Scientific Research Publishing

Voice of the Publisher, 2025, 11(2), 251-260
https://www.scirp.org/journal/vp
ISSN Online: 2380-7598
ISSN Print: 2380-7571

Epidemiological Profile of Acute Flaccid Paralysis in the Lomami Province from 2018 to 2022

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How to cite this paper: Bosalo, R. I., Sambu, M. N., Losangola, G. B., Bosungi, S. I., Gakumu, D. N., Gambolipay, C. Z., Mazembe, D. E., Kasai, E. T., & Likwela, J. L. (2025). Epidemiological Profile of Acute Flaccid Paralysis in the Lomami Province from 2018 to 2022. *Voice of the Publisher, 11,* 251-260.
https://doi.org/10.4236/vp.2025.112018

Received: March 7, 2025
Accepted: May 12, 2025
Published: May 15, 2025

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Abstract

Introduction: The Democratic Republic of the Congo is facing an outbreak of vaccine-derived poliovirus, yet the Lomami Province remained unaffected until the end of the first quarter of 2023. This study describes the epidemiological profile of Acute Flaccid Paralysis (AFP) in this province. **Methods:** A descriptive cross-sectional study was conducted using secondary surveillance data on AFP cases from 2018 to 2022. **Results:** A total of 429 AFP cases were recorded in 16 health zones in Lomami Province, with a detection rate of 4.1 cases per 100,000 children under 15 years. The median age of cases was 3 years (range: 1 - 20 years). Children's health was a major concern, as those aged 12 to 59 months accounted for 67.1% of cases, and 50.4% were male. Onset was marked by fever in 78.2% of cases, and 74.1% presented with progressive paralysis over three days. Paralysis affected both legs in 76.2% of cases but was asymmetric in 20%. The majority of cases came from the Mulumba and Makota health zones, with peaks observed in the third quarter of 2018 and the second quarter of 2022. **Conclusion:** AFP cases mainly affect children aged 12 to 59 months, with symptoms dominated by fever and bilateral leg paralysis. Strengthening public health surveillance is crucial to preventing the re-emergence of poliovirus through effective vaccination strategies.

Keywords

Acute Flaccid Paralysis, Epidemiology, Lomami Province, Poliovirus, Surveil-Lance, Democratic Republic of the Congo

1. Introduction

Poliomyelitis remains a significant public health concern, particularly in low-income countries where vaccination coverage is suboptimal, causing muscle weakness and irreversible, incurable Acute Flaccid Paralysis (AFP) in one out of every 200 people infected through human-to-human transmission (Kew et al., 2005; WHO, 2021). Children under five years old are the most affected (WHO, 2021).

In May 1988, during the 41st World Health Assembly in Geneva, countries joined forces to launch the Global Polio Eradication Initiative (GPEI). This initiative, currently led in partnership with the World Health Organization (WHO), the Rotary Foundation, the Bill & Melinda Gates Foundation (BMGF), the United States Centers for Disease Control and Prevention (CDC), and the United Nations Children's Fund (UNICEF), aimed to eradicate poliovirus worldwide by the year 2000 (Kew et al., 2005).

To combat poliomyelitis, measures include routine vaccination, mass vaccination campaigns, and door-to-door immunization in high-risk areas, along with essential surveillance to detect AFP cases early in children under 15 years and laboratory sample analysis (Kew et al., 2005; Rachlin, 2022).

AFP surveillance plays a crucial role in the early detection of potential poliovirus cases, as it allows for rapid response measures to contain outbreaks. The WHO has set surveillance standards requiring a minimum detection rate of 3 cases per 100,000 children under 15 years to ensure effective monitoring (WHO, 2021).

The WHO African Region was declared free of wild poliovirus (WPV) as of August 25, 2020. However, in 2021, a wild poliovirus type 1 (WPV1) case was reported in Malawi for the first time in over five years, followed by limited spread in Mozambique. Despite this progress, the region continues to face an outbreak of circulating vaccine-derived poliovirus (cVDPV), affecting several African countries, including the Democratic Republic of the Congo (DRC) (Lee, 2023).

While the DRC has experienced recurrent outbreaks of vaccine-derived poliovirus, the Lomami Province remained unaffected until early 2023. However, its proximity to affected regions raises concerns about potential transmission risks.

This study aims to provide a detailed epidemiological profile of AFP cases in Lomami Province from 2018 to 2022, analyzing trends in age distribution, clinical presentation, and geographic clustering. Understanding these patterns is essential for strengthening AFP surveillance and informing targeted public health interventions to mitigate the risk of poliovirus resurgence.

