



**Standard Operating Procedures for
Polio Environmental Surveillance Enhancement Following
Investigation of a Poliovirus Event or Outbreak**

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Abbreviations and Acronyms

AFP	acute flaccid paralysis
ADM1	administrative level 1
aVDPV	ambiguous vaccine-derived poliovirus
bOPV	bivalent OPV (contains Sabin types 1 and 3)
CO	WHO country office
cVDPV1/2/3	circulating vaccine-derived poliovirus type 1/type 2/type 3
DTP3	Diphtheria-tetanus-pertussis vaccine (third dose)
ES	environmental surveillance
GPEI	Global Polio Eradication Initiative
GPLN	Global Polio Laboratory Network
iVDPV	immunodeficiency-associated vaccine-derived poliovirus
mOPV2	monovalent OPV (contains Sabin type 2)
nOPV2	novel OPV type 2
ORRP	Outbreak Response Plan
OPV	oral polio vaccine
RO	WHO regional office
SL2	Sabin-like poliovirus type 2
SOP	standard operating procedure
tOPV	trivalent OPV (contains Sabin types 1, 2 and 3)
VDPV	vaccine-derived poliovirus

Introduction

Although acute flaccid paralysis surveillance is the gold standard of polio surveillance, supplemental surveillance methods such as environmental surveillance (ES) provides additional information to assess the extent of poliovirus circulation (1).

The purpose of this document is to provide standard operating procedures to enhance environmental surveillance following investigation of any polio event or outbreak (Type 1, 2 or 3) to monitor, on a short-term basis, the presence or absence of vaccine-related virus following detection of vaccine derived poliovirus (VDPV) through Acute Flaccid Paralysis (AFP) Surveillance or through the existing environmental surveillance network (2). The document is divided into two sections, describing: i) general principles for enhancing polio environmental surveillance following investigation of a polio virus event or outbreak of any type, and ii) specific details on responding to a type 2 event or outbreak, previously described in the Concept note for Environmental Surveillance Enhancement Following Detection of Vaccine-Related Type-2 Poliovirus, June 2020 (3).

Potential uses for environmental surveillance

<i>Inside known infected communities</i>	<ul style="list-style-type: none"> • To assess transmission of VDPVs or WPV • To assess persistence of transmission and sufficiency of outbreak response activities • If mOPV2, tOPV, or nOPV2 is used in the response, to monitor persistence and potential transmission of type 2 vaccine virus (“OPV2”)
<i>Outside known infected communities</i>	<ul style="list-style-type: none"> • To incidentally detect potential transmissions (e.g., spread from infected communities) and guide the scope of response • If mOPV2, tOPV, or nOPV2 is used in the response, to incidentally detect exportation of vaccine-related virus

The document intends to guide national governments and WHO Country and Regional staff, in coordination with relevant Global Polio Eradication Initiative (GPEI) technical partners, to make prompt decisions and take immediate action to enhance environmental surveillance in high risk area(s) following the detection of a circulating VDPV.

Background and Rationale

Environmental surveillance is a key component in outbreak response preparedness and monitoring, based on its ability to detect the transmission of vaccine derived poliovirus (VDPV) or wild poliovirus (WPV) in infected communities, and to assess the persistence of transmission and sufficiency of outbreak response activities. For areas outside known infected zones, ES can detect potential transmissions (e.g., spread of VDPVs from infected communities or exportation of vaccine-related virus from a response campaign (e.g., vaccine-related virus from an mOPV2 response) and guide the scope of response (3). As it is essential to understand the geographic extent of VDPV transmission and the duration for which it has been transmitting, ad hoc deployment of ES should be considered on a short-term basis.

Ad hoc deployment of environmental surveillance is the targeted collection and testing of environmental (sewage) specimens from designated sites in different cities or areas under special circumstances and for a limited time; generally, minimally for 6 months and not to exceed 12 months (unless otherwise indicated) (4, 8).

ES expansion in a poliovirus outbreak setting consists of rapidly establishing new, ad hoc sites when an event with potential of leading to an outbreak (virus detected in neighboring country or areas, very low RI coverage, etc.) occurs in a new setting. Consensus on the appropriateness and feasibility to implement such expansion should be made in coordination with national governments and relevant GPEI technical partners; decisions must take into consideration the laboratory and field capacity, especially in countries lacking laboratory capacity for poliovirus testing. Additional considerations for expansion include factors such as, presence of an existing ES network in the country, the quality of the existing ES network and the locations of catchment areas in context to the new outbreak. Decisions regarding the extent of geographical area to be covered by ES for a given outbreak will need to be based on the context of the region, population movement, feasibility, and access to sewage systems for sample collection. Based on the evolving risks, high-priority areas and population groups will be identified for the potential establishment of ES.

