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Case Report

Re-emergence and Control of Circulating Vaccine-Derived Poliovirus Type 2 in Post-Elimination Indonesia, 2014-2025: A Public Health Case Report

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Abstract:

Indonesia was certified free of wild poliovirus transmission in 2014, yet persistent immunity gaps and disruption of routine childhood vaccination created conditions for poliovirus re-emergence. This public health case report describes the epidemiological course and control of circulating vaccine-derived poliovirus type 2 in Indonesia from 2014 to 2025. The source report identified an index event in Pidie District, Aceh, in October 2022 involving a 7-year-old boy with fever followed by acute left-leg paralysis; reverse-transcription polymerase chain reaction subsequently confirmed poliovirus type 2. By June 2024, the report recorded 33 confirmed cases across seven provinces. Acute flaccid paralysis surveillance, environmental surveillance, and outbreak response assessments were used to evaluate transmission. The national response combined large-scale supplementary immunization with novel oral poliovirus vaccine type 2, integration of a second inactivated poliovirus vaccine dose, strengthened surveillance, and community mobilization. Approximately 60 million supplementary vaccine doses were delivered, no new case was reported after 27 June 2024, and the outbreak was declared closed on 19 November 2025. This experience shows that polio-free certification is not self-sustaining. Durable protection requires uniformly high vaccination coverage, rapid detection, reliable vaccine logistics, improved sanitation, equitable access to health services, and sustained public trust in immunization.

Keywords: Circulating vaccine-derived poliovirus; Immunization gap; Outbreak response; Poliomyelitis; Surveillance.

1. Introduction

Poliomyelitis is a highly transmissible infection caused by poliovirus and is transmitted predominantly through the fecal-oral route (1). Although most infections are asymptomatic, neuroinvasion can produce acute flaccid paralysis, permanent motor disability, and, in severe cases, respiratory compromise (2). Recent global eradication reports show that poliovirus transmission has become increasingly concentrated in specific settings, while vaccine-derived polioviruses remain a major challenge during the eradication endgame (3),(4).

Indonesia was certified free from endemic wild poliovirus transmission on 27 March 2014 as part of the World Health Organization South-East Asia Region. The subsequent detection of circulating vaccine-derived poliovirus type 2 (cVDPV2) in Indonesia demonstrates that regional elimination does not remove the risk created by immunity gaps and renewed transmission (5). Experience from the Western Pacific Region and other Asian

countries similarly shows that sustained surveillance and population immunity remain necessary after interruption of endemic wild poliovirus transmission (6),(7).

Disruptions associated with the coronavirus disease 2019 pandemic affected routine immunization, supplementary campaigns, and surveillance activities, creating opportunities for susceptible clusters to expand (8),(9). Analyses of vaccine-derived poliovirus emergence indicate that under-immunization, heterogeneous population immunity, and delayed or incomplete outbreak response can support continued type 2 poliovirus spread (10),(11). At community level, perceptions of vaccine-derived poliovirus, uncertainty regarding new vaccines, and loss of confidence can further reduce uptake even when vaccination services are available (12),(13). Post-pandemic assessments therefore emphasize restoration of routine coverage together with targeted outbreak-control strategies rather than reliance on national coverage averages alone (14).

This report presents the re-emergence, epidemiological investigation, national response, and closure of the circulating vaccine-derived poliovirus type 2 outbreak in Indonesia during 2014-2025. It aims to identify the programmatic, epidemiological, and social conditions that enabled resurgence and to derive practical lessons for maintaining polio elimination in a post-certification setting.

2. Case Presentation

Public health setting and case history

This manuscript is a public health case report derived from a clinical rotation report that synthesized national and international outbreak information for Indonesia between 2014 and 2025. Indonesia had maintained certified freedom from endemic wild poliovirus transmission since 2014, but subnational vulnerabilities in population immunity, surveillance performance, and program delivery remained important. Comparable outbreaks in the Philippines, Malaysia, and Papua New Guinea illustrate how vaccine-derived poliovirus can re-emerge in post-elimination settings when immunity is uneven (15),(16).