2. Materials and Methods

2.1. Study Setting

This study was conducted in Lomami Province, one of the 26 provinces of the DRC. Lomami Province shares borders with four epidemic-prone provinces for poliovirus in the DRC: Maniema, Lualaba, Tanganyika, and Haut-Lomami. Lomami is located at 6˚08'01" South and 29'01" East. It is bounded to the north by Sankuru and Maniema Provinces, to the east by Tanganyika Province, to the south by

Haut-Lomami and Lualaba Provinces, and to the west by Kasaï-Central and Kasaï Provinces.

The province is divided into two Expanded Program on Immunization branches, namely the Kabinda and Mweneditu branches, and comprises 16 Health Zones. It has 16 General Referral Hospitals, 316 Health Centers, and 113 high-priority AFP surveillance sites. The estimated population in 2023 was 4,670,492 inhabitants, spread over an area of 56,426 km^2, with a population density of 83 inhabitants/km^2.

2.2. Study Type and Period

This study utilized a descriptive cross-sectional design, analyzing secondary data from the national AFP surveillance system, WHO Kasaï-Oriental sub-office reports, and case investigation forms. Data were collected from January 1, 2018, to December 31, 2022, and included all suspected AFP cases recorded in the national database.

2.3. Data Collection

AFP case definitions were based on WHO guidelines, which classify a suspected case as any child under 15 years presenting with AFP or any individual diagnosed with suspected polio by a clinician (RDC et al., 2018). Laboratory confirmation was performed using stool sample analysis, with cases categorized as confirmed, unconfirmed, or excluded.

To ensure data quality, verification procedures included cross-checking case investigation forms against the WHO surveillance database and excluding incomplete or duplicate records. Sensitivity analyses were conducted to assess potential biases arising from missing data.

The extracted data included:

- Sociodemographic variables (sex, age, residence);
- Spatiotemporal variables (temporal trends, geographic distribution);
- Clinical variables (symptoms, diagnosis, case evolution).

2.4. Statistical Analysis

Data analysis was conducted using Stata 13. Continuous variables were summarized using medians and interquartile ranges, while categorical variables were presented as frequencies and percentages. Temporal trends were assessed using trend analysis, and a spatial distribution map was created using QGIS. Additional analyses examined potential risk factors for AFP occurrence, including vaccination status, geographic location, and clinical symptoms.

2.5. Ethical Considerations

The study protocol was submitted to the Lomami Provincial Health Division for approval and authorization to access administrative data. Confidentiality and anonymity of respondents were ensured.

3. Results

From January 1, 2018, to December 31, 2022, 429 cases of AFP were reported in the 16 health zones of the Lomami Province. The number of reported cases per year ranged from a minimum of 63 cases in 2021 to a maximum of 103 cases in 2022, with an average of 85.8 cases per year. (Figure 1)