Ad hoc deployment of environmental surveillance is the targeted collection and testing of environmental (sewage) specimens from designated sites in different cities or areas under special circumstances, for a limited time period

Emergency deployment of ES during an outbreak does not replace the need for high-quality AFP surveillance, and efforts to strengthen AFP surveillance in response to an outbreak remain the priority. When ad hoc ES is considered under outbreak circumstances, there should be a careful review of the situation and a consideration of the kind of information the new site would provide and information that the site cannot provide.

It is to be noted that the risk status of an area may change within a relatively short period of time, depending on changes in virus epidemiology, immunization coverage and surveillance status.

General Principles

General Steps for Environmental Surveillance Following Confirmation of a VDPV

Determining adequacy of existing environmental surveillance sites

- Identify the location and geographic scope of existing environmental surveillance sites
 - ✓ Where is ES currently conducted?
 - ✓ Does ES exist in the area(s) of interest for the outbreak?
 - ✓ Does ES exist in high risk areas (adjacent community, areas of high risk population settlements or movement, large population centers) and how likely would the (high risk) population of interest (for the current outbreak) be captured by the existing ES network?
 - ✓ What is the estimated proportion of the (high risk) population in the existing ES catchment?
- Assess the quality of site performance
 - ✓ Date of last field assessment (i.e., external review) and results
 - ✓ Review ES data and performance indicators; have site-specific and other ES indicators been achieved during previous 6–12 months? Are there any concerns?
 - ✓ Is the current sampling frequency conducted, minimally, monthly?

Considerations: *Capacity of the national poliovirus (PV) ES laboratory and/or reference poliovirus ES laboratory/ies to process samples in a timely manner with optimum quality should be taken into consideration in finalizing the number of samples / sites in response to the outbreak. For reference poliovirus ES laboratories that are outside the country to which samples are referred for virus isolation, ITD or sequencing, shipment and sample handling need to be coordinated based on any precedent or current feasibility.*

Identifying high risk areas for environmental surveillance expansion during an outbreak

In an outbreak setting the considerable resources required for the field and laboratory components of environmental surveillance must not detract the resource needs for enhancing case-based AFP surveillance, including active case searches and sampling of contacts of inadequate cases.

The identification of highest risk areas should be based on the location of populations considered at risk, behavioral characteristics that represent potential transmission risk, and areas where program performance indicators suggest suboptimal AFP surveillance and low vaccination coverage (5), including:

- Known or suspected population immunity gaps, such as specific age cohorts that missed vaccination, and groups refusing vaccination on religious, philosophical or other grounds
- Areas/districts with a large mobile population (e.g., daily movement of population for work, migrants, nomads, refugees, informal settlements, undocumented guest workers)

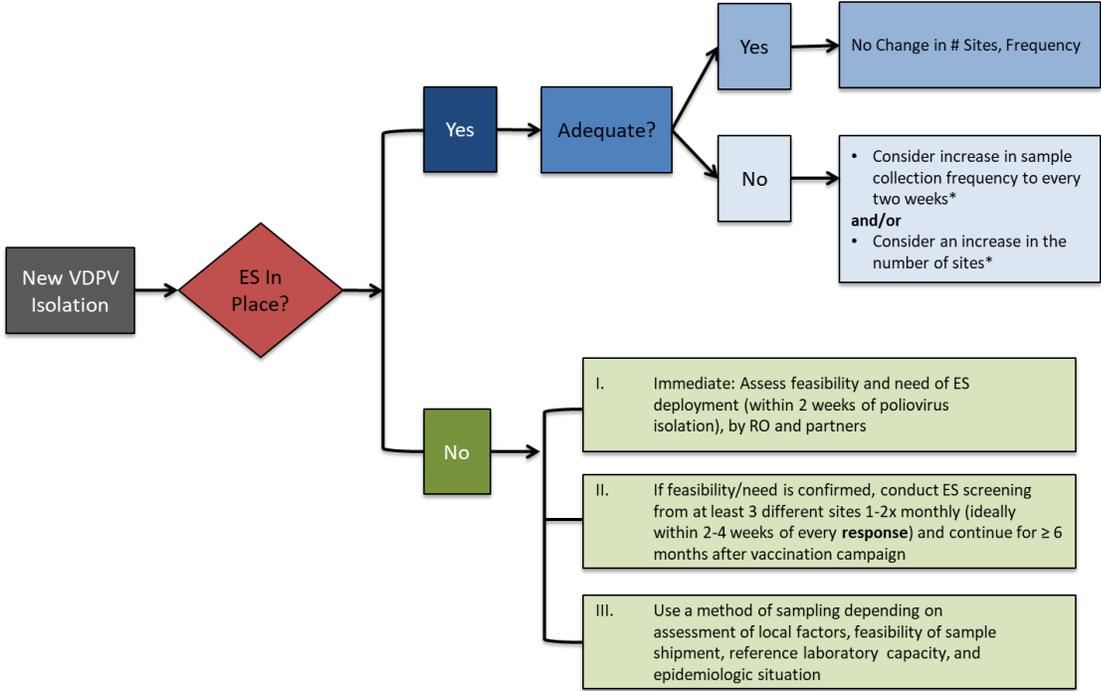
- The occurrence of large gatherings of people for commerce, religious or other occasions, especially where women and infants are included, such as specific events associated with holidays, festivals or mass gatherings
- Sub-national indicators suggestive of poor AFP surveillance performance: silent areas, low NP-AFP rate, high number of inadequate samples, late reporting or investigations, long timelines for specimen transport
- Low coverage in routine vaccination (DTP3) and/or immunization campaigns
Existence of serotype-specific immunity gaps because of prior use of certain vaccines (i.e. IPV stock-out, mOPV use in recent campaigns)

