

ACUTE FLACCID PARALYSIS SURVEILLANCE SYSTEM DATA ANALYSIS, PUJEHUN, SIERRA LEONE, 2011-2020

SHERIFF, Musa D.¹; SHERIFF, A.^{1,2}; ELDUMA, A.²; GEBRU, G.²

¹Ministry of Health and Sanitation, Sierra Leone

²Sierra Leone Field Epidemiology Training Program, Sierra Leone

Corresponding Author: SHERIFF, Musa D.; Email: musadsheriff@gmail.com

ABSTRACT

The Acute Flaccid Paralysis (AFP) surveillance system was established to detect poliovirus and to measure progress toward Poliovirus eradication. Vaccine-derived poliovirus outbreaks have been reported worldwide in 2020, including in Sierra Leone. We analyzed AFP surveillance data to describe the distribution, epidemiological trend, and clinical characteristics of AFP cases. We analyzed secondary data of AFP cases in the Pujehun District for the period from 2011 to 2020. We collected data on key variables such as age, sex, clinical characteristics, outcome, non-AFP rate, stool adequacy, and non-Polio enteroviruses. We analyzed data using Microsoft Excel 2013 and Epi-Info 7 software. Results were reported in tables, graphs, and maps. A total of 60 AFP cases were reported with a median age of 3 years (range 0.7-14), with no confirmed poliomyelitis. Under-five Children accounted for 46 (76.7%), with 27 females and 33 males. Of the sixty cases, 17 (28.3%) were hospitalized and 16 (27%) were detected in the hospital. Ten (16.7%) cases were classified as non-Polio enteroviruses and 50 (83.3%) as negative. Sudden onset of paralysis was reported in 57 (96.6%) cases, paralysis progressed within 3 days in 44 (74.6%) cases, and 56 (94.6%) reported fever. Out of 33, the left legs 28 (84.9%) were the most affected sites. Majority of the cases, 35 (58.1%) had received five and more doses of the Oral Polio vaccine. The stool adequacy was 54 (90%) and the non-AFP rate was above 2.0 except in 2017 when it was 1.8. Of the 14 chiefdoms, 12 (86%) met the minimum AFP reporting target ($1/100,000 < 15$ years' population). None of the AFP cases were confirmed as Poliovirus in Pujehun District. Case detection and reporting rate were high except for two chiefdoms. We recommended maintaining the AFP surveillance system in the district and replicate the strategies used to other districts.

keywords: Acute flaccid Paralysis (AFP), Poliovirus, Pujehun, Sierra Leone

INTRODUCTION

Poliomyelitis is an acute, highly infectious viral disease caused by the poliovirus (World Health Organization, 2022). The disease commonly affects children below the age of 5 years and is transmitted via a fecal-oral route from person to person, and less frequently by a common source such as contaminated water or food. Poliovirus multiplies in the intestine, where it invades the nervous system and causes irreversible paralysis (World Health Organization, 2022). In rare cases, poliovirus can also be transmitted through saliva (Raji *et al.*, 2021a). Humans are the only reservoir of poliovirus and therefore disease eradication is highly possible. Poliomyelitis, which spread mainly among children under 5 years, causes paralytic disease presenting as Acute Flaccid Paralysis. Poliomyelitis mainly affects children under five years of age, with a case fatality rate of 5-10% among paralysed cases (World Health Organization, 2022) One in every 200 infections leads to irreversible paralysis, usually in the legs (World Health Organization, 2022). There is no known cure for Poliomyelitis. However, the disease can be prevented through vaccination (World Health Organization, 2022)

Acute Flaccid Paralysis surveillance system detects the presence of circulating wild poliovirus and measures progress towards Polio eradication. Globally, despite substantial progress toward polio eradication over the last decade, outbreaks of cVDPV2 have recently been steadily increasing, with most of these outbreaks occurring in Africa (Wang, 2020). Nigeria is the latest country to have officially stopped endemic transmission of wild poliovirus, with its last reported case in 2016 (World Health Organisation, 2019).

In Sierra Leone, AFP surveillance was adopted in 1998 and case based surveillance was initiated in 2004 as a syndromic approach for detecting the Poliovirus. Several other conditions may look like clinical poliomyelitis cases, which can lead to misdiagnoses, such as Guillain-Barré Syndrome

which has a similar clinical presentation. If the reporting system for poliovirus is not sensitive, the likelihood to miss cases is high. Therefore, increasing the sensitivity to detect poliovirus will be achieved by reporting a syndrome AFP which should include all polio cases. Immediate reporting of all AFP cases in children less than 15 years old will distinguish polio from other non-polio cases (World Health Organisation, 2019).

