

Risk Assessment on poliomyelitis (polio): implications for the Region of the Americas

25 April 2023

Risk assessment date: 21 April 2023

Overall risk in the Region

High

Confidence in available information in the Region

Moderate

Criteria		Assessment		Risk	Rationale
		Likelihood	Consequences		
Potential risk to human health	Regional	Likely	Moderate	High	<ul style="list-style-type: none"> Between 2019 and 2023, cases of vaccine-derived poliovirus (cVDPV2 and VDPV1) were reported in countries of the Region of the Americas (See <i>exposure assessment</i>). In one of every 200 poliovirus infections, irreversible paralysis occurs (usually of the lower limbs), and 5% to 10% of these cases die from paralysis of the respiratory muscles. Poliomyelitis (polio) mainly affects children under five, but anyone who is not vaccinated can get the disease, regardless of age. Current conditions in the countries and territories of the Region leave vulnerable groups exposed, which could have a potential impact on the severity of clinical presentation and lethality in these groups. The untimely attention of cases due to: 1) a poor health seeking behavior, 2) healthcare workers' lack of experience in detecting and managing cases, and 3) cultural or geographical access barriers, could negatively influence the prognosis of the disease. Polio requires sensitive epidemiological surveillance of acute flaccid paralysis (AFP), including immediate investigation of cases and timely collection of samples. Inadequate polio vaccination coverage and poor AFP surveillance could lead to polio outbreaks in the Region.
Risk of the event spreading	Regional	Likely	Moderate	High	<ul style="list-style-type: none"> The increase in the population susceptible to poliovirus is a result of low vaccination coverage in general for all immunobiologics (See <i>context evaluation</i>). AFP surveillance is weakened, evidenced by the poor performance of surveillance indicators (See <i>context assessment</i>). This could delay detection, notification, confirmation, and control actions at the source. In 2023, a case of vaccine-derived poliovirus type 1 (VDPV 1) was detected in Peru. The complete sequence of the VP1 region of the VDPV1 viral genome presented 31 nucleotides of difference with Sabin virus 1 (VP1) and was not genetically related to any other previously sequenced VDPV1, including those currently circulating in countries with cVDPV1 outbreaks. This is a new VDPV1. Susceptible individuals persist among indigenous populations living along borders. Difficulty maintaining adequate vaccination levels in the migrant population within the Region and from other Regions.
Risk of insufficient prevention and control capacity with available resources	Regional	Likely	Major	High	<ul style="list-style-type: none"> Health service capacity is overburdened due to the impact of concurrent public health emergencies. Limitations and barriers to providing vaccination services to indigenous and migrant populations and other vulnerable populations. Limited capacity of some country-territories of the Region to rapidly detect poliovirus circulation and interrupt transmission through vaccination. The population vaccine hesitancy¹ regarding vaccination is high in some countries of the Region and has been enhanced by misinformation during the concurrent COVID-19 pandemic.

¹ Our World in Data. Vaccination. Available in: <https://ourworldindata.org/vaccination#note-24>

Background information

Hazard assessment

Poliovirus is a human enterovirus with three serotypes: type 1, type 2, and type 3. Wild poliovirus was the cause of thousands of cases of acute flaccid paralysis (AFP) and deaths over many years; however, after the introduction of polio vaccines, only wild poliovirus (WPV) type 1 continued to circulate. The last WPV type 2 (WPV2) was isolated in 1999 and declared eradicated in 2015, while the last WPV type 3 (WPV3) was isolated in 2012 and declared eradicated in 2019. Immunity to one serotype does not confer immunity to the other two. Polio is transmitted by the faecal-oral route, entering the body through the mouth and multiplying in the intestines. Infected people shed poliovirus into the environment for several weeks, spreading rapidly in areas with poor sanitation (1-4).

The incubation period is 7-21 days (range - 40 days). Poliovirus infection can cause minor illness with mild symptoms to infections, including the central nervous system, leading to paralysis. Approximately 90% of infections are asymptomatic or present with nonspecific fever. Other symptoms may include aseptic meningitis, fever, malaise, headache, nausea, and vomiting. If the disease evolves with severe clinical manifestations, intense muscle pain, neck and back stiffness with flaccid paralysis may occur. Paralysis usually presents asymmetrically, with fever at the beginning. Paralysis of the respiratory muscles can be life-threatening. Although some improvements in paralysis may occur during convalescence, paralysis that persists after 60 days is likely to be permanent (1-4).