Requirements for Operationalization of Temporary or Ad hoc Sites during an Outbreak

- All stakeholders are informed
- Sites identified (feasibility established, risk-based approach)
- Roles and responsibilities established (site-specific)
- Laboratory capacity ensured with preliminary agreement on sampling frequency
- Funding available (i.e., existing surveillance funds) or anticipated (i.e., outbreak funds)
- The outbreak response plan (ORP) includes environmental surveillance enhancement activities beginning day 0 of the event/outbreak

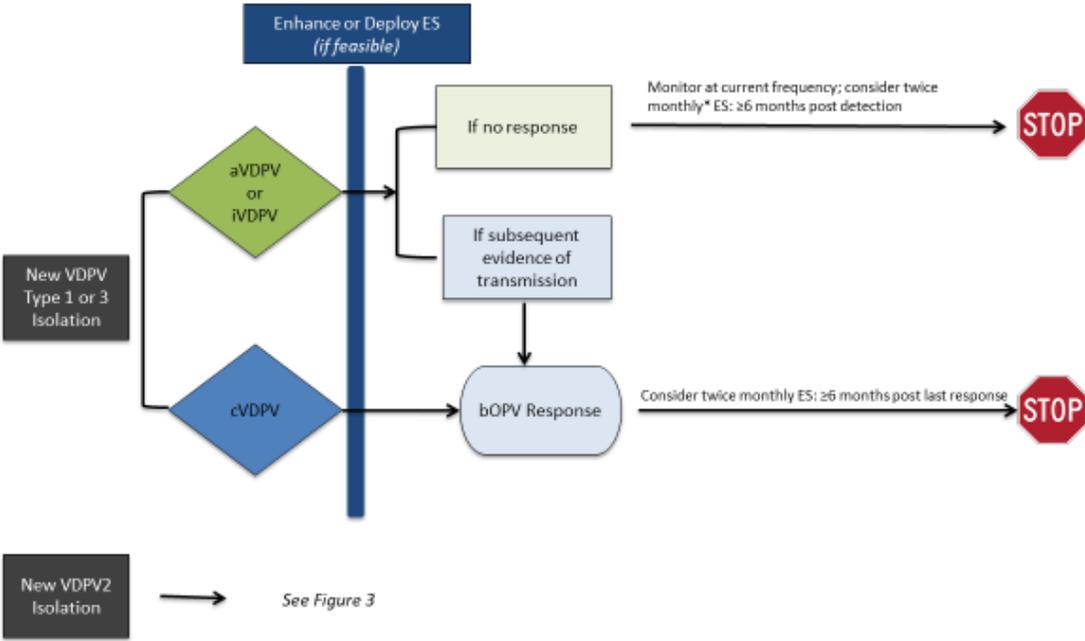
Operational Framework for the Establishment of ES in the Context of VDPV Isolation

An overview of the decision process in determining the enhancement or deployment of ES is given in Figure 1 and is described in more detail below.