The index event described in the source report occurred in Pidie District, Aceh. A 7-year-2-month-old boy developed fever on 6 October 2022 and subsequently experienced paralysis of the left leg. He was taken to Tgk Chik Ditiro Sigli Regional General Hospital on 18 October 2022. Two stool specimens were collected on 21 and 22 October and forwarded for laboratory analysis; reverse-transcription polymerase chain reaction results released on 7 November confirmed poliovirus type 2. The district government subsequently declared a polio outbreak.

Clinical assessment and laboratory confirmation

The source report documents fever followed by acute unilateral lower-limb paralysis and virologic confirmation by reverse-transcription polymerase chain reaction. A detailed neurological examination, sensory findings, reflexes, muscle power grading, cerebrospinal fluid results, imaging, treatment of the index patient, and individual long-term functional outcome were not provided. Consequently, no unsupported patient-level clinical details were added to this manuscript.

Epidemiological investigation

Following confirmation of the Aceh case, outbreak investigation and intensified surveillance identified further transmission (17),(18). The source report records 33 confirmed cases distributed across seven provinces through June 2024, including later cases in Pamekasan and Sampang in East Java and Klaten in Central Java (19). Acute flaccid paralysis surveillance and environmental surveillance are complementary because clinical case detection alone cannot identify silent poliovirus circulation; experiences from the United Kingdom, United States, Israel, South Sudan, China, and Ghana demonstrate the value of combining clinical and wastewater-based surveillance (20),(21),(22). More sensitive molecular detection and sequencing approaches can shorten the interval between circulation, laboratory confirmation, and response, while recent multi-country wastewater detections further demonstrate the importance of environmental surveillance in polio-free settings (23),(24),(25).

The epidemiological assessment indicated that transmission was sustained by heterogeneous vaccination coverage rather than uniformly low national coverage. High-risk pockets were associated with zero-dose and under-immunized children, difficult geography, limited health-service access, weak cold-chain infrastructure, poor water and sanitation conditions, population mobility, and community distrust influenced by misinformation.

These factors are particularly important for district-level microplanning because national averages may conceal communities in which the effective level of protection is substantially lower.

Table 1. Key events in the Indonesian poliomyelitis trajectory, 2014-2025

Period	Event and public health significance
2014	Indonesia received WHO certification as free from endemic wild poliovirus transmission.
2018	The report notes renewed regional concern and a sporadic poliovirus event in Papua; national risk assessment identified major subnational vulnerabilities.
2020-2021	Pandemic-related disruption reduced routine immunization access and widened immunity gaps.
October-November 2022	A child in Pidie, Aceh, developed acute left-leg paralysis; poliovirus type 2 was confirmed and an outbreak was declared.
December 2023-January 2024	Additional confirmed cases were reported in Pamekasan, Sampang, and Klaten.
June 2024	The source report recorded 33 confirmed cases across seven provinces; the last reported case occurred on 27 June 2024.
2023-2025	Mass nOPV2 campaigns, IPV2 integration, strengthened AFP and environmental surveillance, and repeated outbreak response assessments were implemented.
19 November 2025	The outbreak was officially declared closed after sustained absence of new cases and negative surveillance findings.

Treatment plan and public health response

Because the reported event was a communicable disease outbreak rather than an isolated clinical presentation, the principal treatment plan was population-level interruption of transmission. The response used novel oral poliovirus vaccine type 2 (nOPV2) in repeated supplementary immunization rounds, consistent with the accelerated introduction of nOPV2 for type 2 outbreaks and its role as a genetically more stable oral vaccine option in the eradication endgame (26),(27),(28),(29). Evidence from large outbreak campaigns indicates that repeated supplementary immunization activities with nOPV2 can be deployed at scale to close immunity gaps in affected populations (30). In the source report, more than 50 million children aged 0-59 months were reached and approximately 60 million supplementary doses were distributed across the response period.

