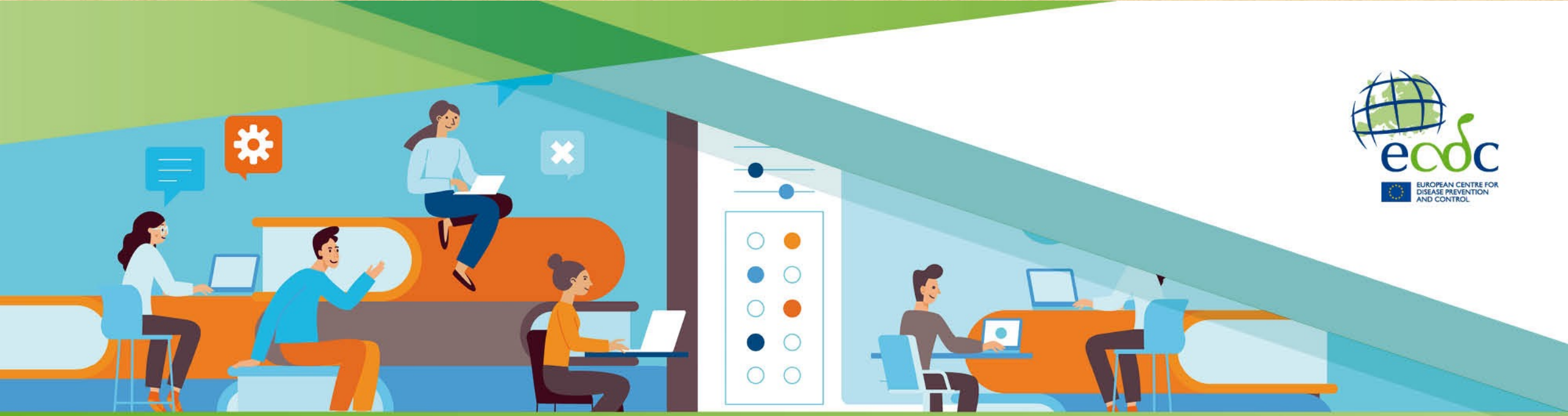

Genomics and Epidemiology of Polioviruses: how a virus resists eradication

Maintaining a Polio-Free World: From Genomic Evidence to Public Health Action

20 July 2026

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Aim and learning objectives

Aim: Provide participants with an understanding of the key strategies and systems to sustain a polio-free world after eradication, including surveillance, bioinformatics, vaccination, and containment

Specific learning objectives

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

- Discuss future challenges and risks in maintaining global polio eradication, including how genomic data inform public health decision-making and preparedness for potential poliovirus detections

Outline

This session consists of the following elements:

1. Introduction to the evolving risks post-eradication
2. Explanation of risk-mitigating strategies
3. Role of bioinformatics post-eradication
4. Future vaccine technologies to sustain a polio-free world

How would we know poliovirus is 'gone?'

Elimination (or interruption of transmission):

- The reduction to zero incidence of infection caused by a specific pathogen in a defined geographical area as a result of deliberate efforts. Actions to prevent re-establishment of transmission are required

Eradication:

- The permanent reduction to zero of the worldwide incidence of infection caused by a specific pathogen, as a result of deliberate efforts. No further actions are required, although interventions may be required for a buffer or transition period; eradication is permanent, barring release from containment laboratories maintaining stocks, genetic engineering to recreate the pathogen or other unforeseen events

Certification:

- the absence of wild poliovirus, isolated from cases of acute flaccid paralysis (AFP) (suspect polio), healthy individuals, or environmental samples, in all WHO regions for a period of at least three years in the presence of high quality, certification-standard surveillance and second, the containment of all wild poliovirus stocks in laboratories through completion of the requirements of the WHO global action plan for laboratory containment of wild polioviruses