*Response may differ depending on Type of poliovirus isolated.
All changes must follow discussion or assessment by the Regional Office (RO) and partners

Figure 1 Overview of decision process to determine the enhancement or deployment of ES following a new VDPV isolation



*Minimum sampling frequency is monthly; all changes must follow discussion or assessment by the Regional Office (RO) and partners

Figure 2 Overview of timeline of enhanced environmental surveillance (ES) depending on the type of initial VDPV isolated

Identify Roles and Responsibilities

Environmental surveillance activities should be documented in the national surveillance plan and enhancement of surveillance activities in response to an outbreak should likewise be documented in any response plans and updated regularly (i.e., at least once a year but preferably every 6 months). The process for establishing an ad hoc ES site and associated activities are described elsewhere (4, 5). In the outbreak context, these activities will likely be fast tracked or would have been completed as a preparedness activity to ensure rapidity of deployment.

The appropriateness and feasibility to enhance environmental surveillance for a given outbreak should be discussed in coordination with national governments and relevant GPEI technical partners; decisions must take into consideration the laboratory and field capacity, especially in countries without laboratory capacity for poliovirus testing.

Timeline for Environmental Surveillance Enhancement Following Confirmation of a Poliovirus Event or Outbreak

Immediately to 2 weeks following virus isolation

In areas with existing environmental surveillance

Immediately following isolation of a poliovirus of concern (i.e., VDPV) a review of the existing ES network in the country should be conducted.

1. If the ES quality indicators are currently not being met, an investigation into the cause, that includes site visit and observation of sample collection, storage and transportation procedures should be performed. Depending on the results of the investigation an adjustment of the ES network may or may not be required.
2. **No change** to the ES network if existing number of sites and frequency of collection are assessed to be **adequate** (in terms of geographic scope and frequency, in the context of the outbreak and its response).
3. Adjustments to the network may be considered, if existing number of sites and frequency of collection are **inadequate in an outbreak context**, in consultation with relevant entities (as stated above):
 - a. Consider increasing the sample collection frequency (e.g., from monthly to fortnightly/twice monthly),
And / or,
 - b. Consider increasing the number of sites if populations considered at risk for virus circulation are not adequately covered by current ES sites. (i.e., cities/communities with links to the outbreak populations, or areas with risk factors for transmission after local importation)

Considerations: *Increasing the number of sites up-stream of the site where poliovirus has been isolated in order to better identify the “source population or individual” is not generally recommended in most settings. Experiences in several countries (e.g., Philippines) have shown that this approach rarely identifies the “source individual/s” (7, unpublished data) and it consumes staff and laboratory resources that may be better used in expanding the ES network to improve detection of circulation among areas or populations at-risk.*

In areas without existing ES sites or with inadequate ES network for outbreak response

If the existing environmental surveillance network is currently not adequate or does not currently exist, conduct a **feasibility assessment**, in close consultation with the national/local government, and relevant GPEI partners as appropriate (e.g., CO, RO).

The feasibility assessment would include

1. A site visit by an experienced person / team to identify potential locations from which to collect samples, and to assess human and logistical resources required for collection, storage and transportation.
2. An assessment of laboratory capacity and resources needed to accommodate increase workload in specimen processing (including identification of existing labs that can receive additional specimens as a contingency plan; and adaptation of schedules for sample collection & shipments to facilitate handling the additional workload by the laboratory).
3. For the countries without a national polio laboratory or ES sample processing laboratory, the storage and shipment of samples should be planned with the lab before collection of samples
4. Obtain a letter of agreement (or other means of approval) from national/local authorities as appropriate, and agencies that oversee sewage/water facilities. *Note: this might be needed for each new site opened depending on the requirements of local governments and other health authorities.*
5. Document the findings of the feasibility assessment in a report summarizing a) the environmental sites for which initiation/continuation of ES would be feasible and which ones could be used on an “ad hoc” basis during the outbreak (versus on a “routine” basis); b) staff & resources required to operationalize the sites.
6. Review and establish data management and reporting mechanisms where needed

If the need for urgent reactive deployment of ES sites is confirmed and it is feasible to start new sites, the assessment report will be incorporated into the operational plans for the outbreak response to ensure allocation of appropriate resources.

Considerations: *Outside of an outbreak response context, implementing these steps can take several months; therefore, national governments with support from WHO country or regional offices could consider pre-training an ES outbreak response team that could be deployed to work with local personnel in an outbreak area within the surge of capacity at the start of the outbreak. Local personnel will be essential to provide local knowledge and not attract unwanted negative attention in high-risk settings.*

Weeks 2-4 following virus isolation or outbreak confirmation:

Following the selection of new sites by the feasibility assessment, and the preparation/ training of staff and logistics, initiate ES sampling from the new sites (within 2-4 weeks of every **response (ideally)** and continue for at least six months after last OPV2 vaccination campaign.

