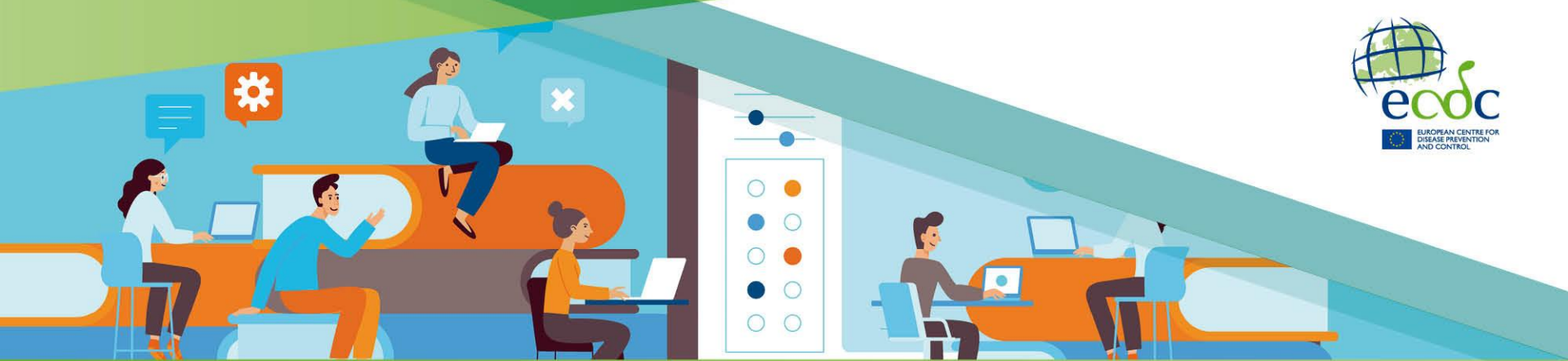




GenEpi-BioTrain – Genomics and epidemiology of polioviruses

Wastewater monitoring of polioviruses

20/07/2026

Dr Sindy Böttcher and Dr Cornelius Rau, Robert Koch Institute, Germany



Wastewater monitoring of polioviruses

Dr Sindy Böttcher

National Reference Center for Poliomyelitis and Enteroviruses

Dr Cornelius Rau, MD, MPhil, MSc

VPD Surveillance Team, Immunisation Unit



Outline

1. Introduction
2. Poliovirus surveillance in Germany
3. German wastewater monitoring for poliovirus
4. Public health response to detections of cVDPV2 in wastewater in Germany
5. Public health response to detections of WPV1 in wastewater in Germany
6. Questions and answers



Aim and learning objectives

Aim

Understand the development of a wastewater monitoring system for poliovirus, and the epidemiological response to poliovirus detections in wastewater in Germany

Specific learning objectives

- Describe the wastewater monitoring for poliovirus in Germany, incl. methods used
- Recall the detections of cVDPV2 and WPV1 in wastewater in Germany
- Analyse the public health response to poliovirus detections in wastewater in Germany



Introduction

Germany country profile

- Federation of 16 federal states
- Approx. 84 million population
- Highly decentralised (public) health system

Polio in Germany

- Last autochthonous case of poliomyelitis in 1990
- Last imported case of poliomyelitis in 1992
- Germany joined the GPLN, the NCC was founded in 1997
- Inactivated polio vaccine (IPV) only recommended since 1998

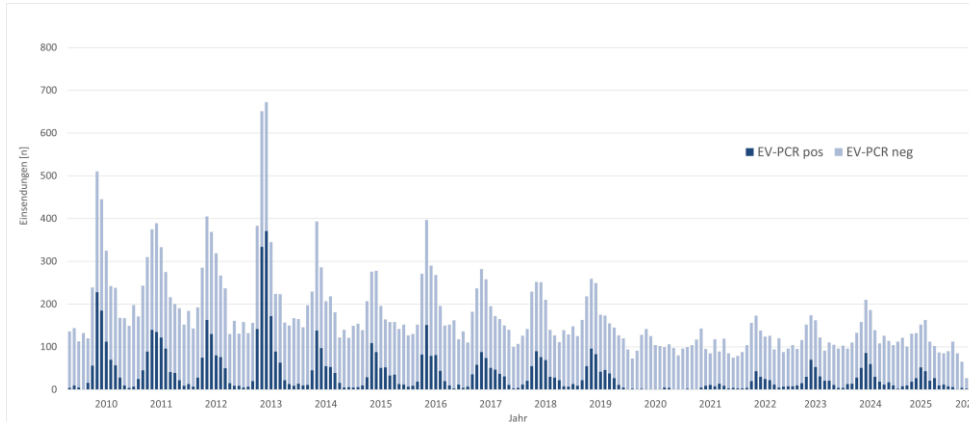
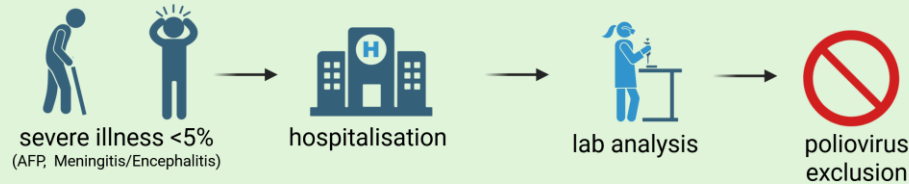