All cases of AFP among children younger than 15 years should be reported, and stool samples should be tested for viral isolation in cell culture. When positive isolation is obtained, intratypical differentiation is performed by quantitative reverse transcription polymerase chain reaction (RT-qPCR). These assays allow an initial characterization of Sabin-like or non-Sabin-like polioviruses. If vaccine-derived poliovirus (VDPV) is suspected, the VP1 region sequencing test of the viral genome allows genetic characterization of the virus and is the final confirmatory test (1-4).

The diagnosis of paralytic poliomyelitis is based on: (i) clinical evolution, (ii) virological tests, and (iii) residual neurological deficit 60 days after the onset of symptoms (1-4).

There are two types of vaccines commercially available for routine immunization: an oral poliovirus (OPV) vaccine and an inactivated poliovirus (IPV) injectable vaccine. In rare circumstances, adverse events associated with OPV could result in a case of vaccine-associated paralytic poliomyelitis (VAPP), which may occur in vaccinated individuals or their contacts, and the emergence of vaccine-derived poliovirus. The incidence of VAPP has been estimated at 2 to 4 cases/million births per year in countries using OPV (1).

When vaccination coverage is very low, live attenuated viruses from OPV vaccines (Sabin virus) can, through prolonged replication in an individual or community, reacquire the neurovirulence and transmissibility characteristics of wild poliovirus (WPV). Through genetic mutations, they can become VDPV causing isolated cases or outbreaks of paralytic poliomyelitis. VDPVs are genetically divergent forms of the original Sabin vaccine virus conventionally defined by more than 1% genetic divergence (or a change of more than 10 nucleotides [nt]) for PV1 and PV3 and greater than 0.6% (or more than six nt changes) for PV2, in the VP1 region of the viral genome (1).

Vaccine-derived polioviruses (VDPV) are classified into three categories: **(1) cVDPV**, circulating VDPV, is a VDPV that demonstrates human-to-human transmission in the community, based on detections of genetically related viruses in human and/or environmental samples; **(2) iVDPV**, VDPV associated with immunodeficiency, is a VDPV from individuals who have evidence of primary immunodeficiency. Unlike immunocompetent persons, who excrete the vaccine virus for a limited period, in rare cases, individuals with a primary immunodeficiency may excrete a

genetically divergent vaccine virus for an extended period after receiving OPV; and **(3) aVDPV**, ambiguous VDPV, is a Poliomyelitis VDPV for which the VP1 sequence is not genetically linked to other previously identified VDPV sequences and there is no evidence of primary immunodeficiency if the virus is from an individual. A VDPV sequence will be classified as ambiguous based on laboratory results, epidemiological research, and communication with field teams, technical experts, and laboratory staff at WHO Headquarters and the WHO Regional Office. Isolates can be from people with no known immunodeficiency or from an environmental sample, without evidence of circulation (5).

Exposure assessment

In 2019, PAHO/WHO was notified of the detection of three VDPVs (two VDPV1 and one VDPV3) in environmental samples in *Guatemala*. These vaccine-derived polioviruses were genetically different and unrelated to each other. A poliovirus outbreak response assessment (OBRA) was conducted between July and August 2021. There was no evidence of circulating VDPV, so all three VDPVs were classified as aVDPV (ambiguous VDPV) (6).

On 21 July 2022, due to surveillance conducted in the *United States*, the New York State Department of Health reported a paralytic poliomyelitis in an unvaccinated individual in Rockland County. Initial sequencing by the U.S. Centers for Disease Control and Prevention (US CDC) identified a vaccine-derived poliovirus type 2 (VDPV2). Subsequently, US-CDC reported the detection of poliovirus in environmental samples from the county of residence of the case and nearby counties (Orange and Sullivan) collected between 21 April and 26 August 2022. These samples were consistently positive for Sabin virus type 2 with genetic sequences related to the virus identified in the New York State polio case; therefore, it was classified as circulating vaccine-derived poliovirus type 2 (cVDPV2). Due to these findings, wastewater surveillance was initiated by repeatedly detecting poliovirus in samples collected in Rockland, Orange, and Sullivan counties, as well as in samples collected in New York City and a sample in Nassau County. As of 22 March 2023, US-CDC sequencing analysis confirmed the presence of poliovirus type 2 in 101 wastewater samples² (7).

