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**Original Research Article**

# 2024 Laboratory Inventory and Poliovirus Containment Survey in Zambia: Nationwide Assessment of Infectious and Potentially Infectious Materials

Andrew Phiri[1]*, Moses Mwale[1], Patrick Sakubita[1], Clara Mbwili-Muleya[1], Peter Chipimo[1], Bryson Musonda[1], Muzala Muchanga[3], Mwaka Monze[4], Bianca Chifwelu[5], Princess L. Kayeye[6], Christopher Simuntala[7], Josias Soko[8], Farai Nyoni[9], Deborah Tembo[10], Mundia Hendrix Kangongwe[11], Constance Mulenga[13], Hiwena Malawo[13], Sandra Diana Mwadetsa[13], Norah Ndambo[13], Vincent Kapungu[13], Innocent Mwaba[13], Thanthwe Mangani[13], Lackeby Kawanga[13], Paul Kasinde[14], Evans Mpabalwani[12], Henry Njapau[2]

[1]World Health Organization (WHO), Zambia
[2]NTF Chair, Zambia Academy of Sciences, Zambia
[3]Principal Inspector / NTF Member, National Anti-terrorism Centre (NATC), Zambia
[4]Head / NTF Coordinator, National Polio Laboratory, University Teaching Hospital (UTH), Zambia
[5]Senior EPI Officer, Ministry of Health – EPI, Zambia
[6]GPEI Coordinator, Global Polio Eradication Initiative (GPEI) – Zambia
[7]Senior Biosafety Officer – Head Standards & Technical / NTF Member, National Biosafety Authority (NBA), Zambia
[8]Biomedical Scientist, UTH Virology Laboratory, Zambia
[9]VMCCL, UNICEF, Zambia
[10]Surveillance & SIA Officer, IQVIA
[11]Principal Biomedical Scientist, Lusaka Provincial Health Office (PHO), Zambia
[12]University of Zambia (UNZA), Lusaka, Zambia
[13]School of Postgraduate Studies, University of Lusaka, Lusaka, Zambia
[14]AIDS Healthcare Foundation Zambia

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**Abstract:** In light of global commitments to eradicate poliovirus and ensure strict laboratory containment, Zambia conducted a nationwide laboratory inventory and survey in November 2024 to identify facilities handling or retaining poliovirus infectious materials (IMs) or potentially infectious materials (PIMs). This effort followed previous surveys conducted in 2015 and 2019 (WHO, 2020), amid recurring vaccine-derived poliovirus (cVDPV2) outbreaks and cross-border risks (WHO, 2021). A total of 42 laboratories across all 10 provinces were surveyed using the Open Data Kit (ODK) tool (CDC, 2020). Of these, 18 laboratories reported handling samples classified as PIMs, and three facilities UTH Virology, ZNPHRL, and TDRC were found to retain 95,455 PIMs (including stool and nasopharyngeal samples), while no facility retained infectious materials (IMs). The UTH Virology Lab remains the only WHO-accredited national polio lab authorized to retain such samples (WHO, 2015). Data were collected and analyzed using SQL Server and GIS tools, providing detailed insights into material distribution and lab categorization. Despite challenges with survey tool limitations and access to centralized databases, the findings underscore Zambia's continued vigilance in poliovirus containment, with only 0.03% of unusable OPV2 vials unaccounted for (WHO, 2021). The survey confirms that Zambia maintains a low risk of poliovirus spread and emphasizes the need for periodic verification visits, refined survey tools, and real-time inventory tracking to uphold global containment standards (Matapo, 2012).

**Keywords:** Poliovirus Containment, Potentially Infectious Materials, Zambia Laboratory Survey, Vaccine-Derived Poliovirus, Infectious Material Inventory, Polio Eradication, Open Data Kit, Laboratory Biosafety, Outbreak Response, Cross-Border Health Risks.