Source: TUBS, CC BY-SA 3.0, via Wikimedia Commons



Poliovirus surveillance in Germany

Syndromic Surveillance

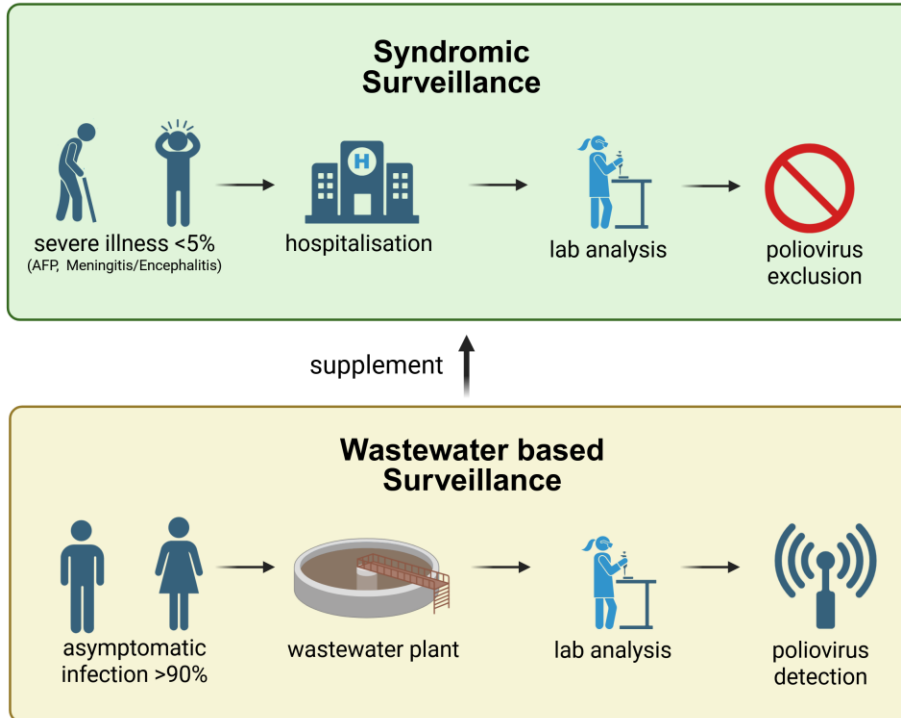


www.RKI.de

- AFP surveillance was performed
- Laboratory network for Enterovirus diagnostic (LaNED) was initiated
- Since 2010 Enterovirus Surveillance > no polioviruses detected
 - Enterovirus Surveillance (EVSurv) in Germany. Keeren et al., 2021. Microorganisms.
- NRZ PE also offers typing of EV+ samples for exclusion of poliovirus



Poliovirus surveillance in Germany



- Unlikely to detect polioviruses by syndromic surveillance in highly vaccinated communities
- Wastewater testing as early detection system
- two pilot research projects
 - 2019-2023: WHO cell culture method
 - 2023-2026: molecular method
- detection of vaccine strains, VDPV and WP1



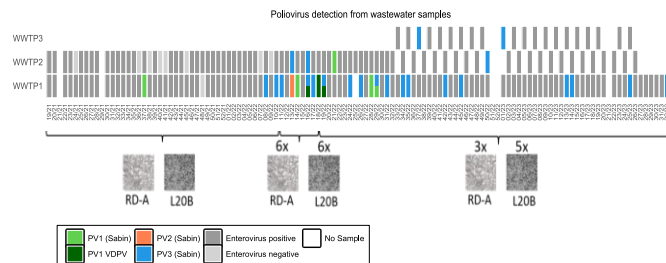
Establishing of poliovirus detection methods

method comparison

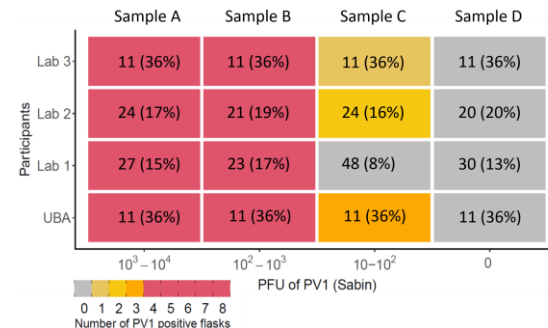
Spike PV1	PEG			UC			GW			REX			CEN		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
10 ⁹															
10 ⁸															
10 ⁷															
10 ⁶															
10 ⁵															
10 ⁴															
10 ³															
10 ²															
10 ¹															
0.5															

