National Health Protection Service of Ireland
An tSeirbhís Náisiúnta um Chosaint Sláinte na h-Éireann

National polio preparedness and response plan

Updated by Polio Working Group

National Health Protection Service, HSE

12th June 2023

Version history of National Polio Response Plan. Abbreviations: AFP, Acute Flaccid Paralysis; DoH, Department of Health; GPEI, Global Polio Eradication Initiative; HPSC, Health Protection Surveillance Centre; NCC, National Certification Committee; NHPSI, National Health Protection Service of Ireland; NIO, National Immunisation Office; NPEC, National Polio Expert Committee; NVRL, National Virus Reference Laboratory; SOP, Standard Operating Procedures.

Version	Date	Originator	Reviewer	Comment
Planned Review	2025	Office of Director of National Health Protection, NHPSI	NPEC/DoH	National Polio Response Plan due to be updated and reviewed biennially.
2.0	12/06/2023	Office of Director of National Health Protection, NHPSI	NPEC/ DoH	Major update by working group comprising NHPSI (including Health Threat Preparedness Programme, HPSC, NIO, Communications, RGDU), Area Depts of Public Health, NVRL, infectious disease and neurology clinicians and others to include streamlined response algorithm, updated sections on clinical and environmental surveillance, and waste-water response pathway. Updated epidemiological section, immunisation uptake, contact forms.
1.5	16/5/2019	DoH/HPSC	DoH/HPSC	Draft document for NCC. Updated August 2019 in consultation with HPSC and National Polio Certification Group.
1.4	15/05/2018	DoH/HPSC	DoH/HPSC	Updates to reflect GPEI SOPs, parts 1 and 2 “Responding to a poliovirus event or outbreak (general and for polio virus type 2)
1.3	04/04/2016	DoH/HPSC	DoH/HPSC	Updates to enhanced surveillance form used for supplementary AFP surveillance; changes in international epidemiology and links; updates to national immunisation uptake data, updates to Irish contact persons
1.2	11/05/2015	DoH/HPSC	DoH/HPSC	
1.1	02/04/2014	DoH/HPSC	DoH/HPSC	Update relating to epidemiological situation, and updated information and guidance on use of vaccines

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Glossary

AFP	Acute Flaccid Paralysis
aVDPV	Ambiguous Vaccine-derived Poliovirus
bOPV	Bivalent OPV (contains Sabin types 1 and 3)
CDC	Centres for Disease Control and Prevention
cVDPV1/2/3	Circulating Vaccine-derived Poliovirus type 1/2/3
DoH	Department of Health
GPEI	Global Polio Eradication Initiative
HSE HPSC	Health Service Executive Health Protection Surveillance Centre
IHR	International Health Regulations
IPV	Inactivated Polio Vaccine
iVDPV	immunodeficiency-associated Vaccine-derived Poliovirus
MOH	Medical Officer of Health
NHPSI	National Health Protection Service of Ireland
NIAC	National Immunisation Advisory Committee
nOPV2	Novel OPV2
NVRL	National Polio Reference Laboratory
OCT	Outbreak Control Team
OPV	Oral Polio Vaccine
PPE	Personal Protective Equipment
SAGE	Strategic Advisory Group of Experts on Immunization
SOP	Standard Operating Procedures
tOPV	Trivalent OPV (contains Sabin types 1, 2, 3)
UNICEF	United Nations Children's Fund
VAPP	Vaccine-associated Paralytic Poliomyelitis
VDPV	Vaccine-derived Poliovirus
WHO	World Health Organization
WPV	Wild Poliovirus

Introduction

Poliomyelitis is a highly infectious disease that largely affects children under 5 years of age, causing permanent paralysis (1 in 200 infections) or death (2-10% of those paralysed) (WHO, 2022a). In 1988, the World Health Assembly adopted a resolution for the worldwide eradication of polio, launching the Global Polio Eradication Initiative (World Health Assembly, 1988).

The last recorded case of polio in Ireland was in 1984 (HPSC, 2023a). In 2022, the number of poliovirus cases reported worldwide increased. Whilst Europe has been free from indigenous polio since 2002, cases were reported in Germany, Poland, Ukraine and the United Kingdom. Additionally, poliovirus was detected in Israel and the United States. The cases in Ukraine, UK and Israel were classified as outbreaks by the World Health Organization (WHO). A European Regional Certification Commission for Poliomyelitis Eradication report of September 2021 suggested 11 European Union/European Economic Area (EU/EEA) countries are now at an intermediate risk of sustained polio outbreaks (WHO, 2021a).

Any case of polio virus in Ireland is considered a public health emergency and requires immediate response. This response plan has been prepared for use should one or more cases of wild type (WPV) or vaccine-derived poliovirus (VDPV) infection occur in Ireland.

Building on earlier work led by the Department of Health, this document (2023) reflects amendments made to reflect WHO guidance, changing epidemiology worldwide, the role of environmental surveillance and the need to continue to strengthen vaccination uptake across the population and, in particular, among vulnerable groups. It presents the response plan for Ireland, with strengthened clinical surveillance, establishment of wastewater surveillance, and pathways for response including containment, contact tracing and consideration of wider population investigation and measures for any detection.

1. Epidemiological background

1.1. Poliovirus

Polio is a highly infectious disease spread mainly through close contact with an infected person. The virus lives in the gut and the throat. Polio is spread though the faeces (bowel movements) of an infected person. It can also be spread through saliva, and through poor hand washing or water contamination.

Poliomyelitis (polio) is caused by infection with poliovirus, a highly infectious small, non-enveloped enterovirus of the family *Picornaviridae*. Poliovirus infection is acquired principally by faecal-oral transmission, usually from person to person but occasionally through contaminated food/water. Ingested virus replicates in the gut, usually asymptomatically, and is then shed in faeces. Transmission is generally enhanced under conditions of poor sanitation. The incubation period is commonly 7-14 days for paralytic cases but can range from 3 to possibly 35 days. Cases are most infectious during the days before and after onset of symptoms and the period of communicability occurs for the period of time the virus is excreted (ECDC, 2013).

Poliovirus infection, although usually asymptomatic, can cause fever, vomiting and muscle stiffness. In rare cases, infection can lead to permanent paralysis including, occasionally, of the breathing and swallowing muscles, leading to death.

In fewer than 1% of cases (1 in 200) the virus invades the central nervous system, leading to inflammation of the anterior horn cells of the spinal cord (myelitis). Clinically, this causes a syndrome of acute flaccid paralysis (AFP), characterised by acute onset weakness, usually involving the legs, evident as a lower motor neuron lesion (Racaniello, 2006). Bulbar paralysis, presenting with paralysis of the respiratory muscles results in a mortality of between 5% to 10% (ECDC, 2013). Polio can affect any age group, although the WHO reports that the majority of cases are in children under the age of five (WHO, 2022a). As most cases are asymptomatic, poliovirus transmission can occur rapidly before a case of paralysis presents. Poliovirus is readily shed from symptomatic and asymptomatic cases: it is detected in the nasopharynx for up to two weeks post- infection and disappears with the appearance of serum antibodies. Poliovirus is shed in the faeces for up to 5–6 weeks (Alexander et al., 1997), or significantly longer in those individuals who are immunosuppressed (Martín, 2006). There is no cure for polio; it can only be prevented by immunisation. Vaccination with oral polio vaccine (OPV) provides robust gut mucosal immunity and therefore attenuates viral shedding, however inactivated polio vaccine (IPV) offers little protection to asymptomatic viral shedding (Connor et al., 2022).

Polio virus detection may be of:

a) Sabin/Sabin-like virus, which is closely genetically related to the Sabin oral live attenuated vaccine strain
b) Wild poliovirus (WPV) or
c) Vaccine-derived poliovirus (VDPV)

WPV and VDPV can both cause clinical illness, including AFP, and lead to outbreaks.

a) Sabin and Sabin-like virus:

Sabin virus type 1 and Sabin type 3 are live attenuated poliovirus currently included in the bivalent oral polio vaccine OPV (bOPV) (GPEI, 2023a). Considering the global burden of circulating vaccine-derived poliovirus type 2 (cVDPV2), Sabin type 2 vaccination is no longer used. Rather, a novel OPV with a more genetically stable type 2 virus (nOPV2) has recently been approved for use by the WHO in countries with a high cVPDV burden (WHO, 2023a).

Sabin-like viruses includes viruses which are genetically closely related to the OPV viruses (less than 1% (types 1 and 3)/0.6% (type 2) nucleotide sequence difference from parental vaccine strain) and have not genetically diverged sufficiently to fulfil the VDPV criteria (CDC, 2007), classified below. Sabin and Sabin-like viruses are commonly detected following OPV administration.

b) Wild poliovirus (WPV)

Of the 3 strains of WPV (type 1, type 2, and type 3), WPV type 1 (WPV1) continues to circulate. Between April and October 2022, there were WPV1 cases in Afghanistan, Pakistan and Mozambique (GPEI, 2023b). Only Pakistan and Afghanistan remain endemic for WPV1.

- WPV1 transmission has not yet been interrupted. Its incidence has decreased by over 90% since 2014.
- WPV2 was last isolated in 1999 and declared eradicated in September 2015.
- WPV3 was last isolated in 2012 and classified as eradicated in October 2019.

c) Vaccine-derived poliovirus (VDPV)

Use of OPV can lead to the emergence of VDPV and vaccine-associated paralytic poliomyelitis (VAPP), a rare condition in vaccine recipients. Both VDPV and VAPP can have identical clinical presentation to WPV infection.

In under-immunised populations, if Sabin-like viruses (arising from live-attenuated poliovirus from oral polio vaccine) continue to circulate they can acquire genetic mutations in the 'VP1' regions, in particular within the attenuation sites, and diverge genetically and become classified as VDPV which may regain the ability to cause paralysis. There are three types of VDPV Sabin strains: types 1,2, and 3. VDPV are identified based upon their divergence from the OPV virus strain and include viruses that are > 1% divergent (for types 1 and 3: ≥ 10 nucleotide changes) or >0.6% divergent for type 2 (≥ 6 nucleotide changes). VDPV can cause paralytic poliomyelitis, indistinguishable from wild type disease (Burns et al., 2014).

There are three categories of VDPV:

- cVDPV: Circulating vaccine-derived poliovirus: VDPV demonstrating person-to-person transmission in the community, based upon human or environmental detection.
- iVDPV: Immunodeficiency-related vaccine derived poliovirus: VPDV isolated from an individual with evidence of primary immunodeficiency. An immunodeficient person may excrete the VDPV for an extended period of time.
- aVDPV: Ambiguous vaccine-derived poliovirus: Classification based upon exclusion when investigation does not support cVDPV or iVDPV.

1.2. Global Eradication Initiative

In 1988, the World Health Assembly adopted a resolution for the worldwide eradication of polio (World Health Assembly, 1988), marking the launch of the Global Polio Eradication Initiative, spearheaded by national governments, WHO, Rotary International, the US Centers for Disease Control and Prevention (CDC), UNICEF, and later joined by the Bill & Melinda Gates Foundation and Gavi, the Vaccine Alliance. WPV cases have decreased by over 99% since 1988, from an estimated 350,000 cases in more than 125 endemic countries to 30 reported cases in 2022. Please see Appendix A for further information.

1.3. Public Health Emergency of International Concern

In May 2014 the WHO declared the ongoing spread of polioviruses, both WPV and cVDPV a 'public health emergency of international concern' (PHEIC) (WHO, 2014), which remains in force at the time of writing this guidance (WHO, 2023b). The Emergency Committee for polio convened under the International Health Regulations (IHR) included cVDPVs in their remit for monitoring action and progress. In under-immunised populations, cVDPVs represent a particular risk and, since withdrawal of OPV2 in 2016, a global increase in cVDPV2 has been observed, related to a fall in global intestinal immunity to type 2 polioviruses (GPEI, 2022a).

In May 2014 the World Health Assembly endorsed a strategy to reduce the risk associated with attenuated poliovirus (Sabin strains) used in OPV. In line with the Polio Eradication and Endgame Strategic Plan 2013–2018 (GPEI, 2013), all countries ceased using OPV2 in their routine immunization programmes from 17 April to 1 May 2016. This marked the largest globally-coordinated vaccine introduction in history, with all OPV-using countries switching from using trivalent OPV (tOPV, containing Sabin 1, 2, and 3) to a bivalent form (bOPV, containing Sabin 1 and Sabin 3). All existing stocks of tOPV have been removed from circulation, to further reduce the likelihood of cVDPV type 2 virus emergence.

The tOPV was used in Ireland in the routine immunisation programme until 2001 and was replaced at that time by the IPV. No form of the OPV is available or used in Ireland currently.

1.4. International situation update

WPV is close to global eradication, with WPV reported from just two countries (Afghanistan and Pakistan) in 2023 (GPEI, 2023c). However, while live attenuated OPV continues to be used in some countries there remains a risk of ongoing transmission of cVDPV.

The international move from oral to inactivated polio vaccination in most parts of the world was part of a major drive to limit further introductions of VDPV, however this switch came at a cost of the reduced mucosal immunity that is conferred by OPV, but not by IPV (Connor et al., 2022). This loss of mucosal immunity means that non-vaccinated individuals and IPV-vaccinated individuals can carry polio virus within their gut, with subsequent stool shedding. IPV-vaccinated individuals may be infected with polio virus and secrete in their gut, but have a much reduced chance of developing paralytic poliomyelitis, as vaccination with IPV provides excellent immunity against disease (Grassly, 2014).

