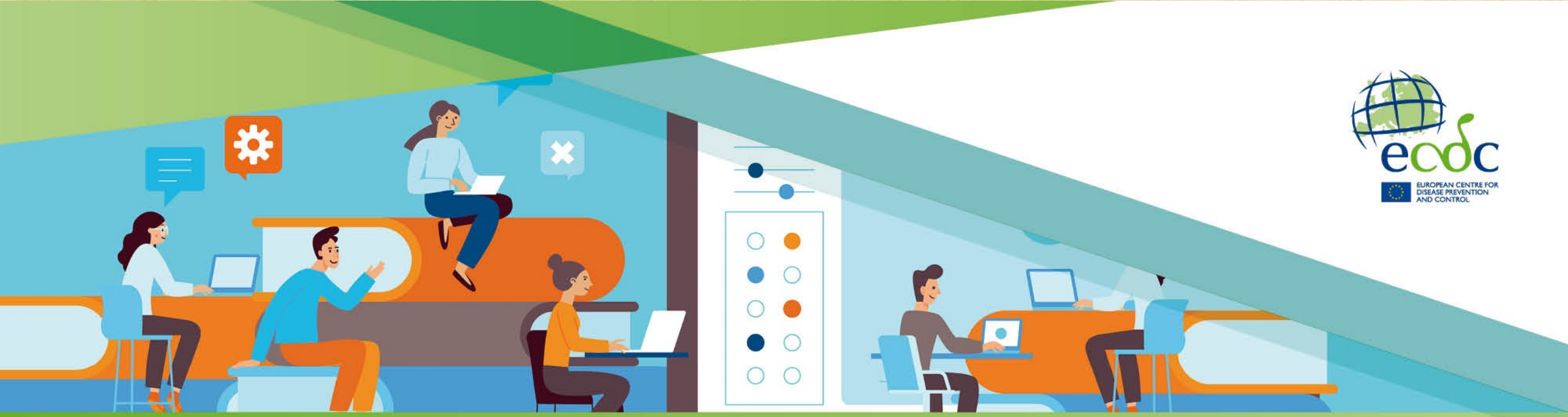


GenEpi-BioTrain – Virtual Training 28 – Genomics and epidemiology of polioviruses

Future directions in polio research and eradication efforts

20 July 2026

Kathleen Rankin

Aim and learning objectives

Aim Provide participants with a comprehensive understanding of how genetic data are used for polio outbreak responses and their context within the outbreak response framework

Specific learning objectives

At the end of this session, you will be able to:

1. Understand the surveillance signal required to launch a polio outbreak response
2. Understand different approaches to reaching undervaccinated populations in outbreak responses
3. Apply uses of genomic data to define virus circulation and optimize response strategies

Outline

This session consists of the following elements

1. Introduction to the Global Polio Eradication Initiative strategy
2. Description of the use of genomic data for outbreak response
3. Overview of strategies to improve immunization coverage in low coverage areas

Global Polio Eradication Initiative

The Global Polio Eradication Initiative is a public private partnership led by national governments with six partners – the World Health Organization(WHO), Rotary International, the US Centers for Disease Control and Prevention (CDC), the United Nations Children's Fund (UNICEF), Gates Foundation and Gavi, the Vaccine Alliance. Its goal is to eradicate polio worldwide.

Interrupt and eradicate WPV1 in the final endemic countries

Setting the stage:

In 1988, wild poliovirus was endemic in **125 countries.**

In 2024, wild poliovirus is endemic in **2 countries.**

Two of the three types of wild poliovirus – types 2 and 3 – have been eradicated.

One type of wild poliovirus – type 1 – remains.

Stop and prevent type 2 variant poliovirus outbreaks

Setting the stage:

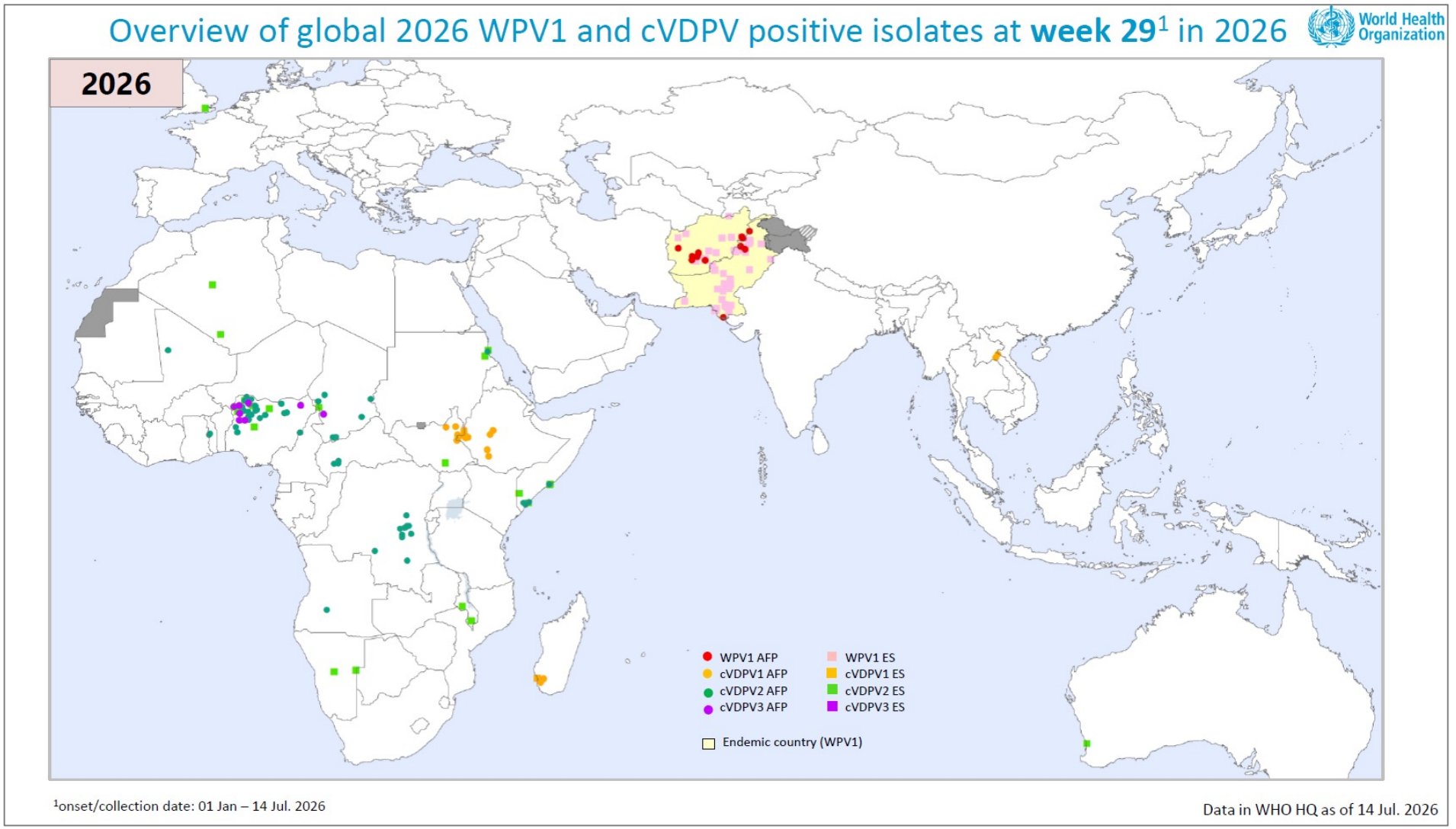
Campaigns target **3x** more children now than in 2020.

Cases have steadily declined from **688** in 2022 to **196** so far in 2024.[2]

A total of **1.2 billion** doses of novel oral polio vaccine type 2 (nOPV2) have been administered in **42** countries.

New emergences have declined annually from **15** in 2020 to just **3** so far in 2024.