Poliovirus Type 1 (Sabin) NPEV NEV CPE negative

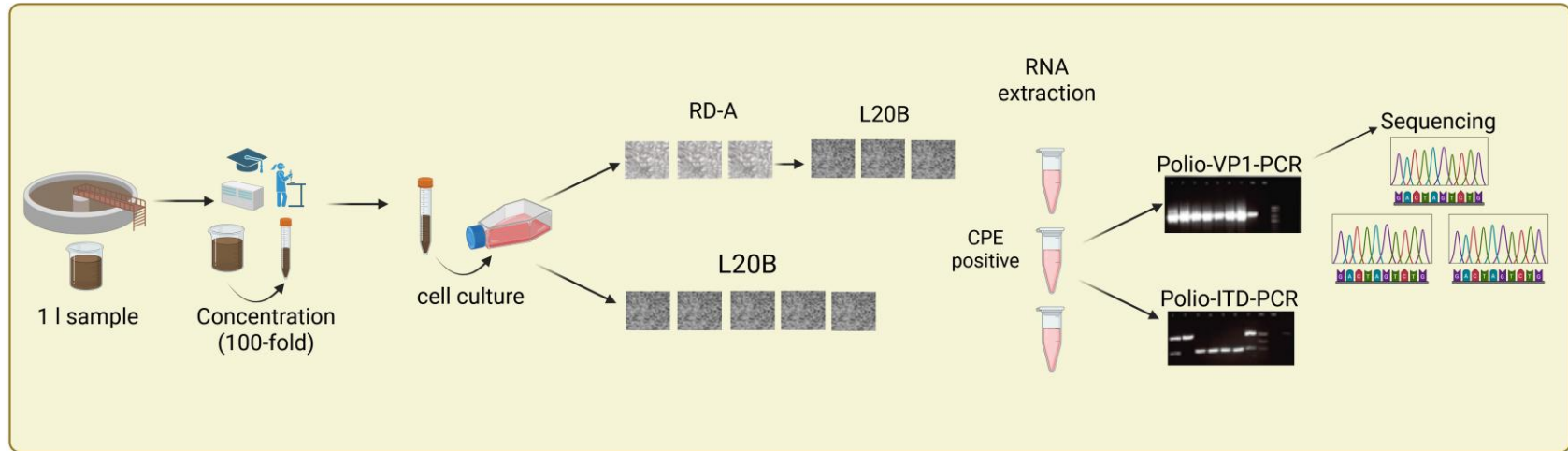
regularly testing



interlaboratory testing

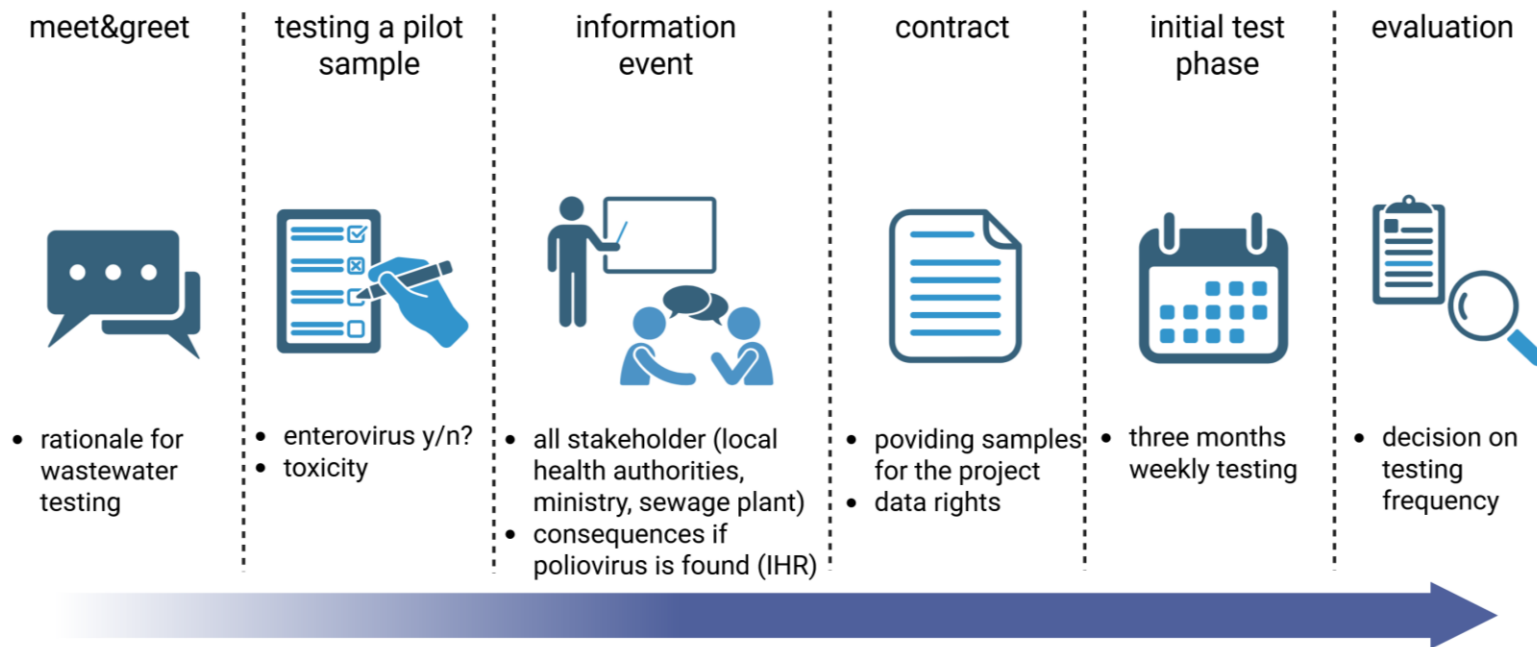


Poliovirus detection workflow



> Successfully participated in the WHO proficiency test for PV detection in wastewater.

Recruiting sampling sites



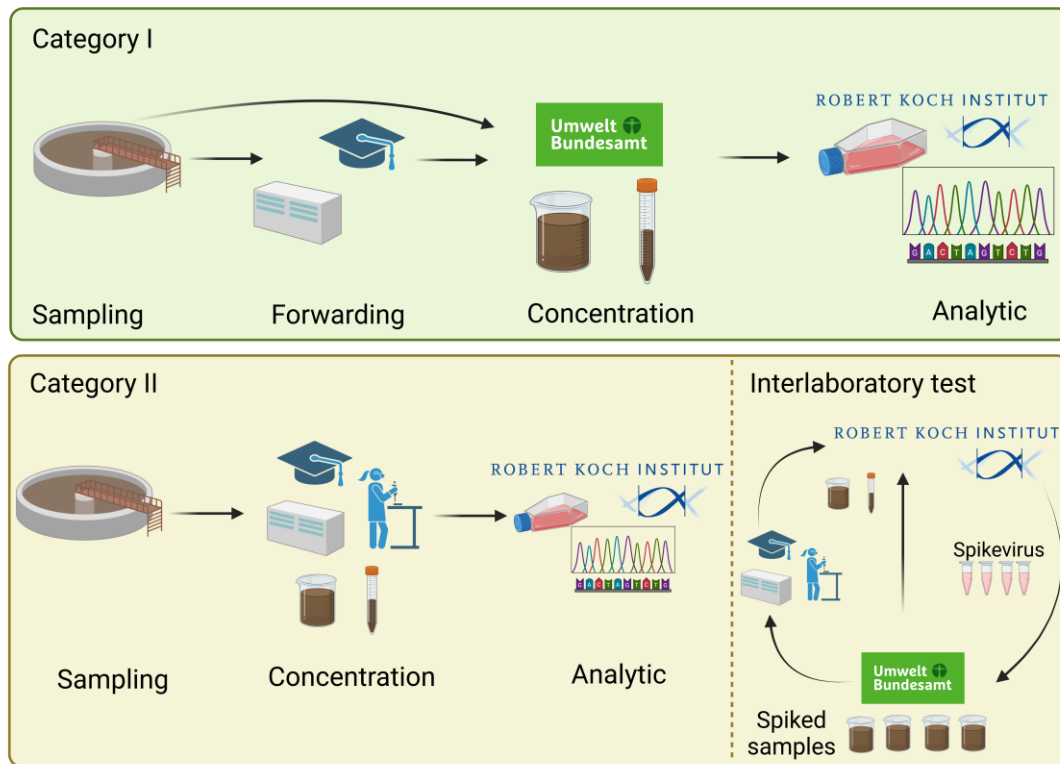
Sample collection and logistic



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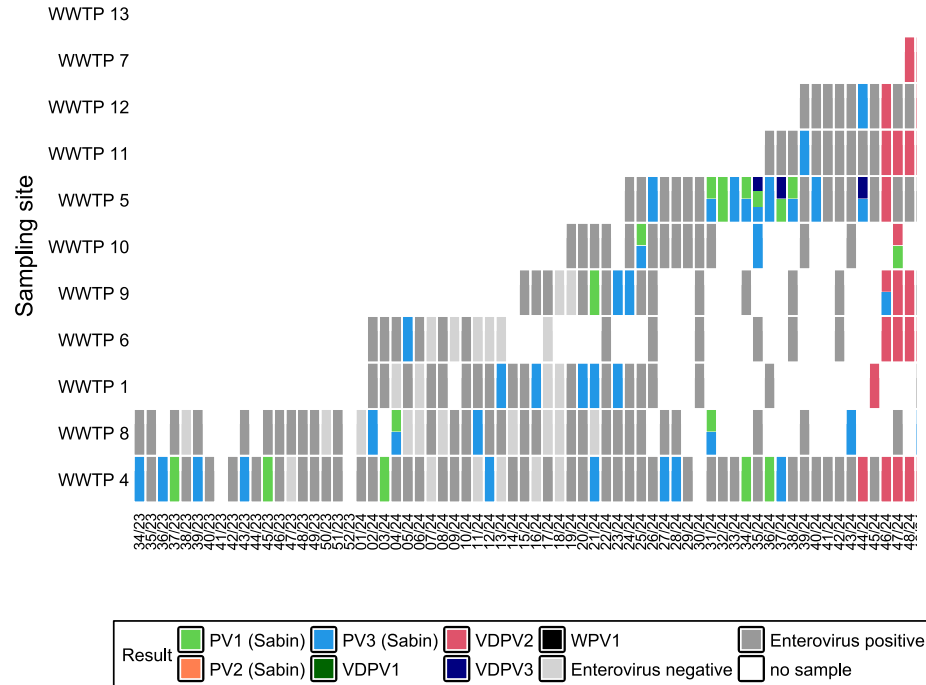