Polio-free nations are obliged to have robust poliovirus surveillance programmes in place in order to maintain their polio-free status (PAHO, 2019). Surveillance for polio varies from country to country, but a combination of AFP and environmental surveillance is generally recommended.

In June 2022, the UK Health Security Agency announced that VDPV2 had been detected in several sewage samples in northern and eastern London (Wise, 2022). In July 2022, the New York State Department of Health issued a Public Alert reporting a case of paralytic polio in an unvaccinated male, the first case of polio in the United States reported to the Centre for Disease Control (CDC) since 2013 (New York State DoH, 2022). In December 2022, Canada IHR National Focal Point reported the detection of VDPV2 in two wastewater samples collected in August 2022 from Canada (PAHO, 2022). There is evidence the VDPV2 strains detected in London, Israel, New York and Canada are genetically related (GPEI, 2023d, 2022b; Hill et al., 2022). These detections of cVDPV serve as a reminder that until polio is eradicated, countries free of indigenous polio will remain at risk of polio re-infection or re-emergence.

1.5. Irish situation update

No cases of polio have been notified in Ireland since 1984. Any suspected polio requires immediate preliminary notification to the Medical Officer of Health (MOH). A confirmed case of polio virus in Ireland is considered a public health emergency. A single case of poliovirus infection in Ireland without evidence of transmission is classified as an event and requires immediate response and assessment and activation of this response plan. A case with evidence of transmission is considered an outbreak and requires activation of this response plan.

As a certified polio-free region, Ireland has a responsibility to (PAHO, 2019):

- Maintain WHO certification-standard AFP surveillance;
- Ensure access to a WHO-accredited polio reference laboratory;
- Ensure containment of WPV and circulating cVDPV;
- Supplement clinical surveillance with wastewater surveillance.

1.6. Extant risk

In January 2023, the WHO convened the thirty-fourth meeting of the Emergency Committee under the IHR (2005) on the international spread of poliovirus (WHO, 2023b). The Committee unanimously agreed that the risk of international spread of poliovirus remains a Public Health Emergency of International Concern (PHEIC) and recommended the extension of Temporary Recommendations for a further three months. The Committee reported that the following factors constitute risk of international spread;

a) Ongoing risk of WPV1 international spread:

In 2022, there was an outbreak of WPV1 in Pakistan, with spread outside the source of the outbreak but contained within Pakistan. High-risk mobile populations in Pakistan present a specific risk of international spread, to Afghanistan in particular. In southern Afghanistan, there is a large pool of unvaccinated 'zero dose' children, who represent a risk factor for re-introduction of WPV1 into Afghanistan, and expose themselves to high risk of disease. In addition, there has been importation of WPV1 from Pakistan into Malawi and Mozambique.

b) Ongoing risk of cVDPV2 international spread:

There has been an outbreak of cVDPV2 in northern Yemen, ongoing high rates of transmission in eastern Democratic Republic of the Congo and northern Nigeria, which have caused international spread to neighbouring countries. Countries reporting recent cases include Botswana, Canada, Sudan and Zambia. There has been long distance spread by air travel of cVDPV2 between Israel, the United Kingdom and the USA, and recent importation, without apparent further spread, to Canada.

c) Weak routine immunisation:

Many countries have weak immunisation infrastructure, which was further impacted by the COVID-19 pandemic. These services can be affected by humanitarian emergencies, including conflict and protracted complex emergencies. This poses a continued risk to health systems' vaccination programmes, leaving populations in these fragile states vulnerable to polio outbreaks.

1.7. Vulnerable groups

The risk of infection from an individual who is excreting virus is higher in settings/regions with low immunisation coverage, inadequate sanitation, over-crowding in living accommodation and where there is a higher prevalence of immuno-compromised individuals who may excrete poliovirus for longer periods.

Ukraine migrants

Individuals coming from countries where polio virus has been identified are recommended to receive polio vaccination. In Ukraine the uptake of vaccines was reported as sub-optimal pre-dating the current war (ECDC, 2022a). Ukraine had two cases of polio related to cVDPV2 in 2021 (WHO, 2021b), and a polio vaccination catch-up campaign commenced in February 2022 for children aged 6 months to 6 years who missed routine polio doses (WHO, 2022b). The first stage of the plan provided IPV to children aged 6 months to 6 years who had not received the required number of doses. In the second stage, all children under the age of 6 were to be vaccinated with OPV, even if they had received all their scheduled vaccination doses, to protect children from infection and to stop the circulation of the virus. There is no information available on the uptake of OPV in the public domain. However, it is known that Ukraine reported 78% uptake of a third dose of polio vaccine in 2021 (WHO, 2022c).

Other vulnerable groups

Uptake among international protection applicants is difficult to ascertain as many individuals coming in to Ireland do not have vaccination records and may not recall which vaccines have been received. Of relevance, in 2022 many cases of diphtheria have been reported in Europe (none currently in Ireland) among individuals arriving from countries experiencing conflict and political unrest, indicating the likelihood that vaccination uptake for other vaccine-preventable diseases is also low (ECDC, 2023; WHO, 2023c).

Some groups may experience difficulty accessing services (e.g. access to GP service) or may move around frequently, thereby disrupting their access to a GP with whom they may have registered. GPs

in many areas are challenged to provide a vaccination service to new arrivals. Contractual agreements between GPs and the HSE may dis-incentivise acceptance of new patients, who have already started their vaccination elsewhere. Such experiences have been documented in particular groups in Ireland (e.g. Irish travellers, Roma and international protection applicants).

Low vaccine coverage may be a result of vaccine refusal, individually or within groups.

2. Immunisation

In Ireland inactivated polio vaccine is given as part as part of the '6-in-1' vaccine (at 2, 4 and 6 months of age) and another dose is given as part of the '4-in-1' vaccine at 4-5 years of age. (HSE, 2015)

In the National Immunisation Programme Schedule (www.immunisation.ie), polio vaccination (IPV) is recommended at 2, 4 and 6 months of age with a booster at 4-5 years of age. The vaccination schedule and contraindications for use of the vaccines are outlined in the Royal College of Physicians Immunisation Guidelines for Ireland.

IPV was introduced to Ireland in 1957, and replaced by Sabin OPV in the early 1960s. Use of OPV can lead to the emergence of VDPV and VAPP. IPV, which cannot generate VDPP or result in VAPP, was reintroduced into the primary immunisation schedule in 2001.

IPV is now given in combination vaccines to reduce the number of injections received by each child. Unimmunised individuals travelling in countries that still use OPV are at risk of becoming infected with a VDPV, with subsequent risk of poliomyelitis, as was reported for a United States citizen in March 2005 (MMWR, 2006). No OPV is available in Ireland.

2.1. Immunisation uptake

Primary immunisation

Most recent available data (Q4 2022) indicates a national IPV uptake rate of 86% and 93.3% for children aged 12 and 24 months, respectively. Regionally, lowest uptake of IPV was 72.2% (Cavan/Monaghan). Immunisation coverage in these age groups has declined since coverage highs of 93% and 95%, respectively, in 2017 (HPSC, 2023b).

Junior Infant programme

Booster doses are delivered as part of the school programme (HSE, 2022). Most recent data from academic year 2020/2021 indicates an uptake of 88.3% in HSE-vaccine administered local health offices (LHO) and 88% in GP-vaccine administered LHO (Donegal, Sligo, Leitrim) – both down from 91.5% and 88.5% in academic year 2019/2020, respectively. Vaccine uptake varied markedly across HSE-vaccine administered LHOs, ranging from 73.9% (Dublin North Central) to 97.2% (Carlow/Kilkenny) (HPSC, 2022).

Immigrant and refugee immunisation

Uptake among immigrant and refugee groups is not easily available for reporting. Since March 2022, during the war in the Ukraine, a system is in place to document vaccination status of individuals arriving in Ireland from Ukraine. 18,884 out of the total 81,038 that had been granted PPSN by 20th April 2023 have filled in a Health Status Questionnaire on a voluntary basis in the National Transit Centre. Of these, 12,414 (68.84%) were vaccinated, 440 (2.44%) not sure, and 5,178 (28.72%) not vaccinated. A similar health questionnaire is also implemented in some CHOs. One report from Public Health Area E (Midwest) on the uptake of childhood vaccines for children under 18 years of

age (n=601) found that completed vaccinations were reported in 73%. The data were self-reported and it was not possible to validate the records.

Those travelling to endemic regions

IPV is recommended for individuals travelling to countries with endemic transmission of polio, however no data are available on vaccines administered to this population. The Department of Foreign Affairs website asks travellers to Pakistan to "…ensure they have completed the recommended age-appropriate polio vaccine schedule and have received a booster dose, if necessary." (DFA, 2023a) A do-not-travel advisory is in place for Afghanistan (DFA, 2023b).

The HSE advises that all travellers to polio-affected countries should receive a booster dose if more than 10 years have elapsed since last vaccine dose (HSE, 2021).

3. Polio surveillance

Polio-free nations are obliged to have robust poliovirus surveillance programmes in place in order to maintain their polio-free status (PAHO, 2019). Surveillance for polio varies from country to country, but generally a combination of AFP and environmental surveillance is recommended.

3.1. Clinical surveillance of acute flaccid paralysis and poliomyelitis

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Notify and investigate all suspected cases of paralytic poliomyelitis regardless of age.

Notify and investigate all suspected cases of non-paralytic poliovirus infection regardless of age.

Notify and investigate all cases of AFP in children, even those that are later found not to be due to poliovirus infection based on clinical and laboratory investigation.

Ireland's ongoing national surveillance system, in commitment to the WHO polio eradication programme, mandates immediate preliminary notification to the Medical Officer of Health (MOH) of all cases meeting the case definition. This includes all AFP cases in children < 15 years of age, and older individuals in whom polio is suspected by a physician (see Polio Case Definition - Health Protection Surveillance Centre (hpsc.ie) for further information, and Appendix B). Polio surveillance is undertaken as a collaborative process between the HPSC within the National Health Protection Service of Ireland (NHPSI) and the National Virus Reference Laboratory (NVRL). HPSC delivers an annual report to the WHO regional office regarding polio eradication activities. Maintenance of a surveillance system that is sensitive enough to detect a case of polio in Ireland is essential, particularly as clinicians will rarely have experience of polio as a diagnosis.

The WHO has set a performance indicator for AFP surveillance in children. In a polio non-endemic country, such as Ireland, the performance indicator is one case of non-polio AFP per 100,000 children aged less than 15 years of age (GPEI, 2023e), which in 2022, equated to 10 cases per year. Of note in Ireland the reporting of AFP cases in this age groups has generally not reached this target (Flanagan et al., 2016) (2 cases were reported through the Irish Paediatric Surveillance unit to the HPSC in 2022 giving an AFP rate of 0.2/100,000 population < 15 years of age (based on CSO 2022 estimates)). Thus, Ireland's clinical surveillance system is considered not sensitive enough to detect a potential case of poliomyelitis in this age group. Supplemental surveillance through waste-water sampling is recommended in this instance (see below).

In the context of good sanitation and high (although unstable and variable) immunisation rates, AFP is unlikely to be polio related; however active surveillance of AFP cases is vital to trigger the appropriate laboratory investigation to detect any cases that are due to poliovirus. This requires

clinicians to investigate and notify (as outlined below) even where poliovirus infection is considered a highly unlikely clinical diagnosis. Concurrent with notification to the MOH of an AFP or suspected polio case, the National Virus Reference Laboratory (NVRL) in UCD should be contacted by phone to inform them that a case is being investigated and that samples are being sent. This will ensure the samples are fast-tracked for rapid processing, and reported quickly to the investigators and MOH. NVRL investigates faecal samples for poliovirus. Virological testing of faecal specimens can identify the serotype of the poliovirus infecting an individual, and using molecular methods can distinguish between WPV, Sabin-like polio strains or non-Sabin-like VDPV.

All AFP cases in children less than 15 years of age (in one or more limbs, or acute bulbar paralysis)

Investigate: To ensure the detection of a case of poliomyelitis, clinical, epidemiological and laboratory investigation is necessary including:
*initial stool sample obtained within 48 hours of paralysis onset, with accompanying throat swab; (informing NVRL ahead of request) to exclude/confirm poliomyelitis
*a second stool sample should be obtained 24-48 hours later.
https://www.hpsc.ie/a-z/vaccinepreventable/polio/guidanceforhealthprofessionals/

Notify: This is notifiable under national Infectious Disease legislation and should be notified immediately to the MOH even while investigations are ongoing to identify the cause of paralysis. This is regardless of alternative diagnoses under consideration by the hospital clinician at the time of presentation with flaccid paralysis.
Notification process: https://www.hpsc.ie/notifiablediseases/whotonotify/

The differential diagnosis of an AFP case upon initial presentation is broad and may include poliomyelitis, Guillain-Barré syndrome, transverse myelitis, acute disseminated encephalopathy (ADEM), spinal cord ischaemia, cord tumour, peripheral neuropathy due to infection (diphtheria, borreliosis) or intoxication (tick paralysis, heavy metal or insecticide poisoning) (Marx et al., 2000).

