

Peer Review

# Review of: "Integrated Determinants of Persistent Wild Poliovirus Transmission in Pakistan and Afghanistan: The Roles of Cross-Border Mobility, Hard-to-Reach Populations, and Micro-Transmission Hotspots, 2010-2025"

Sana Tamim<sup>1</sup>

1. Public Health Laboratory Division, National Institute of Health, Islamabad, Pakistan

This review article focuses on understanding the integrated determinants that sustain persistent wild poliovirus type 1 (WPV1) transmission in Pakistan and Afghanistan between 2010 and 2025. These two countries represent the last global reservoirs of the virus. The persistence of WPV1 transmission in Pakistan and Afghanistan. To provide an integrated assessment of factors sustaining WPV1 transmission, specifically cross-border mobility, immunity gaps in hard-to-reach populations, and localized micro-transmission hotspots. The study also aims to examine operational and health-system limitations hindering immunization and surveillance to inform targeted strategies. While not explicitly stated as questions, the objectives imply inquiries into *what* factors contribute to persistent WPV1 transmission, *how* cross-border mobility and immunity gaps affect it, *where* micro-transmission hotspots are located, and *what* operational/health-system constraints exist.

The review investigates the multifactorial determinants sustaining WPV1 circulation in the last two polio-endemic countries globally. The stated objectives include providing an integrated assessment of cross-border mobility patterns, immunity gaps in marginalized populations, localized transmission hotspots, and health system constraints. While these objectives are relevant to ongoing eradication efforts, they address questions that have been the subject of considerable research and documentation throughout the study period.

The study employs a scoping review methodology consistent with PRISMA-ScR guidelines and WHO evidence synthesis standards, which is appropriate for mapping the breadth of existing literature. The systematic search strategy across multiple databases (PubMed, Embase, Scopus, Web of Science) and grey literature sources (WHO, UNICEF, GPEI reports) demonstrates comprehensiveness. The inclusion of 52 studies following rigorous screening by independent reviewers enhances methodological transparency and reduces selection bias.

Despite methodological soundness, several critical limitations warrant attention:

- The review exclusively synthesizes secondary sources without contributing primary data or novel analytical perspectives. No new empirical observations, field investigations, or original surveillance findings are presented.
- While narrative synthesis is acceptable for scoping reviews, the lack of quantitative synthesis or meta-analytic approaches limits the ability to derive new statistical insights or identify previously unrecognized patterns across studies.
- The 15-year timeframe, while extensive, does not yield temporally stratified analysis that might reveal evolving patterns or inflection points. The findings are presented as static observations rather than dynamic trends that could inform adaptive strategies.
- Although the review identifies 12 micro-transmission hotspots in the abstract, the text does not provide granular spatial analysis or novel geographic insights beyond what has been documented in routine surveillance reports and previous publications.

### **Critical Assessment of Findings**

#### **Cross-Border Transmission Dynamics**

The study confirms Pakistan and Afghanistan function as a single epidemiological block, with over 85% genetic linkage among cross-border WPV1 isolates and bidirectional transmission in 72% of border-adjacent cases.

**Critical Analysis:** These findings are not novel. The epidemiological connectivity between Pakistan and Afghanistan has been extensively documented since the early 2010s through molecular epidemiology studies published by the Global Polio Laboratory Network and peer-reviewed journals. The genetic linkage and bidirectional transmission patterns have been routine components of WHO polio surveillance bulletins and GPEI reports for over a decade. The observation regarding unsynchronized supplementary immunization activities (SIAs) prolonging viral circulation has been a well-recognized

programmatic challenge since at least 2012-2013, repeatedly emphasized in Independent Monitoring Board reports and operational reviews. Please see Vasallo et al 2021, (doi: [10.1136/bmjgh-2021-006568](https://doi.org/10.1136/bmjgh-2021-006568)) and Ahmad et al., 2023 ( doi: [10.1155/2023/4801424](https://doi.org/10.1155/2023/4801424)).

The review does not identify new transmission corridors, propose novel surveillance methodologies, or offer fresh insights into the mechanisms of cross-border viral movement beyond what has been previously established.

### **Immunity Gaps in Hard-to-Reach Populations**

The study highlights immunity gaps among nomadic, displaced, and conflict-affected children, with routine vaccination coverage of 22-41% and seroprevalence below 70% in these populations.