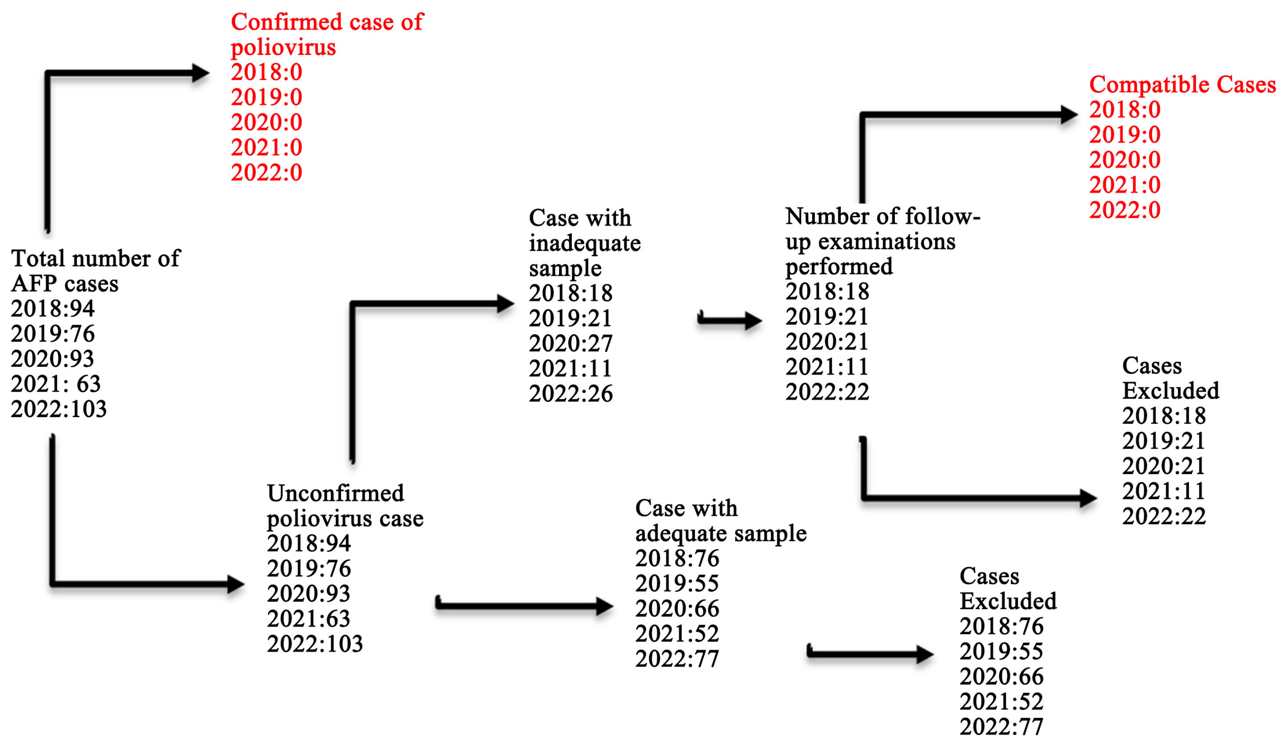

Figure 1. Flowchart showing the classification of AFP cases in Lomami Province.

3.1. Incidence Rate

The detection rate of AFP cases was 4.1 cases per 100,000 children under 15 years old. This rate varied from 2.9 in 2021 to 4.9 in 2018. At the health zone level, the rate varied from 0.0 in the Kamana health zone in 2021 to 18.3 in 2020 in the Kami-ji health zone. Table 1 shows the detection rates of AFP cases per 100,000 children under 15 years old by health zone during the study period.

3.2. Sociodemographic and Clinical Characteristics of AFP Cases

The median age of the respondents was 3 years (min-max: 1 - 20 years). Most of the cases involved children aged 12 to 59 months, representing 67.1% of the cases. Males accounted for half of the cases (50.4%). The majority of cases (78.2%) presented with fever at the onset of paralysis. The paralysis was progressive over 3 days in 74.1% of cases. Paralysis was asymmetric in only 20.0% of the cases. Fourteen percent of cases were admitted to the hospital. In most cases (76.22%), paralysis affected both legs. The most likely diagnosis was not defined for many cases, with 56.8% being fully vaccinated. (Table 2).

Table 1. Evolution of the AFP detection rate in Lomami Province.

Health Zone	2018	2019	2020	2021	2022	Cumulative
Ngandajika	4.4	2.4	1.2	2.8	3.3	2.8
Kabinda	4.2	3.5	3.4	2.1	4.0	3.4
Kalambayi Kabanga	8.3	2.8	3.6	1.8	6.8	4.7
Kalenda	5.7	2.8	4.5	0.9	3.4	3.4
Kalonda-Est	6.6	3.2	1.6	2.3	2.9	3.3
Kamana	6.1	5.7	0.9	0.0	3.4	3.2
Kamiji	7.8	5.7	18.3	7.1	6.9	9.2
Kanda Kanda	3.3	1.6	4.7	6.0	5.9	4.3
Lubao	10.0	3.5	3.3	1.6	6.9	5.1
Ludimbi-Lukula	2.5	1.2	7.0	6.6	2.1	3.9
Luputa	4.2	2.0	2.6	1.3	5.6	3.1
Makota	4.1	12.7	3.1	4.5	4.4	5.7
Mulumba	4.8	5.4	4.0	3.3	4.8	4.5
Mwene Ditu	1.8	1.3	6.3	2.9	2.8	3.0
Tshofa	5.5	6.7	12.9	3.8	8.6	7.5
Wikong	6.5	6.3	4.4	4.3	9.7	6.2
Total	**4.9**	**3.8**	**4.4**	**2.9**	**4.7**	**4.1**

Table 2. Description of AFP cases recorded in Lomami Province.