Depending on the context, sampling frequency could be twice monthly (i.e., every two weeks) or monthly; weekly sample collection is no longer recommended. Use a method of sampling accepted by GPLN, depending on assessment of local factors, feasibility of sample shipment, reference laboratory capacity, and epidemiologic situation.

Minimal recommended sampling frequency is monthly per ES site; any changes to the sampling frequency or adjustments in the overall ES network (i.e., opening new sites) should be discussed and coordinated with the GPEI partners in coordination with Country and Regional WHO staff and government counterparts, for feasibility

Considerations: 1) *Capacity of the laboratory/ies to process samples in a timely manner with optimum quality should be taken into consideration in finalizing the number of samples / sites in response to the OB. For reference poliovirus ES laboratories that are outside the country to which samples are referred for virus isolation, ITD or sequencing, shipment and sample handling need to be coordinated based on any precedent or current feasibility.*

2) *For countries/regions with limited/no lab capacity for prompt expansion, consideration for shipping samples or (BMFS) filters to a reference lab should be included in the initial assessment.*

3) *The feasibility assessment should consider the ability to train collectors, identify suitable sites, and prepare laboratories for a timely response.*

Ensuring the Quality of ES Sites Implemented in Outbreak Settings

- 1) **Site selection and validation:** The same principles of permanent site selection apply for ad hoc ES site selection, though the reason for operationalization differ, and some allowances can be made for emergency situations.
 - a. Determine feasibility of opening new sites through field assessment, laboratory communication, funding, etc.
 - b. Review of performance, this will help in validation
 - c. Validation of new sites is based on performance over the first six months of being established; the goal being that only validated sites should continue collection as permanent, routine sites. In an outbreak setting, given the purpose, scope and rapidity of

implementing activities, ad hoc sites might not be “validated” per se, but should be of high quality and perform well. Thus, regular (monthly) monitoring of site performance is critical.

2) **Pre-selection of potential ad hoc sites** (preparedness)

- a. Given the need to quickly implement detection and response activities during outbreaks, countries should consider identifying key locations (e.g., according to risk assessments for high risk areas, large population centers) for possible (ad hoc/temporary) ES sites in advance, which can be rapidly operationalized.
- b. Areas or sites that have been considered and are potentially feasible as ad hoc ES sites should be further vetted by a surveillance officer proficient in ES; to a) determine if it meets the criteria for site selection (3,8), and b) provide options as needed for optimal sampling locations based on the catchment area. GPEI partners are available to provide assistance as needed.
- c. While environmental factors will change over time, potential ad hoc sites should be reviewed every 6 months to ensure they are still relevant and viable (3,8)

3) **Site quality indicators:**

- a. Due to the often, rapid evolution of outbreaks and the need to adjust activities quickly, frequent monitoring of ad hoc sites, is needed. Both permanent ES sites AND ad hoc ES sites collectively contribute the knowledge of poliovirus circulation in a community and the same basic principles of site sensitivity apply.
- b. Standard ES process indicators should be followed for all ES sites regardless of the reason for opening.
- c. While it may take several collections over several months to assess performance (e.g., routine sites need at least 6 months of cumulative observed collections), ES sites opened in response to an outbreak should be monitored closely to ensure functionality of the sites and adequate sensitivity through analysis of indicators; possible reasons for low EV detection should be investigated **immediately**, corrective action taken, and closure of ad hoc ES sites or adjustment of sample collection points should be considered and implemented rapidly and according to standard guidance (5).

4) Deployment of environmental surveillance in response to an outbreak targets collection and testing of environmental (sewage) specimens from designated sites in different cities or areas under **special circumstances and for a limited period of time**; generally, minimally for 6 months and up to 12 months (unless otherwise indicated).

- a. Any determination to continue ad hoc ES beyond 12 months should be made in agreement with the national authorities, RO and laboratory staff and consider the overall ES network in the country
- b. The poor performing sites may be reassessed and issues related to poor performance should be addressed before closing the site. only sites with good performance should be considered for continuation; keep an ad hoc site opened “just in case” results in resource drain and reduction in efficiency of the ES system overall

Tips for Success and Enabling Factors

- Always engage the national authorities prior to establishing ES system.
- Consider sampling in the capital or major city of each administrative unit surrounding the initial detection location
- If the current catchment population of an ES site is very large (i.e., >1 million) consider sampling tributaries of the larger area to focus the catchment on those with high-risk subpopulations
- Dumping sites are NOT ideal sampling locations and should be pursued with caution
- Sampling sites located in areas with a high concentration of children aged <15 years are preferred
- If sampling sites are close to each other, consider composite samples by mixing portions derived from different sites (does not add to laboratory burden, but catchment population could be more difficult to determine)
- Ability to deploy rapidly (crucial in outbreak settings)
- Think ahead; pre-select areas of interest and locations for future sites when feasible