The second inactivated poliovirus vaccine dose was incorporated into routine immunization from June 2023 to strengthen humoral protection against type 2 poliovirus (31). Serological surveys and clinical studies of nOPV2 have documented population antibody responses and evaluated immunogenicity, tolerability, and fecal shedding across different age groups, while post-deployment analyses underscore the need to monitor genetic and epidemiological risks during large-scale use (32),(33),(34),(35). Inactivated poliovirus vaccine remains an important complementary component of outbreak and routine strategies because it strengthens systemic protection against paralytic disease; evidence from campaign reviews, outbreak-response guidance, follow-up studies, program transitions, and effectiveness analyses supports its continued role alongside oral vaccination (36),(37),(38),(39),(40). Program implementation in Indonesia was also supported by intensified acute flaccid paralysis surveillance, expanded environmental sampling, repeated outbreak response assessments, health-worker mobilization, and community engagement.

Expected and actual outcomes

The expected outcomes were rapid closure of immunity gaps, interruption of person-to-person and environmental transmission, improved sensitivity of surveillance, and restoration of public confidence in immunization. The source report states that no new human case occurred after 27 June 2024, poliovirus was not detected in environmental samples after the third quarter of 2024, and the outbreak was officially declared closed on 19 November 2025 following international assessment. These outcomes should be interpreted as the result of combined vaccination, surveillance, logistics, and community-response measures rather than as the effect of a single intervention.

3. Discussion

This episode demonstrates the distinction between regional elimination and global eradication. Certification in 2014 confirmed interruption of endemic wild poliovirus transmission in Indonesia, but it did not guarantee

permanent protection from imported or vaccine-derived strains (41). Current eradication analyses consistently describe the final phase of polio control as a problem of sustaining high immunity, maintaining sensitive surveillance, and overcoming operational weaknesses that allow recurrent vaccine-derived outbreaks to persist (42),(43).

The host-agent-environment framework helps explain the outbreak dynamics. Host susceptibility was increased by zero-dose and incompletely immunized children, the agent consisted of a vaccine-derived type 2 strain capable of continued evolution during prolonged circulation, and environmental conditions such as poor sanitation, crowding, mobility, and geographic barriers facilitated fecal-oral transmission (44),(45). Recent literature on the changing cVDPV2 landscape, vaccine-derived poliovirus outbreaks, and modeled Sabin 2 reversion reinforces that vaccine-derived transmission is fundamentally linked to prolonged circulation in insufficiently immunized populations (46).

The reported reduction in routine vaccination during the pandemic was especially important because national averages can conceal local clusters of susceptibility. Modeling work indicates that selectively reaching under-immunized groups can materially influence outbreak control, supporting microplanning based on district- and village-level immunity gaps rather than national coverage alone (47). Conflict, displacement, insecurity, and disruption of health services can further widen these gaps and complicate both vaccination and surveillance, as shown in the Sahel and in cVDPV2 outbreaks occurring in chronic-conflict settings (48),(49).

Program inputs also shape outbreak risk. Delayed outbreak response and inappropriate choice or timing of type 2-containing oral vaccines can allow transmission to continue, whereas rapid, well-designed response strategies improve the probability of interruption (50),(51). Operational performance also depends on adherence to outbreak-response standards and the availability of adequately managed vaccine stockpiles (52),(53). Accordingly, strengthening polio resilience requires reliable transport, cold-chain capacity, trained personnel, supervision, financing, and local accountability in addition to vaccine procurement.