If reporting of AFP is delayed to exclude other causes, or if a case of AFP is not reported and no follow up laboratory investigation occurs, it is possible that a case of AFP due to polio could be missed and there is potential for onward viral transmission. Failure to report AFP cases, a lack of stool specimens or insufficient information in clinical questionnaires have contributed to historical failure to detect and report the expected annual number of AFP cases (as defined by WHO), particularly with regard to virological investigations.

It is imperative that any case with a clinical suspicion of poliomyelitis in a person of any age should be fully investigated for poliovirus infection. It is estimated that 90% of poliovirus infections are asymptomatic. This includes close contacts of confirmed polio cases, immunocompromised individuals from whom a poliovirus was isolated and laboratory derived infections.

The procedures to be followed by clinicians regarding notification and investigation are outlined in Appendix C, including case definition, samples required, and enhanced surveillance form. This information is also available on the HPSC website (https://www.hpsc.ie/a-z/vaccinepreventable/polio/). Additional information regarding referral of specimens to the NVRL is available in Appendix D.

3.2. Environmental surveillance of wastewater for poliovirus

Environmental surveillance for poliovirus circulation has been supported by the WHO and has been implemented in a number of countries. The current approved WHO protocols still require viral

culture; however, this has been increasingly replaced by molecular assays to detect poliovirus with selective virus isolation for confirmation. Direct molecular screening increases the speed of detection and sequencing. The recent detections of VDPV in wastewater in the UK have highlighted the benefits of wastewater surveillance for poliovirus circulation.

Wastewater surveillance for polio commenced in Ireland in February 2023. The programme currently focuses on poliovirus type 2 based on the occurrence of VDPV2 cases and environmental detections internationally in recent months (PAHO, 2022; Ryerson et al., 2022; Wise, 2022). Sampling covers the Ringsend wastewater catchment area. This is the largest wastewater catchment area in Ireland, covering an estimated residential population of 1.2 million people within Dublin City and the greater Dublin area. Samples are collected weekly, pooled, and tested fortnightly. Samples are initially screened by digital polymerase chain reaction (PCR).

If PV2 RNA is detected, the wastewater sample will be investigated by viral culture utilising specific cell lines at the NVRL to confirm the initial result. If poliovirus can be grown from the wastewater, further characterisation of the isolate is performed, as per the algorithm in Section 6.2. Virological investigation will be undertaken in collaboration with the WHO Global Polio Laboratory Network. In the event of a detection at Ringsend catchment area, consideration will be given to additional environmental surveillance and sampling may be extended to other to other catchment areas within the National Wastewater Surveillance Programme. Expansion of wastewater surveillance to include testing for PV1/3 is under consideration. Further information on the process involved in wastewater surveillance for polio (including associated response actions) is available in Section 6.2.

3.3. Enhanced surveillance of enterovirus

The NVRL performs enhanced enteroviral surveillance by molecular sequencing and viral culture for patients presenting with neurological symptoms, meningitis, encephalitis or a generalised systemic illness. Many of the samples investigated are cerebrospinal fluid (CSF) and stools, often collected in parallel, although respiratory specimens are also tested, in particular for enterovirus EV D68. In particular, suspected clusters of neurological illness are investigated to determine if there is a common aetiology. These investigations supplement data generated by testing stool samples in accordance with WHO National Polio Laboratory protocols.

3.4. Potential scenarios for a poliomyelitis outbreak in Ireland

Possible presentation scenarios for a case of poliovirus infection in Ireland are shown below.

- Scenario 1: **A detection within wastewater in the absence of any known case or illness:** detection of VDPV or cVDPV in wastewater.
- Scenario 2: **A person with polio which is a WPV or cVPDV within Ireland** in the absence of travel history to an endemic or epidemiologically affected country; detected through clinical suspicion of poliovirus infection or AFP surveillance.
- Scenario 3: **A person with polio from importation of cVDPV** from a country that has circulating cVDPV; detected through clinical suspicion of poliovirus infection or AFP surveillance.

- Scenario 4: **A person with polio from importation of WPV** from a country where poliovirus is circulating, or a country with recently imported poliovirus; detected through clinical suspicion of poliovirus infection or AFP surveillance.

4. Confirmation of poliomyelitis

A confirmed case of poliomyelitis requires both clinical evidence and definitive laboratory confirmation (from testing conducted by the NVRL), except in the case of non-paralytic infection. A poliovirus infection that does not cause paralysis, such as in a close contact of a confirmed polio case, is verified by laboratory testing at the NVRL.

4.1. Case definition

The Irish case definition for poliovirus infection (WPV, Sabin-like and VDPV) includes clinical, laboratory and epidemiological criteria, as shown below. Cases are then defined as "possible", "probable" or "confirmed" based on the fulfilment of these criteria. Further details can be found on the HPSC website (https://www.hpsc.ie/a-z/vaccinepreventable/polio/).

Case definition for Acute Flaccid Paralysis
Acute onset of focal weakness or paralysis characterised as flaccid (reduced tone) without other obvious cause (e.g., trauma) in children less than 15 years old. Transient weakness (e.g., post-ictal weakness) should not be reported.
Case definition for Acute anterior poliomyelitis (HPSC, 2019)
Clinical criteria Any person <15 years of age with AFP OR Any person in whom polio is suspected by a physician
Laboratory criteria At least one of the following three: • Isolation of a polio virus and intratypic differentiation – WPV • VDPV (for the VDPV at least 85% similarity with vaccine virus in the nucleotide sequences in the VP1 section) • Sabin-like poliovirus: intratypic differentiation performed by a WHO-accredited polio laboratory (for the VDPV a >1% up to 15% VP1 sequence difference compared with vaccine virus of the same serotype)
Epidemiological criteria At least one of the following two epidemiological links: • Human to human transmission • A history of travel to a polio-endemic area or an area with suspected or confirmed circulation of poliovirus

Case classification

- Possible case: Any person meeting the clinical criteria (in the absence of any alternative diagnosis)
- Probable case: Any person meeting the clinical criteria and with an epidemiological link
- Confirmed case: Any person meeting the clinical and the laboratory criteria

4.2. Laboratory confirmation of poliomyelitis in Ireland

The NVRL utilises both molecular diagnostic assays and, where appropriate, virus isolation to detect and characterise poliovirus in clinical samples. The NVRL has the capability to discriminate between WPV, Sabin-like and VDPV. Currently, additional sequencing to determine if the VDVP is a cVDPV is performed at National Institute for Biological Standards and Control, WHO reference laboratory, in the UK. The same laboratory protocols are utilised to detect and confirm the presence of poliovirus in wastewater samples. Further information available in Appendix E.

4.3. Notification of poliomyelitis: process of response activation

In Ireland, public health legislation requires medical practitioners and pathology laboratories to notify the occurrence of specific communicable diseases to the local MOH in their respective Department of Public Health. Nationally, information on such cases is collated by the HPSC. Information on how to contact local Medical Officers of Health and other key contacts are available in Appendix F.

All AFP cases in children < 15 years of age are immediately notifiable while investigations are ongoing to identify the cause of the paralysis. All cases (of any age) where polio is suspected are immediately notifiable to the MOH.

4.4. National Polio Expert Committee

The National Polio Expert Committee (NPEC) is a multi-disciplinary group of a range of expert clinicians who, having regard to evidence-based best practice, Public Health principles and achieving optimum patient care, examine and make recommendations on prevention of, preparedness for and response to poliovirus outbreak within Ireland. The NPEC acts as key point of contact for the WHO with regard to polio eradication certification requirements (Appendix G).

Clinical review of all notifications relevant to poliomyelitis is undertaken by the NPEC. All clinical and laboratory details of each AFP case less than 15 years of age who has been reported are reviewed by the NPEC 6-monthly, or as required. The decisions made by the NPEC are reported to WHO after each meeting and are included in the WHO global AFP surveillance data. Cases are classified by the NPEC according to the following:

i) Confirmed poliomyelitis due to WPV, Sabin-like or VDPV;

ii) Non-polio AFP;

iii) Polio-compatible; or

iv) Non-AFP.

As these definitions are based on laboratory investigations of stool specimens it is essential that stool specimens be collected from all patients, even when an alternative definitive diagnosis has been confirmed. A decision-making tree used by the NPEC is shown in Appendix H, where cases are either classified as confirmed polio, discounted and labelled as non-polio AFP, or, if there is not enough information to exclude polio, classified as polio-compatible. This data is reported to the WHO and so every effort is made to obtain enough information to enable a final classification of each AFP notification.

5. Polio event/outbreak response plan

Algorithms depicting the steps involved in the investigation and response to a suspected case of poliomyelitis or detection of poliovirus in Ireland are presented below. They outline the likely diagnostic pathway and public health response to a case of suspected poliomyelitis.

Important elements include:

- Identification of the source of infection
- Detailed epidemiological, environmental and microbiological investigation
- Identify contacts and 'at risk' populations
- Consideration of targeted immunisation of 'at risk' populations
- Heightened awareness of AFP surveillance among clinicians

5.1. Algorithm for the investigation of, and response to, a suspected case of poliomyelitis

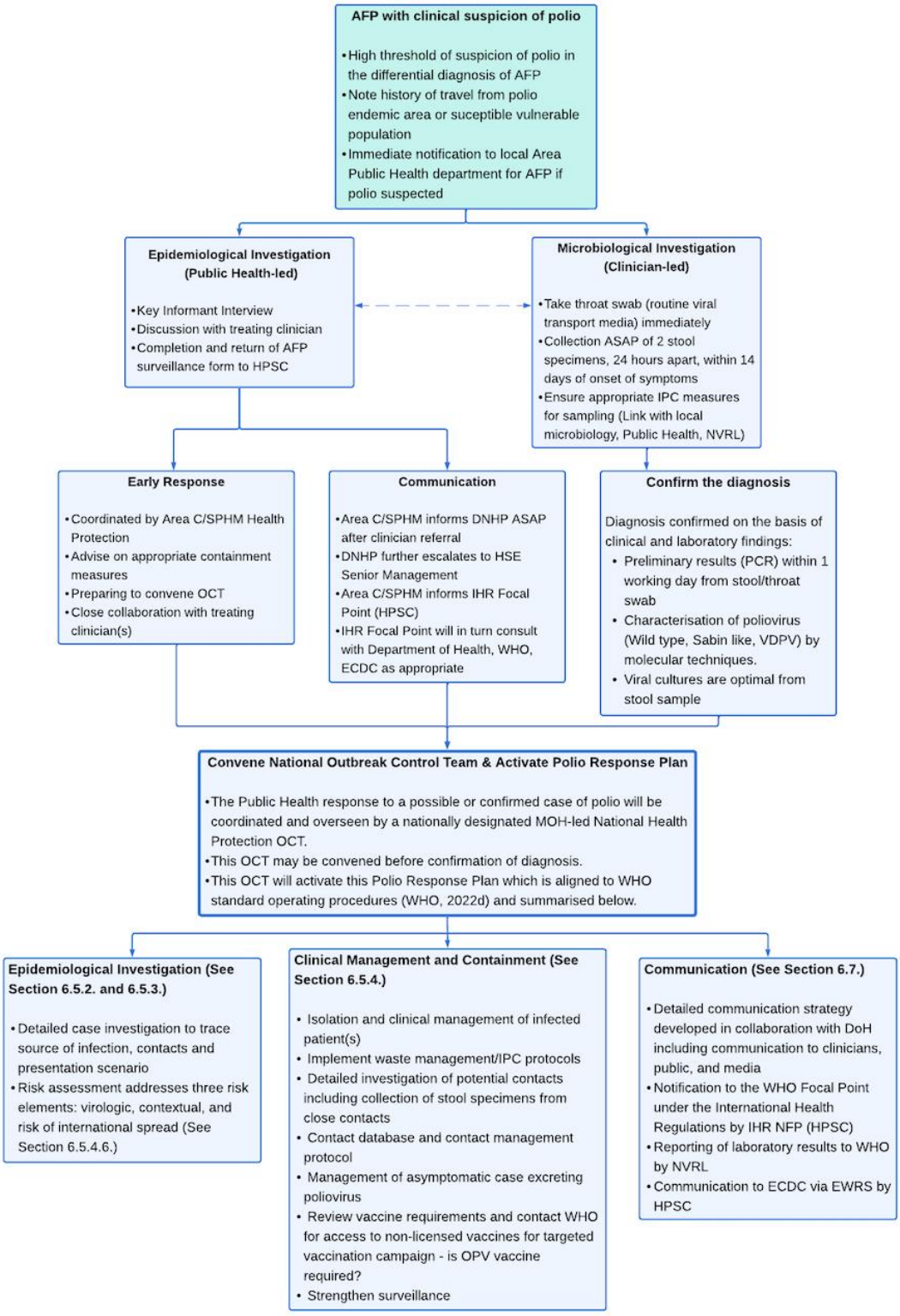


Figure 1: Algorithm for the Investigation of, and Response to, a Suspected Case of Poliomyelitis.