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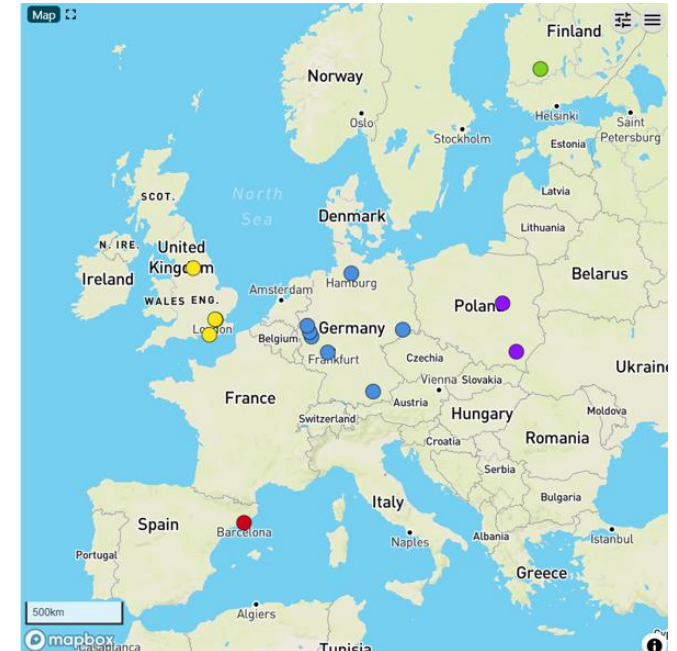




Poliovirus detection in Germany



cVDPV2 detection in Europe

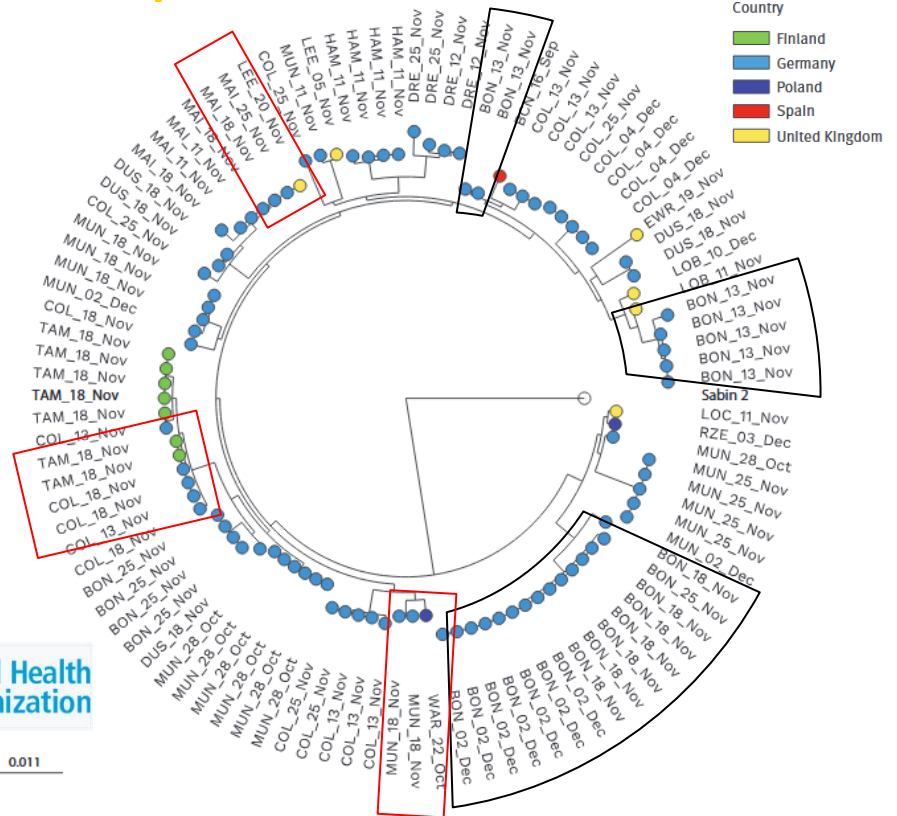
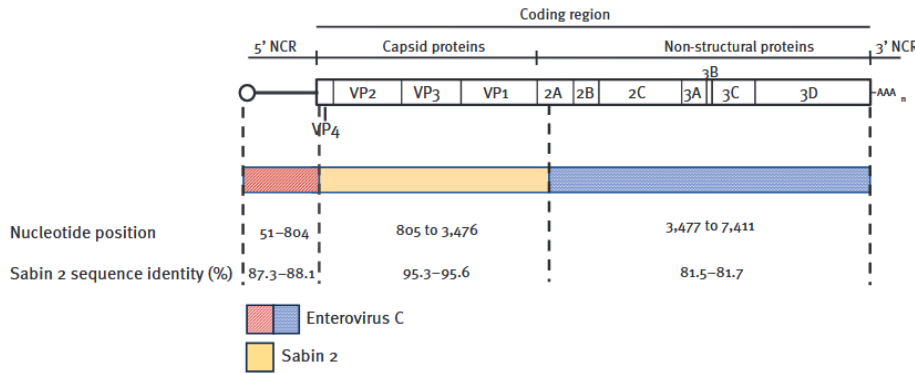




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Umwelt
Bundesamt

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UK Health
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health and welfare



UNIVERSITAT DE
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World Health
Organization