Global Polio Eradication Initiative (GPEI) focuses on strengthening AFP surveillance worldwide to detect and respond to Poliovirus outbreaks, build herd immunity to protect populations, and stop WPV transmission (CDC, 2022). Poliovirus is targeted for eradication because the virus is present everywhere, putting all children at risk, and the virus only exists in human hosts. The Global Polio Eradication Initiative sets performance indicators to monitor progress and assess countries' performance. These global efforts have reduced the number of WPV cases by more than 99% (Polio | Bill & Melinda Gates Foundation - Bill & Melinda Gates Foundation, no date). An estimated 350,000 WPV cases were reported from 125 countries in 1988, and by end of 2018, only 33 cases were reported. No WPV case has been detected outside Afghanistan and Pakistan Since August 2016. (World Health Organisation, 2021a). Despite the success of stopping the wild poliovirus, the vaccine-derived poliovirus is still circulating in Africa, including Sierra Leone. The GPEI has introduced the novel oral poliovirus vaccine (nOPV2) in response to the circulating vaccine-derived poliovirus (cVDPV) outbreaks in Africa and works closely with countries to support vaccine supply and demand, rollout, and maintain high campaign coverage of high of high-risk populations (World Health Organization, 2021).

As described in the technical guidelines for Integrated Disease Surveillance and Response (Ministry of Health and Sanitation, 2008), the AFP case is a notifiable disease and an important indirect measure of Wild Poliovirus incidence and re-importation of poliovirus into polio-free areas.

The quality of AFP surveillance is critical particularly for countries and regions that have attained Polio free certification. Successful interruption of wild poliovirus transmission cannot be achieved without high-quality AFP surveillance. A good AFP surveillance system serves as a sensitive instrument to detect potential poliomyelitis cases, which informs the health system to institute interventions promptly to interrupt any poliovirus transmission (World Health Organisation, 2021a).

In December 2020, the MOHS, Sierra Leone received a confirmation of cVDPV2 cases of samples collected from children manifesting weakness of the limbs in Kambia, Tonkolili, and Western Area Rural Districts, respectively. A total of 25 confirmed cVDPV2 cases with paralysis, within 14 days of onset, and eight environmental isolates were detected from December 2020 to June 2021.

Despite the re-emergence of polio cases in Sierra Leone, there is paucity of data on the distribution, epidemiological trend, clinical features and indicators for monitoring AFP cases in Pujehun district. Therefore, we analyzed AFP surveillance data to describe the distribution, trend, and clinical characteristics and assess the performance indicators of the system in Pujehun.

METHODS

Study design

We conducted a descriptive data analysis of AFP cases in the Pujehun District for the period 2011 to 2020.

Study area

Pujehun District is one of the 16 districts in Sierra Leone. It has a border with Kenema District in the East, Bo District in the North, Bonthe district in the West, and Liberia Southwest/Atlantic Ocean. According the 2015 national population and housing census, Pujehun district has a population of 346461 (Leone SS, 2015).. The district has 14 Chiefdoms and covers a total area of 71,174 square kilometers. There are 97 health facilities in the district, including one referral hospital, 15

community health centers, 16 community health posts, and 65 maternal and child health posts.

Study population

The study population was under-fifteen children reported with AFP in Pujehun District.

AFP Case definition

A suspected case of Polio is any child under 15 years of age with acute flaccid paralysis (AFP) or any person of any age with paralytic illness in whom the clinician suspects poliomyelitis, and a confirmed case is any suspected case from whom the wild poliovirus is isolated.

Data collection

AFP surveillance system data was obtained from the district health management team. We reviewed and cleaned data, define key variables, and created an analysis plan using case investigation form and performance indicators. We included Demographic variables (person such as age, and sex), outcome, signs, and symptoms, Place, time, and AFP performance indicators. We used line lists and case investigation forms to collect data and stored it in an excel folder and Epi info software to avoid missing files.

Data analysis

We analyzed data using Microsoft Excel 2013, Epi-Info statistical software (version 7). Frequencies, percentages were calculated for categorical variables and median and range for the continuous variables. We summarized and displayed the results using tables, charts, and map.