On 23 December 2022, *Canada* reported the detection of vaccine-derived poliovirus type 2 (VDPV2) in two wastewater samples collected in August 2022; (i) an environmental sample collected on 27 August 2022, from a wastewater treatment plant, eight nucleotides apart from the VP1 region of Sabin virus type 2, and (ii) an environmental sample collected on 30 August at a sampling site, with six nucleotides difference from Sabin virus type 2. Genetic sequencing confirmed that these are related to cVDPV2 detected in New York, United States (8). All subsequent samples collected in Canada (n=23) were negative for poliovirus. Additional analyses conducted by the U.S. CDC on the two samples of VDPV2 isolated from environmental samples collected in Canada on 27 and 30 August of 2022, confirmed that they are genetically related to cVDPV2 from the Rockland County acute flaccid paralysis case and to polioviruses found in environmental samples collected from several counties in New York State between May and December of 2022.³

On 21 March 2023, the National Focal Point for the International Health Regulations of Peru notified PAHO/WHO of a laboratory-confirmed case of vaccine-derived poliovirus type 1 (VDPV 1)⁴. The case is a child who, at the date of symptom onset, was 14 months old, belonging to an indigenous community of the district of Manseriche in the Datem del Marañón Province of the Loreto Department, with no history of vaccination, nor a history of travel before the onset of symptoms. On 28 December, he was referred to the Regional Hospital of Loreto and on 29 December he presented paralysis in the lower limbs. Based on this, faecal samples were collected and sent to the regional

² New York State Department of Health. Wastewater monitoring. January 2023. Accessed on 18 April of 2023. Available from: <https://on.ny.gov/3IKLw3w>

³ Global Polio Eradication Initiative, Canada. State: affected by circulating vaccine-derived poliovirus type 2 (cVDPV2). Available at: <https://bit.ly/3kxlQhL>

⁴ Ministry of Health of Peru. National Center for Epidemiology, Prevention and Control of Diseases of Peru. Epidemiological Alert. Presentation of a case of vaccine-derived poliovirus in the macro-east of the country. 22 March 2023. Available at: <https://bit.ly/3UNWaLh>

reference laboratory. The investigation and clinical evaluation of the case ruled out that it was an immunocompromised patient (9).

The National Institute of Health of Peru sent the case samples to the regional polio reference laboratory, the Oswaldo Cruz Foundation - Fiocruz in Brazil, for the genetic characterization of the virus, where the detection of vaccine-derived poliovirus serotype 1 (VDPV type 1) was confirmed. On 31 March, Fiocruz reported that the complete sequence of the VP1 region of the viral genome presented 31 nucleotides of difference with Sabin virus 1 (VP1) and was not genetically related to any other previously sequenced VDPV1, including those currently circulating in countries with cVDPV1 outbreaks. This is a new VDPV1 (9).

During the field investigation, six native communities have been intervened, and a case of acute flaccid paralysis (AFP) has been identified in the town of Atahualpa, Maseriche District, in a minor of 18 months, still under investigation, with an onset date of paralysis on 25 December 2021. A total of nine faecal samples were collected from the four contacts and from other children without the polio vaccine, in addition to 21 environmental samples (9).

Context assessment

Vaccination coverage

In 2021, according to WHO and UNICEF estimates of national immunization coverage (WUENIC)⁵, vaccination coverage for vaccine-preventable diseases has been low in the Region of the Americas. It has declined significantly over the past 10 years.

In 2020, coverage of the third dose against polio OPV or IPV (polio3) greater than or equal to 95% was not achieved in 28 countries/territories of the Region of the Americas, and 17 countries had coverage less than 80%: Argentina, Bahamas, Bolivia, Brazil, Ecuador, El Salvador, Grenada, Guatemala, Haiti, Honduras, Mexico, Panama, Paraguay, Peru, Saint Lucia, Suriname, and Venezuela (10) (**Figure 1**).