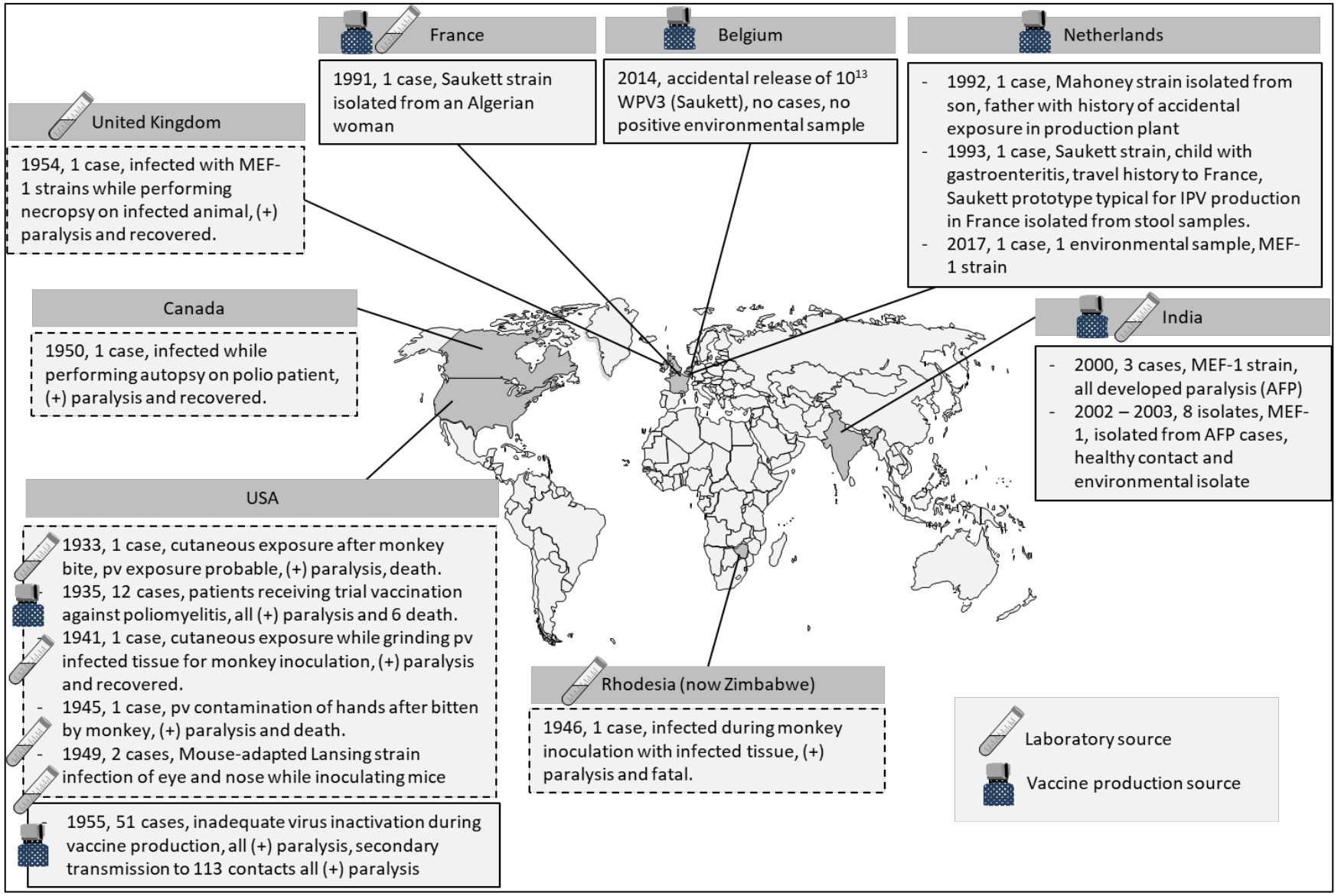
Sources: Global Commission for the Certification of the Eradication of Poliomyelitis (GCC). *Report of the 24th Meeting of the GCC*. 2024; Smith et al. Certification of polio eradication: process and lessons learned. Bull World Health Organ. 2004.

Risk remains after eradication

Risk of poliovirus re-emergence changes after eradication, but does not disappear

Source: GPEI. Sustaining a Polio-free World: A Strategy for Long-term Success (2025)

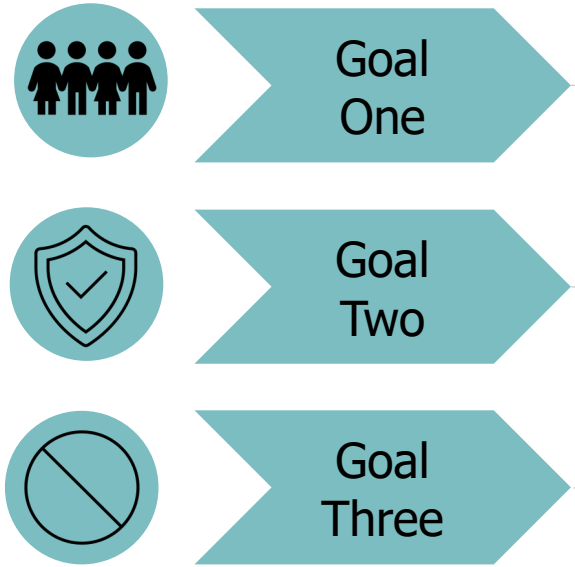
Reported incidents of facility-associated poliovirus release



Source: Bandyopadhyay AS, Singh H, Fournier-Caruana J, Modlin JF, Wenger J, et al. Facility-associated release of polioviruses into communities—risks for the posteradication era. Emerg Infect Dis. 2019 Jul. https://doi.org/10.3201/eid2507.181703

How do we manage those risks?