***Abbreviations**: AFP, Acute Flaccid Paralysis; C/SPHM, Consultant/Specialist in Public Health Medicine; DNHP, Director of National Health Protection; DoH, Department of Health; ECDC, European Centre for Disease Prevention and Control; EWRS, European Early Warning and Response System; HPSC, Health Protection Surveillance Centre; IHR, International Health Regulations; IHR NFP, IHR National Focal Point; IPC, Infection Prevention and Control; NVRL, National Virus Reference Laboratory; OCT, Outbreak Control Team; OPV, Oral Polio Vaccine; PCR, Polymerase Chain Reaction; VDPV, Vaccine-derived Poliovirus; WHO, World Health Organization.*

5.2. Algorithm for the investigation of, and response to, a detection of poliovirus in wastewater

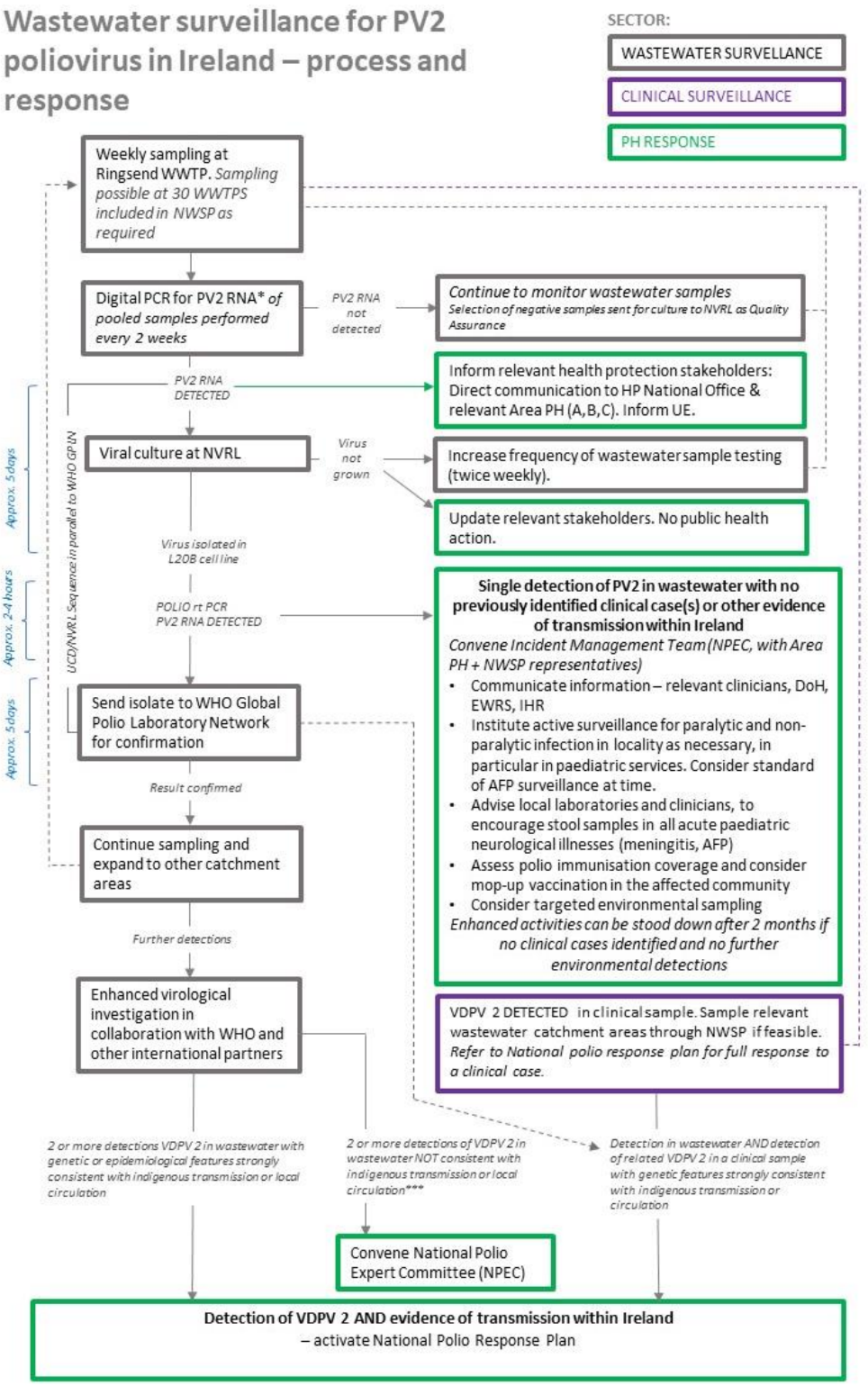


Figure 2: Algorithm for the Investigation of, and Response to, a Detection of Poliovirus in Wastewater.

***Abbreviations**: AFP, Acute Flaccid Paralysis; Area PH, Area Public Health Department; DoH, Department of Health; EWRS, European Early Warning and Response System; GPLN, Global Polio Laboratory Network; IHR, International Health Regulations; NPEC, National Polio Expert Committee; NVRL, National Virus Reference Laboratory; NWSP, National Wastewater Surveillance Programme; UE, Uisce Eireann (formerly Irish Water); VDPV, Vaccine-derived Poliovirus; WHO, World Health Organization; WWTP, Wastewater Treatment Plant.*

5.3. Stakeholders involved in a suspected case of poliomyelitis

The stakeholders involved in an investigation of a suspected case of poliomyelitis include those listed below:

- Director of National Health Protection
- The Chief Medical Officer Department of Health, and Health Protection Division
- Regional/National Crisis Management Teams
- Chief Clinical Officer, HSE
- National Health Protection Senior Management Team (including National Clinical leads, Director of Nursing, HPSC, NIO)
- The NPEC: including neurologists, paediatricians, microbiologists, infectious disease physicians
- National Immunisation Advisory Committee (NIAC)
- Area Directors of Public Health, Consultants in Public Health Medicine with a special interest in Health Protection (all Medical Officers of Health)
- NVRL at UCD Dublin
- WHO National Polio Laboratory at Belfield, Dublin
- HSE Communications
- Relevant others e.g. HSE Emergency Management, HSE Social Inclusion, HSE Environmental Health Services
- Diagnostic networks of neurologists, neuropathologists, paediatricians
- Clinical Microbiology departments
- Hospitals and care facilities in the public and private sectors
- General Practitioners
- WHO IHR Focal Point, ECDC EWRS Focal Point
- The WHO European Regional Office, Copenhagen (re: laboratory)
- Counselling and patient support services; including translating services
- Irish and international media

5.4.Co-ordination of response

A possible case of poliomyelitis requires urgent investigation and response. In the event of a suspected case of poliovirus, the local MOH will coordinate the initial response with relevant stakeholders and with support from the NHPSI, as required.

The public health response to a possible or confirmed case of polio or poliovirus environmental detection will be coordinated and overseen by an MOH-led National Health Protection Outbreak Control Team (OCT). The OCT will have broad membership and include members of the NPEC (including neurologists, paediatricians, microbiologists, infectious disease physicians, Director of Nursing – Health Protection), Public Health Area MOH, National Health Protection MOH, Treating Clinicians, HPSC, NIO, NVRL, HSE Communications and Operations among others. Draft terms of reference for the OCT are available in Appendix I.

The MOH-led OCT will adhere to the WHO standard operating procedures for responding to a poliovirus event or outbreak (WHO, 2022d) including undertaking detailed investigation, active surveillance and providing expert advice to inform, control and manage the outbreak including conducting vaccination campaigns when advised by WHO. Close coordination of all relevant stakeholders, at national and regional levels, will be facilitated through the OCT. In the event of a HSE crisis management team being convened (to coordinate HSE operational response) and/or a

Department of Health-led response (e.g. National Public Health Emergency Team), the OCT will interface with and report to these structures, as depicted in Figure 3.

Reporting Structure in the Event of a Polio Outbreak

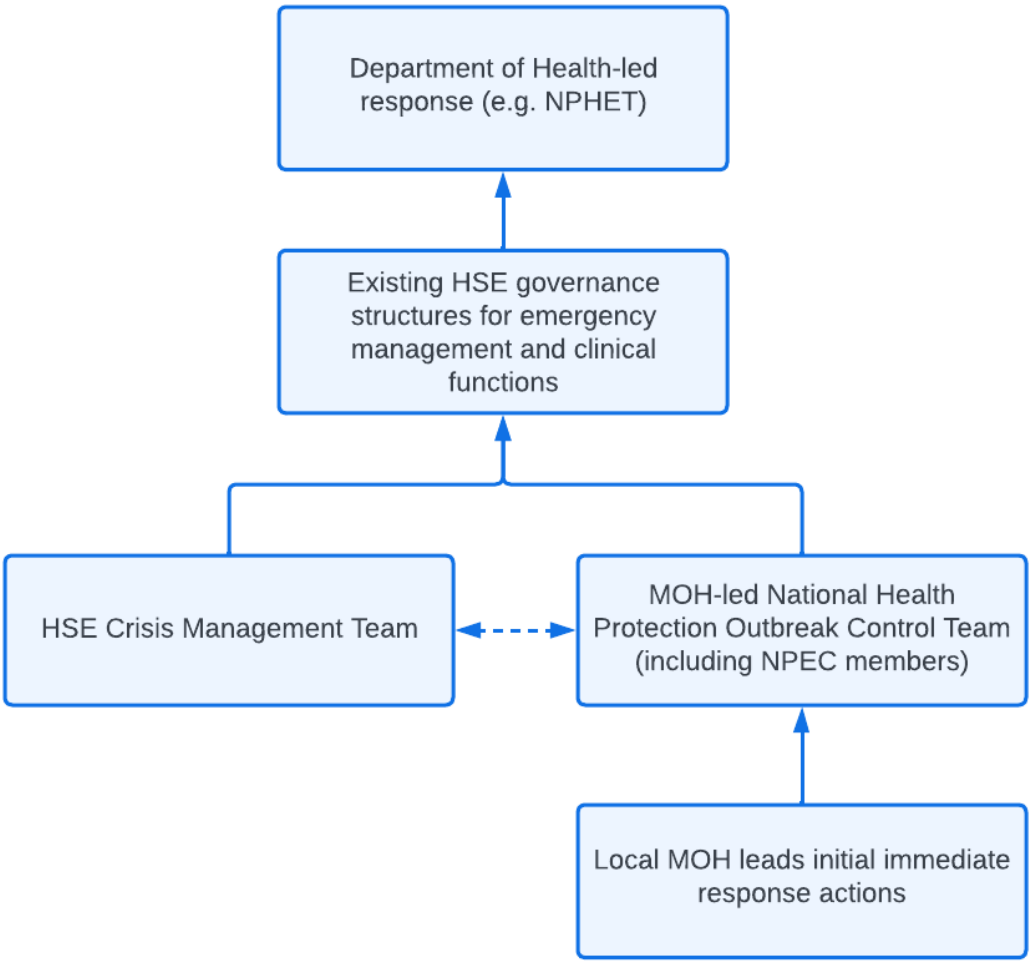


Figure 3: Reporting Structure in the Event of a Polio Outbreak.

Abbreviations: *MOH, Medical Officer of Health; NPEC, National Polio Expert Committee; NPHET, National Public Health Emergency Team.*

5.5. Health Protection response

5.5.1. International reporting to WHO

All instances of poliovirus detection in Ireland must be reported to WHO by the national focal point in Ireland (HPSC) within 24 hours, regardless of the type of isolate (e.g. WPV, VDPV) or the source (case, environmental sample, other). Urgent IHR contact with WHO is appropriate for polio notification. ECDC is notified through EWRS (this channel is available for WHO to view also).

All cases of polio must be reported to the WHO through the IHR National Focal Point within 24 hours of receiving positive result (a HPSC function). WHO regional and global polio laboratory coordinators will review and confirm results with the reporting laboratory and share with WHO regional and global polio programme focal points within 24 hours of receiving laboratory results. WHO global polio focal point or programme coordinator informs all concerned Global Polio Eradication Initiative (GPEI) partnership members.

5.5.2. Epidemiological and environmental investigation of poliovirus infection

This includes case and contact investigation, risk assessment, assessment of population immunity and implementation of enhanced surveillance as per the protocol.

The response team reviews the patient's records obtaining the following information on the index case:

- Age of patient and date of onset of paralysis;
- Residence or travel to a polio-endemic country, or one that has recently reported imported cases or cVDPV;
- Vaccination status, including timeframes and the vaccine used (OPV, or IPV);
- Contact with persons recently immunised with OPV or persons who have recently travelled to a polio-endemic country, or one that has recently reported imported cases or cVDPV;
- Potential for further spread; healthcare workers and people who have contact with children, or are involved in food preparation have a greater chance of spreading infection to a larger number of people;
- Potential for laboratory exposure to Poliovirus Infectious Material (PIM); and
- Vaccination status of contacts.

The epidemiological investigation aims to establish where the infection was acquired and to where it may have spread. If the initial infected patient does not have a travel history that indicates they have acquired the infection overseas, or potential for laboratory exposure to poliovirus, the epidemiological investigation needs to urgently establish where the infection was acquired to inform

public health containment strategies. The short incubation period and ability for asymptomatic patients to shed virus may mean that many individuals have been exposed to the virus before a case of AFP is detected. The epidemiological investigation, and collection of stool specimens may involve the local community, including childcare facilities, schools and other community groups.