Instituto de Salud Carlos III

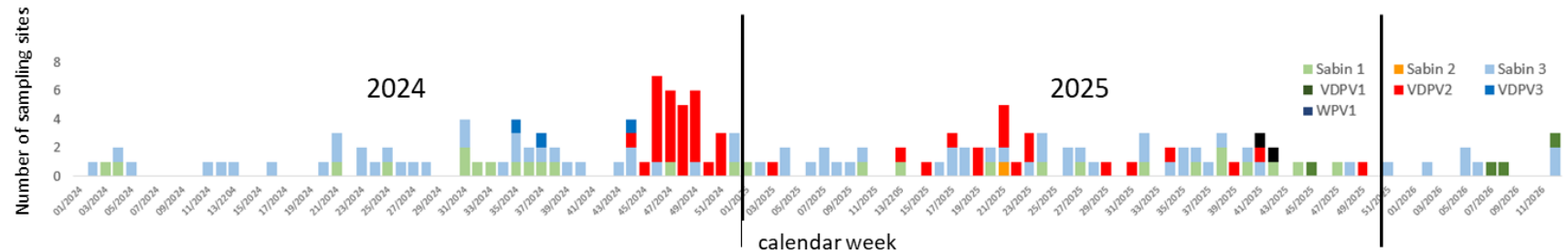
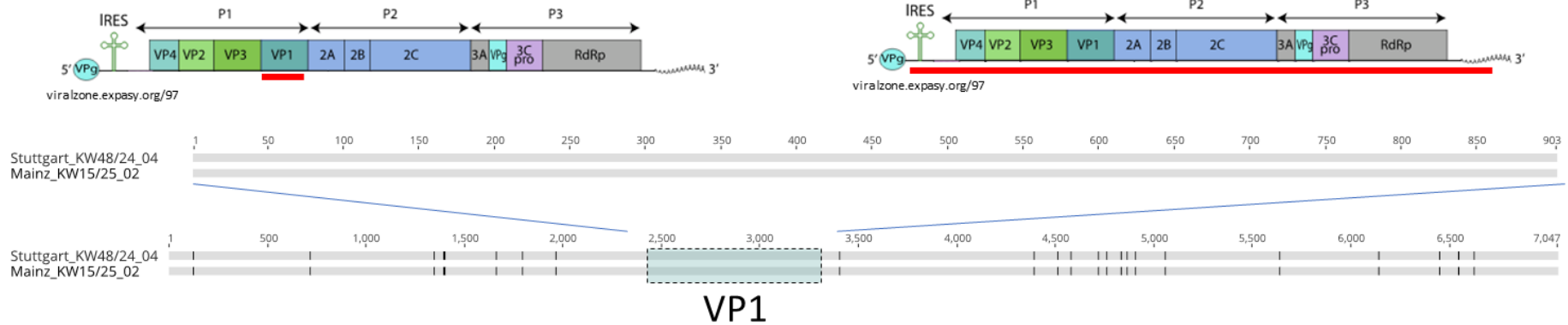


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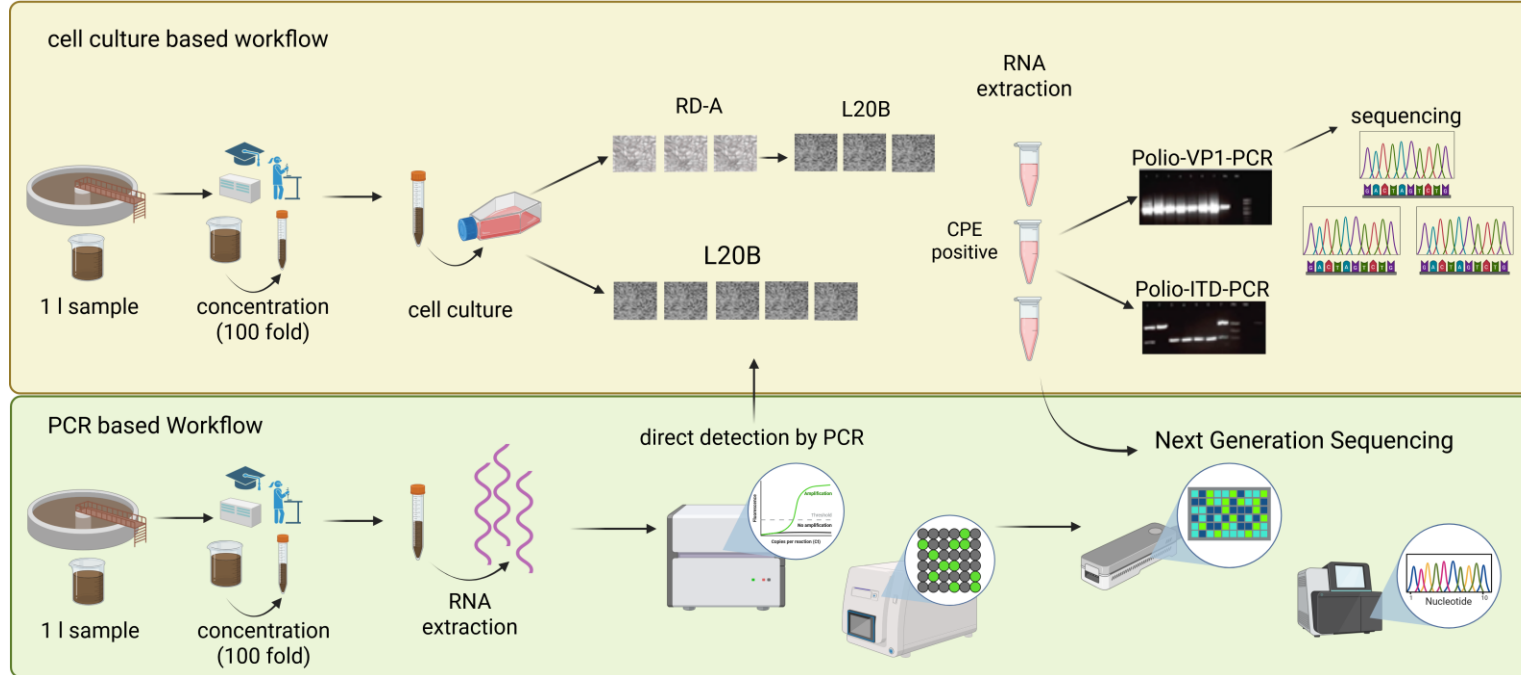




cVDPV2 sequence analysis



Perspective





**Circulating vaccine-derived polio
viruses type 2 (cVDPV2) in
wastewater in Germany,
multiple federal states, 2024–2025**

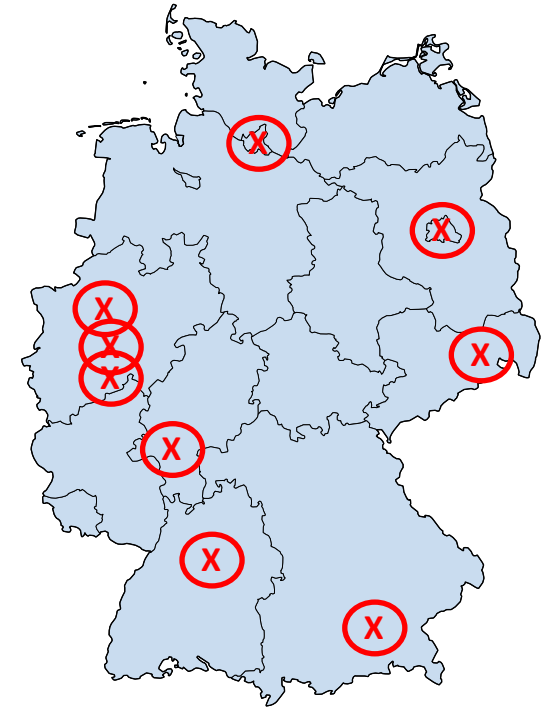


Event

- 28/11/2024: Germany's National Reference Center for Poliomyelitis and Enteroviruses informed RKI and affected federal states that **circulating vaccine-derived poliovirus type 2 (cVDPV2) was isolated from wastewater samples in Munich, Bonn, Cologne and Hamburg** during the weeks of 28 Oct to 11 Nov 2024
- Until December of 2025: further cVDVP2 detections in 10/10 environmental sampling sites across the country