***Corresponding Author:** Andrew Phiri
World Health Organization (WHO), Zambia

# INTRODUCTION

**History of Past Lab Surveys on Containment**

In 2015 the Global Certification Committee (GCC) declared Wild Polio Virus Type 2 (WPV2) eradicated, and therefore all member states and territories were mandated to move all WPV2 both Infectious Material (IM) and Potentially Infectious Material (PIM) under containment in 2016, with the SWITCH from tOPV to bOPV as a complimentary activity. Later, in November 2019 the GCC made another declaration of the certification of global eradication of WPV3. However, due to the use of the bOPV in response to outbreaks globally, the type 3 Sabin virus is yet to be targeted for containment.

The global and regional declaration of the non-circulation of WPV anywhere, was not a guarantee that no laboratories/facilities are in possession of WPV of both poliovirus infectious materials (IM) or poliovirus potentially infectious materials (PIM) and associated materials such as cVDPV/Sabin/unusable OPV vials in the region. Hence, confidence could only be guaranteed through documented inventories and surveys evidence as proof.

Zambia has experienced several outbreaks in the past 20 years. These include the following;

- In 2001, Zambia had a wild poliovirus type1 imported from Angola.
- Zambia also confirmed two separate cVDPV type 2 outbreaks from AFP cases between October and December 2019.
- The first AFP cVDPV2 case with 10 nucleotide changes was reported on July 16, 2019, in Chiengi district in the Luapula province.
- The second AFP cVDPV2 case with 9 nucleotide changes was also reported on November 25, 2019 in Chavuma district in North-Western province
- A third cVDPV2 AFP case reported on November 13, 2019 in Kalabo district in the Western province was later delisted from Zambia and given to Angola.
- The fourth cVDPV2 AFP case reported in Mpulungu district of Northern province in 2023.
- In 2023, the country recorded 4 cVDPV2 cases from AFP samples in Mpulungu and another 4 cVDPV2 outbreaks from ES in Lusaka (cVDPV2), Mufulira (VDPV2) and Ndola (VDPV2).
- In 2024, one (1) VDPV was recorded in Ndola from ES.

Since the country had outbreaks in the period prior to the survey, there is a possibility that clinical samples collected during the period may have contained the virus of interest and may have been kept in storage.

**Laboratories Surveyed for Laboratory Containment Exercise**

In 2015, a total of 192 laboratories were reached and surveyed for PIMs. Out of the 192 laboratories covered in the survey 3 were categorised as handling or storing potentially infectious material: these were Virology (National Polio Laboratory), Parasitology and Bacteriology all located at UTH.

In 2019, a total of 231 laboratories were reached and surveyed for PIMs. The increase is attributed to the addition of new laboratory facilities established between 2015 and 2019 which were incorporated in the survey.

No survey for polio potentially infectious materials was conducted in 2023. However, the current report records the one done in 2024.

**Rationale for Laboratory Inventory for 2024**

The country needs to update its inventory of laboratories/facilities that handle or store potentially infectious material and Infectious materials such as WPV/cVDPV/Sabin viruses/unusable OPV vials (used in outbreak response) of all the 3 poliovirus types (1, 2, and 3).

In addition, since the last inventory survey there had been significant changes in the public health landscape, including the ongoing risk of poliovirus importation due to regional and global travel, cross-border activities, and the growing threat of Vaccine-Derived Poliovirus (VDPV) outbreaks.

The survey targeted laboratories and facilities that included research laboratories (Rota, enteroviruses, poliovirus, influenza, COVID-19, water and sewage, immunology, virology, nutrition, bacteriology, parasitology, serology), diagnostic labs, OPV vaccination centres for travellers, OPV storage facilities, OPV routine vaccination centres, poliovirus outbreak response centres, OPV testing facilities, Poliovirus diagnostic facilities, regional and reference poliovirus laboratories.

**General Objective**

To know the presence of the IMs and PIMs in these laboratories/ facilities that could potentially handle clinical samples of WPV/cVDPV/Sabin viruses/ unusable OPV vials (used in outbreak response) of all the 3 poliovirus types (1, 2, and 3).

**Specific Objectives**

The specific objectives of this survey included to:

1. Constitute a country team of focal points on containment from both Ministry of Health (Provincial biomedical scientists/ Provincial surveillance Officers) to identify laboratories and facilities to be surveyed.

2. Collect data from the identified laboratories and facilities using the ODK survey tool on lab inventory.
3. Produce a report for submission to NCC.

