

Evaluation of Acute Flaccid Paralysis (AFP) surveillance system, Kebbi State, Nigeria, 2013-2018

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Abstract

Background

Since 1988, the incidence of polio has reduced by more than 99 percent, worldwide, according to the WHO. Each year, more than 350,000 children were paralyzed, in more than 125 endemic countries. Today, only two countries are still having transmission of polio: Pakistan and Afghanistan. No wild poliovirus has been reported anywhere in Africa since 2016. A good and effective Acute Flaccid Paralysis (AFP) surveillance system is necessary to detect any suspected case of polio to interrupt the transmission of polio within any country. We evaluated the AFP surveillance system to identify gaps in its operations.

Methods

We used the updated CDC guidelines for evaluating public health surveillance systems and the WHO performance standards to assess the system. We also interviewed stakeholders using an adapted questionnaire, and a key informant interview. We also reviewed AFP surveillance data from 2013–2018. We summarized data using means, frequencies, and proportion.

Results

We interviewed a total of 49 respondents. Of these, 47 (98%) reported case definitions as being easy to use, and case investigation forms as being easy to fill, 46 (97%) reported data tools could easily accommodate changes, and all the surveillance officers understand the case definition of AFP. All respondents were willing to continue with the system. The non-polio AFP rate (24.6–55.2), stool adequacy (95–99.7%), timeliness, and completeness of reporting were found to be consistently above the WHO minimum standard.

Conclusion

The AFP surveillance system in Kebbi State was found to be useful, simple, flexible, acceptable, sensitive, representative, timely, and stable, though donor-driven. Absence of data on 60-day follow up and feedback from the laboratory was a major problem with the system.

Background

Poliomyelitis is a highly contagious viral disease caused by infection with the poliovirus (serotypes m1, 2, and 3) (1). The poliovirus infects mostly under-five children, among which, up to 1% of those infected the virus invades the central nervous system leading to muscle weakness and paralysis (usually of the lower limbs), and often can progress to breathing problems, and maybe death (1, 2).

Acute Flaccid Paralysis (AFP) is a clinical syndrome characterized by a sudden onset of weakness of a limb, described as flaccid (reduced tone) in a child below 15 years of age (3). Many conditions are presenting in the form of AFP, apart from poliomyelitis, such as Guillain Barre Syndrome. therefore, AFP surveillance was adopted globally as a strategy for monitoring the progress of the polio eradication initiative (3, 4). A good AFP surveillance system is a sensitive instrument for detecting potential poliomyelitis cases, therefore, alerting surveillance officers and clinicians to timely institute appropriate intervention measures to interrupt any poliovirus transmission. Effective AFP surveillance is essential for verifying the absence of wild poliovirus circulation in countries that no longer report any cases of poliomyelitis (2, 5).

There are three strains of wild poliovirus (type 1, type 2, and type 3), wild poliovirus type 2 was eradicated in 1999 and no case of wild poliovirus type 3 has been found since the last reported case in Nigeria in November 2016 (6). Nigeria is the only country in Africa yet to be certified as polio-free.

The purpose of evaluating public health surveillance systems is to ensure that problems of public health importance are being monitored efficiently and effectively (7). Additionally, evaluation helps to determine if a system is meeting the set objectives and whether the attributes are efficient to achieve these objectives. We described the operations of the Kebbi State AFP surveillance system, assess its key attributes and performance of the system in line with its set objectives (8).

Methods

Kebbi is a state in the north-western part of Nigeria. The 2019 projected population of Kebbi State was 4,671,594 while the under-five population was 2,223, 679. It has 21 Local Government Areas (LGAs), 225 political wards, and 122 districts spread over four emirate councils namely Argungu, Gwandu, Yauri, and Zuru. Seventy percent of the people live in rural communities, where the predominant economic activities are fishing, farming, and trading. There are 22 general hospitals, 225 primary health care centers, a Federal Medical center, and a Specialist Hospital. In total, there are 203 focal sites for AFP which include all the secondary and tertiary public health facilities. And all the facilities offering routine immunization (RI) services offer free RI services.