5.5.3. Microbiological investigation of poliovirus infection

For individuals diagnosed with AFP or with suspected poliovirus infection, laboratory testing of stool specimens is required to confirm poliovirus infection and to discriminate between WPV, VDPV or Sabin-like strain. All WPV and cVPDV detections would necessitate an immediate public health response. Detection of a cVDPV would be considered a significant risk and should be treated the same as for isolation of a WPV. The response to isolation of a vaccine strain of poliovirus and Sabin-like strain from a potential case of VAPP may vary according to the perceived risk for further person-to-person transmission. Since more specific laboratory tests are needed to differentiate a VDPV from a Sabin-like strain of poliovirus, the initial public health response should assume isolation of a VDPV until laboratory results indicate otherwise.

The detection of WPV, VDVP or cVDPV in wastewater would trigger additional focused wastewater investigations in attempt to identify geographical areas where viral excretion into wastewater is occurring. This would provide additional information for a targeted public health response. In the event of more widespread infection, a larger number of wastewater sites across Ireland will be investigated.

The WHO standard operating procedures for responding to a poliovirus event or outbreak (WHO, 2022d) provides details on the minimum response requirements to polio events, in reference to the type of isolate (PV1, 2 or 3) and the source of the isolate (environment or human).

5.5.4. Containment strategies

The containment of a potential outbreak of poliovirus will include the following:

- Isolation of infected individuals (and those with high index of suspicion)
- Contact tracing
- Management of potential contacts
- Cleaning and disinfection
- Immunisation
- Risk assessment
- Communication
- Education
- Increased surveillance

5.5.4.1. Isolation of infected individuals

Individuals identified as being infected with poliovirus, and those with a high index of suspicion, should be isolated to minimise potential for transmission. Droplet and contact precautions should be immediately implemented, and cases quarantined pending clearance (Russo et al., 2022). Personal protective equipment (PPE) needs will be determined by site-specific risk assessment (WHO, 2022e). For details on implementation of contact precautions, see IPC Guidelines (NCEC, 2022). Depending on the circumstances, isolation of the individual may be at home, in a hospital setting or HSE Infectious Disease Isolation Facility.

For individuals with suspected or confirmed poliovirus infection, measures should be put in place to ensure safe disposal of stool material to avoid release into the environment (stools should be quarantined and incinerated). This would require the collection, and safe disposal, of potentially infectious material (faecal matter) to avoid release to public drains. This should include all nappies, if applicable. If hospitalised, the patient should have a single room, with commode facilities for dedicated single patient use. The commode should be double-bagged using clinical waste bags, which are then disposed of as clinical waste. A solidifying agent can be added for liquid stools. When no longer required, the commode should be placed directly into a 'black lidded' rigid waste bin for collection and incineration.

A stool specimen should be collected weekly for testing at the NVRL. Isolation should continue until two stool samples taken seven days apart are shown to be negative for poliovirus. Poliovirus infection is usually cleared within six weeks by an immunocompetent person but long-term shedding may occur in immunocompromised individuals.

Management of a patient with an immune disorder will include intravenous immunoglobulin (IVIG) (and monoclonal antibodies or antivirals, if available) plus IPV of household contacts and close community contacts. Stool samples should be taken monthly in immunocompromised individuals until three stools are negative.

Families and carers of a patient infected with poliovirus should observe good sanitation and hand washing. All health and care workers, carers and family should have evidence of adequate primary immunisation against polio (see Tracing and Management of Potential Contacts below) and receive booster IPV dose as per NIAC guidelines (NIAC, 2023). As most cases of AFP require hospitalisation, healthcare workers should refer to the NCEC Guidance on Infection Prevention and Control 2022 (NCEC, 2022) for the prevention of transmission of infectious diseases in the healthcare setting for the correct infection control procedures.

5.5.4.2. Contact Tracing

In order to contain the spread of poliovirus, which produces a large number of asymptomatic infections, contact tracing undertaken by the relevant jurisdiction(s) is important to identify potentially infected individuals. There are four major categories of people who may have had contact with the index patient and therefore may have been exposed to poliovirus:

- **Household contacts:** (people who lived with the index patient during the infectious period). These people represent the greatest risk as they may have had contact with the index patient prior to the appearance of symptoms. Where the index case is an infant, those involved in hygiene procedures, such as nappy-changing, should be treated as household contacts. Congregate settings may operate like a household (see below).

- **Toilet contacts:** people who shared a toilet with the index patient during the infectious period.

- **Health and care workers** (people who cared for the index patient during the infectious period) and laboratory workers involved with testing the patient's specimens. It will be necessary to ensure that appropriate procedures are followed by laboratory workers during testing of suspect samples.

- **Public contacts** including consumers, in the event that the case prepares food for others to eat.

- **Congregate settings:** those within a "household nature" (those living directly with index case) should be managed as "Household contacts". Others within congregate settings, who may share a toilet, but are not living in close quarters, with index case should be managed at "Toilet contacts".

Previous vaccination, especially if only IPV was administered, does not necessarily prevent infection and as most people infected with poliovirus are asymptomatic the precautions outlined below are advised to prevent transmission by potentially infected contacts.

A Eurosurveillance Rapid Communication describing the response to a WPV2-shedding event in the Netherlands describes the contract tracing process in detail (Duizer et al., 2017).

5.5.4.3. Management of infected individuals and potentially infected contacts

Table 1: Management of Infected Individuals and Potentially Infected Contacts

Individual or contact	Management action
Infected individuals	Isolate in hospital, HSE Infectious Disease Isolation Facility or quarantine in a dedicated room in their dwelling and use droplet and contact precautions. Ensure safe collection and safe disposal of faecal material. Ensure that stool samples are not released into environment without decontamination. A stool specimen should be collected weekly for testing at the NVRL. Isolation should continue until two stool samples taken 7 days apart are shown to be negative for poliovirus.
Household contacts (people who lived with the index patient during the infectious period)	Quarantine household contacts at home. Take stool samples > 3 days after the contact's first exposure to the index patient. Offer vaccination with IPV. Contacts can be released from quarantine when two stool samples taken 24-48 hours apart are shown to be negative for poliovirus. Continue surveillance of family members for at least 60 days post initial case investigation.
Toilet contacts/co-workers (people who shared a toilet with the index patient during the infectious period, i.e. within 30 days before the case's onset of illness or those who had contact with stools or faecal matter of the case within 30 days before the patient's onset of illness, without using infection control precautions)	Offer education on hygiene and vaccination. Check vaccine history: if fully vaccinated, offer IPV booster (if > 10yr since last booster); otherwise offer full IPV vaccination course. If uncertain, offer full IPV course.
Health and care workers (people who cared for	Offer a booster vaccination with IPV for anyone

the index patient during the infectious period and laboratory workers involved with testing the patient's specimens)	who has not had a booster within the previous 10 years. For health and care workers in close contact with the index patient who have no recorded immunisation history, or are not completely vaccinated, take two stool samples, 24-48 hours apart, with the first being taken > 3 days after the contact's first exposure to the index patient and offer a course of IPV vaccination (three doses a minimum of one month apart).
Public contacts (including consumers, in the event that the case prepares food for others to eat)	Offer education on hygiene and vaccination. Check vaccine history: if fully vaccinated, offer IPV booster (if > 10yr since last booster); otherwise offer full IPV vaccination course. If uncertain, offer full IPV course.

Summary information pertaining to the household transmission of polioviruses and non-polio enteroviruses can be found in Fields Virology 4th Edition (Fields et al., 2001), which states that: "Household secondary attack rates in susceptible members may be greatest for the agents of acute haemorrhagic conjunctivitis (enterovirus type 70 and coxsackievirus A24 variant) and for the polioviruses, and of lesser magnitude for the coxsackieviruses and echoviruses. *In some studies, secondary attack rates may be 90% or greater, although they are typically lower".*

Tracing of close household or toilet contacts (such as those sharing a section of an aeroplane, workplace or childcare centre with the infected patient) is important to reduce the risk of onward transmission of infection. For containment, the tracing of contacts needs to be more rapid than the spread of the virus. One of the most important reasons for tracing of contacts is to educate them on hygiene and vaccination. Collection of stool samples should be obtained from contacts for polio investigation.

Contact tracing may not prevent the contact becoming infected with poliovirus, particularly if they are not adequately immunised, but stool sampling of household and close community contacts (such as co-workers) and incompletely vaccinated health and care worker contacts (as outlined in **Table 1** above) and increased surveillance for clinical symptoms such as AFP will identify spread of the virus and can prevent further transmission. Targeted tracing, collection and investigation of stools and immunisation of close/toilet contacts such as close household contacts, and healthcare workers, food handlers, childcare workers, who have the potential to spread infection to a large number of people, should be prioritised (Eames and Keeling, 2003). The Department of Defence may become involved in identification of contacts overseas should a defence member or dependant be exposed to poliovirus in the course of their duty abroad.

5.5.4.4. Cleaning and disinfection

Proper cleaning and disinfection of areas contacted by an infected individual is required to prevent onward transmission.

Survival of poliovirus is favoured by lower temperatures and high moisture content. Once excreted, the virus can survive outside the human body for weeks at room temperature (Minor and Bell, 1990). Laboratory studies have shown that polio virus survival in the environment is enhanced at

high relative humidity (Abad et al., 1997). Typical relative humidity for aircraft is below 10% suggesting the virus may not survive for long periods in this environment (Hocking and Foster, 2004). Interpolating data from various studies, Dowdle and Birmingham estimated poliovirus infectivity to decrease by 90% every 20 days in winter and 1.5 days in summer, in sewage every 26 days at 23°C, in fresh water every 5.5 days at ambient temperatures, and in seawater every 2.5 days under the same conditions (Dowdle and Birmingham, 1997). Poliovirus survived on cotton fabric with minimal loss for 24-48 hours at ambient temperature and 35% relative humidity, with rapid loss after 48 hours. Poliovirus survived longer on woollen fabrics with recovery after 20 weeks at the same humidity (Dowdle et al., 2006).

Active disinfection procedures should involve the use of cleaning practices to remove soiling that may harbour and protect viral particles. Common disinfectants such as 70% ethanol, lysol and quaternary ammonium compounds are not effective against poliovirus. The virus is also resistant to lipid solvents (such as Dettol®) and is stable in many detergents at room temperature, although temperatures above 60°C for prolonged periods will reduce the infective capability of poliovirus.

Effective disinfectants are those which contain free chlorine, such as sodium hypochlorite or bleach, glutaraldehyde solutions, formaldehyde solutions and iodophores. Contact time is also important in inactivating the virus. Laundry should be soaked in chlorine bleach (diluted according to the manufacturer's instructions) for at least 15 minutes.

5.5.4.5. Immunisation

IPV is currently the vaccine of choice for use in an outbreak response in Ireland and is the only polio vaccine readily available in Ireland or Europe.

In a WHO meeting of the Strategic Advisory Group of Experts on Immunization (SAGE) of October 2022, SAGE endorsed the option for the timely initial use of IPV to respond to outbreaks, in countries like Ireland which use only IPV for routine childhood immunization (WHO, 2023d) and have a high level of sanitation and hygiene. This option is recommended if the poliovirus transmission is confined to a well-defined population group or geographical area. If transmission persists, OPV response should be considered.

SAGE provides guiding principles on selection of target age group in outbreak response campaigns. It reiterates that the outbreak response campaigns should primarily target children less than 5 years, though a wider age range response may be considered when there is evidence of immunity gaps in older age groups or low historical vaccination coverage rates. SAGE also recommends that all countries have outbreak response plans to be prepared for timely response against VDPV or WPV1 outbreak.

Ireland would consult with WHO and work closely with WHO guidance following identification of polio virus in the country, including discussions on preparations for access to nOPV, if it was to be required. WHO has defined transmission risk zones based on population risk for polio virus transmission.

There is no published evidence on the role of polio vaccination as post-exposure prophylaxis against paralytic disease.

Theoretically, as IPV induces IgG immunity in some people after a single dose, IPV provided during the incubation period to paralytic disease could protect the individual. It is more likely that the high immunisation rate in Ireland and an individual's previous immunisation will prevent disease

however, it may not prevent viral replication in the intestine of the vaccinated individual and therefore onward transmission throughout the community, and potential paralysis in infected contacts is possible.

At present, immunisation with IPV-containing vaccine in contacts and health and care workers without a known immunisation history of receiving at least three previous doses of an appropriate poliovirus vaccine (e.g. IPV or OPV), or with incomplete immunisation history, is recommended in order to ensure that all possible harm minimisation measures are implemented.

As there is an absence of evidence on the protective role of IPV vaccination after possible exposure, *vaccinated contacts need to be informed that they may require a booster dose of IPV-containing vaccine, and may not be protected against clinical polio in the immediate term* and that they should still contact their public health department if they develop any of the symptoms outlined on a supplied fact sheet.

Individuals offered immunisation *should be reassured that IPV is not a live vaccine* and will not cause polio infection.

5.5.4.6. Risk Assessment

A risk assessment addresses three risk elements: virologic, contextual, and risk of international spread (see **Table 2**). It is presented by HPSC and/or WHO Europe regional office to GPEI partners within 72 hours of receipt of a genetic sequencing result, or confirmation of an outbreak. A detailed summary of elements required to produce a robust risk assessment is available in Annex 1: Risk assessment overview in the WHO standard operating procedures for responding to a poliovirus event or outbreak (WHO, 2022d).

Table 2: Poliovirus Risk Assessment.