**Experimental Section/Material and Methods:**
**Methodology**
**Preparatory Meeting for Lab Data Collection**

Prior to data collection, all data collectors (including PBSs, PSOs, national laboratory scientists) were oriented through PowerPoint presentations via teleconference on:

i. AFRO Roadmap for WPV/cVDPV/Sabin Virus/Unusable OPV Vials 1,2 & 3 (IM/PIM): Inventory Generation and Survey Implementation
ii. Step-by Step Guidance for the Use of ODK-Based Containment Tool for Inventory and Survey Data Collection

The inclusion criteria were adopted as prescribed by AFRO. The AFRO criteria comprised of laboratories and facilities that store clinical samples at -20°C or lower including research laboratories for (Rota, enterovirus, poliovirus, influenza, COVID-19, water and sewage), immunology, virology, bacteriology, parasitology, diagnostic labs, OPV storage facilities, National poliovirus laboratory (Environmental Surveillance), lab/facility involvement with stool/nasopharyngeal, Veterinary labs and the Ministry of Health Reference labs. In additional to the above, the country team defined long term storage as 6 months and above.

**Data Collection**

The Provincial biomedical scientists/ Provincial surveillance Officers utilized the ODK Country Level Form entitled ***"Containment Investigation Tool"*** for the survey in all the 10 provinces of Zambia from 4$^{th}$ to 22$^{nd}$ November 2024.

**Data Analysis**

The data was analysed using Structured Query Language (SQL) Server Management Studio (SSMS) tool and Excel. GIS was used to analyse the data for distribution of lab surveyed. A summary of the results was generated as per prescribed AFRO format.

Data visualization and report writing was carried out by the NTF and the secretariat over a period of 5 days from 2 to 6 December 2024.

Data on unusable OPV2 Vials as Poliovirus Infectious Materials (IM) Identified and Destroyed from Poliovirus Outbreaks Response activities were collected from the national vaccine storage.

## RESULTS AND DISCUSSION

**Findings/ Results**

Ten teams, one in each province were constituted to carry out the survey. Each team comprised a Provincial Biomedical Scientist and Provincial Surveillance Officer. The teams used the ODK Country Level Form entitled ***"Containment Investigation Tool"*** for the survey in all the 10 provinces of Zambia from 4$^{th}$ to 22$^{nd}$ November 2024.

The labs that qualified for inclusion in the survey as per survey criteria are shown in figure 1. In total, 42 labs that could potentially handles PIMs/Ims were included in the survey. The number of labs included in the survey from each of the 10 provinces is shown in table 1.

The labs were also categorized according to field of specialization. Four general fields of specialization, i.e. Bacteriology, Immunology, Microbiology, Parasitology, and Virology. The number of labs that fell in each category is shown in table 2.

A summary of the consolidated results of the survey is shown in table 3. All the 42 labs that were selected for inclusion in the survey fully responded to elements of the survey.

Eighteen of the 42 laboratories/ facilities indicated that they handle stool and nasopharyngeal samples which were classified as potentially infectious materials. Of the 18 labs that handle PIMs, three labs/ facilities (UTH Virology, ZNPHRL, and TDRC) indicated that they retain some of the PIMs. Of the three labs, only the UTH Virology Lab is accredited to handle to Polio viruses. The total number of PIMs retained by the three labs was 95,455 as shown in table 3. Of the retained PIMs, 11,729 were stool samples and 83,726 were nasopharyngeal samples. Of the 11, 729 stool samples, 6,647 were at the UTH Virology and 5,082 were at ZNPHRL. Of the 83, 726 nasopharyngeal samples, 40,325 were at ZNPHRL, 42, 056 were at UTH Virology Lab, and 1,345 were at TDRC.