**Critical Analysis:** The vulnerability of mobile, displaced, and conflict-affected populations has been a consistent theme in polio eradication literature since the onset of the Syrian crisis and the intensification of conflict in Afghanistan and Pakistan's tribal areas. Numerous studies, programmatic reports, and humanitarian assessments have documented these exact coverage gaps and their contribution to sustained transmission. The cited seroprevalence levels and coverage estimates align with previously published data without providing new epidemiological insights or identifying previously unrecognized at-risk subpopulations.

The review does not explore innovative vaccination strategies that have been piloted in these contexts, nor does it provide new evidence on the effectiveness of mobile vaccination teams, cross-border health initiatives, or community engagement approaches that have emerged in recent years.

### **Localized Micro-Transmission Hotspots**

Environmental surveillance identified 12 persistent hotspots in cities including Karachi, Peshawar, Quetta, and Kandahar, with year-round WPV1 detection despite high overall immunization coverage in surrounding areas.

**Critical Analysis:** The concept of persistent micro-transmission hotspots, often termed "core reservoirs" or "silent circulation zones," has been well-established in the polio eradication literature since environmental surveillance was scaled up in Pakistan and Afghanistan around 2014-2015. The specific cities mentioned (Karachi, Peshawar, Quetta, Kandahar) have been consistently identified as high-risk areas in annual polio surveillance reports and published studies. The phenomenon of persistent environmental detection despite high reported coverage, often attributed to underserved urban informal

settlements or specific high-risk mobile populations (HRMP) corridors, has been extensively analyzed in previous research.

The review does not provide novel granular analysis of these hotspots, such as new phylogenetic clustering patterns, previously unidentified transmission networks within these cities, or innovative environmental sampling strategies that could enhance detection sensitivity. The findings largely recapitulate what is already known from routine surveillance.

### **Operational and Health-System Constraints**

The study identifies operational challenges including campaign delays, insecurity, funding shortfalls, weak integration with routine immunization services, and persistent cross-border coordination issues.

**Critical Analysis:** These operational constraints have been thoroughly documented throughout the past 15 years in numerous programmatic evaluations, Independent Monitoring Board reports, WHO technical advisory group assessments, and peer-reviewed literature. The impact of insecurity on campaign access, the challenges of funding sustainability, and the difficulties in integrating vertical polio campaigns with routine immunization services are well-worn themes in global polio eradication discourse. The review does not present new evidence on the magnitude of these constraints, their relative contributions to transmission persistence, or innovative solutions that have been implemented and evaluated.

The findings regarding operational challenges are essentially summaries of known barriers rather than revelations that could inform novel programmatic approaches.

**This review accomplishes none of the objectives.**

Instead, it presents a static summary of well-known challenges without temporal analysis, quantitative synthesis, or innovative interpretation. The 15-year scope, rather than being an asset, highlights the redundancy of the findings—the same issues identified in 2010-2012 are essentially restated in 2025 without evidence of evolution, resolution, or new understanding.

- **What has changed over 15 years?** The review does not elucidate how transmission dynamics, operational challenges, or programmatic responses have evolved.
- **What has worked?** There is minimal analysis of successful interventions or strategies that have demonstrably reduced transmission in specific contexts.
- **What remains unknown?** The review does not identify genuine knowledge gaps that require new research; it only reiterates known challenges.

- **What should be done differently?** Recommendations are generic and have been repeatedly made in previous literature without being operationalized here with new evidence.

## **Conclusion**

This scoping review, while methodologically sound in its approach to literature synthesis, is fundamentally limited by its failure to generate novel scientific findings. After examining 15 years of evidence from 52 studies, the review presents a compilation of previously reported observations regarding cross-border transmission, immunity gaps, micro-transmission hotspots, and operational constraints, all of which have been extensively documented in existing literature.

The central issue is not methodological inadequacy but rather the absence of scientific advancement. The 15-year timeframe, rather than being an asset, accentuates the problem. In the context of the global polio eradication endgame, where resources are constrained and evidence needs are acute, research outputs must provide tangible value.

Future research in this domain must prioritize originality, whether through primary data collection, innovative analytical approaches, implementation science perspectives, or interdisciplinary integration, to genuinely advance understanding and inform the strategies needed to finally interrupt WPV1 transmission in these last endemic reservoirs.

The polio eradication community deserves research that not only documents what is known but actively pushes the boundaries of knowledge to solve the complex, persistent challenges that have defied resolution for over a decade. This review, regrettably, does not fulfill that imperative.

## **Declarations**

**Potential competing interests:** No potential competing interests to declare.