Risk assessment

- Genotyping results: event of **multiple importations** with no evidence for ongoing local transmission
- Occurrence of clinical cases** in unvaccinated or insufficiently immunized individuals considered **possible**
- No clinical cases reported**



 cVDPV2
in wastewater



Communication

- **Notification** of local, federal state and national health authorities
- **Consultation** with ECDC, WHO/EURO and WHO/HQ
- **Threat report** by RKI, incl. recommendations to close immunity gaps and to enhance disease surveillance
- Ad-hoc meeting and public statement of **National Polio Certification Committee**
- Statement of **STIKO** (Germany's National Immunization Technical Advisory Group), including call for timely vaccination and catch-up for children
- Communication with the **public**
 - **Online vaccination check** in 7 languages, updated FAQs
 - **Social media** activities
 - Nationwide **radio spots**

Hinweis auf Schluckimpfstoff-abgeleitete Polioviren in Abwasserproben an mehreren Orten in Deutschland

In Abwasserproben aus vier Städten in Deutschland wurde genetisches Material von Schluckimpfstoff-abgeleiteten Polioviren Typ 2 nachgewiesen. Die Proben stammen aus München (Kalenderwoche 44) und aus Bonn, Köln und Hamburg (Kalenderwoche 46). Bislang sind keine Verdachtsfälle und Erkrankungen von Polio an das Robert Koch-Institut (RKI) übermittelt worden, weder über die in Deutschland etablierte Enterovirus-Surveillance noch auf offiziellem Meldeweg gemäß Infektionsschutzgesetz (IfSG). Die Polioimpfung ist sicher und wirksam. Bestehende Impfungen sollten gemäß den Empfehlungen der Ständigen Impfkommission (STIKO) geschlossen werden.

Polio myelitis („Kinderlähmung“) ist eine hoch ansteckende Krankheit, die vor allem Kinder unter fünf Jahren betrifft und bei nicht ausreichend immunisierten Personen im schlimmsten Fall zu dauerhaften Lähmungen führen kann. Sie wird vor allem fäkal-oral übertragen. Die Krankheit kann durch Polioimpfungen verhindert werden. Weltweit existieren zwei Arten von Polioimpfstoffen: eine Schluckimpfung, die abgeschwächte vermehrungsfähige Impfviren enthält (*oral polio vaccine*, OPV); und ein inaktivierter Polioimpfstoff (*inactivated polio vaccine*, IPV), der in den Muskel gespritzt wird. Die Schluckimpfung wird derzeit noch in manchen Ländern eingesetzt, aber nicht mehr in Deutschland. Die Schluckimpfung ist sehr effektiv, jedoch können die abgeschwächten Impfviren wieder ausgeschieden werden und sich genetisch so verändern, dass sie andere Menschen infizieren und eine symptomatische Erkrankung hervorrufen können (Schluckimpfstoff-abgeleitete Polioviren, *vaccine-derived poliovirus*, VDPV). In Deutschland wird daher seit 1998 ausschließlich IPV-Impfstoff verabreicht. Menschen, die vollständig gegen Polio geimpft wurden, sind vor der Erkrankung geschützt. Der Impfstoff ist sicher und wirksam.

Abwertestungen auf Polioviren dienen als Frühwarnsystem. Das Nationale Referenzzentrum für Polio myelitis und Enteroviren (NRZ PE) hat Schluckimpfstoff-abgeleitete Polioviren des Typs 2 in Abwasserproben aus München, Bonn, Köln und Hamburg nachgewiesen und sequenziert. Der Nachweis an verschiedenen Orten weist auf eine Zirkulation dieser Viren hin (*circulating vaccine-derived poliovirus type 2*, cVDPV2). Weitere Proben werden derzeit untersucht. Auch in Spanien (Barcelona) und Polen (Warschau) wurden kürzlich cVDPV2 in Abwasserproben nachgewiesen.

Das RKI hat unmittelbar die Landesbehörden aller Bundesländer informiert und – den Internationalen Gesundheitsvorschriften (IGV) entsprechend – auch die Weltgesundheitsorganisation (World Health Organization, WHO) sowie die Europäische Union (European Centre for Disease Prevention and Control, ECDC) benachrichtigt.

Auch wenn aufgrund der allgemein hohen IPV-Impfquoten und guten Hygienebedingungen in Deutschland eine geringe Wahrscheinlichkeit für das Auftreten von cVDPV2-Erkrankungen besteht, so ist es bei anhaltender Zirkulation möglich, dass vereinzelt cVDPV2-Rolle unter nicht ausreichend geschützten Menschen auftreten. Daher sollte eine Zirkulation von cVDPV2 möglichst rasch gestoppt werden, sowohl um Poliofälle in unzureichend geimpften Bevölkerungsgruppen zu verhindern, als auch um das Ziel der globalen Polioeradikation nicht zu gefährden.

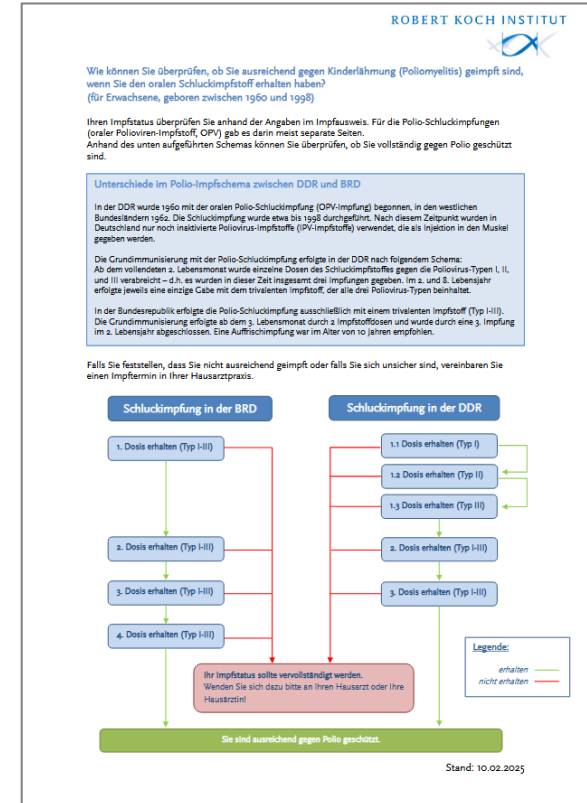
Aufgrund der Situation empfiehlt das RKI insbesondere für medizinisches Personal und Mitarbeitende im öffentlichen Gesundheitsdienst folgende Maßnahmen:

- Erhöhte Wachsamkeit in Hinblick auf Polio myelitis-typische Symptome, insbesondere akute schlaffe Lähmungen (*acute flaccid paralysis*, AFP), sofern sie nicht traumatisch bedingt sind.