No laboratory confirmed retaining Infectious Materials (Ims)

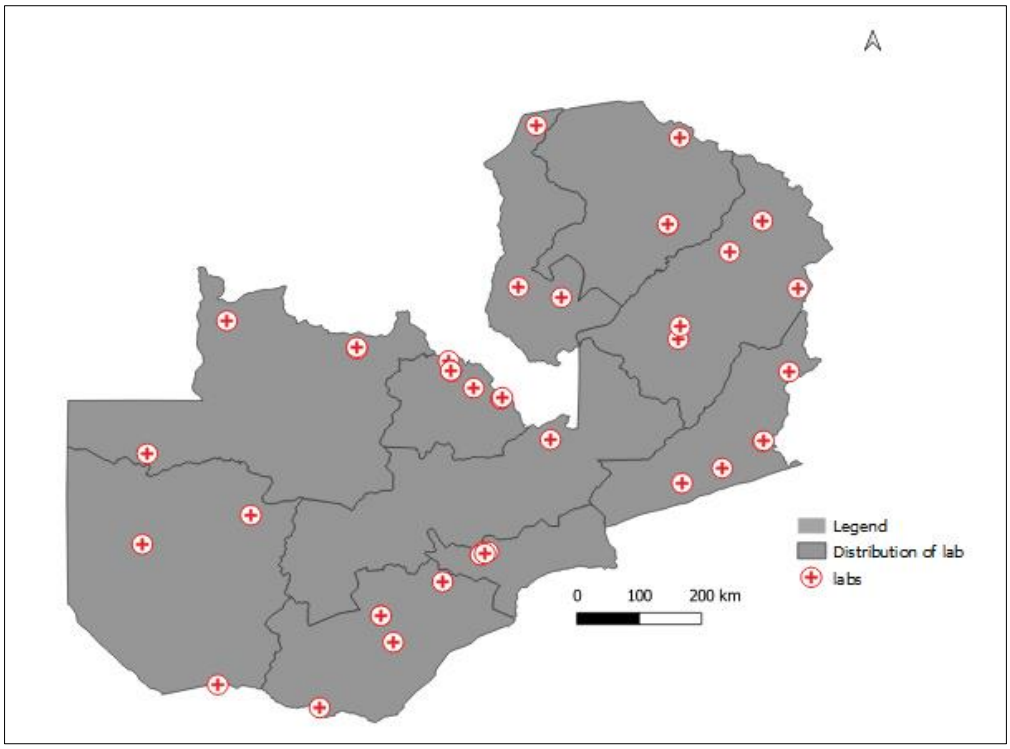


**Figure 1: Geo-locations of laboratories covered in the 2024 survey.**

**Table 1: Provincial Distribution of Labs and Specialization**

| Province | No. of Labs covered/ Province | Name of Lab | Type of facility (Polio lab, Non-polio lab or Other) | Specialization | Materials/ Organisms handled |
|---|---|---|---|---|---|
| CENTRAL | 1 | Mkushi district hospital | Non-polio | Microbiology<br>Bacteriology<br>Immunology | Viral and bacterial Swabs |
| COPPERBELT | 7 | Ndola Teaching Hospital | Non-Polio | Microbiology<br>Bacteriology<br>Parasitology<br>Immunology<br>Molecular Biology | Viral and bacterial Swabs |
| | | Arthur Davison Children Hospital | Non-Polio | Microbiology<br>Bacteriology<br>Parasitology<br>Immunology<br>Molecular Biology | Viral and bacterial Swabs |
| | | Kitwe Teaching Hospital | Non-Polio | Microbiology<br>Bacteriology<br>Parasitology<br>Immunology<br>Molecular Biology | Viral and bacterial Swabs |
| | | Nchanga South General Hospital | Non-Polio | Microbiology<br>Bacteriology<br>Parasitology<br>Immunology | Bacterial Swabs |
| | | Nchanga North General Hospital | Non-Polio | Microbiology<br>Bacteriology<br>Parasitology<br>Immunology | Bacterial swabs |
| | | Konkola Mine Hospital | Non-Polio | Microbiology<br>Bacteriology<br>Parasitology<br>Immunology | Viral and bacterial Swabs<br>Ultra-freezer |
| | | TDRC | Non-Polio | Microbiology<br>Bacteriology | Viral and bacterial Swabs |