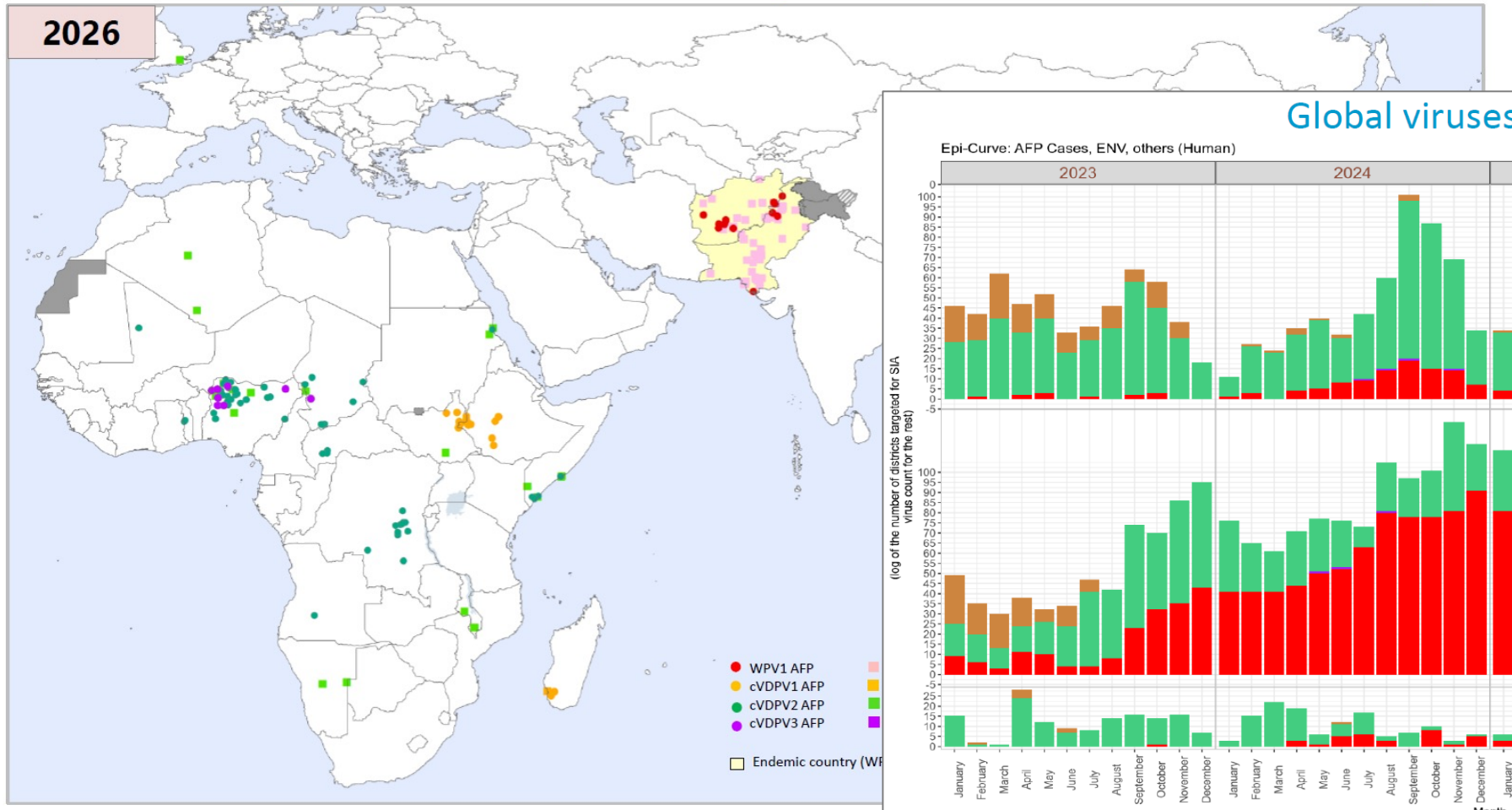
Poliovirus Epidemiology



Data in WHO HQ as of 14 July 2026

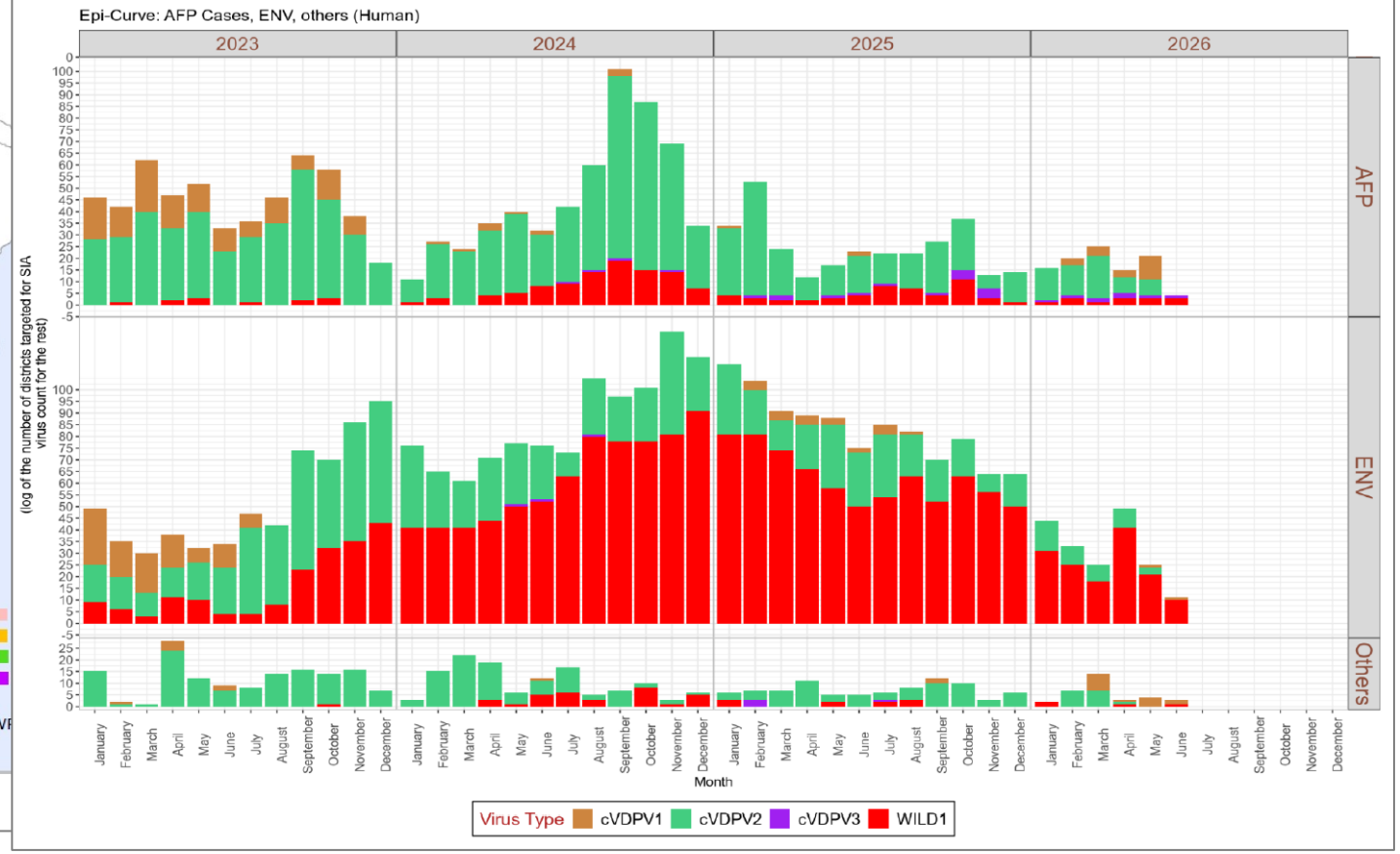
Poliovirus Epidemiology

Overview of global 2026 WPV1 and cVDPV positive isolates at **week 29**[1] in 2026