(WHO, 2022d)

Risk Element	**Sample of risk factors considered (non exhaustive)**
Virologic risk *(considered high for any WPV or cVDPV)*	High degree of genetic deviation from parent Sabin, number and nature of nucleotide changes, and expert interpretation by virologists, etc.
Contextual risk	Recent poliovirus detection or other sentinel events, sensitivity of AFP surveillance system, high population, low immunisation coverage and population immunity, geographic access, conflict, inaccessible or hard-to-reach populations, and population movements, etc.
Risk of international transmission	Border area with high population mobility, nomadic or refugee populations, cross-border conflict, and international travel routes, etc.

All polio outbreaks and any type 2 polio event that are assessed to meet the criteria for high risk of transmission will require implementation of Rapid Response vaccination campaigns within 14 days of notification. High-quality vaccination campaigns (Supplementary Immunisation Activities) should follow the Rapid Response. Please refer to WHO standard operating procedures for responding to a

poliovirus event or outbreak (WHO, 2022d) for further detail on the considerations of quality versus speed of response.

All outbreaks, and potentially also events in high-risk contexts, will be graded by WHO according to the Health Emergency Response Framework. This procedure will instigate outbreak response policies in WHO and in Ireland. The grading will indicate level of risk of local or international transmission and determine actions required to manage the event or outbreak. WHO will allocate an outbreak Grade 1 (low risk), 2 (medium risk) or 3 (high risk) within 72 hours of Day 0.

In the case of type 2 events and outbreaks, the nOPV2 advisory group will assist the WHO Director General to determine the appropriate release of nOPV2, based on the country risk assessment and proposed response plan and the expert recommendations of the Advisory Group. The use of nOPV2 is strictly controlled for high risk areas as the risk benefit of using nOPV2 in a country where it is not routinely used may increase the risk of cVDPV circulation after widespread use.

Ireland would comply with immediate notification of any instance of poliovirus isolation – and other notifiable polioviruses, such as cVDPV2 or Sabin 2 virus, isolated anywhere, regardless of the type of isolate (WPV, VDPV, Sabin 2), or the source (case, environmental sample, other).

5.5.4.7. Education and increased surveillance

Education

As part of the containment strategy, education will be essential as poliovirus infection is a very rare occurrence in Ireland. Healthcare workers need to be educated on appropriate contact precautions, specific poliovirus laboratory investigation and appropriate sample collection and immunisation. Cleaning staff will need to be educated on appropriate cleaning agents and contact times. Potential contacts need to be educated on testing and immunisation and symptoms of which they should be aware.

Clinical Surveillance

In order to detect asymptomatic infection and prevent further transmission, clinicians need to ensure that all suspected cases of polio infection and cases of AFP have appropriate stool sampling and are referred to NVRL for testing. Ireland's freedom from poliovirus infection can only be demonstrated by maintaining the WHO performance indicators for AFP surveillance, including appropriate stool sampling.

Environmental Surveillance

Individuals excrete poliovirus for several weeks after infection, and it is estimated that poliovirus can survive in sewage with a 90% loss of infectivity every 26 days at 23°C (Dowdle and Birmingham, 1997). WHO estimates the theoretical maximum sample sensitivity of environmental surveillance at detection of one individual infected with poliovirus among 10,000 uninfected ones (WHO, 2003). However, there are a number of environmental variables such as excessive rain water, which would impact on this.

Following the detection of VDPV2 in sewage samples in London, United Kingdom, the UK health authorities advised a targeted booster dose with IPV to all children between 1 and 9 years of age in all London boroughs to ensure a high level of protection against the virus and to limit its further spread. Some of the VDPV2 isolates found in the UK were genetically linked to VDPV2 isolated from a polio case that had been reported in July 2022 from New York, USA, as well as to environmental samples collected in New York, USA, and Greater Jerusalem, Israel (GPEI, 2022b).

Environmental surveillance for poliovirus has been implemented in Ireland and is described in section 4.2. In the event of a detection at Ringsend catchment area, consideration will be given to additional environmental surveillance and sampling may be extended to other to other catchment areas within the National Wastewater Surveillance Programme.

5.6. Biosafety and bioterrorism

WHO published the *Global Action Plan (GAP III) to minimise poliovirus facility-associated risk after type-specific eradication of wild poliovirus and sequential cessation of oral polio vaccine (OPV) use* (WHO, 2015). Ireland does not have a Polio Essential Facility for containment of poliovirus. As of 2018, only the WHO National Polio Laboratory at UCD hold Sabin PV1/3 poliovirus. These were provided by the WHO regional Polio laboratory in the UK to allow the National Polio Laboratory to perform cell susceptibility testing (as a QC measure), in keeping with WHO Polio laboratory diagnostic protocols. The NVRL has indicated that it has no isolates or clinical samples known to contain WPV or cVDPV. The NVRL is reviewing its bio-containment measures, and is already an accredited containment level (CL) 3 facility.

As a part of the Certification of Global Polio Eradication process, Ireland has contacted laboratories that may have archived poliovirus potentially infected material (PIM), such as stool specimens, respiratory samples and swabs, which may have been collected from individuals at a time when WPV was circulating or when OPV was in use. Currently the guidance specifically refers to PV2 and states that samples collected as of 3 months after the last reported WPV2 or OPV are no longer considered PIM. The last reported case of WPV2 in Ireland was in 1982, and the last dose of tOPV was given in July 2001. It is therefore highly unlikely that samples collected around 1982/83 would still be stored in diagnostic facilities, but work is ongoing to confirm and document this.

Laboratory workers who are at high risk of exposure to PIM should have a full and documented vaccination history against poliovirus. All specimens containing, or that may contain, poliovirus must be handled using CL2 facilities with dedicated risk assessment procedures.

In the event of a laboratory-acquired case of poliovirus infection, the Public Health Area department would be involved in investigation of the incident and contact tracing, with involvement of National Health Protection Service, as appropriate.

Poliovirus is a potential bioterrorism threat, as it is relatively available in laboratories throughout the world from live vaccine stocks and isolation from clinical specimens. In an area with high vaccination coverage, such as Ireland, release of poliovirus would likely cause localised spread in susceptible populations prior to detection and may affect Ireland's polio-free status. Any poliovirus picked up by routine environmental monitoring would be cause for further investigation.

5.7. Media response to a case of poliovirus infection

One of the most important elements of a public health response will be the communication strategy to ensure that accurate information is provided to the media and the community, as release of inaccurate or premature information may have serious repercussions for the affected individual, their family, carers and their community. It is important that the media are presented with up to date and factual information in order to minimise speculation and public concern. The media may also be important in education of the public on the importance of sanitation, hand washing and immunisation in the containment phase.

It is important for key stakeholders to have agreed on a national notification and communication strategy. Developing an appropriate response to public concerns and media queries requires a partnership between Government representatives, senior media figures, emergency planners, representatives from the medical profession and other key professionals. The OCT will consider specific communications and engagement required with stakeholders including government, health professionals and the public via media. The HSE will formulate the key messages in conjunction with the Department of Health. The Department of Health and HSE website will have up to date information and media releases.

6. Conclusion

Ireland continues to be free of endemic poliovirus, but must maintain and improve IPV coverage to ensure population immunity to poliovirus, and be prepared to respond in a timely and effective way to a poliovirus event following importation of wild or vaccine-derived poliovirus from a country where poliovirus (whether wild or vaccine-derived) continues to circulate.

Maintaining high coverage of IPV within the routine immunisation programme, with supplementary targeting of high-risk groups such as migrants, ethnic minority groups and communities with lower IPV uptake will minimise susceptibility to infection in the event of re-introduction. Clinical and environmental surveillance, early notification by clinicians, rapid case isolation, investigation, contact tracing and control are key elements of a coordinated national approach.

Appendix A: Global Eradication

In 1988, the World Health Assembly adopted a resolution for the worldwide eradication of polio, marking the launch of the Global Polio Eradication Initiative, spearheaded by national governments, WHO, Rotary International, the CDC, UNICEF, and later joined by the Bill & Melinda Gates Foundation and Gavi, the Vaccine Alliance.

WPV cases have decreased by over 99% since 1988, from an estimated 350,000 cases in more than 125 endemic countries to 30 reported cases in 2022. Of the 3 strains of WPV (type 1, type 2 and type 3), WPV2 was declared eradicated in 1999 and WPV3 in 2019. As of 2022, WPV1 remains endemic in two countries: Pakistan and Afghanistan.

The EU/EEA, as well as the UK and the wider WHO European Region, have remained free of indigenous polio since 2002. IPV is used in all EU/EEA countries. Two EU/EEA countries (Poland and Romania), and one neighbouring country (Ukraine), remain at high risk of a sustained polio outbreak following WPV importation or the emergence of cVDPV, due to sub-optimal vaccination programme performance and low population immunity, according to the European Regional Certification Commission for Poliomyelitis Eradication (RCC) report from September 2021 assessment, referring to data from 2020. According to the same report, 11 EU/EEA countries are at an intermediate risk of sustained polio outbreaks (WHO, 2021a).

The continuing circulation of WPV1 in Pakistan and Afghanistan, and detection of four WPV1 cases in Mozambique in 2022 genetically linked to a strain from Pakistan, demonstrate a remaining risk of disease importation into the EU/EEA. Furthermore, the worrying occurrence of outbreaks of circulating cVDPV, which emerges and circulates due to lack of polio immunity in the population, indicates the potential risk for further international spread.

Following the detection of sewage samples positive for VDPV2 in London, United Kingdom, the UK health authorities advised a targeted booster dose with IPV to all children between 1 and 9 years of age in all London boroughs to ensure a high level of protection against the virus, and to limit its further spread. Some of the VDPV2 isolates found in the UK were genetically linked to VDPV2 isolated from a polio case that had been reported in July 2022 from New York, USA, as well as to environmental samples collected in New York, USA, and Greater Jerusalem, Israel (GPEI, 2022b).

To limit the risk of re-introduction and sustained transmission of WPV and cVDPV in the EU/EEA, it is crucial to maintain high vaccine coverage in the general population, and increase vaccination uptake among under-immunised populations. The EU/EEA countries should review their polio vaccination coverage data to ensure there are no immunity gaps in the population, and that there is capacity to identify circulating virus through well-performing surveillance systems (ECDC, 2022b).

On July 18, 2022, the New York State Department of Health notified CDC of detection of VDPV2 in stool specimens from an unvaccinated immunocompetent young adult from Rockland County, New York, who was experiencing acute flaccid weakness (Ryerson et al., 2022). The patient initially experienced fever, neck stiffness, gastrointestinal symptoms, and limb weakness, and was hospitalised with possible acute flaccid myelitis. VDPV2 was detected in stool specimens obtained on days 11 and 12 after initial symptom onset. The individual had no history of travel outside the USA. Environmental surveillance of wastewater identified cVDPV2, indicating unidentified community transmission in the county of residence of the patient.

In 2016, WHO, as part of the GPEI, prepared guidance and Standard Operating Procedures (SOP) for Member States "Responding to a Poliovirus Event or Outbreak" (Part 1: General SOPS and Part 2: protocol for poliovirus type 2) (GPEI, 2022a). The publication of these SOP coincided with the globally synchronised switch from tOPV to bOPV.

The recommendations focussed on the response in the first 12 months following the switch. Since then a number of updates have been done, the most recent of which includes lessons learned from outbreak response efforts since the tOPV-bOPV switch in April-May 2016, and an outline of specific measures for responding to WPV2 events (in the event of a laboratory containment breach, as WPV2 is now considered an eradicated pathogen).

In 2020, the GPEI launched a revision of the strategy for polio eradication, continuing on from the successes of the Polio Eradication & Endgame Strategic Plan (GPEI, 2013). The strengthened plan puts emphasis on cutting outbreak response times, increasing vaccine demand, transforming campaign effectiveness, working systematically through integration, increasing access in inaccessible areas, transitioning towards government ownership, and improving decision-making and accountability.

Many of the new tactics and strengthened approaches outlined in this plan are already operational, and the current plan (Polio Eradication Strategy 2022-2026: Delivering on a Promise) came into effect in January 2022 (WHO, 2021c).

Please refer to GPEI Strategy 2022-2026 for further detail.

Appendix B: Request to Clinicians Regarding AFP Surveillance

Polio Eradication

Dear Dr _____
Re: Case name / identifier: _____
Reported on/by: _____

As you may know, the World Health Organization is working hard to eradicate poliovirus. As part of this process, each year all countries are requested to report to WHO regarding the status of poliovirus infection in the country, and on the quality of surveillance to identify any case, should it occur, in a timely fashion. The criteria that will be used will be extremely stringent and, in particular, that there is no evidence that poliovirus infection was the cause of a case of paralysis.

The WHO has established a gold standard that **all** cases of acute flaccid paralysis (AFP), regardless of the underlying cause, should be investigated by the submission of stool samples and nasopharyngeal swabs for virological investigation of poliovirus, sent to the NVRL, as part of the national surveillance programme for polio.

We are asking all hospital clinicians to report the clinical findings and investigations in all AFP cases < 15 years of age, and to ensure that two faecal samples are taken as soon as possible, at least 24 hours apart, but within two weeks of onset of symptoms, to outrule poliovirus infection. Additionally, please take throat or nasopharyngeal swabs for cases to identify if cause of AFP may be due to Enterovirus D68.