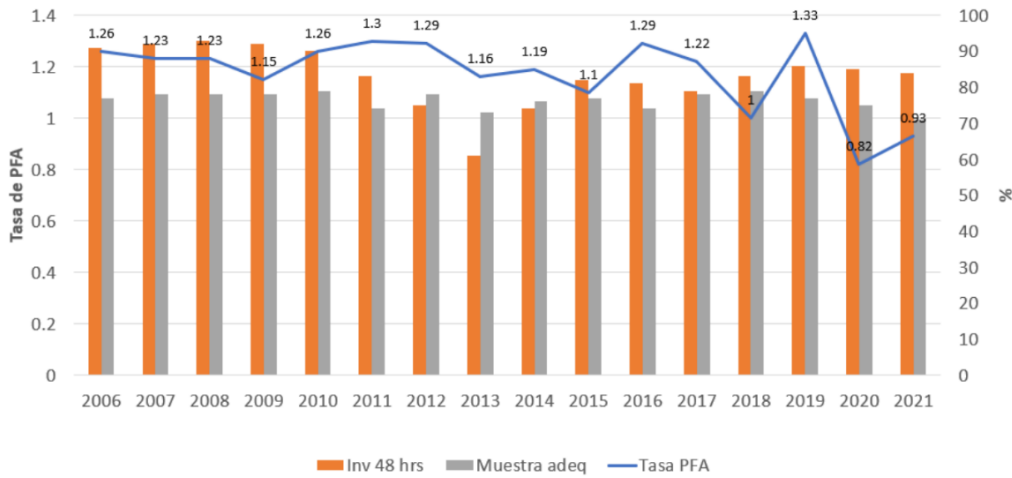
Regional vaccination coverage for the third dose of polio vaccine (Polio3) in 2021 was at 80%. The decrease in coverage began before the pandemic. When comparing the coverage rates of 2018 and 2019, the decrease was observed in 20 of the 39 countries/territories of the Region. Comparing coverage between 2018 and 2021, coverage decreases are observed in 33 of the 39 countries/territories. According to the information available for 2021, approximately 5.7 million children under one year of age (corresponding to 46% of the regional birth cohort) live in areas where coverage is <80%, and 1.3 million of these children live in municipalities with coverage <50% (11) (**Figure 1**).

Decreased mucosal immunity to type 2 virus among young children born after the *switch* (from trivalent OPV (tOPV) to bivalent OPV (bOPV) + IPV, coupled with low IPV immunization coverage, contribute to the risk of a cVDPV2 outbreak.

Some countries have repeatedly reported coverage below 80% in some areas at the subnational level, increasing the risk of a resurgence of VDPV.

⁵ WHO/UNICEF WUENIC vaccination coverage estimates. Available in English at: <https://bit.ly/2x7CSGA>

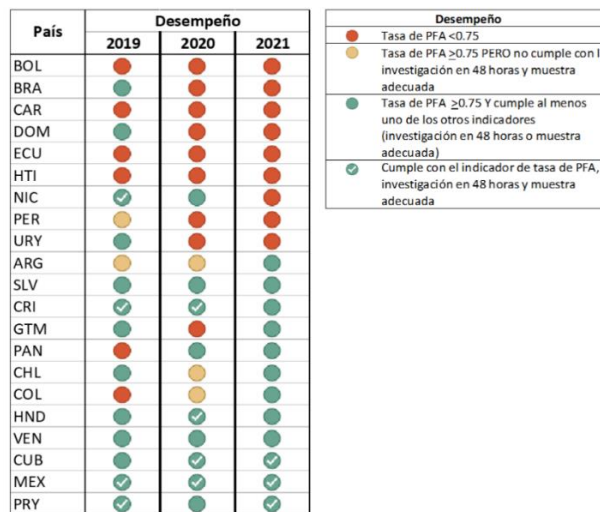
Figure 2. Indicators of AFP surveillance. Region of the Americas, 2006-2021*



* Preliminary data from 2021.

Source: PAHO/WHO. 14th Meeting of the Regional Certification Commission (RCC) for Polio Eradication in the Region of the Americas. Report of the meeting. Available from: <https://bit.ly/3loZFdx>

Figure 3. Overall AFP surveillance performance, Region of the Americas, 2019-2021.



Source: PAHO/WHO. 14th Meeting of the Regional Certification Commission (RCC) for Polio Eradication in the Region of the Americas. Report of the meeting. Available from: <https://bit.ly/3loZFdx>

Health Systems and services in the Region of the Americas

Health systems and services in the Region have experienced the impact of concurrent Public Health Emergencies of International Concern (PHEIC) (COVID-19, mpox, and polio), in health systems and services, during the last three years:

- Chronic challenges to health systems such as fragmentation, inequity in access to comprehensive health services, shortage of health workers, inequitable access to health technologies, limited capacities for essential public health functions (EPHF), underfunded infection prevention and control (IPC) programs, and limited compliance with IPC practices.
- The continuity of essential services provided at the first level of care has been limited, mainly in peri-urban and rural areas and indigenous populations.
- Reduction in demand for vaccination services.