[1]onset/collection date: 01 Jan – 14 Jul. 2026

Global viruses 2023-2026

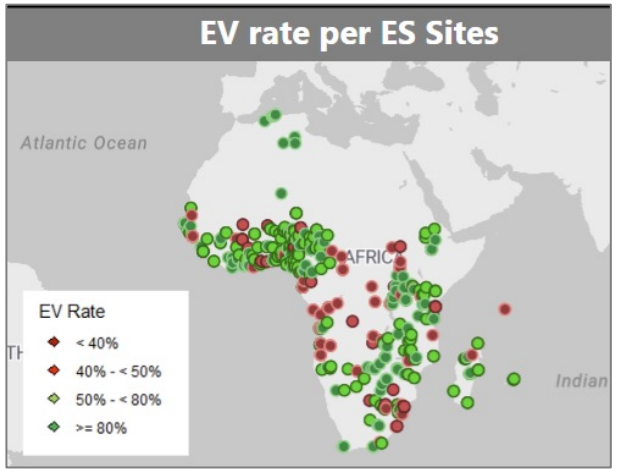


Data in WHO HQ as of 14 July 2026

Outbreak detection – using surveillance data

For poliovirus, a VP1 sequence is required to confirm VDPV status and the subsequent vaccination response

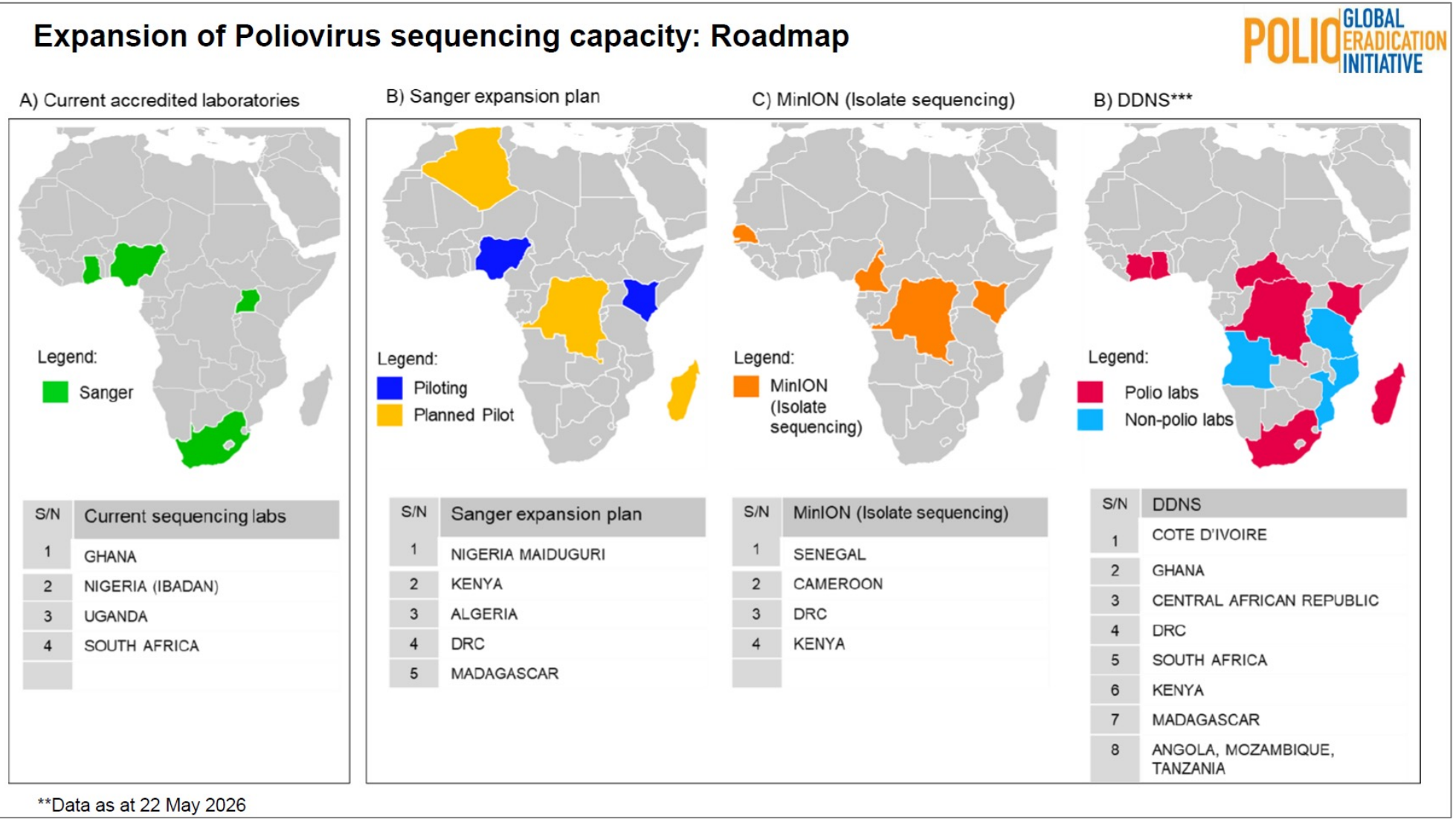
Acute Flacid Paralysis (AFP) surveillance and wastewater surveillance form the backbone of the surveillance system