Interpretation of results

As with any ES (routine/permanent, ad hoc, seasonal, or otherwise), results are limited to the geographic scope of the catchment area. Positive results indicate viral excretion or importation in the community; but cannot pinpoint the exact source of the virus (among infected individuals or sub-communities). Negative results (WPV and VDPV) from an ES site do not rule out circulation and should be interpreted with caution as negative results do not exclude the absence of virus circulation. The degree to which negative samples support evidence for absence of poliovirus circulation in the catchment area depend on the quality of the site and sensitivity of sample collected, stored, transported and lab testing.

Limitations of “Ad Hoc” ES Approach

Per GPEI guidelines, ES sites are ideally placed in areas with convergent sewage networks, where sampling can be done at inlets to sewage treatment plants, pumping stations or other major sewage collectors, covering a population of approximately 100,000 to 300,000, with variations depending on the setting and epidemiological need (2,3). Given these standards and the conditions in the highest-risk areas, it is possible, even likely, that suitable sampling sites will not be available near a new detection or in areas at high risk for importation or transmission. However, epidemiologic or contextual need, such as high risk of undetected spread, may allow some compromise in site selection so long as ad hoc ES does not put unreasonable burden on the laboratory and program, and sites are closed if not useful. Tracking the source of infection and response planning will remain as a challenge.

Although the triggers for expanding the elective pattern of ES establishment to incorporate more reactive, “ad hoc” sampling is recognized in the current context, such an approach will have inherent limitations such as lack of standardization and comparability with a known baseline (i.e. the value of a negative result is unknown and unknowable), challenges related to prompt selection and deployment of ES sites and tools, and variance related to sensitivity dependent on timing, seasonality, and local factors.

Responding to a Type-2 Poliovirus Event or Outbreak

The following replaces the existing *Concept Note for Polio Environmental Surveillance Enhancement Following Detection of Vaccine-related Type-2 Poliovirus (December 2018)*.

Background and rationale

Following the global cessation of routine use of OPV2 in April/May 2016, immunity against infection with type 2 poliovirus is on the decline. Since cessation, new VDPV2s have emerged causing events/outbreaks due to ongoing transmission of OPV2-related viruses, suspected unauthorized use of trivalent OPV (tOPV), and use of type 2 monovalent OPV (mOPV2) for outbreak response. Risks of ongoing circulation of VDPV2s may also arise from immune-deficient, long-term VDPV excretors (iVDPV), or from circulating VDPV2 (cVDPV2) released from a laboratory. Circulation of type 2 poliovirus requires an urgent response with mOPV2 to interrupt transmission. However, a response with mOPV2 carries the risk of seeding subsequent outbreaks of vaccine-derived poliovirus (VDPV), which has been estimated to become greater over time due to the accumulation of OPV2-naïve children. Per modelling estimates, even if campaign coverage is relatively high in the response zone, connected (through geographic proximity and/or population movement) areas outside the response zone with OPV2-naïve individuals may be at risk of new VDPV transmission (particularly > 18 months after cessation). Increasing number of cVDPV2 outbreaks, as well as the continued transmission of WPV1 and periodic emergence of cVDPV1 and cVDPV3, have led to concurrent circulation of different poliovirus types in several countries. As of April 2020, strategic use of tOPV in areas of co-circulation of type 1 and 2 polioviruses, or areas at high-risk of co-circulation may be used, in order to avoid the need to conduct dual monovalent OPV type 2 (mOPV2) and bivalent OPV (bOPV)SIAs (8).