Characteristic	Parameters	Total (%)
Age (n = 429)	Median (Min-Max)	3 (1 - 20)
	0 to 11 months	16 (3.7)
	12 to 59 months	288 (67.1)
	5 to 15 years	117 (27.3)
	Over 15 years	8 (1.9)
Sex	Male	216 (50.5)
	Female	212 (49.5)
Vaccination Status	Zero dose	18 (4.2)
	Under-vaccinated	42 (9.7)
	Fully vaccinated	244 (56.8)
	Unknown	125 (29.1)
Symptoms	Fever at onset of paralysis	335 (78.2)
	Asymmetric paralysis	89 (20.7)
	Progressive paralysis in 3 days	316 (74.1)
	Hospitalized	62 (14.8)
	Injection history	34 (7.93)

Continued

Paralyzed Limbs	4 Limbs	12 (2.80)
	Right arm and both legs	1 (0.23)
	Left arm and left leg	24 (5.59)
	Both arms	1 (0.23)
	Both legs	327 (76.22)
	Unknown	1 (0.23)
	Right leg	23 (5.36)
	Right leg and right arm	16 (3.73)
	Left leg	24 (5.59)
Probable Diagnosis	Abscess	1 (0.23)
	Acute arthritis	3 (0.70)
	Sickle cell crisis	1 (0.23)
	Malnutrition	12 (2.80)
	Myalgia	1 (0.23)
	Transverse myelitis	8 (1.86)
	Neuropathy	2 (0.47)
	Post-injection neuritis	3 (0.70)
	Traumatic neuritis	13 (3.03)
	Osteomyelitis	6 (1.40)
	Malaria	36 (8.39)
	Post-lumbar puncture paralysis	1 (0.23)
	AFP	82 (19.11)
	Guillain-Barré syndrome	10 (2.33)
	Neuromuscular trauma	3 (0.70)
	Paralytic poliomyelitis	17 (3.96)
	Hemiplegia	2 (0.47)
	Meningitis/meningoencephalitis	26 (6.06)
	Undefined	202 (47.09)

3.3. Distribution of Cases over Time

From 2018, a notable peak occurred in the third quarter, with 43 cases, followed by a gradual decline in cases in the following quarters, reaching a stable level in 2019 and 2020, where cases remained between 15 and 23 per quarter. However, a second significant peak occurred in the second quarter of 2022, with the number of cases reaching 47. After this peak, cases dropped rapidly, with only 4 cases in the fourth quarter of 2022. Figure 2 shows the distribution over time of AFP cases reported in Lomami Province.

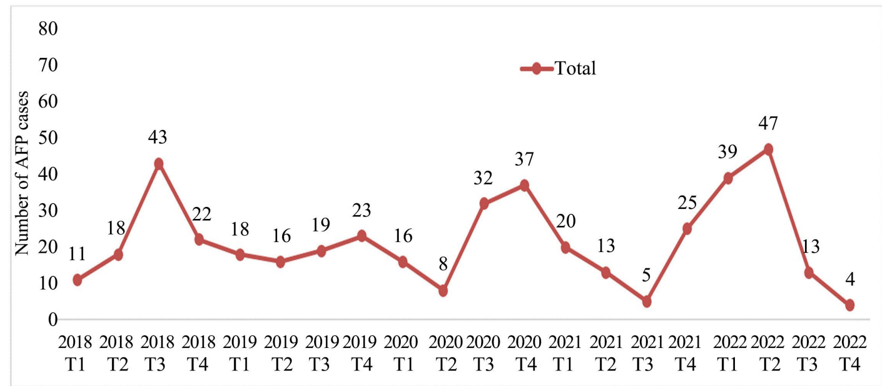

Figure 2. Distribution of AFP cases over time.

3.4. Distribution of AFP Cases in Space

The distribution of AFP cases in Lomami Province shows a concentration in certain areas such as Mulumba (39 cases), Makota (37 cases), and Mwene Ditu (36 cases), indicating more vulnerable areas. Other districts, such as Kabinda (34 cases) and Lubao (30 cases), also report significant numbers. However, areas like Ludimbi-Lukula (17 cases) and Kalenda (19 cases) report fewer cases. This geographic distribution suggests varying spread across the province, requiring targeted surveillance and interventions in the most affected areas. (**Figure 3**)