- Determining circulation and geographic extent of the outbreak
  - The VP1 sequence links the virus detected to other prior detections – definitions of circulation determine the need for an outbreak response
- Virus importation
  - The genetics of the virus allow determination of an importation from a neighboring geography or continuation of local circulation that was silent
- Surveillance gaps
  - Long genetic distances between viruses can indicate surveillance gaps – though with a preponderance of asymptomatic transmission, interpretation is key

Decreasing the time to detection

Sequencing Expansion and Direct Detection Pilots

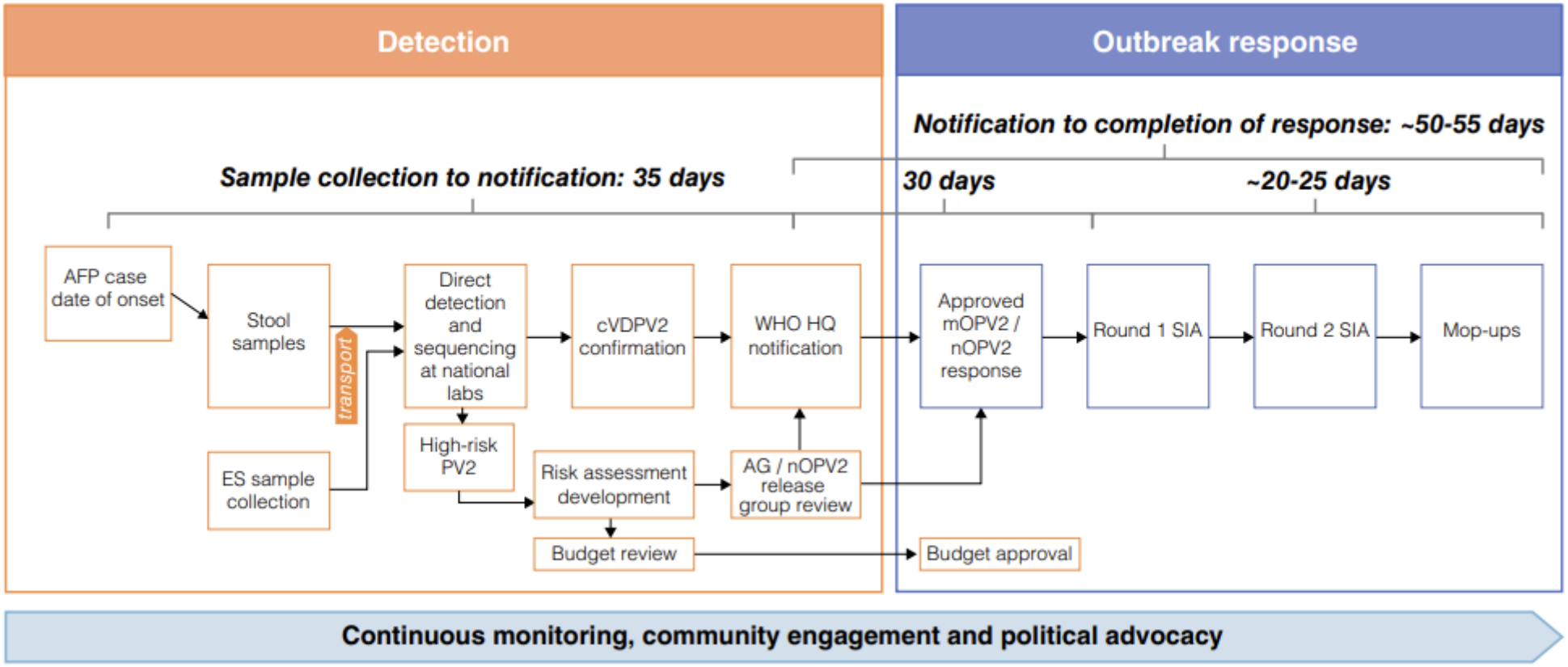


Courtesy of WHO AFRO

- Minimizing sample shipment decreases time from onset to actionable result
- Expanding the number of labs in WHO AFRO that can sequence has substantially decreased the time from onset/collection to result
- Direct detection methods further decrease this time to actionable result
- NGS methods greatly expand the throughput and the ability to detect virus mixtures in samples

Surveillance -> Response

Faster laboratory-based surveillance is **one piece** of a rapid surveillance-response system



Outbreak Response Strategy

- Polio outbreak responses are based around house to house vaccination with OPV – nOPV2 for cVDPV2 outbreaks, bOPV for cVDPV1/3
- Response scopes are modulated depending on transmission based on risk assessments and range from multiple provinces to national (e.g. 28 million children in a national campaign in DRC)
- Co-administration of nOPV2 and bOPV is used in areas with co-circulation of cVDPV2 and cVDPV1/3

Vaccine distributors pick up vaccines and geospatial tracking devices in Nigeria before heading out for house-to-house campaign.