Ethical consideration

Permission to conduct this study was obtained from the DHMT and the MOHS. All ethical considerations were observed to maintain the confidentiality of the study population. No personally identifiable information was disclosed.

RESULTS

Demographic characteristics and clinical history of AFP cases

Table 1: Demographic distribution of AFP cases in Pujehun from 2011- 2020

Variables	Category	Frequency	Percentages
Age group	< 5 years	46	77%
	> = 5 years	14	23%
Gender	Female	27	45%
	Male	33	55%
Hospitalized	Yes	17	28%
	No	43	72%

A total of 60 AFP cases were reported for children under 15 years of age with a median age of 3.0 years with a range of 0.7 to 14. Children under-five years accounted for 46 (77%), males accounted for 33(55%) and only 17 (28%) were hospitalized (Table 1).

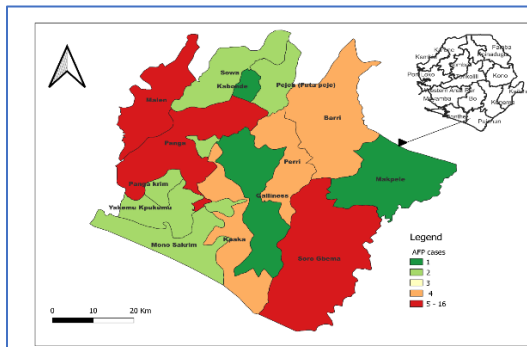


Figure 1: Distribution of AFP cases by chiefdom, Pujehun district, 2011 - 2020

Three chiefdoms reported five and more cases whilst nine reported four cases and below (Figure 1).

Clinical manifestations and immunization status of AFP cases

Table 1: Clinical characteristics and immunization status of AFP cases, Pujehun district, 2011 - 2020

Variables	category	Number of cases	Percent ages
Site of Paralysis	Left arm(n=29)	13	45%

	Left leg(n=33)	28	85%
	Right arm(n=32)	12	38%
	Right leg(n=36)	28	78%
Symptoms	Fever at onset	56	95%
	Asymmetrical	41	69%
	Progression within 3days	44	75%
	Flaccid sudden paralysis	57	97%
Polio immunization	< 5 doses	25	42%
	5 - 10 doses	31	52%
	> 10 doses	4	7%
Response time interval	Less than 48 hours	49	82%
	48 - 72 hours	9	15%
	>72 hours	2	3%
Cell culture result	Negative	50	83%
	NPENT	10	17%

None of the AFP cases were classified as poliomyelitis, but 10 (16%) cases were classified as a non-polio enterovirus (NPENT) and 50 cases (83%) as negative. Sudden onset of paralysis was reported in 57 (95%) of the AFP cases, paralysis progression within 3 days of onset in 44(73%) cases, and 56 (93%) AFP cases reported fever at the onset of paralysis. The left leg 28(84.9%) out of 33 and right legs 28(78%) out of 36 were among the most affected sites of paralysis. Most of the cases (58%) had received five and above doses of OPV. Of the sixty cases only 17(28%) were hospitalized and no contacts were identified. Most of the cases, 49(82%) received response within 48 hours of reporting (Table 2).

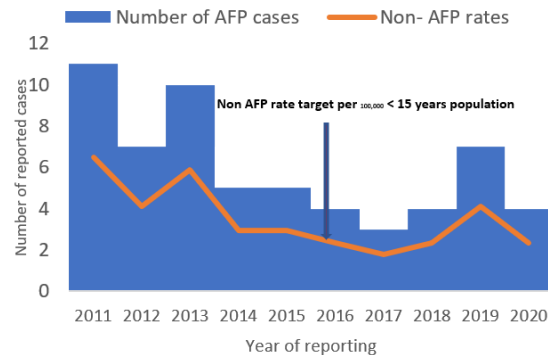
AFP surveillance performance indicators

Figure 2: Trend of AFP cases and non-AFP rates, Pujehun district, 2011 - 2020

All AFP cases were investigated with more than 90% of AFP cases having 'adequate' stool specimens, while 10% of cases had inadequate stool samples that required 60 days of follow-up. The mean NP-AFP rate was 3.54 per 100,000 children under 15 years. Fifty-four (90%) of the AFP cases had stool samples collected in less than 14 days. The NP-AFP rate minimum and maximum value ranged from 1.8/ 100,000 to 6.5/100,000 under 15 years' population during the period under review. Of the total 14 chiefdoms, 12 (86%) met the WHO minimum target of 1/100,000 children under 15 years. Overall, 27% of AFP cases were detected in the chiefdom with referral hospitals. These was a decline in AFP cases in 2017 (**Error! Reference source not found.**).

