hexavalent aP-IPV vaccine at 2, 4, and 6 months and booster at 18 months. Does not use OPV
	Mexico	Hexavalent aP-IPV vaccine at 2, 4, and 6 months and booster at 18 months. Still recommends booster with bOPV in preschool-age children and during vaccination campaigns
3	Brazil and Colombia	Stand-alone IPV at 2, 4, and 6 months and booster with bOPV at 18 months and between 4-6 years or during vaccination campaigns
	Panama	Hexavalent aP-IPV at 2, 4, and 6 months and bOPV at 18 months and between 4 and 6 years
2	El Salvador, Guatemala, Honduras, Paraguay and Peru	Stand-alone IPV at 2 and 4 months; 3rd dose and boosters with bOPV
	Ecuador	2 divided doses of IPV, other doses with bOPV
	Cuba	2 divided doses of IPV at 4 and 8 months, other doses with bOPV
1	Bolivia, Haiti, Nicaragua, Dominican Republic, and Venezuela	Stand-alone IPV at 2 months; 2nd and 3rd doses with bOPV, other doses with bOPV

aP: acellular pertussis vaccine. bOPV: bivalente oral polio vaccine. IPV: inactivated polio vaccine. OPV: oral polio vaccine. Tdap: Tetanus, diphtheria, and acellular pertussis vaccine. Source: Modified from reference 36.

Bolivia, Haiti, Nicaragua, the Dominican Republic and Venezuela (Table 2).

Conclusions and Recommendations

Three key elements in Latin America significantly increase the risk of polio outbreaks: continued use of OPV, low vaccine coverage, and inefficient AFP surveillance. Thus:

- As long as OPV available today is used, we will continue to monitor the presence of VDPV, as the virus will continue to circulate and can cause polio in susceptible populations, especially children. With the data available so far, polio will only be eradicated by discontinuing OPV and using IPV exclusively.
- Maintain a schedule of no less than 3 doses of IPV, removing OPV from the schedule. A fourth dose is recommended at 18 months and, if possible, a fifth dose between 4 and 6 years to maintain immunity for longer.
- In previous years, vaccine coverage was already low, especially in 2019. This situation was aggravated by the restrictive measures imposed by COVID-19, further reducing coverage and leaving thousands of children unprotected globally, including Latin American children.
- Improved AFP surveillance is essential for detecting cases of wPV, VAPP, cVDPV, iVDPV, and cases associated with bOPV. High-quality epidemiological surveillance of AFP with environmental surveillance is essential. Despite being expensive and difficult to carry out, environmental surveillance is essential to supplement the epidemiological surveillance of AFP.

Control and improvement of these three key elements in Latin America continue to be a priority in the process of eradication of poliomyelitis. Governments should do everything possible to ensure the proper functioning of these pillars, including:

- Priority in vaccination, with complementary and sustainable vaccination actions, both within and outside the walls, until reaching a coverage equal to or greater than 95%.
- Allocation of resources for vaccination.
- Sustained policy for the allocation of resources and prioritization of vaccination.
- Communication strategy to give credibility and confidence in the vaccination process.
- National leadership and public trust.

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