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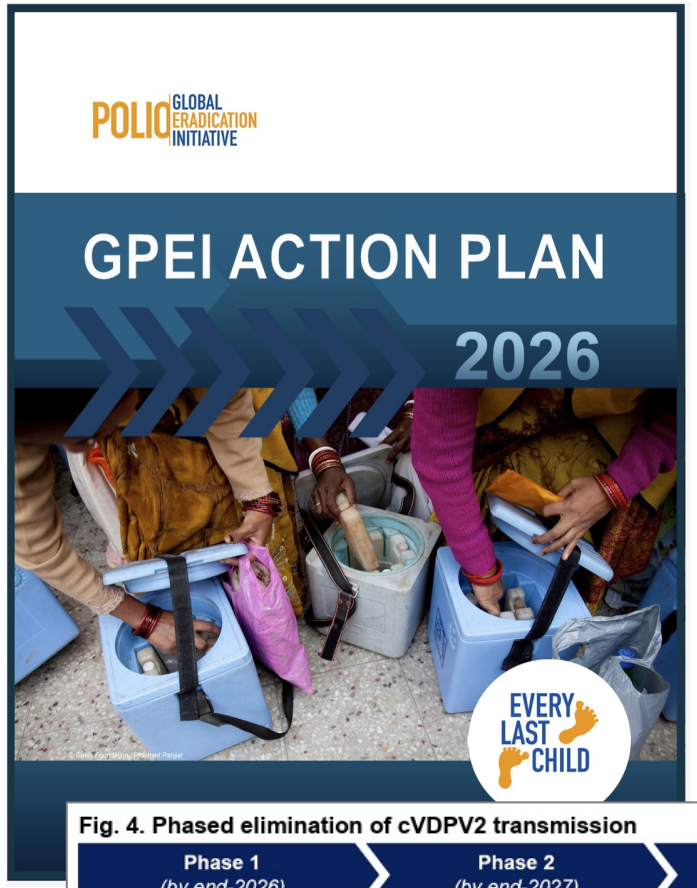
Innovation	Problem it addresses	Status of use	Future of use
Novel oral polio vaccine type 2 (nOPV2)	· nOPV2 is a next-generation version of monovalent oral polio vaccine type 2 (mOPV2). · nOPV2 is as safe and effective at stopping outbreaks as mOPV2, but it is much more genetically stable and therefore less likely to seed new type 2 variant poliovirus outbreaks.	· Since rollout began in March 2021, over 1.2 billion doses have been administered in 42 countries. · Data suggest it is 80% less likely to seed new type 2 variant poliovirus outbreaks than if mOPV2 were used. · Two manufacturers have now received prequalification for nOPV2, supporting the stability of supply.	· nOPV2 is now the vaccine of choice for responding to type 2 variant poliovirus outbreaks and it will continue to be an important part of the GPEI's strategy. · The success of nOPV2, like any polio vaccine, depends on the ability to rapidly implement high-quality immunization campaigns that reach every child.
Novel oral polio vaccine types 1 and 3 (nOPV1 and nOPV3)	· Like nOPV2, nOPV1 and nOPV3 are expected to be more genetically stable versions of the previous vaccine viruses to sustainably stop type 1 and type 3 variant poliovirus. · These types of variant poliovirus are much less prevalent than type 2 today, but any form of polio threatens children everywhere.	· nOPV1 and nOPV3 are in development.	· If clinical trials prove successful, nOPV1 and nOPV3 are expected to be ready for use in 2028, assuming the Emergency Use Listing procedure is a feasible regulatory pathway. If not, access may be delayed to 2029. · Post-elimination, they will also be kept in stockpiles in case of future type 1 and 3 variant poliovirus outbreaks.
Mobile money payment system	· Delays and challenges to cash payments for polio staff have affected campaign quality. · Digital payments ensure that health workers receive their money faster and more reliably, further motivating them to continue strengthening the health of their communities.	· Since it was established in 2020, WHO's Digital Finance Team has designed and implemented digital payment solutions in nearly every country experiencing a polio outbreak, including, last year, in Benin, Botswana, Madagascar, Rwanda, Togo and Zimbabwe.	· These systems will continue to be expanded, and technical improvements will be made as needed to increase efficiency.
Direct detection laboratory methods for detecting polioviruses	· Direct detection methods can help skip the time-consuming step of virus isolation from clinical stool samples. · They therefore can speed up the laboratory testing process for surveillance samples, so authorities can more rapidly be alerted of polio's presence, respond to the detection and minimize its impact.	· Two methods are being reviewed and validated by the WHO Global Polio Laboratory Network.	· Once validated, direct detection will be rolled out across the Global Polio Laboratory Network, prioritizing high-risk places for polio first. · Future research will focus on developing direct detection methods
Open Data Kit (ODK)	· ODK is a simple mobile application that provides software and standards for electronic field data collection. · It is helping to accelerate surveillance alerts and facilitate rapid responses to potential polio cases.	· ODK technology has been expanded since the start of the strategic period and it is now the standard for all campaigns.	· ODK will continue to be used for all campaigns, and operational improvements will be made as needed.
Geographic information system (GIS) data	· Campaigns are struggling to reach every child because of insufficient microplanning and poor operational accountability. GIS data are helping to more accurately map hard-to-reach communities to inform planning and track vaccination teams to course correct as needed in real time. · Surveillance gaps are also difficult to identify.	· The GPEI has used GIS data extensively in recent years to improve microplanning, especially in the river and lake areas of the Democratic Republic of the Congo, Nigeria and Somalia. · Active clinical surveillance visits and wastewater surveillance sites are being mapped to help the programme identify areas where transmission may be going undetected. · All GIS data are being shared with essential immunization programmes.	· GIS tools, especially to strengthen campaign quality and address surveillance gaps, will be thoughtfully expanded into additional high-risk areas. · Data sharing with essential immunization programmes will be strengthened.