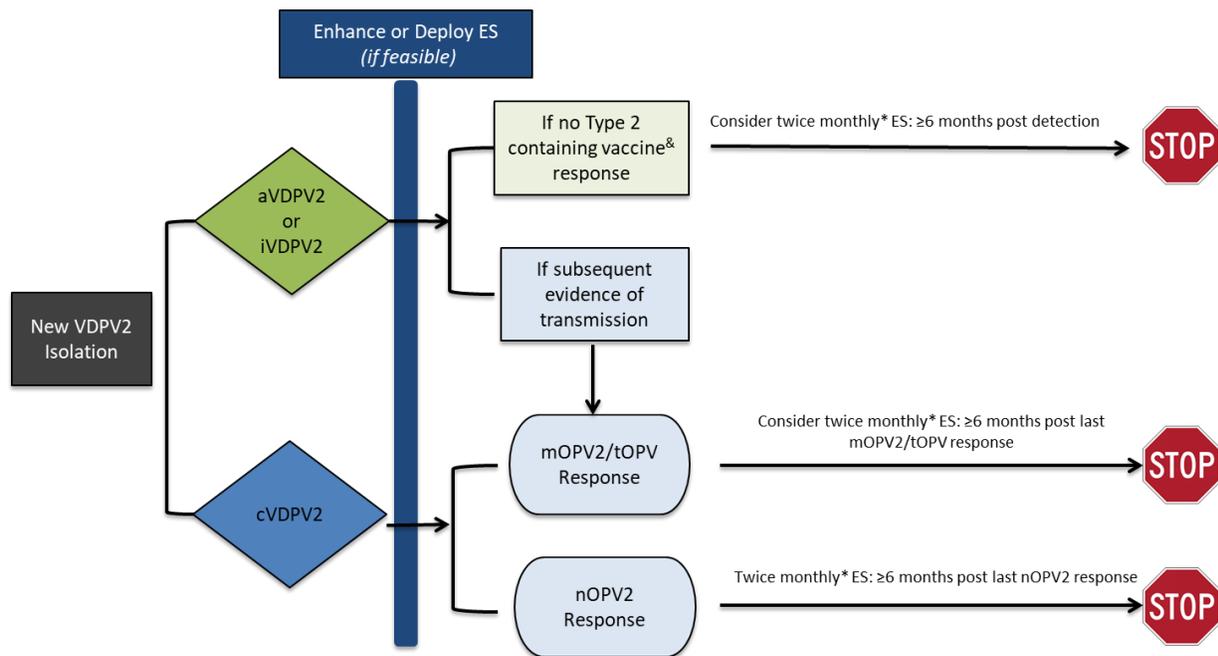
Although the overall risks of seeding new VDPV2 outbreaks may be low and difficult to specifically quantify, if such events do happen the progress to eradication will be impeded. A potential consequence of uncontrolled cVDPV2 outbreaks includes the need to restart OPV2 in routine immunization. In order to minimize this risk a new vaccine, nOPV2, is being rolled out in 2020 under a WHO emergency use listing (EUL). Studies to date have shown nOPV2 offers similar levels of protection as mOPV2, but with significantly reduced risk of seeding new outbreaks.

It is important to systematically enhance virus detection in/around areas when i) a VDPV2 is first reported to inform the response; ii) a response with mOPV2, tOPV, or nOPV2 is conducted to closely monitor the impact of the response in interrupting VDPV2 transmission; iii) monitoring any inappropriate large-scale use of mOPV2, tOPV, or nOPV2 after the official response; and iv) monitoring persistence of SL2 within the response region or in connected areas at risk.

*Countries responding to Type 2 outbreaks with nOPV2 (under Emergency Use Licensing) will need to ensure additional measures are taken to comply with pharmacovigilance standards. Please refer to the **Polio Field and Laboratory Surveillance Requirements in the Context of nOPV2 Use** for further details.*

Timeline for Environmental Surveillance Enhancement Following Confirmation of a Type 2 Poliovirus Event or Outbreak

The duration, frequency, and geographical scale of sampling will be determined by the type of VDPV2 isolated (Figure 3). Please refer to [the previous section](#) for more detail on the timeline.



*Minimum sampling frequency is monthly; all changes must follow discussion or assessment by the Regional Office (RO) and partners); ⁸Type 2 containing vaccine: mOPV2, nOPV2, tOPV

Figure 3 Overview of timeline of enhanced environmental surveillance (ES) depending on the type of initial VDPV2 isolated

Options for ES Following an Initial Ambiguous/Unclassified VDPV2 Isolation

Objectives

Monitor to determine whether there is evidence of transmission of a recently isolated aVDPV2 or iVDPV2 to inform whether a response is required. Although one-off VDPV2 isolations have been common in the past and have not led to outbreaks, there is a greater need, **in the coming months to years**, to quickly determine if the virus is circulating given the increase in risk of potential transmission as the cohort of susceptible children grows. A response with mOPV2 may be more detrimental than beneficial if a VDPV2 is not circulating, hence the need to increase surveillance.