| | | | | | |
|---|---|---|---|---|---|
| | | | | Parasitology<br>Immunology<br>Molecular Biology<br>Virology | Ultra-freezer |
| EASTERN | 6 | Chama District Hospital | Non_polio_lab | Microbiology_lab<br>Parasitology_lab<br>Virology_lab<br>immunology_lab<br>Bacteriology_lab Other | Viral and bacterial Swabs |
| | | Chipata Central Hospital | Non_polio_lab | Mcrobiology_lab<br>Bacteriology_lab<br>Parasitology_lab<br>Virology_lab<br>immunology_lab | Viral and bacterial Swabs |
| | | Kalindawalo General Hospital | Non_polio_lab | Microbiology_lab<br>Bacteriology_lab<br>Parasitology_lab | Viral and bacterial Swabs |
| | | Kapata Health Centre | Non_polio_lab | Parasitology_lab<br>Bacteriology_lab<br>microbiology_lab<br>immunology_lab<br>Virology_lab | Viral and bacterial Swabs |
| | | Lumezi Mission Hospital | Non_polio_lab | Microbiology_lab<br>Bacteriology_lab<br>immunology_lab<br>Parasitology_lab | Viral and bacterial Swabs |
| | | St'Francis Hospital | Non_polio_lab | Microbiology_lab<br>Bacteriology_lab<br>Parasitology_lab<br>immunology_lab | Viral and bacterial Swabs |
| LUAPULA | 3 | Chienge District Hospitals. | Non_polio_lab | diagnostic_lab | Viral and bacterial Swabs |
| | | MANSA General Hospital | Non_polio_lab | Microbiology_lab<br>Bacteriology_lab<br>immunology_lab<br>Parasitology_lab<br>MoH_reference_lab<br>water_sewage_testing_facil ity Other | Viral and bacterial Swabs |
| | | Samfya District Hospital | Non_polio_lab | diagnostic_lab | Viral and bacterial Swabs |
| LUSAKA | 6 | CHAZ LAB | Non_polio_lab | Microbiology_lab<br>Bacteriology_lab<br>Parasitology_lab<br>Virology_lab<br>Rota_virus_lab<br>Enterovirus_lab<br>Noro_virus_lab<br>MoH_reference_lab<br>water_sewage_testing_facil ity Research_facility_others | Viral and bacterial Swabs |
| | | CIDRZ Campus hq | Non_polio_lab | Research_facility_others<br>Rota_virus_lab<br>Noro_virus_lab<br>immunology_lab<br>microbiology_lab<br>Virology_lab | Viral and bacterial Swabs |
| | | Levy Mwanawasa UTH Lab | Non_polio_lab | Microbiology_lab<br>Bacteriology_lab<br>immunology_lab<br>Parasitology_lab<br>Virology_lab<br>MoH_reference_lab<br>Research_facility_others | Viral and bacterial Swabs |

| | | | | | |
|---|---|---|---|---|---|
| | | UTH BACTERIOLOGY LAB | Non_polio_lab | Microbiology_lab Bacteriology_lab MoH_reference_lab Research_facility_others | Viral and bacterial Swabs |
| | | UTH VIROLOGY LAB | polio_lab | Immunology_lab Measles_lab Virology_lab Rota_virus_lab Enterovirus_lab MoH_reference_lab water_sewage_testing_facility Research_facility_others | Viral and bacterial Swabs |
| | | ZNPHI REFERENCE LABORATORY | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Measles_lab Virology_lab Rota_virus_lab Enterovirus_lab Noro_virus_lab MoH_reference_lab water_sewage_testing_facility Research_facility_others | Viral and bacterial Swabs |
| MUCHINGA | 4 | Chilonga Mission General Hospital | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Virology_lab | Viral and bacterial Swabs |
| | | Chinsali general hospital. | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Virology_lab Enterovirus_lab | Viral and bacterial Swabs |
| | | Isoka District Hospital | General Laboratory. Non polio laboratory | | Viral and bacterial Swabs |
| | | Michael Chilufya Sata District Hospital | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Virology_lab | Viral and bacterial Swabs |
| NORTHERN | 3 | KASAMA GENERAL HOSPITAL | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Virology_lab | Viral and bacterial Swabs |
| | | Location Urban Clinic | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab | Viral and bacterial Swabs |
| | | Mbala General Hospital | Pathology laboratory | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab | Viral and bacterial Swabs |
| NORTH-WESTERN | 4 | Chitokoloki Mission Hospital | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Virology_lab | Viral and bacterial Swabs |
| | | Marybegg Health services- Solwezi | Non_polio_lab | Parasitology_lab Bacteriology_lab diagnostic_lab | Viral and bacterial Swabs |
| | | Mwinilunga District Hospital Laboratory | Non_polio_lab | diagnostic_lab Parasitology_lab Bacteriology_lab | Viral and bacterial Swabs |