A National Expert Committee for Polio certification has been established and includes a consultant in neurology, virology, microbiology and public health who will review the data on all AFP cases. The committee will submit a report to WHO-EURO annually.

With many thanks for your help with this important initiative.

Appendix C: Case definition, samples required and enhanced surveillance form

(1) CLINICAL CASE DEFINITION:

Any person < 15 years* of age with AFP, or
Any person in whom polio is suspected by a physician

(See https://www.hpsc.ie/a-z/vaccinepreventable/polio/casedefinition/ for full case definition)

(2) REPORTING INSTRUCTIONS FOR AFP CASES IN ADULTS AND CHILDREN

All AFP cases in children and all **suspected polio in adults** are notifiable

Telephone reporting: Report all cases where polio is suspected, **immediately** by telephone to the local MOH (see Appendix F) as a public health emergency. In addition, contact the NVRL to request urgent processing of samples, on 01 716 4401/1321 (https://nvrl.ucd.ie/).

Email: Email completed AFP surveillance form to local MOH, who will forward to HPSC at hpsc-data@hpsc.ie or healthprotectionhpsc@hpsc.ie

For non-urgent cases (AFP, but Polio considered unlikely) complete AFP surveillance form and email to the HPSC at healthprotectionhpsc@hpsc.ie

***Irish Paediatric Surveillance Unit (IPSU) reporting:** For children under 15 years of age, in addition to contacting the NVRL, cases must be reported on the monthly INOPSU report card (which informs HPSC for follow-up).

(3) INVESTIGATIVE SAMPLING:

Advise local laboratory that samples are collected for investigation of AFP/suspected polio, and that **all samples must be sent urgently to the WHO National Polio Laboratory at the NVRL**. See Appendix D for details of sample transport. The NVRL can be contacted on 01 716 4401. In addition, the local laboratory should be informed of the potential infectivity of faecal samples and throat swabs and restrict additional investigations until a risk assessment has been performed.

On the laboratory testing request form **the patient must be identified as having AFP**. The NVRL request form is available at: http://www.ucd.ie/nvrl/pdfs/General_request_form.pdf

a) Stool sample: Collect 2 stool samples in a sterile container, taken at least 24 hours apart and within 14 days of onset of paralysis, and send for viral culture to the WHO National Polio Laboratory at the NVRL.

b) Nasopharyngeal and Oropharyngeal Swab: Collect and label "Collected for enteroviral PCR for AFP case", and send to the WHO National Polio Laboratory at the NVRL.

c) Serum: Collect 1ml minimum serum sample, send to WHO National Polio Laboratory at the NVRL for enteroviral PCR testing.

d) CSF: Poliovirus yield from CSF is low, therefore perform only if CSF sampling already being undertaken as part of case investigation. Send to WHO National Polio Laboratory at the NVRL for enteroviral PCR testing.

The NVRL will send the results to the referring clinician, the local laboratory and the HPSC for collation to go for review by the National Polio Expert Committee (NPEC);

If poliomyelitis is considered a possible cause for a case of AFP or if an infection with poliovirus is confirmed as the cause of the AFP, the local MOH should be informed immediately by telephone (Appendix F)

Follow-up of clinical information: A clinical questionnaire requesting further details is sent by the HPSC to clinicians reporting a case of AFP or suspected poliomyelitis.

If poliomyelitis is suspected and/or if poliovirus is isolated, the case should be immediately notified to the local MOH and the HPSC and this response plan will be activated. Key contact details for local MOH are included in Appendix F.

The adequate collection of stool specimens is the responsibility of clinicians and is essential for confirmation of poliovirus infection and **should be performed urgently** and not in response to no other cause being identified. Collection of adequate patient history by clinicians and public health physicians allows for a more accurate assessment of the risks to contacts. It is essential to collect as much information as possible about the patient's history and risks of exposure to poliovirus or OPV, including VDPV:

- Age of patient, date of onset of paralysis;
- Residence or travel to a polio-endemic country or a country that has recently reported poliovirus importations or VDPV;
- Vaccination status, including timeframes and the vaccine used (OPV or IPV);
- Contact with persons recently immunised with OPV or persons who have recently travelled to a polio or VDPV endemic country, or a country that has recently reported importation of polio cases or VDPV, or a country that uses OPV;
- Potential for laboratory exposure to strains of poliovirus;
- Immune status of patient and contacts;
- Nationality;
- Ethnicity.

Such information is critical when attempting to trace potential sources of infection both forward and back.

The current (updated 9th March 2023) case investigation form is accessible here.

Appendix D: Referral of Specimens to the National Virus Reference Laboratory

1. Collect two stool specimens as soon as possible, at least 24 hours apart, and within 14 days of onset of paralysis, in sterile containers. Each specimen should be approximately five grams. Two specimens are required due to intermittent virus shedding.
2. Store the specimens at 4°C until ready to send. If the shipment cannot be sent for more than 72 hours, freeze the specimens.
3. Complete the AFP specimen laboratory request form, with as detailed information and possible, and include with the shipment.
4. Send the specimens to the National Virus Reference Laboratory. If poliovirus infection is suspected please contact Jeff Connell, Assistant Director of NVRL (01 716 1321, jeff.connell@ucd.ie). For OOH sample processing, clinicians please contact 087 980 6448 before sending samples.
5. Respiratory samples for investigation of AFP. Patients with AFP should also be tested for EV-D68 as a possible differential diagnosis. They should consider laboratory testing of respiratory specimens for enteroviruses when the cause of infection in severely ill patients is unclear. Nasopharyngeal or throat swab, or sample from bronchoalveolar lavage or CSF should be sent to NVRL.

Currently, the transport of dangerous goods in Ireland by any mode of transport is regulated by EU directive 94/55/EC (road and rail transport) and the International Civil Aviation Organisation (ICAO)/International Air Transport Association (IATA) regulations (air travel) both of which use the United Nations Model Regulations system. This system is standardised almost worldwide. Within the UN system dangerous goods are classified into 9 different groups, of which, Class 6, division 6.2 (Infectious substances) is relevant here. Within division 6.2, infectious substances are divided into two categories:

Category A – UN2814(infectious substances affecting humans); packing instruction 602
UN2900 (infectious substances affecting animals); packing instruction 602

Category B – UN3373 (Diagnostic specimens); packing instruction 650.

Category A Infectious Substances are defined as infectious substances in a form that, when exposure occurs, are capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals. **If there is any doubt** as to whether or not a pathogen falls within this category it must be transported as a Category A Infectious Substance.

Category B Infectious Substances are infectious substances that do not meet the criteria for inclusion in Category A.

Packaging of samples

All infectious substances must be transported in triple packaging system.

1) Primary containers must be leak-proof and a water-proof, leak-proof seal must be used.
2) The secondary packaging must also be leak-proof and contain sufficient absorbent material to absorb the entire contents of the primary container. If multiple primary containers are packaged together they must be individually wrapped to prevent contact. Clearly labelled "Pathological Specimen – Open only in Laboratory"

3) The outer shipping packaging can be boxes, cans or drums and must be of sufficient strength for its capacity, weight and intended use. An itemised list of the contents must be enclosed between the secondary and outer packaging.

Specimen data forms, letters etc. should be taped to the secondary container. The primary or secondary container must be able to withstand, without leakage, an internal pressure producing a pressure differential of not less than 95kPa and temperatures –40^{o}C to +55^{o}C.

Appendix E: Laboratory confirmation

Confirmation or exclusion of poliovirus infection is not possible without laboratory testing of stool specimens. It is therefore important that stool specimens are collected as soon as possible from every case of AFP in children, and from cases with a clinical suspicion of poliomyelitis in persons of any age. Stool specimens from close contacts of confirmed polio cases should also be tested for poliovirus.

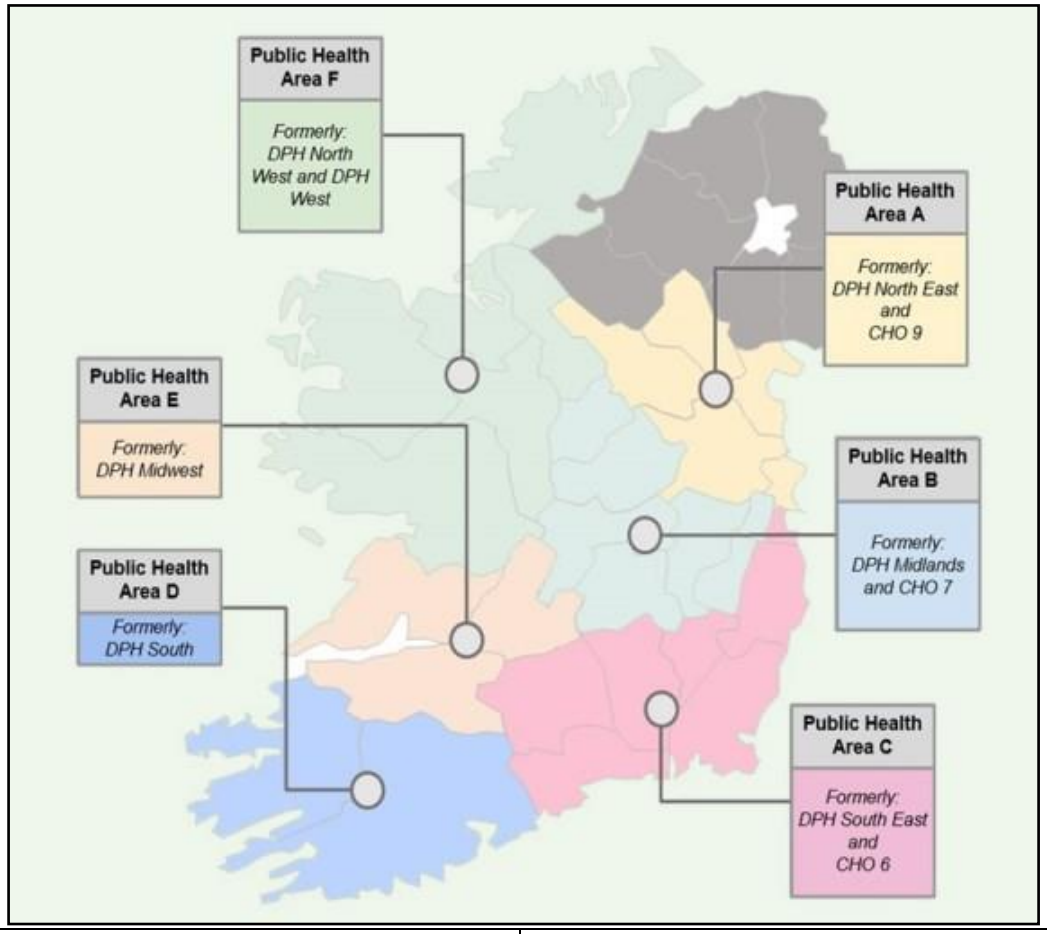
The isolation of a poliovirus from a specimen of an asymptomatic person would be regarded as a poliovirus infection that did not cause paralysis. Laboratories should ensure rapid investigation of all isolated polioviruses. Definitive diagnosis will establish the need for follow up actions to contain and prevent spread of a WPV or VDPV. As poliovirus can spread very quickly, rapid detection of cases is critical. Under WHO guidelines, stool specimens must be tested in the NPL, NVRL at UCD. The NVRL utilises two cell lines, supplied by the WHO, to amplify poliovirus from faecal samples. One cell line, L20B, is a mouse cell line, which has been genetically modified to express the cell surface receptor for CD155, which is specific for poliovirus. Therefore, any viral growth in the L20B cell line would be highly suspicious for a poliovirus. The second cell line is a human rhabdomyosarcoma (RD), which is susceptible to most enteroviruses, and is used to amplify the concentration of virus to enable molecular investigation.
Laboratories should request the following investigations in cases of AFP or suspected polio (see Appendix C):

- Viral culture of stool samples (2 stool samples collected 24 hours apart) and respiratory samples (nasopharyngeal and oropharyngeal swabs) – it is essential that the samples are labelled as collected from a possible AFP case
- Enterovirus PCR investigation on CSF specimens (the CSF usually contains an increased number of leukocytes, from 10 to 200 cells/mm^3 (primarily lymphocytes) and a mildly elevated protein from 40 to 50 mg/100 ml). This finding is non-specific and may result from a variety of infectious and non-infectious conditions. Information relating to the cell count, glucose and protein should accompany the CSF sample
- Enterovirus PCR on stool and respiratory samples (nasopharyngeal and oropharyngeal swabs)
- Viral culture/enterovirus PCR investigation of stool from household contacts
- Molecular Intratypic differentiation - distinguish between WPV, Sabin-like and VDPV
- Molecular sequencing to confirm WPV/VDPV
- Suspect viral cultures are referred to the WHO reference laboratory in the UK for confirmation of poliovirus and further differentiation, through molecular sequence analysis of WPV and VDPV strains
- NVRL will report routine poliovirus investigations on specimens from cases with paralytic, or other neurological, symptoms as outlined above within one week of receipt
- Laboratories should assist the local MOH/DPH and the HPSC with the public health response to suspected cases

Appendix F: Key contact details

Information below accurate as of date of April 2023. Up-to-date contact details available at https://www.hpsc.ie/notifiablediseases/whotonotify/