- Postponement of vaccination campaigns.
- Negative social and economic impact.

Vulnerable Populations in the Region of the Americas

- Migration within the Region of the Americas and from other Regions has increased due to social, political and economic crises in countries and territories.
- Populations of indigenous communities are especially susceptible to developing diseases due to various barriers to access to health care services and vaccines; therefore, they have a higher risk of getting sick and developing life-threatening complications.
- Unvaccinated children under five, school-age children, pregnant women, healthcare workers, military service personnel, inmates' communities and persons who, by the nature of their occupation, are in contact with large numbers of people daily.

Table 1: Strengths and vulnerabilities of countries and territories in the Region of the Americas by Subregion related to their capacity to respond to polio outbreaks, April 2023.

Southern Cone Subregion ⁶
Strengths
<ul style="list-style-type: none"> • Polio3 vaccination coverage for 2021 is above 80% in two countries and is equal to or greater than 95% in one country (10). • In 2022, up to EW 52, in four of the five countries of the Subregion (Argentina, Brazil, Chile and Paraguay), the number of AFP cases reported was above the expected number (12). • Two countries Argentina and Paraguay have implemented follow-up vaccination campaigns against measles, rubella, and polio, reducing population immunity gaps. However, contingency plans are still required in countries whose campaigns did not reach 95% coverage at national and subnational levels (13).
Vulnerabilities
<ul style="list-style-type: none"> • Between 2020 and 2021, Polio3 vaccination coverage decreased in three of the five countries. In 2021, OPV 3 coverage greater than or equal to 95% was only achieved in one of the five countries (10). • Health and epidemiological surveillance systems are overburdened by public health events occurring simultaneously. • Migratory movements and challenges in reaching unvaccinated immigrants. • Exposure of vulnerable populations. • Overcrowding in temporary and residential shelters, rural and peri-urban areas; challenges in implementing prevention and control measures. • Challenges in maintaining the cold chain in rural and peri-urban areas.
Andean Subregion ⁷
Strengths
<ul style="list-style-type: none"> • In 2022, up to EW 52, in three of the five countries of the Subregion (Bolivia, Colombia and Venezuela), the number of reported AFP cases is above the expected number (12). • Three countries in the Subregion (Bolivia, Colombia, and Venezuela) have implemented follow-up vaccination campaigns against measles, rubella and polio that have reduced population immunity gaps. However, contingency plans are still required in countries whose campaigns did not reach 95% coverage at national and subnational levels (13).
Vulnerabilities
<ul style="list-style-type: none"> • In 2023, one country identified a case of vaccine-derived poliovirus type 1 (VDPV 1) (9) • Between 2020 and 2021, Polio3 vaccination coverage decreased in 3 of the 5 countries. In 2021, none of the 5 countries in the Subregion achieved Polio3 coverage greater than or equal to 95% (10). • The number of AFP cases reported as of EW 52 of 2022 is below the expected number in two of the countries in the Subregion (12). • Indigenous communities are moving along the border between Brazil, Colombia, and Venezuela. • Health systems and epidemiological surveillance systems are overburdened by public health events occurring simultaneously. • Migratory movements and challenges in reaching unvaccinated immigrants.

⁶ Argentina, Brazil, Chile, Paraguay, and Uruguay.

⁷ Bolivia, Colombia, Ecuador, Peru, and Venezuela.