| | | | | | |
|---|---|---|---|---|---|
| | | Solwezi General Hospital Laboratory | Non_polio_lab | diagnostic_lab microbiology_lab Bacteriology_lab Parasitology_lab Virology_lab | Viral and bacterial Swabs |
| SOUTHERN | 5 | Choma Provincial Veterinery Diagnostic Laboratory | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Virology_lab Research_facility_others | Viral and bacterial Swabs |
| | | Macha Mmedical lab | Non_polio_lab | Microbiology_lab Parasitology_lab Other | Viral and bacterial Swabs |
| | | Macha Research Trust | General laboratory | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Measles_lab Virology_lab Rota_virus_lab Enterovirus_lab MoH_reference_lab water_sewage_testing_facility Research_facility_others | Viral and bacterial Swabs |
| | | Mazabuka General Hospital | Non_polio_lab | Microbiology_lab Bacteriology_lab immunology_lab Parasitology_lab Virology_lab | Viral and bacterial Swabs |
| | | University teaching hospital | Non_polio_lab | Virology_lab Enterovirus_lab | Viral and bacterial Swabs |
| WESTERN | 3 | Kaoma District Laboratory | Non_polio_lab | Parasitology_lab microbiology_lab | Viral and bacterial Swabs |
| | | Lab survey | Non_polio_lab | Microbiology_lab Parasitology_lab | Viral and bacterial Swabs |
| | | Lewanika General hospital Lab | Non_polio_lab | Microbiology_lab Bacteriology_lab Parasitology_lab | Viral and bacterial Swabs |
| Grand Total | 42 | | | | |

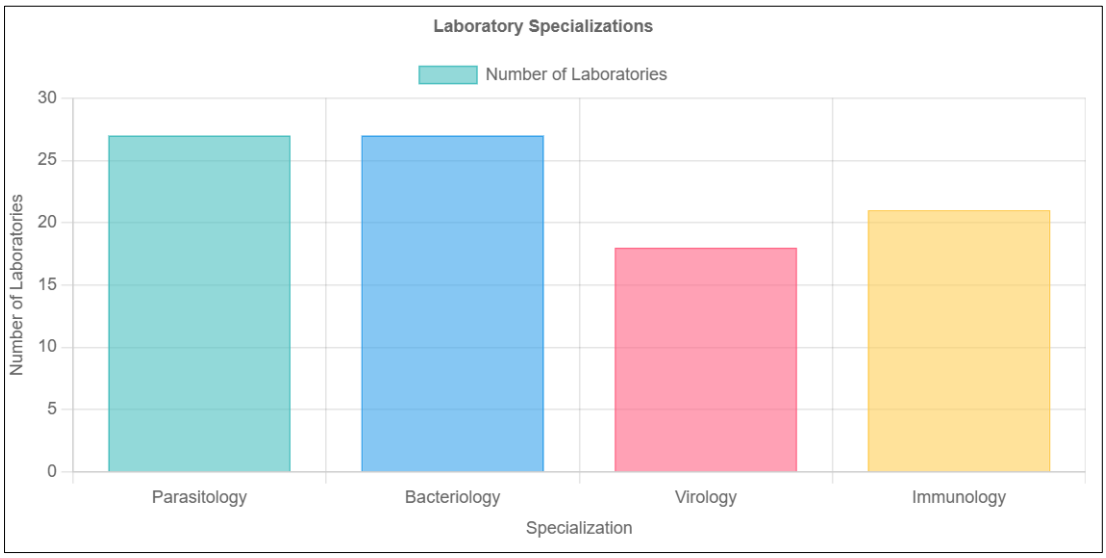


**Figure 2: Lab Specialization Categories**

The bar chart visualizes the number of laboratories across four specializations: Parasitology and Bacteriology each have 27 laboratories, Immunology has 21, and Virology has 18. Created using Chart.js, the chart features color-coded bars for easy comparison, with labeled axes and a title for clarity. Parasitology and Bacteriology lead in laboratory count, followed by Immunology, with Virology having the fewest.