The focus shifts from interrupting transmission to preventing re-establishment of poliovirus transmission



Goal One

Protect populations

- Maintain immunity

Goal Two

Detect and respond

- Surveillance, laboratory network, & genetic characterization
- Potential response

Goal Three

Prevent reintroduction

- Containment

Adapted from: Global Polio Eradication Initiative. Sustaining a Polio-free World: A Strategy for Long-term Success (2025)

How do we protect populations from the remaining risk?

Achieve and maintain population immunity by:

1. Maintaining routine immunization with WHO-recommended schedules
2. Ensuring continued access to safe and effective polio vaccines
3. Implementing globally coordinated OPV cessation, guided by epidemiologic milestones and readiness criteria
4. Supporting vaccine policies that evolve with epidemiologic risk

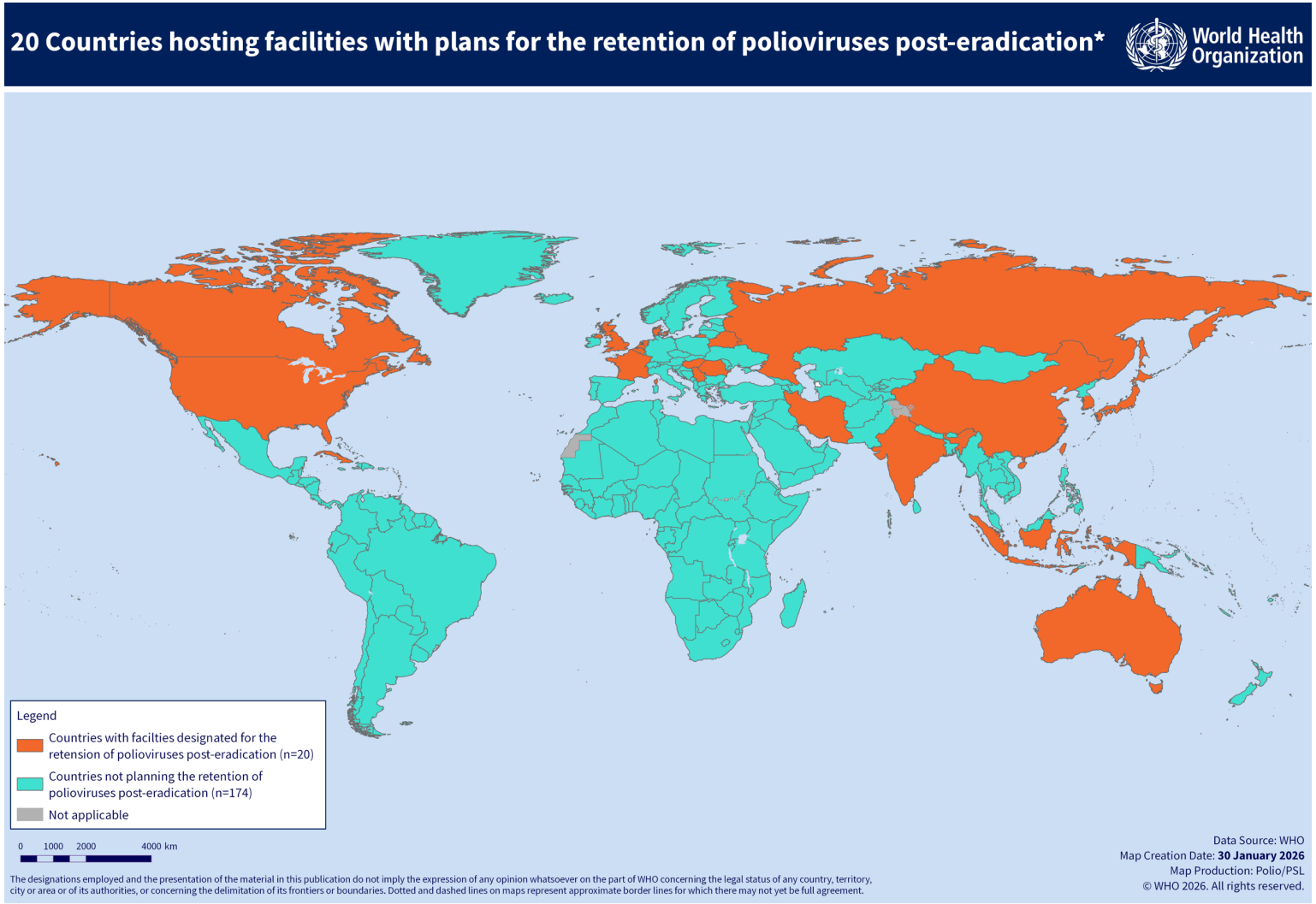
High population immunity reduces the likelihood that any reintroduced poliovirus can establish sustained transmission