Table 1. Key events in the Indonesian poliomyelitis trajectory, 2014-2025

Domain	Observed vulnerability	Priority action
Population immunity	Zero-dose children, incomplete schedules, heterogeneous coverage.	District-level microplanning, defaulter tracking, catch-up vaccination, sustained coverage of at least 95%.
Virus characteristics	Prolonged circulation and genetic reversion of oral vaccine-derived type 2 virus.	Rapid nOPV2 outbreak response, timely laboratory sequencing, maintenance of IPV protection.
Health services	Unequal workforce distribution, difficult access, weak cold chain, constrained operations.	Reaching-the-unreached strategies, cold-chain investment, workforce deployment, local financing.
Environment	Poor sanitation, unsafe water, crowding, contaminated wastewater.	Water, sanitation, and hygiene improvement plus environmental poliovirus surveillance.
Community trust	Misinformation, safety concerns, religious or cultural doubts.	Risk communication, trusted local leaders, transparent adverse-event communication.
Mobility and geography	Domestic migration, border movement, archipelagic and remote settings.	Cross-border coordination, transit vaccination, risk-based surveillance in mobile populations.

The outbreak response combined the mucosal-immunity advantages of nOPV2 with broader routine protection through IPV, intensified surveillance, and repeated assessment. Operational experience from Tajikistan, Nigeria, Yemen, Ghana, and Sierra Leone shows that preparedness, rapid vaccine deployment, repeated campaign rounds, and context-specific field implementation are central to cVDPV2 response (54),(55),(56),(57),(58). A recent global time-series analysis of mass vaccination campaigns further supports the importance of large-scale supplementary immunization as a population-level tool for controlling circulating type 2 vaccine-derived poliovirus outbreaks (59). At the same time, vaccine safety monitoring remains essential during emergency use and supplementary campaigns so that adverse-event information can be detected, interpreted, and communicated transparently (60),(61).

Community trust is a core epidemiological resource. Community engagement during eradication endgames is most effective when it is continuous, locally grounded, and integrated with strategies for reaching populations that are repeatedly missed (62). Community surveillance following environmental poliovirus detection can

complement formal surveillance systems, while qualitative assessment of outbreak responses shows that restoring vaccination coverage requires attention to local concerns as well as service availability (63),(64). Communication should therefore use clear explanations of vaccine benefits and risks, trusted community and religious leaders, and rapid responses to misinformation.

The social and economic consequences extend beyond the confirmed case count. Paralytic poliomyelitis can create lifelong rehabilitation needs, reduce educational and employment opportunities, and impose substantial caregiving and transport costs on families. Outbreak control additionally requires emergency vaccination, laboratory testing, environmental and clinical surveillance, logistics, and health-worker deployment, which can compete with other essential health-service priorities.

This report has limitations. It is based on a secondary synthesis rather than a national case line list, and detailed patient-level examination, treatment, and follow-up data were unavailable. Some cumulative figures vary between sections of the source report because they appear to reflect different surveillance updates. Before journal submission, final case counts, provincial distribution, campaign denominators, and surveillance dates should therefore be cross-checked against definitive Ministry of Health and World Health Organization records.

Despite these limitations, the case supports the broader evidence that vaccine-derived poliovirus outbreaks are primarily sustained by immunity gaps and delayed detection rather than by vaccination itself. The implication for practice is to maintain strong routine immunization, rapidly identify zero-dose and under-immunized children, combine acute flaccid paralysis and environmental surveillance, secure outbreak vaccine logistics, and sustain locally trusted communication. Integrated approaches that explicitly connect acute flaccid paralysis surveillance, environmental surveillance, and vaccination strategy provide a practical framework for preventing poliovirus re-emergence after elimination (65).

4. Conclusion

The re-emergence of circulating vaccine-derived poliovirus type 2 in Indonesia after the 2014 polio-free certification resulted from geographically concentrated immunity gaps interacting with viral evolution, service inequities, poor sanitation, mobility, and vaccine hesitancy. Coordinated supplementary immunization, strengthened routine vaccination, acute flaccid paralysis and environmental surveillance, and repeated outbreak assessment were followed by interruption of reported transmission and closure of the outbreak in November 2025. The principal lesson is that polio-free status must be actively maintained. Future practice should prioritize uniformly high district-level coverage, rapid identification of zero-dose children, dependable cold-chain and workforce capacity, improved water and sanitation, and sustained community engagement.

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