**Table 3: Summary of Findings from the 2024 Laboratory Inventory Survey**

| No | Description | Number/ Percentage |
|---|---|---|
| 1 | Facilities that received questionnaire | 42 |
| 2 | % Survey respondent | 100% |
| 3 | % complete responses obtained from these facilities | 100% |
| 4 | Facilities that had poliovirus infectious or potentially infectious materials | 18 |
| 5 | Facilities that never had any poliovirus infectious or potentially infectious materials | 24 |
| 6 | Facilities that had but have destroyed, inactivated, or transferred to a PEF all their poliovirus infectious or potentially infectious materials (including poliovirus nucleic acid) | 15 |
| 7 | Facilities that do not retain any poliovirus infectious or potentially infectious materials (including poliovirus nucleic acid) | 15 |
| 8 | Facilities that retain any poliovirus infectious or potentially infectious materials (including poliovirus nucleic acid) | 3 |
| 9a | Number of IMs/PIMs found during the survey | 95,455 |
| 9b | IMs retained by facility | 0 |
| 9c | % of IMs destroyed | 0 |
| 9d | PIMs retained by facility | 95,455 |
| 9e | % of PIMs destroyed | 0 |

**NB**: Stool (ZNPHRL-40, 325; UTH Virology-6,647), Nasopharyngeal swabs (ZNPHRL-5, 082; TDRC-1,345; UTH Virology Lab-75), COVID-Swabs (UTH Virology Lab; 41,981)

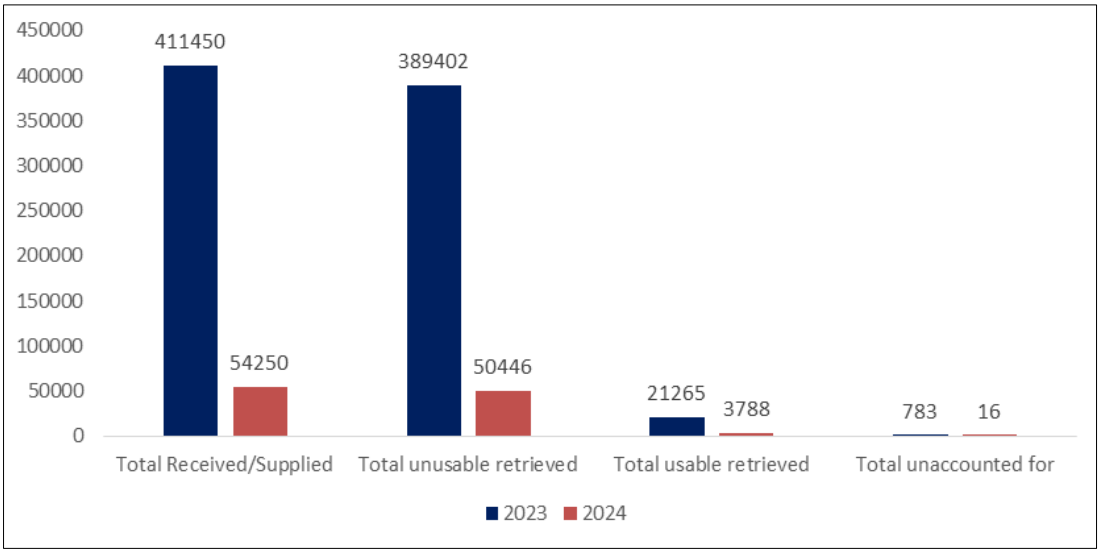


**Figure 3: Summary of Unusable OPV2 Vials as Poliovirus Infectious Materials (IM) Identified and Destroyed from Poliovirus Outbreaks Response in Zambia illustrates the comparison of poliovirus vaccine vial management between 2023 and 2024. The total number of vials received or supplied dropped markedly from 411,450 in 2023 to 54,250 in 2024. Correspondingly, the total unusable vials retrieved decreased from 389,402 to 50,446, while the total usable vials retrieved also declined from 21,265 to 3,788. Notably, the figure highlights a significant improvement in accountability, with the number of unaccounted-for vials reducing from 783 (0.17%) in 2023 to only 16 (0.03%) in 2024, indicating enhanced containment and inventory control measures.**