Sources: GPEI. Sustaining a Polio-free World: A Strategy for Long-term Success (2025); WHO. *Polio vaccines: WHO position paper* (2022).

How do we prevent reintroduction?

Prevent reintroduction through:

- Safe and secure containment of poliovirus materials
  - Implementing GAPIV biorisk management requirements
  - Limiting poliovirus materials to designated Poliovirus Essential Facilities (PEFs)
  - National and international oversight of containment



*Includes WPV1, 2 and 3, VDPV1, 2 and 3, OPV 1, 2 and 3 or Sabin 1, 2 and 3 or a combination thereof

Sources: GPEI. Sustaining a Polio-free World: A Strategy for Long-term Success (2025); WHO. Global Action Plan for Poliovirus Containment (GAPIV), 4th ed. (2022); GPEI. Containment. https://polioeradication.org/what-we-do-2/containment/

Role of bioinformatics in post-eradication detection

If poliovirus is detected after eradication, genomic data must be rapidly translated to support public health decisions

Bioinformatics help us to understand:

- What virus is this?
- Where did it come from?
- Is it linked to previous detections?
- Is there evidence of ongoing transmission?
- Did surveillance systems miss transmission?
- How long has it been circulating?
- Could this reflect an iVDPV or facility-associated release?

To inform decisions like:

- Does this warrant a response?
- Which vaccine should be used, if so?
- How broad should the scope of response be?
- Is international coordination needed?
- Is additional surveillance needed?
- Should a potential chronic excretor be investigated?
- Are mitigating actions needed at a poliovirus containing facility, if there were to be a release?

Sources: GPEI. *Sustaining a Polio-free World: A Strategy for Long-term Success* (2025); WHO. *Global Polio Surveillance Action Plan 2025–2026*; Jorba J, et al. (Global Polio Laboratory Network / molecular epidemiology).

Potential future vaccine landscape

Intervention	Attribute	Examples	Primary Use	Status
Oral, live-attenuated vaccines	Enhanced genetic stability	Novel OPV candidates	Outbreak Response (OBR)	• nOPV1: phase III trials in planning • nOPV3: phase II clinical trials • Multi-valent nOPV: phase I/II clinical trials • "Next Gen OPV": AI-based, discovery phase
Parenteral, inactivated or non-replicating vaccines	Program efficiency	wP Hexavalent	Routine Immunization (RI)	One PQ'd product, others in Phase III
	Safe production	Virus-like particles	RI	In clinical development (phase I/II)
	Improved immunogenicity and effectiveness	Mucosal adjuvants	OBR, RI	Preclinical / Discovery
		Controlled release	OBR, RI	Preclinical / Discovery

Source: Modlin, J, Bandyopadhyay AS, Sutter R. Immunization Against Poliomyelitis and The Challenges to Worldwide Poliomyelitis Eradication. JID: Special Issue on Immunization. *2021*. (adapted and updated)

In summary

List of learning points in this session:

- Risks remain after eradication of poliovirus, so surveillance and bioinformatics remain critical in the post-eradication era
- Vaccination must continue post-eradication to support population immunity
- Facilities continuing to manufacture or work on poliovirus will be limited in the post-eradication era, and subject to containment/GAPIV requirements
- Vaccine innovations like VLPs could further reduce remaining risks

Recommended material to explore further

Strategy
GPEI. *Sustaining a Polio-free World: A Strategy for Long-term Success* (2025)

Certification
Global Commission for the Certification of the Eradication of Poliomyelitis (GCC). *Report of the 24th Meeting of the GCC* (2024)

Surveillance
WHO. *Global Polio Surveillance Action Plan 2025–2026*

Vaccination
WHO. *Polio vaccines: WHO position paper.* Weekly Epidemiological Record. 2022.

Containment
WHO. *Global Action Plan for Poliovirus Containment (GAPIV), 4th edition*

Current guidance & technical resources
Global Polio Eradication Initiative (GPEI) – https://polioeradication.org

Reusing this content

Acknowledgements

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