DISCUSSIONS

The results indicated that many of the AFP cases were below the age of five years and the AFP surveillance system will pick any case of Polio Virus or circulating Vaccine Derived Polio Virus type 2 in the district. This result is consistent with what was reported by WHO that under-five children are most affected. Same finding was reported from studies conducted in Ghana (Odoom *et al.*, 2014), Iran (Poorolajal *et al.*, 2011), Nigeria (Raji *et al.*, 2021b), and Australia (An *evaluation of the sensitivity of acute flaccid paralysis*

surveillance for poliovirus infection in Australia | SpringerLink, no date).

The chiefdom Panga, which has a referral hospital, detected, and reported the highest number of AFP cases as compared to other chiefdoms. This may be due to the reason that most severe cases were referred to this hospital. This indicate the need to strengthen active case search in other hospitals, particularly in the area where low AFP cases were reported. Few AFP cases were admitted to hospitals. This finding requires to heighten AFP surveillance through active case searches in the community and health facilities (*Home - Africa Kicks Out Wild Polio, no date*).

Legs were predominantly affected than the arms and none of the AFP cases were confirmed as poliovirus. Based on our findings, the proportion of AFP cases was higher among males. This result was in line with a previous study conducted in Kenya with the similar proportion (55%) of boys affected and developed fever at onset of paralysis (Tesfaye *et al.*, 2020). Most of the AFP cases had received at least three doses of OPV through the routine and supplementary immunization activities. This high proportion of OPV among AFP cases might be attributed to overestimated reporting by mothers or caregivers which might lead to bias, particularly among children whose immunization cards could not be traced during the investigation. In addition, the high polio vaccination coverage among the reported AFP cases might be attributable to multiple high-quality polio Supplementary Immunization Activities (SIAs) conducted many times with greater emphasis on high-risk, hard-to-reach, and underserved populations. However, the high immunization coverage could have boosted herd immunity, disrupted the chain of infections, and stop poliovirus circulation (World Health Organisation, 2021b).

Response time and the quality of investigation of suspected AFP cases are also vital in achieving surveillance system's objective. Almost all the suspected cases were investigated within 48 hours

of notification during the analysis period. This good performance may be attributed to proper training and supervision of the surveillance team in the district. Pujehun performed well in the NPENT which indicated that the AFP surveillance system was able to maintain the reverse cold chain and good performance of the laboratories in the routine isolation of enteroviruses. The NPENT exceeded the minimum value of 10%, which is important especially if it is required to report cVDPV2 outbreak. It has been reported that cVDPV has the potential to combine and recombine with other enteroviruses, which can cause emerging of new pathogenic strains (Muslin *et al.*, 2015). Therefore, adequate NPENT surveillance will help to detect and control any possible outbreak (Khuzwayo, Kuonza and Ngcobo, 2013). This finding proved that Pujehun District has a sensitive and high-quality AFP surveillance system that can easily detect and report Poliovirus cases (Kisanga *et al.*, 2019). The minimum non-polio-AFP rate and stool adequacy targets were surpassed at the district level except in 2017 when the performance was low. Responses to all AFP cases were very timely demonstrating the good performance of the surveillance system.

CONCLUSION

There was no confirmed poliovirus among the AFP cases. Pujehun District demonstrated a sensitive and quality AFP surveillance system that can easily detect and report Poliovirus cases. We recommend maintaining AFP surveillance system in Pujehun district and the stakeholders within the Ministry of Health and Sanitation to replicate the strategies used to other district with poor AFP indicators.

REFERENCES

An evaluation of the sensitivity of acute flaccid paralysis surveillance for poliovirus infection in Australia | SpringerLink (no date). Available at: <https://link.springer.com/article/10.1186/1471-2334-9-162> (Accessed: 16 November 2022).

CDC (2022) *Global Polio Eradication Initiative Information, Centers for Disease Control and Prevention*. Available at: <https://www.cdc.gov/polio/gpei/index.htm> (Accessed: 14 December 2022).

Home - Africa Kicks Out Wild Polio (no date). Available at: <https://www.africakicksoutwildpolio.com/> (Accessed: 26 August 2021).