## DISCUSSION

Despite, the global and regional declaration by Ministers of Health of the non-circulation of WPV anywhere, it is not guaranteed that no laboratories/facilities are in possession of WPV of both poliovirus infectious materials (IM) or poliovirus potentially infectious materials (PIM) and associated material such as cVDPV/Sabin/unusable OPV vials in the region. Hence, confidence could only be guaranteed through documented inventories and surveys. In fact, there is documented evidence of WPV1 importation in Malawi during 2022. Therefore, surveys of laboratories/facilities for that could potentially in possession of WPV/cVDPV/Sabin viruses/unusable OPV vials of all the 3 poliovirus types (1, 2, and 3) is imperative.

The 2024 Zambia laboratory inventory and survey has shown that 43% of laboratories and facilities handle material that could potentially contain polio viruses and three of the facilities actually retain such materials. That 12% of the retained PIMs are stool samples increases the potential of the retained materials being infectious. However, once confirmed as infectious the material is promptly destroyed by incineration under supervision.

In addition, despite the significant changes in the public health landscape, including the ongoing risk

of poliovirus importation due to regional and global travel, cross-border activities, and the growing threat of Vaccine-Derived Poliovirus (VDPV) outbreaks, the number of laboratories and facilities that have been found to retain PIMS has remained three as determined in the previous surveys of 2015 and 2019. This guarantee limiting the potential for spreading of infections in Zambia. Furthermore, potential spread of infections from unusable OPV2 vials has remained low at 0.03%.

The UTH Virology laboratory, the only WHO accredited National Polio Laboratory of Zambia has continued to retain PIMs and Ims for research purposes. The Bacteriology and Parasitology laboratories at UTH no longer retain PIMs/IMs. On the other hand, the ZNPHRL and TRDC are holding PIMs hence join the UTH virology laboratory as laboratories that require continued monitoring.

**Challenges**

i) Selection criteria not very explicit and clear in terms of biosafety level and PIMs retention time.
ii) ODK Survey Tool not fully amenable to information desired by Zambia.
iii) Data collectors determined laboratories to be surveyed based on availed criteria.
iv) Submission of data to AFRO repository not harmonized.
v) Access of AFRO ODK project for extraction of country-specific data was problematic.

**LESSONS LEARNT**

- It is important for the NTF and Secretariat to have a pre-listing of all the laboratories of interest to use as a checklist for review and validation of labs visited in future surveys.
- Real time monitoring of lab inventory and survey is of paramount importance.

## RECOMMENDATIONS

i) NTF to undertake site visits to verify the safety and security of retained PIMs in all facilities.
ii) There is need to modify the ODK Survey Tool to make it suitable for local data requirements.
iii) The survey tool should be piloted (data collectors and interviewees) prior to rolling it out
iv) The qualifying laboratories should be verified prior to the survey implementation.

## CONCLUSION

The 2024 laboratory inventory and survey in Zambia, conducted from November 4 to 22, 2024, across all 10 provinces, demonstrates the country's robust commitment to poliovirus containment following global and regional eradication declarations. Covering 42 laboratories using the Open Data Kit (ODK) Containment Investigation Tool, the survey identified 18 facilities handling potentially infectious materials (PIMs), with three laboratories UTH Virology, ZNPHRL, and TDRC retaining 95,455 PIMs, primarily stool and nasopharyngeal samples. Notably, no infectious materials (IMs) were retained, and only 0.03% of unusable OPV2 vials remained unaccounted for, reflecting effective containment measures. Despite challenges, such as limitations in the ODK tool's customization and data submission processes, Zambia maintains a low risk of poliovirus spread, supported by consistent findings from prior surveys in 2015 and 2019. Recommendations include refining the ODK tool, conducting site visits to verify PIM storage safety, and pre-validating laboratories to enhance future surveys. These efforts affirm Zambia's proactive stance in sustaining polio-free status amidst ongoing regional and global risks, such as vaccine-derived poliovirus outbreaks and cross-border transmission.

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