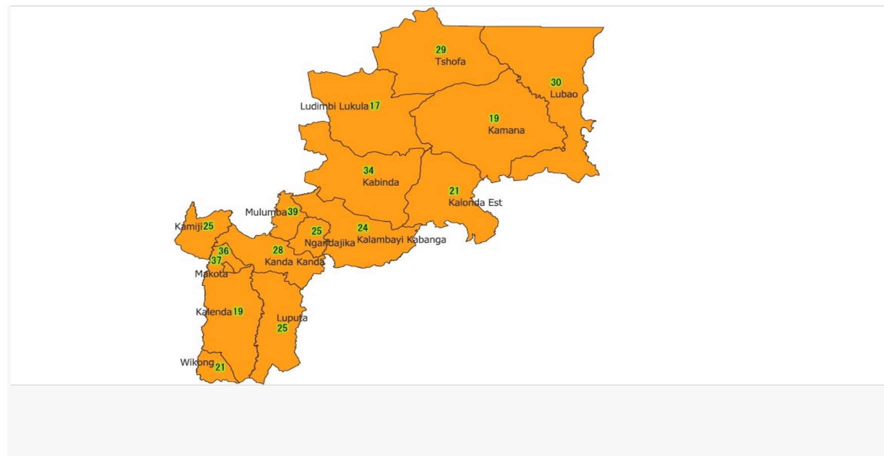

Figure 3. Distribution of AFP cases by health zone. (Source: DRC, Health Information System)

4. Discussion of Results

The detection rate of AFP in the province of Lomami was 4.1 cases per 100,000 children under 15 years old. This rate varied between 2.9 in 2021 and 4.9 in 2018. At the level of the health zones, the rate varied from 0.0 in the health zone of Kamana in 2021 to 18.3 in 2020 in the health zone of Kamiji. This result highlights significant variations in the detection of AFP cases in the province of Lomami, both over time and between health zones. The overall rate is higher than the recommended threshold of 3 cases per 100,000 children during an epidemic, according to WHO recommendations for ensuring effective surveillance, indicating sat-

isfactory effort in detection (WHO, 2018). Previous studies conducted in the DRC had shown that rates above the norm were reached (Nsambu et al., 2013; Membo et al., 2016). In Guinea and Sudan, studies reported average incidences above the norm, with 7.09/100,000 and 4.02/100,000 children under 15 years old, respectively (Ali et al., 2023; Conté et al., 2021).

Our results showed a median age of 3 years, with the majority of cases (67.1%) observed in children aged 12 to 59 months, indicating that younger children are the most vulnerable. This is consistent with the literature, which emphasizes that young children are at higher risk (WHO, 2021). This result aligns with those of previous studies in Kenya, Nigeria, and Ghana (Odoom et al., 2014; Tesfaye et al., 2020; Bassey et al., 2011). Special attention should be given to this age group during AFP case searches. Furthermore, the nearly equal proportion of cases between sexes (50.4% male) shows an absence of gender predisposition.

Fever, observed in 78.2% of cases, is a cardinal sign of the onset of AFP, reinforcing its role as an alert signal for healthcare providers. This result corroborates studies conducted in Guinea, where 94% of children were febrile (Conté et al., 2021). Progressive paralysis within 3 days in 74.1% of cases reflects the typical nature of AFP, requiring early surveillance to intervene promptly. Asymmetry, present in only 20% of cases, and involvement of both legs in 76.22% of cases, differ from the classical expectations where asymmetry is more common. This trend was also observed in Guinea (86.18%) (Conté et al., 2021), while in Ghana, the proportion of asymmetrical cases was 54.3% (Obodai et al., 2024).

In 2018, a first peak of 43 cases in the third quarter reflected an improvement in surveillance, followed by stabilization between 2019 and 2020 (15 to 23 cases per quarter). A second peak in 2022 (47 cases in the second quarter) indicates a resurgence linked to intensified detection efforts or increased transmission. The drop to 4 cases by the end of 2022 is encouraging but requires sustained vigilance.

Geographically, the health zone of Mulumba, Makota, and Mwene Ditu (36 - 39 cases) were the most affected, likely due to structural challenges. In contrast, the health zones of Ludimbi-Lukula and Kalenda (17 - 19 cases) showed better results, but enhanced surveillance remains essential.

Spatio-temporal variations require targeted interventions and strengthening of vaccination and monitoring systems. However, missing data and ineffective archiving limited the quality of the analysis, highlighting the need to improve information management.

5. Conclusion

AFP cases in Lomami Province primarily affect young children, with fever and bilateral leg paralysis as predominant symptoms. The findings emphasize the necessity of enhanced surveillance, improved case investigation protocols, and strengthened routine immunization programs to prevent potential poliovirus resurgence.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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