In-hours contact details for Public Health Areas (MOH)



Public Health Area A	***Public Health Area B***
Area Director of Public Health Area A: Dr Deirdre Mulholland Cavan / Louth / Meath / Monaghan Department of Public Health Public Health Area A Health Service Executive Kells Business Park Kells Co. Meath A82 W2P3 Tel: +353 (0)46 928 2700 Fax: +353 (0)46 928 2744 Email: PublicHealth.AreaA@hse.ie Dublin North Central - North West Dublin - North Dublin Department of Public Health	Area Director of Public Health Area B: Dr Fionnuala Cooney Dublin South City / Dublin South West / Dublin West / Kildare / Wicklow (West) Department of Public Health Public Health Area B Health Service Executive Dr. Steevens' Hospital Dublin 8 D08 W2A8 Tel: (057) 9359891 Email: PublicHealth.AreaB@hse.ie Laois / Offaly / Longford / Westmeath Department of Public Health Public Health Area B Health Service Executive

Public Health Area A Health Service Executive Dr. Steevens' Hospital Dublin 8 D08 W2A8 Tel: (046) 928 2700 Email: PublicHealth.AreaA@hse.ie	HSE Area Office Arden Road Tullamore Co. Offaly R35 TY28 Tel: +353 (0)57 9359891 Email: PublicHealth.AreaB@hse.ie
Public Health Area C Area Director of Public Health Area C: Dr Carmel Mullaney (Interim) Dublin (South East) / Dun Laoghaire / Carlow / Kilkenny / South Tipperary / Waterford / Wexford / Wicklow (East) Department of Public Health Public Health Area C Health Service Executive Dublin Road Lacken Kilkenny Tel: +353 (0)56 770 4301 Fax: +353 (0)56 778 4393 ID Fax: +353 (0)56 778 4599 Email: PublicHealth.AreaC@hse.ie	***Public Health Area D*** Area Director Public Health Area D: Dr Anne Sheahan Cork and Kerry Department of Public Health Public Health Area D Health Service Executive Floor 2 - Block 8 Zone B2, St. Finbarr's Hospital Douglas Road Cork T12 XH60 Tel: +353 (0)21 4927601 Fax: +353 (0)21 4923257 Email: dph.south@hse.ie
Public Health Area E Area Director Public Health Area E: Dr Mai Mannix Limerick / Clare / North Tipperary Department of Public Health Public Health Area E Health Service Executive Mount Kennett House Henry Street Limerick V94 KN3N Tel: +353 (0)61 483 338 Fax: +353 (0)61 464 205 Email: MWnCoV1@hse.ie	***Public Health Area F*** Area Director of Public Health Area F: Dr Áine McNamara Galway / Mayo / Roscommon Department of Public Health Public Health Area F Health Service Executive Merlin Park Galway H91 N973 Tel: +353 (0)91 775 200 Fax: +353 (0)91 758 283 Email: public.health@hse.ie Donegal / Sligo / Leitrim Department of Public Health Public Health Area F Health Service Executive 3rd Floor Bridgewater House Rockwood Parade Sligo F91 Y9YY Tel: +353 (0)71 917 4750 Fax: +353 (0)71 913 8335 Email: infoid@hse.ie

Out-of-hours contact details for Public Health

Clinicians to contact Public Health through Ambulance Control 0818 501 999

Other key contacts

National Polio Laboratory (NPL) in the National Virus Reference Laboratory
University College Dublin, Belfield
NVRL clinician on call: 087 980 6448.
Website: http://nvrl.ucd.ie/
Email: jeff.connell@ucd.ie

The Health Protection Surveillance Centre HSE
25-27 Middle Gardiner St, Dublin 1
Contact medical officer on-call
Telephone: 01 876 5300 (reception)
Out-of-hours on-call service available
Website: www.hpsc.ie
Email: healthprotectionhpsc@hpsc.ie

Department of Health
Block 1, Miesian Plaza, 50 – 58 Lower Baggot Street, Dublin, D02 XW14
Tel: (01) 6354000
Website: www.health.gov.ie

WHO IHR Focal Point
Health Protection Surveillance Centre
25-27 Middle Gardiner St, Dublin 1
Telephone: (+35) 1 876 5300 and IHR on call service
Fax: (+35) 1 856 1299
Website: www.hpsc.ie

Appendix G: Achieving Certification of Global Polio Eradication

In 1997, the Global Commission for the Certification of the Eradication of Poliomyelitis (GCC) finalized the criteria for certifying whether the goal of polio eradication is achieved. Certification is conducted on a regional basis. Each region (there are 6 WHO regions - the Americas, the Western Pacific region, the European Region, the Eastern Mediterranean Region and Southeast Asian Region and the African Region) can consider certification only when all countries in the area demonstrate the absence of WPV transmission for at least three consecutive years in the presence of excellent surveillance.

In addition to achieving the certification of global polio eradication, all facilities holding WPV infectious and potentially infectious materials must have implemented bio-containment measures. The WHO Global Action Plan for Poliovirus Containment, Fourth Edition (GAPIV) (WHO, 2022e) outlines the activities and adherence procedures required of laboratories to minimize the risk of the reintroduction of WPV from laboratories into the community. The WHO Global Action Plan for Poliovirus Containment is an evolving document, in its fourth iteration.

What is required to achieve global certification?

1. Achieving certification-standard surveillance

In endemic regions:

- Achieve and sustain certification-standard AFP surveillance at the national level.
- Identify and close any gaps in surveillance performance at the sub-national level in all countries.
- Increase the speed of surveillance and virologic data analysis to ensure timely emergency response.

In certified polio-free regions:

- Maintain certification-standard AFP surveillance
- Ensure highest possible immunity levels against WPV
- Develop action plans for responding rapidly to importations of WPV
- Integrate AFP reporting into national surveillance mechanisms to respond to other important diseases

2. Ensuring access to a WHO-accredited laboratory

- Reduce the time required for intra-typic differentiation (ITD) results to be available from endemic areas
- Establish ITD capacity in all polio reservoir countries
- Sustain the international capacity to process all specimens from AFP cases in WHO-accredited laboratories through global certification and OPV cessation

3. Ensuring containment of wild and vaccine-derived poliovirus

- Disseminate further, and ensure national implementation of activities outlined in, the WHO Global Action Plan for Poliovirus Containment, Fourth Edition (GAPIV).
- Complete laboratory survey and inventory activities in all polio-free countries.
- Prepare for implementation of phase II laboratory containment activities prior to global certification.
- Complete CL3/polio containment in facilities producing IPV from WPV.

4. Completing the certification process

- National Certification Committees (NCC) to collect, review and decide on the national documentation through consultations.

What is certification-standard surveillance?

- the ability to detect at least one case of non-polio AFP for every 100,000 children under 15 years of age, annually
- the collection of two adequate stool specimens from at least 80% of cases of AFP
- the processing of all specimens at a WHO-accredited laboratory

Appendix H: Investigation of AFP Notification by the National Polio Expert Committee

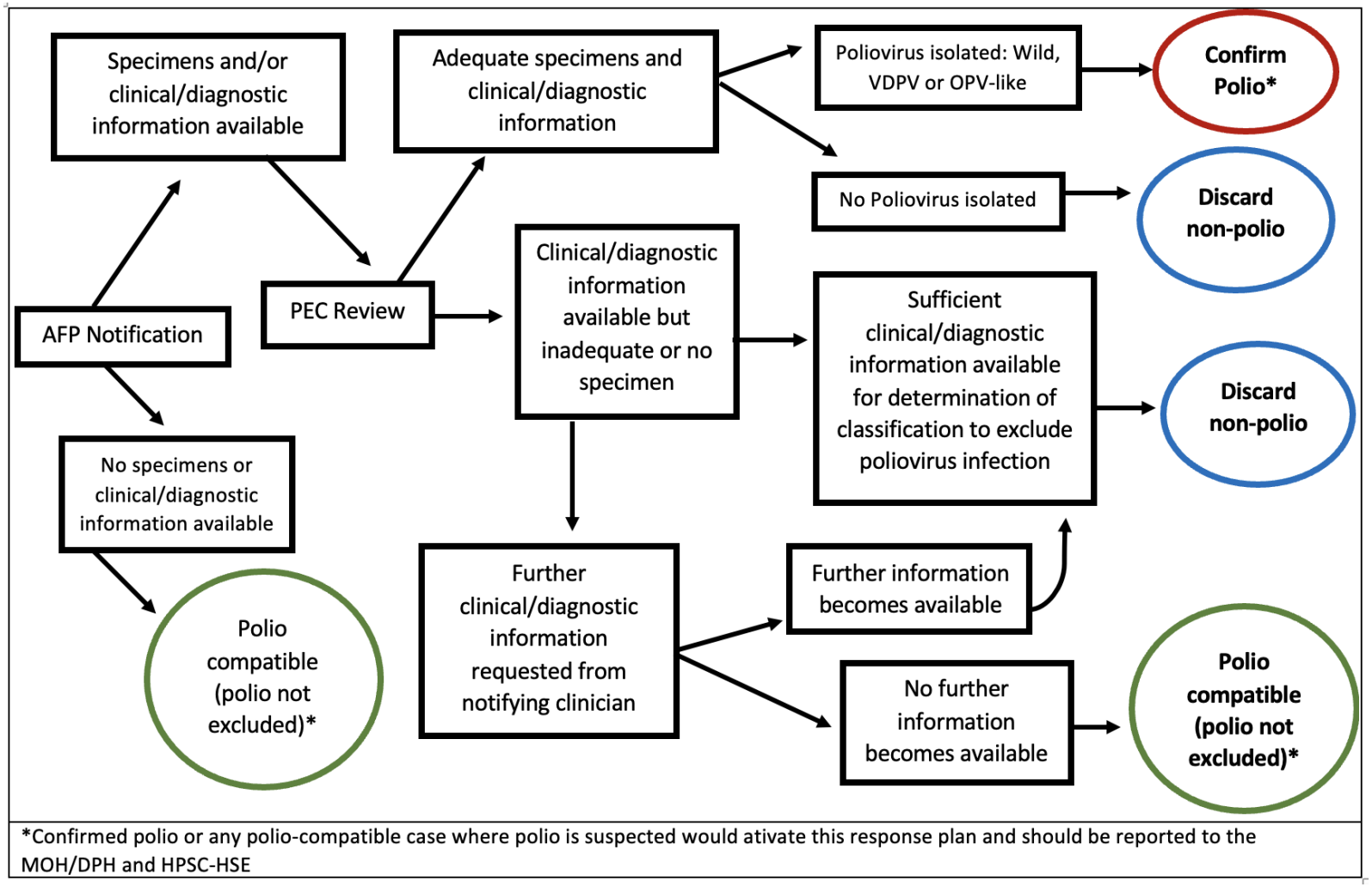


Figure 4: Investigation of AFP Notification by the National Polio Expert Committee.

Appendix I: Outbreak Control Team Terms of Reference

1.0 Background

The Polio Outbreak Control Team will oversee the HSE's Public Health/Health Protection response to polio event/outbreak.

2.0 Purpose

To address statutory responsibilities in control of a polio event/outbreak, Polio OCT will provide expert advice and decision-making regarding management and control of the event/outbreak.

3.0 Terms of Reference

1. To coordinate actions to control the outbreak nationally in collaboration with all relevant stakeholders to deliver this response (members of the NPEC (including neurologists, paediatricians, microbiologists, infectious disease physicians), Public Health Area MOH, National Health Protection MOH, Treating Clinicians, HPSC, Health Protection Nursing, NIO, NVRL, HSE Communications and Operations among others).
2. To act as an OCT, to prevent further transmission and spread including:
    a. To review epidemiological, microbiological, and clinical aspects of suspect/confirmed case(s) to provide evidence to inform control actions.
    b. To risk assess the current situation.
    c. To provide expert advice to inform control and management of the outbreak including undertaking appropriate surveillance and investigation, providing guidance on contact management, post-exposure prophylaxis, therapeutics, immunisation, Occupational Health management, PPE, IPC, and advising on any other steps necessary to control the outbreak.
3. To establish and oversee necessary subgroups as required to fulfil the brief.
4. To consider specific communications and engagement required with key stakeholders including government, health professionals and the public via media.
5. To agree on and establish effective and consistent communications, alerting and briefing, internally and externally and to stakeholders.
6. To advocate if necessary for additional resources.
7. To ensure that a report is written, documenting operational aspects of the response, and that lessons learnt are disseminated.

4.0 Governance

Chaired by the MOH (as designated by the Director of National Health Protection) and is accountable for delivery of its responsibilities to the HSE Chief Clinical Officer (CCO) through the Director of National Health Protection.

5.0 Membership

The following OCT membership is recommended:

Chair
Medical Officer of Health
Membership
Area Public Health (C/SPHM, ADPH)
National Health Protection (DNHP, NIO, HPSC, Threat Preparedness, Acute Response, Director of Nursing)
Treating Clinician(s)
Hospital Management
National Virus Reference Laboratory (NVRL)
NPEC members (including neurologists, paediatricians, microbiologists, infectious disease physicians)
Environmental Health
Occupational Health
Emergency Management
HSE Communications
HSE Acute and Community Operations

Subject Matter Experts may be co-opted in, as required, to identify risks relevant to their areas and to contribute to the risk assessment process.

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