<ul style="list-style-type: none"> • Exposure of vulnerable populations. • Overcrowding in temporary and residential shelters, rural and peri-urban areas; Challenges in the implementation of prevention and control measures. • Challenges in maintaining the cold chain in rural and peri-urban areas.
North America Subregion⁸
Strengths
<ul style="list-style-type: none"> • Polio3 vaccination coverage by 2021 is at or above 90% in both countries (10).
Vulnerabilities
<ul style="list-style-type: none"> • In 2022, one of the countries identified a case of circulating vaccine-derived poliovirus type 2 (cVDPV2) (7). • In 2022, two countries identified vaccine-derived poliovirus type 2 (VDPV2) in wastewater samples (7, 8). • In 2022, up to EW 52, the number of AFP cases reported is below the expected number in one of the countries in the Subregion (12). • Migratory movements.
Latin Caribbean Subregion⁹
Strengths
<ul style="list-style-type: none"> • Polio3 vaccination coverage for 2021 is above 95% in one of the two countries (10). • In 2022, as of EW 52, in one of the countries of the Subregion (Cuba), the number of AFP cases reported is above the expected number (12). • In 2022, one of the countries in the Subregion (Dominican Republic) has successfully implemented its follow-up vaccination campaign against measles, rubella, and polio, which has reduced population immunity gaps, reaching 97% at the national level and is still continuing with documented sweeps to further reduce immunity gaps (13).
Vulnerabilities
<ul style="list-style-type: none"> • The number of AFP cases reported as of EW 52 of 2022 is below the expected number in one of the countries (12). • Health systems and epidemiological surveillance systems are overburdened by public health events occurring simultaneously. • One country has an active cholera outbreak. • Social, economic, and political crisis in a border country. • Migratory movements.
Non-Latin Caribbean Subregion¹⁰
Strengths
<ul style="list-style-type: none"> • Polio 3 vaccination coverage for 2021 is above 80% in seven countries/territories (10).
Vulnerabilities
<ul style="list-style-type: none"> • Between 2020 and 2021, polio3 vaccination coverage decreased in 8 countries/territories. In 2021, Polio3 vaccination coverage greater than or equal to 95% was only achieved in two of the countries/territories (10). • Health systems and epidemiological surveillance systems are overburdened by other public health events occurring simultaneously. • One country has an active cholera outbreak. • Social, political, and economic crisis in one of the countries. • Migratory movements.
Central American Isthmus and Mexico Subregion¹¹
Strengths
<ul style="list-style-type: none"> • In 2022, as of EW 52, in six of the countries of the Subregion (El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama), the number of reported AFP cases is equal to or above the expected number (12). • Four countries in the Subregion (El Salvador, Honduras, Mexico, and Nicaragua) implemented follow-up vaccination campaigns against measles, rubella, and polio that have reduced population immunity gaps. However, contingency plans are still required in countries whose campaigns did not reach 95% at national and subnational levels (13).
Vulnerabilities
<ul style="list-style-type: none"> • Between 2020 and 2021, OPV3 vaccination coverage decreased in three of the eight countries. In 2021, OPV3 coverage greater than or equal to 95% was not achieved in seven of the eight countries (10).

⁸ United States of America, and Canada.

⁹ Cuba, Dominican Republic, and Puerto Rico.

¹⁰ Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Bermuda, Bonaire, Curaçao, Dominica, Grenada, Guadeloupe, French Guiana, Guyana, Haiti, Cayman Islands, Saint Martin Island (France), Saint Martin Island (Netherlands), Virgin Islands (United States), Virgin Islands (United Kingdom), Jamaica, Martinique, Montserrat, Turks and Caicos Islands, Saba, Saint Barthélemy, San Kitts and Nevis, Sint Eustatius, Saint Lucia Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

¹¹ Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama.

References

1. WHO. Poliomyelitis. Available from: <https://bit.ly/3RTjZza>
2. Heymann DL. Manual of control of communicable diseases. American Public Health Association. 2000.
3. Field Manual - Control of communicable diseases in emergencies. MA Connolly. WHO/CDS/2005.27. Available from: <https://bit.ly/3dgE4Av>
4. American Academy of Pediatrics. Report of the Red Book of the Committee on Infectious Diseases, 29th Edition. 2012. Available from: <https://bit.ly/2IZZ7D4>
5. Global Polio Eradication Initiative. Standard operating procedures. Responding to a poliovirus event or outbreak. Version 4. March 2022. Geneva: GPEI; Available from: <https://bit.ly/3LjZedF>
6. National Focal Point for the International Health Regulations in Guatemala. Email reportss. Not published.
7. National Focal Point for International Health Regulations in the United States. Email reportss. Not published.
8. National Focal Point for International Health Regulations in Canada. Email reports. Not published.
9. National Focal Point for the International Health Regulations in Peru. Email reports. Not published.
10. World Health Organization/United Nations Children's Fund (UNICEF). WUENIC vaccination coverage estimates. Available from: <https://bit.ly/3c2ZAEr>
11. Pan American Health Organization/World Health Organization. 14th Meeting of the Regional Certification Commission (RCC) for Polio Eradication in the Region of the Americas. Report of the meeting. Available from: <https://bit.ly/3LlpbuL>
12. Pan American Health Organization / World Health Organization. Polio Weekly Bulletin. Available from: <https://bit.ly/3mXKtW3>
13. Immunization Unit of the Pan American Health Organization / World Health Organization.