Global Action Plan – Differentiating Response Approaches



- The GPEI Global Action Plan outlined a phased elimination strategy recognizing the entrenched challenges with stopping outbreaks in the Lake Chad Basin and Horn of Africa
- Phased elimination plan focuses first on Southern and Central Africa; followed by Horn of Africa; and last Lake Chad Basin, West and North Africa

Fig. 4. Phased elimination of cVDPV2 transmission

Phase 1 (by end-2026)	Phase 2 (by end-2027)	Phase 3 (by mid-2028)	Phase 4 (by end-2028)
Stop transmission in Southern and Central African countries	Stop transmission in Horn of Africa countries	Stop transmission in West & North Africa and the Lake Chad Basin	Interrupt all type 2 transmission
Implement Horn of Africa strategy →			*Focus is to respond to new / breakthrough cases*
Implement Lake Chad Basin strategy →			

Note: Progress against the timelines will be assessed annually as part of the Action Plan's regular performance monitoring.

Pillars for phased elimination of cVDPVs*

1. Maintain the gains through active, aggressive responses to any cVDPV detections, including circulating vaccine-derived poliovirus type 1 or 3 (cVDPV1 or cVDPV3), to ensure that certified regions remain polio-free.
2. Stop cVDPV transmission in areas with persistent transmission by sequentially targeting transmission across epidemiological blocks and ensuring circulation is controlled globally.

* The elimination of all three cVDPV types, starting with type 2, is a necessary step toward the eradication of all polio.

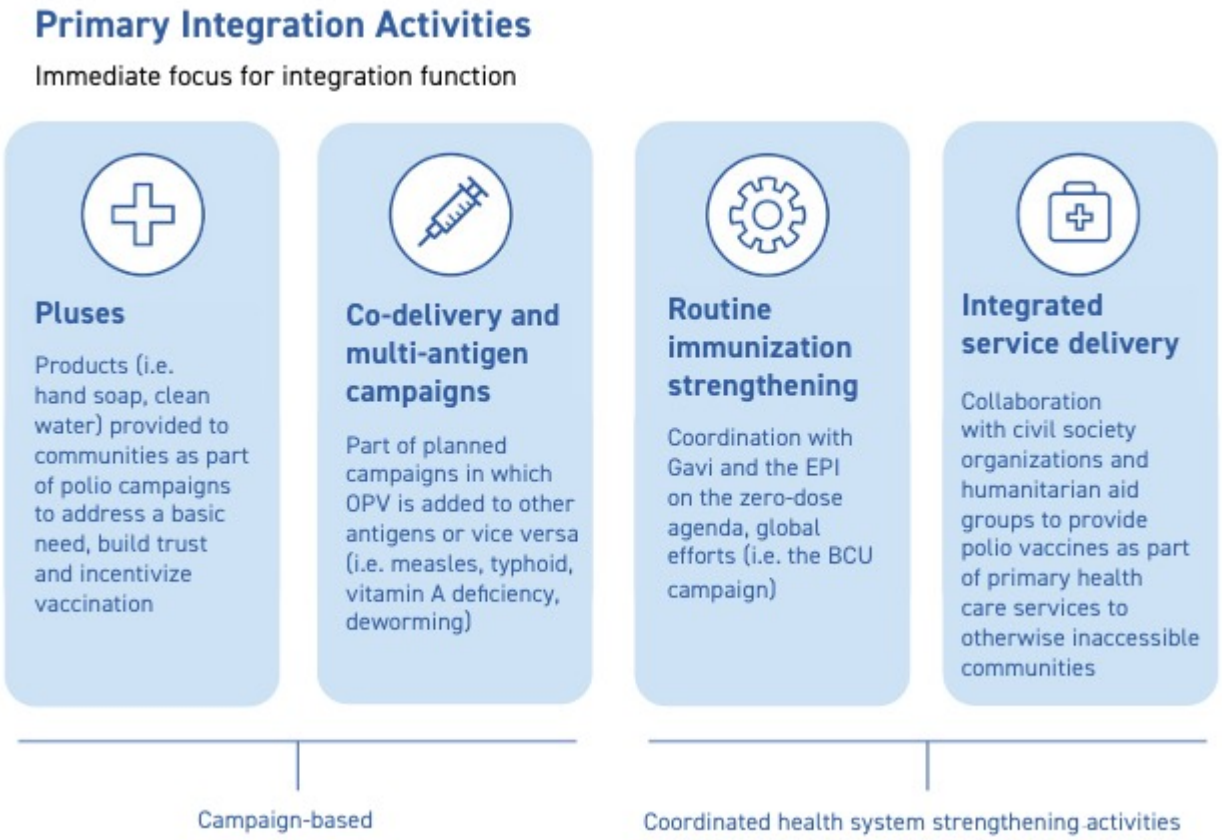
Reaching the unreached

In areas where house-to-house campaigns are not sufficient to stop transmission, new, tailored strategies need to be implemented