Study tools and data management

A structured self-administered questionnaire, adapted from previous similar studies and adapted for this study was used to obtain information from respondents (State DSNO, Assistant State DSNO, LGA DSNOs/ADSNOs). To assess their views on the surveillance system attributes (simplicity, flexibility, representativeness, stability, usefulness, and acceptability of the system) (2, 9–14). The questionnaire is attached as appendix 1

The WHO standard guidelines for AFP performance standards were:

Indicators of AFP surveillance performance

- Percentage of all expected monthly reports that were received: target $\geq 90\%$
- - Annualized non-polio AFP rate per 100 000 children under 15 years of age: target $\geq 2/100\ 000$
- - Percentage of AFP cases investigated within 48 hours: target $\geq 80\%$
- Percentage of AFP cases with two adequate stool specimens collected 24-48 hours apart and ≤ 14 days after onset: **Target = $\geq 80\%$**
- Percentage of specimens arriving at the laboratory in good condition: target $\geq 80\%$
- Percentage of specimens arriving at a WHO-accredited laboratory within three days of being sent: **Target $\geq 80\%$**
- Percentage of specimens for which laboratory results sent within 28 days of receipt of specimens: **Target $\geq 80\%$ (3)**

A key informant interview (KII) guide also adopted from similar studies (22), was used to gather information from relevant stakeholders (State epidemiologist, Medical officers and Monitoring & Evaluation officers) to also gather information on stability representativeness, funding and other challenges facing the system. Those selected for KII include: Kebbi state Epidemiologist, Deputy State DSNO, Chief Medical Officers in General Hospital Zauru and General Hospital Zuru.

A retrospective record review of the AFP surveillance data from 2013–2018 was carried out. We used the data to determine the sensitivity, timeliness, representativeness of the system. We assessed data quality, by determining the timeliness and completeness of reporting. Completeness was assessed by estimating the proportion of complete weekly reports that got to the State by close of work (4.00 pm) of Tuesday of the reporting week. Representativeness was calculated by determining the proportion of all the health facilities that report.

AFP notified cases aged < 15 years old between January 2013 and December 2018 was analysed. The analysis was performed using Microsoft Excel version 2016. Evidence regarding performances were assessed using system attributes according to the CDC updated guidelines to describe the attributes of the surveillance system.

Ethical consideration

We obtained Permission from the Kebbi State Ministry of Health Ethics Committee. We interviewed each participant privately and we maintained the confidentiality of data obtained. We also obtained written permission from the Public Health Department of the Kebbi State Ministry of Health (doc no; MOH/STA/PER/6007/205751). A written consent was also obtained from the study participants as indicated in the questionnaire.

Results

Four thousand five hundred and thirteen cases (4513) of AFP were reported between January 2013 to December 2018, from all LGAs. Fakai and Ngaski LGAs reported 362 (8%) cases, while Bagudo reported

45 (1%). Non-polio AFP rate (NP-AFPR) for Ngaski and Fakai LGAs were 71.5/100,000 & 73.8/100,000 respectively, while Wasagu/Danko had NP-AFP rate of 20.1/100,000.

Data quality

The data is also valid because the surveillance system aims to detect AFP cases and the system has been consistently and effectively reporting AFP cases throughout the review period. Ninety-seven percent of data fields used were complete.

Timeliness and completeness of reporting

In the years under review, the timeliness of monthly reporting was consistently above 90% (Fig. 1)

Simplicity

All the respondents knew that polio is a disease caused by a virus. 47 (97.6%) responded that the AFP case definition is easy to understand. Many of the respondents 45 (97%) felt the case investigation form CIF is easy to fill, however, 33 (70%) believed there is a need for regular training and retraining.

Flexibility

The AFP surveillance is well integrated into the integrated disease surveillance and response (IDSR) system. The AFP surveillance system uses the minimum data collection recommended by the WHO which are few. It can easily accommodate new specific variables as needed. Though 50% of the respondents feel that any change in the surveillance system process can be accommodated by the data collection forms.

Acceptability

The system was generally found to be acceptable by the surveillance officers. All of them were willing to continue to participate in the AFP surveillance in the state. Interview with some focal persons in some health care facilities showed that they are willing to continue with AFP surveillance despite their busy schedules. Community informants were always willing to participate in reporting of suspected cases. Nonetheless, some private health care facilities were not fully reporting.

However, despite their willingness to continue with the current system as it is, 62% of the respondents said they have made contributions or suggestions on areas where they think the system can be improved. Among the suggestions were, the surveillance officers should be supported especially with means of transportation to improve active case search, to increase the number of focal sites, or to completely

change the reporting system to electronic format. The majority, 74% of the respondents said their suggestions were considered and some were even implemented (e.g. they were supported with motorcycles, android phones, and the number of focal sites were increased).