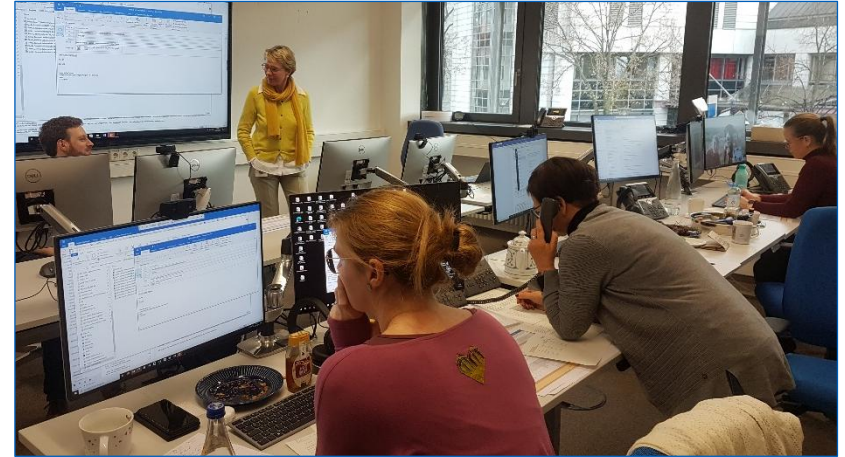
Emergency response

- Establishment of **Incident Management Team (IMT)** at RKI
- Analysis and publication of up-to-date **immunisation coverage**
- Call for intensification/strengthening of laboratory-based **enterovirus surveillance**
- Further **threat reports** on diagnostics, notification, and immunisation
- Preparation of **catch-up vaccination plan** (using IPV)
- Exchange with **National Regulatory Authority** regarding potentially increased demand of IPV to avoid shortage
- Creation or update of **FAQs, flowcharts** to self-check immunisation status and **guidance** on poliomyelitis
- Increase of wastewater **testing frequency** and geographical expansion from 7 to 10 sites



Emergency response

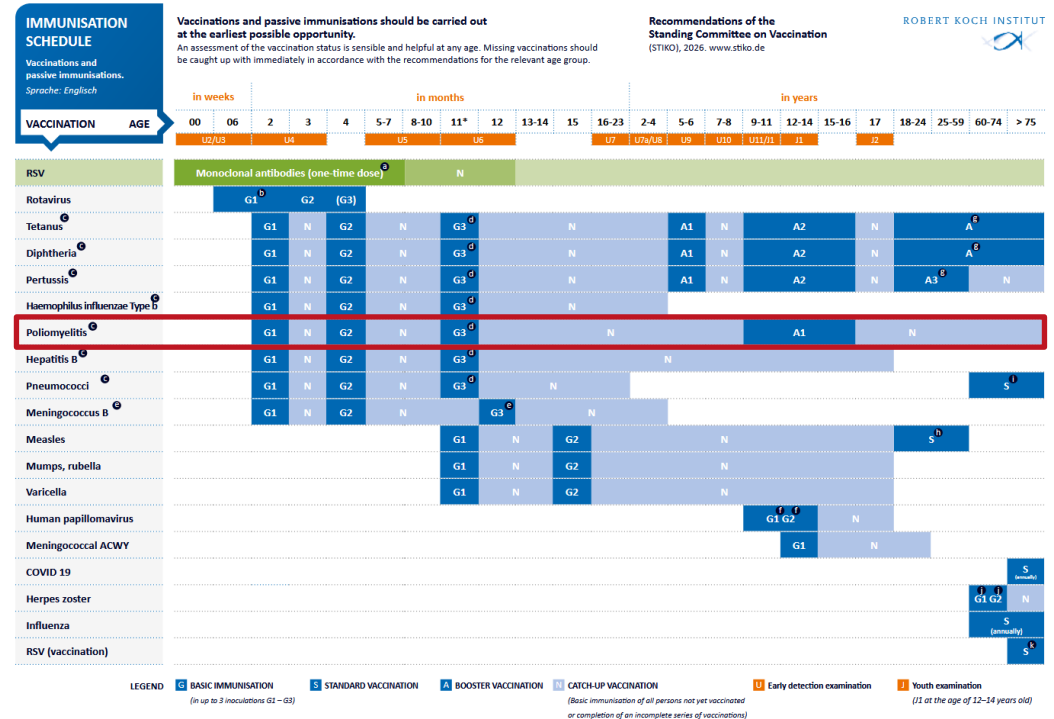
- **Polio outbreak simulation exercise**
 - 1 day
 - Local, federal state and national health authorities
- Cross-sectional **representative online survey among parents**
 - to assess vaccine acceptance, polio awareness and evaluate risk communication





Polio immunisation in Germany

- **IPV-only** since 1998
- **Primary vaccination series**
 - 2 months
 - 4 months
 - 11 months
- **Adolescent booster**
 - 9-16 years
- No further **booster recommended**



Sources: https://www.rki.de/EN/Topics/Infectious-diseases/Immunisation/STIKO/STIKO-recommendations/Downloads/04_26_english.pdf