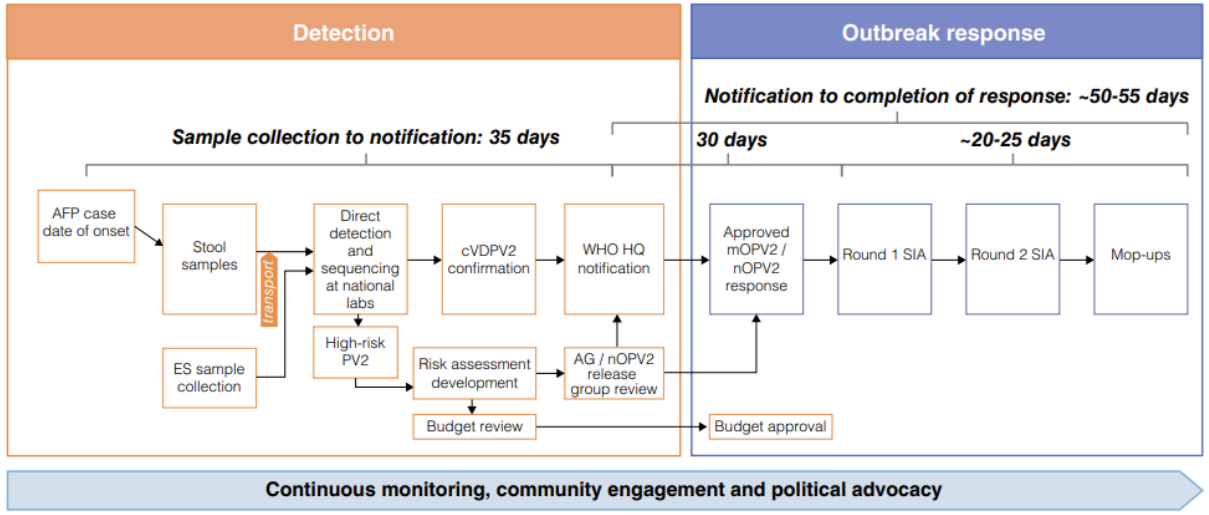
Improving coverage and reach of nOPV2
- nOPV2 expanded use
  - IBRA
  - PIRI
  - Transit point/cross border
  - Health Facility opportunistic administration

Enhancing induction of mucosal immunity in populations previously immunized with nOPV2
- fIPV or IPV campaigns

Integrating activities with other antigens and additional activities



Other factors for faster outbreak response



To quickly identify, respond to and close outbreaks, all parts of the surveillance -> response chain need to work quickly and robustly

- Sensitive field surveillance
- Rapid laboratory diagnosis
- Rapid outbreak response planning (scope, funding, vaccine shipment)
- Field logistics, training
- Campaign implementation and monitoring

In summary

List of learning points in this session:

- Poliovirus VP1 sequences are the primary diagnostic that determine outbreak response requirements
- The VP1 sequence determines if a virus is vaccine virus or c/VDPV, and if it is due to local circulation or importation
- Decreasing the time from onset/collection to sequence is a primary objective for GPEI to accelerate outbreak responses
- House to house vaccination campaigns with OPV form the core of outbreak response strategies
- In areas with persistent transmission, additional tailored strategies need to be utilized to achieve high vaccination coverage and sufficient mucosal immunity to stop transmission

Recommended material to explore further

Real time tracking of poliovirus and outbreak response - WHO AFRO Rapid Response Team Hub
Https://afro-rrt-who.hub.arcgis.com/pages/RRT%20Home

Global Polio Surveillance Action Plan 2025-2026
https://iris.who.int/bitstream/handle/10665/382037/9789240111844-eng.pdf

Global guidance for acute flacid paralysis (AFP) surveillance in the context of polio eradication
https://polioeradication.org/wp-content/uploads/2026/01/Global-AFP-guidance-pre-publiation-2026.pdf

Field guidance for the implementation of environmental surveillance for poliovirus
https://polioeradication.org/wp-content/uploads/2024/05/Field-Guidance-for-the-Implementation-of-ES-20230007-ENG.pdf

Standard Operating Procedures for responding to a poliovirus event or outbreak version 5 – Pre-publication - https://polioeradication.org/wp-content/uploads/2026/04/Standard-Operating-Procedures-for-responding-to-a-poliovirus-event-or-outbreak-Pre-publication-V5-20260520.pdf

GPEI guidelines: Classification and reporting of vaccine-derived polioviruses (VDPV), published in 2016
https://polioeradication.org/wp-content/uploads/2016/09/Reporting-and-Classification-of-VDPVs_Aug2016_EN.pdf

Reusing this content

Acknowledgements

The creation of this training material was commissioned by ECDC to Gates Foundation with the direct involvement of Kathleen Rankin