Stability

There are dedicated surveillance officers from the State Ministry of Health (i.e. The State Epidemiologist, State DSNO, and his Deputy), from the Local Government Authorities (LGAs) (i.e. LGA DSNOs and their Deputies), Health Facility surveillance focal persons, Community Informants, etc. The State is also supported by The WHO Cluster Consultants, WHO LGA facilitators, Field Volunteers, etc. therefore, the AFP surveillance system in Kebbi State is stable. However, the system is donor-driven. The WHO provides all the logistic support, laboratory reagents and consumables, sample collection bottles, and transportation of samples to the reference laboratories.

Representativeness

The AFP surveillance system in the State is representative because the surveillance data analyzed showed that the system is ongoing in all the LGAs in the State. Both males and females were represented in the data. Though there were more males (53%) than females (47%). It cuts across individuals from different ethnic backgrounds within the State, suspected cases cuts across individuals from different socioeconomic backgrounds, and all from both urban and rural settlements. The data is also obtained from both public and private health facilities.

The above figure is the map of Kebbi State, showing all the Local Governments involved in AFP surveillance. The map depicts that all the 21 LGAs were reporting throughout the review.

Sensitivity of AFP surveillance system in Kebbi State, 2013–2018

Because the minimum non-polio AFP rate ($\geq 2/100,000/\text{year}$ of under 15) and stool adequacy rate ($> 80\%$ stool samples must be adequate) were consistently above the WHO minimum standard, as depicted in the Figs. 3 and 4 respectively, the system is, therefore, sensitive.

Timeliness of AFP surveillance in Kebbi State (2013–2018)

Timeliness of case investigation & stool arriving lab on time

All AFP cases should be investigated within 24–48 hours of reporting and two stool samples should be collected 24 hours apart, and each should be adequate. Furthermore, all collected stool samples should reach the WHO accredited laboratory in good condition and on time (48–72 hours of collection)

The proportion of AFP cases investigated within 48 hours of notification as well as the proportion of stool samples arriving at the lab on time (i.e. 72 hours from of being sent to the lab), between January 2013 and December 2018. Both results were consistently above the WHO minimum standard of 80%. The minimum level obtained was 98% (for timeliness of case investigation), and 99% (for timeliness of sample arriving at the laboratory on time).

Good condition in terms of the time of arrival at the laboratory (48–72 hours of collection), the quantity of stool collected (at least 8 g), not desiccated, the container and Case investigation form well labeled, the container well sealed and at a good temperature of 2-8⁰C (reverse cold chain).

Figures 5 and 6 above show the system met the minimum criteria set by the WHO, therefore, timely.

Discussion

AFP surveillance system in Kebbi State was found to meet some of the attributes of a good surveillance system. The state-level surveillance officers (State Epidemiologist, State disease surveillance and notification officer) and LGA-level health workers (DSNOs) attested to the ease of operation of the system which is well structured and flexible to changes. The ease of operation of the system was due to the simplicity of the data tools and case definition. These findings were similar to some studies conducted in Oyo State Nigeria and another survey in Ghana and Pakistan (12, 21–23) where the AFP system was found to be simple and flexible. However it is in contrast to a study in Zimbabwe, where a good number of respondents found it difficult to fill the case investigation forms (11).

The Kebbi State surveillance system is majorly donor-funded. The WHO is the major funder, which provides logistic support for transportation during active case search, transportation of samples to the designated laboratories, provision of some laboratory reagents and consumables. And some from the state government. Previous studies in Oyo State, Nigeria showed the majority of funding was also from partner agencies. (16)

In terms of data quality, the timeliness and completeness of reporting, the system in Kebbi State has surpassed the 80% target by the WHO, throughout the review. Similar findings were seen in Oyo state(16) but contrary to findings in other similar studies, wherein some cases, the reporting was not complete and not timely (11). This was due to bad roads and lack of dedicated mobility and resources to conduct active case search and transportation of samples to the laboratory on time.

We found out that the system was generally acceptable to the surveillance officers. All the respondents were willing to continue with the AFP surveillance. This is in line with several similar studies (25,23,12). This is probably because of incentivization and intensification of support by the WHO towards the

eradication of polio. In yet another study, the AFP surveillance system was found to be less acceptable (17). This was because about 4% of respondents felt it wasn't their duty to fill the case investigation forms, though about 96% were willing to continue filling the forms (17).

The system was also representative. This is because the data collected were from all the tertiary and secondary health facilities across the State. From both urban and rural areas and includes all the focal primary health facilities both public and private. This is similarly found in other studies where the AFP surveillance system is representative(8, 15, 18). However, in another study, the system was found not to be representative. This is because data from private clinics and hospitals were not available (17).