Guidelines

1. **Duration:** Broadly, the enhancement or deployment plan should include monitoring for at least six months from the initial VDPV2 detection.
2. **Frequency:** Minimum recommended sampling frequency is monthly; where feasible and with consultation, consider sampling every two weeks
3. **Stopping / continuation trigger:**
 - a. No further VDPV2s are isolated throughout the six-month period from all types of surveillance and mOPV2 is not administered: stop
 - b. Genetically linked VDPV2s are isolated from AFP cases, AFP case contact sampling, or ES samples and/or an mOPV2, tOPV, or nOPV2 response is initiated: transition to protocol for ES following an outbreak response.
4. **Geographic scope:** As a minimum the closest urban area of the first administrative level (ADM1) in which the VDPV occurred should be sampled (with a population >100,000 people). In addition, other large urban areas (>100,000 people) of adjacent ADM1s could be considered depending on the local epidemiology (note this may fall across neighboring countries). If these cities are not large enough, the closest feasible city with a population >100,000 should be considered, taking into account the feasibility to transport specimens to the lab. The 'closest' urban area should be defined by local knowledge of population movement as well as distance.

Options for ES Following Confirmation of a cVDPV2 Outbreak

Objectives

Monitor i) the geographic extent of cVDPV2 transmission to verify that the scale of the planned response is appropriate; ii) duration and geographic extent of SL2 excretion following mOPV2, tOPV or nOPV2 use (to confirm mOPV2/tOPV/nOPV2 is used appropriately); iii) detect early evidence of the emergence and transmission of new VDPV2s that may result from mOPV2, tOPV, or nOPV2 use; and iv) supplement AFP surveillance (and existing ES) to confirm interruption of the outbreak as needed.

Guidelines

1. **Duration:** Broadly, the enhancement or deployment plan should (i) be started within 2-4 weeks of every response, and (ii) include monitoring for at least six months following the last use of mOPV2, tOPV, or nOPV2 in the affected area.
2. **Frequency:** Minimum recommended sampling frequency is monthly; where feasible and with consultation with appropriate GPEI, WHO RO/CO, and national counterparts, consider sampling every two weeks until at least six months after last mOPV2, tOPV, or nOPV2 use
3. **Stopping / continuation trigger:** Stop after at least six months from last mOPV2, tOPV or nOPV2 use
4. **Geographic scope:** This is difficult to pre-define and should be strategically defined, based on country context and knowledge of previous poliovirus circulation and population migration pattern. Nonetheless it should be broad in general, and consider the following:

- a. The closest urban area (>100,000 people) within the ADM1 unit of outbreak case or ES site (where closest may be defined by distance or local knowledge of population movement)
- b. Major cities within the response zone and cities of ADM1 units adjacent to response zones (including areas in neighboring countries that fall within this definition). Major cities are defined as those >100,000 people.
- c. If new and genetically related cVDPV2 viruses are isolated from a geographically different location to the original outbreak location, new sites should be added given the change in the geography of transmission, if deemed feasible to implement. The location of new sites will be informed by the local knowledge of population movement.

Enhancement in the Context of nOPV2 use

GPEI must ensure and document that a robust and sensitive surveillance system is in place when implementing nOPV2 under Emergency Use Licensing (EUL). As such, certain requirements regarding environmental surveillance will be necessary in the countries where the nOPV2 will be used; a brief summary of the requirements are included in this document, however please refer to the *Polio Field and Laboratory Surveillance Requirements in the Context of nOPV2 Use (9)* for details.

Reviewing current ES sites & mapping out potential new sites

The program with the support of the RO/GPEI will review the performance of all current ES sites in country with a focus on the areas of outbreak/nOPV2 use.

If ES does not exist in nOPV2 use areas, the program should assess and explore the feasibility of implementation of environmental site(s), targeting, where possible, large population centers of approximately 100,000 population.

Opening ad hoc sites in areas of nOPV2 use

Before opening a new site, a discussion must take place between the country program, the laboratory and the RO on feasibility.

- Any new ad hoc site, opened for outbreak response using nOPV2
 - Will collect specimens every two weeks, for the first six months of implementation. After discussion with key decision makers, the frequency may revert to monthly for the remainder of the assessment period (except for initial use countries where sampling frequency should remain twice a month for six months after nOPV2 use)
 - Measures will be implemented for at least 12 months. Ad hoc sites will be assessed at the end of the 12 months for feasibility to continue sample collections for an additional six months
- Existing (routine) ES sites will be monitored as per their current sampling schedule for 12 months (except for initial use countries where they will shift to twice a month sampling frequency for the first six months following the last use of nOPV2)

As it might be difficult to know in advance where nOPV2 will be used in a country, it is recommended to explore and possibly expand the ES network to the main populated areas of the country.

References

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