Immunisation coverage in Germany

- High uptake – but completion of primary vaccination series often delayed

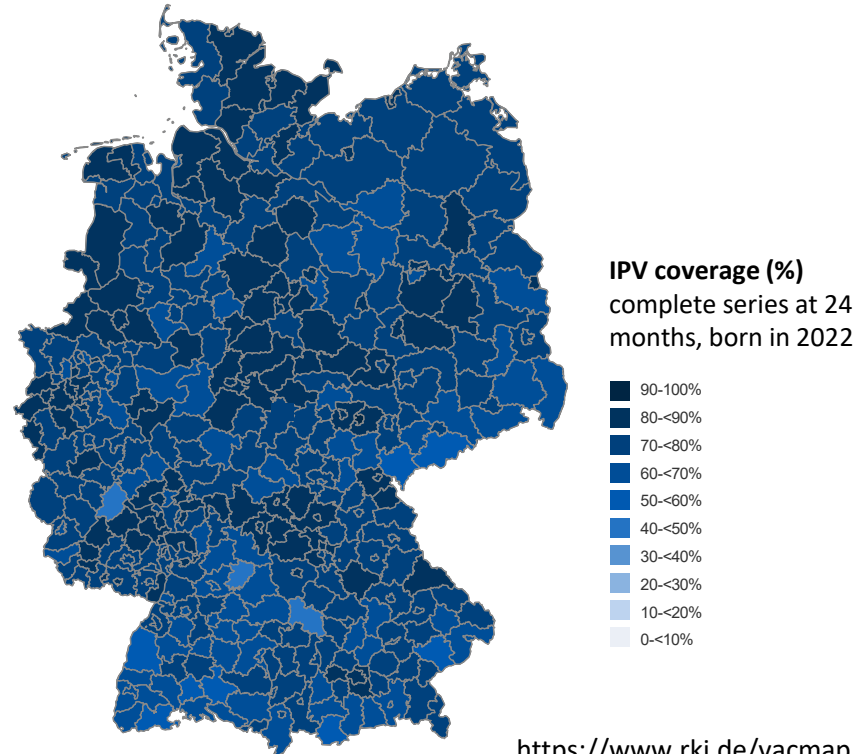
IPV dose	Age	Coverage
1 st dose	24 months	96%
2 nd dose	24 months	94%
Complete	24 months	75%
Complete	6 years	88%
Booster	9-16 years	~50%

Data as of 11 December 2025



Immunisation coverage in Germany

- High uptake – but completion of primary vaccination series often delayed
- Geographical differences



<https://www.rki.de/vacmap>



Wild polio virus type 1 (WPV1) in wastewater in Germany, federal state of Hamburg, 2025

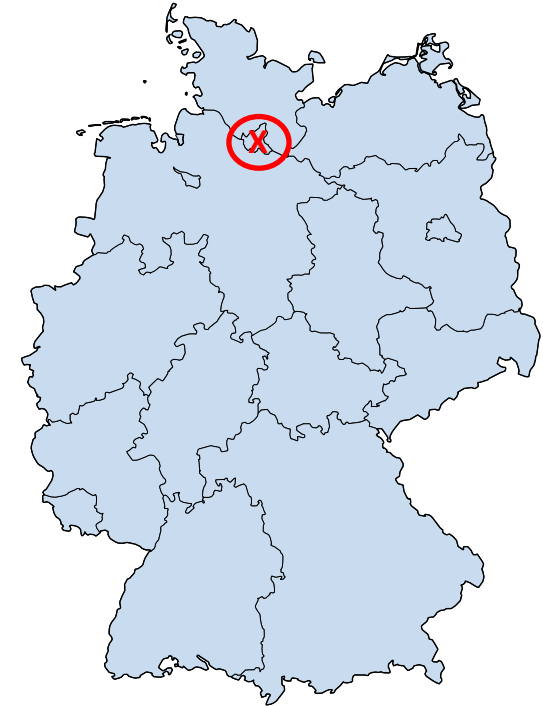


Event

- On 10/11/2025: Germany's National Reference Center for Poliomyelitis and Enteroviruses informed RKI and federal state of Hamburg that **wild poliovirus type 1 (WPV1)** was isolated from a wastewater sample in Hamburg drawn during the week of 6 October 2025
- Linked to WPV1 in an environmental sample collected in **Kandahar, Afghanistan**, on 24 August 2025
- **Second and third wastewater sample** taken in Hamburg on 7 October and 13 October 2025 later also tested positive for WPV1

Risk assessment

- **Unusual event** – but generally **not unexpected**
- **Risk** to population in Germany: considered **very low**, given high immunisation coverage and detections only in wastewater
- **Occurrence of clinical cases** in unvaccinated or insufficiently immunized individuals considered **possible**
- **No clinical cases reported**



WPV1
in wastewater



Communication

- **Notification** of local, federal state and national health authorities
- **Consultation** with ECDC, WHO/EURO, GPEI and WHO/HQ
- **Awareness raising e-mails** to local clinicians, laboratories, asylum reception centres, hospitals, occupational health physicians etc.
- **Threat report** by RKI, including
 - Risk assessment and call for enhanced disease surveillance
 - Information for clinicians on clinical symptoms, notification requirements and diagnostics
 - Call to close immunity gaps through vaccination
- **Social media** activities
- Updated **FAQs** on wastewater monitoring
- **Press releases** by Hamburg Ministry of Health, WHO EURO and GPEI
- **Rapid Risk Assessment** and press release by ECDC

Sources: <https://www.hamburg.de/politik-und-verwaltung/behoerden/sozialbehoerde/aktuelles/pressemitteilungen/-polio-wildviren-im-hamburger-abwasser-gefunden-1116806>; <https://www.who.int/europe/news/item/13-11-2025-detection-of-wild-poliovirus-type-1-in-environmental-sample-in-germany>; <https://polioeradication.org/news/detection-of-wild-poliovirus-type-1-wpv1-in-environmental-sample-in-germany/>; <https://www.ecdc.europa.eu/en/news-events/detection-wild-poliovirus-wastewater-germany-risk-and-recommendations>





Emergency response

- **Re-activation of IMT** at RKI and in Hamburg
- Development of **local response and communication strategies**
- Analysis of **immunisation coverage data** for Hamburg at zip-code level
- **Expansion of wastewater monitoring** in Hamburg
 - Increased testing frequency (weekly) and retrospective testing
 - Separate testing of two major wastewater catchment areas
- **Awareness raising for vaccination recommendations as issued by WHO & STIKO**, including catch-up vaccination for newly-arriving migrants
- **Identification of population groups with potential exposure to poliovirus in Afghanistan** with relevant travel history, including provision of information in multiple languages
- **Voluntary stool testing** in 9 federal states offered to people from Afghanistan, who arrived in Hamburg between 22 September and 25 November 2025
- Retrospective testing of stool samples from **child daycare centres** in Hamburg
- **No poliovirus detected in stool samples**



Emergency response

- **Re-activation of IMT** at RKI and in Hamburg
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Acknowledgements

- **Colleagues from local, federal state and national health authorities**
 - PD Dr. Silja Bühler
 - Fach- und Reaktionsgruppe Seuchenschutz in Hamburg
- **WHO, ECDC and GPEI**
- **Immunisation Unit at RKI**
 - Franziska Badenschier
 - PD Dr. Ole Wichmann
- **National Reference Center for Poliomyelitis and Enteroviruses**
- **German Agency for Environment**
- **National Certification Commission and its secretary**
- **All collaboration partners, the labs and wastewater treatment plant, the local health authorities and ministries**
- **AMELAG-Team**
- **Funding by German Federal Ministry of Health**



Thank you!

Overview of global 2026 WPV1 and cVDPV positive isolates at week 29¹ in 2026