Khuzwayo, L., Kuonza, L. and Ngcobo, N. (2013) 'Evaluating the acute flaccid paralysis surveillance system in South Africa, 2005-2009 - an analysis of secondary data', *PanAfrican Medical Journal*, 14. Available at: <https://doi.org/10.11604/pamj.2013.14.86.2032>

Kisanga, A. *et al.* (2019) 'Evaluation of the Functionality and Effectiveness of the CORE Group Polio Project's Community-Based Acute Flaccid Paralysis Surveillance System in South Sudan', *The American Journal of Tropical Medicine and Hygiene*, 101(4_Suppl), pp. 91-99. Available at: <https://doi.org/10.4269/ajtmh.19-0120>.

Leone SS (2015) *Population and Housing Census Summary of Final Results Planning A Better Future. Statistics*. Available at: <https://sierraleone.unfpa.org/sites/default/files/pub-pdf/Census%20Agriculture%20Report.pdf> (Accessed: 2 December 2022).

Ministry of Health and Sanitation (2008) 'Technical Guidelines for Integrated Disease Surveillance and Response in Sierra Leone'.

Muslin, C. *et al.* (2015) 'Evolution and Emergence of Enteroviruses through Intra- and Inter-species Recombination: Plasticity and Phenotypic Impact of Modular Genetic Exchanges in the 5' Untranslated Region', *PLoS Pathogens*, 11(11), p. e1005266. Available at: <https://doi.org/10.1371/journal.ppat.1005266>.

Odoom, J.K. *et al.* (2014) 'Evaluation of AFP surveillance indicators in polio-free Ghana, 2009-

2013', *BMC Public Health*, 14(1), p. 687. Available at: <https://doi.org/10.1186/1471-2458-14-687>.

Polio | Bill & Melinda Gates Foundation - Bill & Melinda Gates Foundation (no date). Available at: <https://www.gatesfoundation.org/our-work/programs/global-development/polio> (Accessed: 26 August 2021).

Poorolajal, J. *et al.* (2011) 'Evaluation of Acute Flaccid Paralysis in Hamadan, Iran from 2002 to 2009', *Epidemiology and Health*, 33, p. e20110011. Available at: <https://doi.org/10.4178/epih/e2011011>.

Raji, I.A. *et al.* (2021a) 'Evaluation of acute flaccid paralysis surveillance indicators in Sokoto state, Nigeria, 2012-2019: a secondary data analysis', *BMC public health*, 21(1), p. 1148. Available at: <https://doi.org/10.1186/s12889-021-11238-1>.

Raji, I.A. *et al.* (2021b) 'Evaluation of acute flaccid paralysis surveillance indicators in Sokoto state, Nigeria, 2012-2019: a secondary data analysis', *BMC Public Health*, 21(1), p. 1148. Available at: <https://doi.org/10.1186/s12889-021-11238-1>.

Tesfaye, B. *et al.* (2020) 'An epidemiological analysis of Acute Flaccid Paralysis (AFP) surveillance in Kenya, 2016 to 2018', *BMC Infectious Diseases*, 20(1), p. 611. Available at: <https://doi.org/10.1186/s12879-020-05319-6>.

Wang, H. (2020) 'Why Have cVDPV2 Outbreaks Increased Globally After the Polio Immunization Strategy Switch: Challenges for the Polio Eradication Endgame', *China CDC Weekly*, 2(11), pp. 176-179.

World Health Organisation (2019) *Global Polio Surveillance Status Report 2019*.

World Health Organisation (2021a) *Circulating vaccine-derived poliovirus type 2 - Global update*. Available at: [https://www.who.int/emergencies/disease-outbreak-news/item/circulating-vaccine-derived-](https://www.who.int/emergencies/disease-outbreak-news/item/circulating-vaccine-derived-poliovirus-type-2-global-update)

[poliovirus-type-2-global-update](#) (Accessed: 8 December 2022).

World Health Organisation (2021b) *Polio Eradication Strategy 2022-2026: Delivering on a promise*.

World Health Organization (2021) *Pursuing the endgame: novel polio vaccine rollout in Africa*, WHO | Regional Office for Africa. Available at: <https://www.afro.who.int/news/pursuing-endgame-novel-polio-vaccine-rollout-africa> (Accessed: 14 December 2022).

World Health Organization (2022) *Poliomyelitis*. Available at: <https://www.who.int/news-room/fact-sheets/detail/poliomyelitis> (Accessed: 8 December 2022).