Throughout review (2013–2018), the AFP surveillance system in Kebbi State was found to be sensitive. The non-polio AFP rate and the stool adequacy were consistently above the WHO minimum standards. Similar results were found in other surveys (2, 9, 10, 19). In other studies, the system was found not to be sensitive (11, 15). An uninvestigated Case was found in a hospital in one of the studies(12), and in another study, the insensitivity of the system was due to a failure to report a case as a result of lack of resources to conduct active case search, and transport stool specimens on time (11).

Conclusion

Even though the performance of the surveillance system was excellent, most of the major stakeholders found the surveillance system to be useful and acceptable as it was able to detect cases. The surveillance system also played an important role in assessing the effectiveness of the current AFP control strategies. However, the system was discovered to be highly donor-dependent for funding and technical support.

Recommendation

Private healthcare facilities currently not reporting should be encouraged to report. Finally, Kebbi State should take complete ownership of the AFP surveillance system and ensure its sustainability by providing funding and logistic support.

Abbreviations

1. Acute Flaccid Paralysis (AFP)
2. Assistant state disease surveillance and notification officer (ADSNO)
3. Case investigation form (CIF)
4. Center for disease control (CDC)
5. Disease surveillance and notification officer (DSNO)
6. Disease surveillance and notification officers (DSNOs)
7. Key informant interview (KII)

- 8. Local Government Authorities (LGAs)
- 9. Ministry of Health (MOH)
- 10. Non-polio AFP rate (NP-AFPR)
- 11. Routine immunization (RI)
- 12. World Health Organization (WHO)

Appendix 1

Questionnaire on Evaluation of AFP Surveillance System in Kebbi State

Introduction: This questionnaire is to assess the knowledge, attitude, and practice of stakeholders on the AFP surveillance system of Kebbi state. This will allow us to assess its performance and make recommendations towards improving the AFP surveillance. All information obtained from you shall be treated with utmost confidentiality. It is therefore expected that you will give true answers to what you know and practice. You are free to opt-out of the study at any point without any penalty.

Nigeria Field Epidemiology and Laboratory Training Program (NFELTP)

Do you agree to freely participate in the study? Yes , No

Thank you.

Section A: Socio Demographics

Designation _____	Sex _____	Age _____
Facility _____	Years of experience as a surveillance officer _____	

Section B: Surveillance System Attributes

Simplicity

<

1.	Polio is a disease caused by a virus	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2.	Is the AFP CIF form easy to fill?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3.	Is the case definition of AFP easy to understand?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
4.	Do you think you need training regarding filling the forms?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
5.	Do you report all cases of AFP detected?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Flexibility

6.	Do you think that any change in the surveillance system process can easily be accommodated by the data collection forms?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
7.	Do you think the forms have been easily modified in the past to reflect the present data collected?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
8.	Has there been any change in case definition over the years?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Acceptability

9.	Are you willing to continue to participate in this system?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
10.	Have you ever made suggestions/comments about improving the system?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
11.	If yes, please state the suggestions _____		
12.	Were your suggestions considered?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
13.	Do you feel the system appreciates you for doing your job effectively?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Timeliness/planned use of the data

14.	How long does it take to collect data and stool samples from a single AFP case (in hours)? _____		
15.	What is the time interval between the two stool samples collected (in hours)? _____		
16.	How soon do you complete your monthly report within the new month? <input type="checkbox"/> 1st 5 days <input type="checkbox"/> end of 1st week <input type="checkbox"/> 2nd week <input type="checkbox"/> 3rd week		
17.	Are there any challenges in sending data on a timely basis?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
18.	If yes, state the challenges please _____		
19.	Has any effort to address these challenges been made?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
20.	Are there written policy or agreement on the timeliness of data reporting	<input type="checkbox"/> Yes	<input type="checkbox"/> No
21.	What do you think the data collected is used for		
	<input type="checkbox"/> To know more about the disease <input type="checkbox"/> To forward to FMOH <input type="checkbox"/> for budgeting <input type="checkbox"/> For nothing		
22.	Estimate time spent on collecting the following information as it applies to you		
	a. Collecting case information _____		
	b. Transmitting /transferring case definition to the next level _____		

Sensitivity

23.	Are you satisfied with the case definition?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
24.	Does the case definition capture all AFP cases without any missed case?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Representativeness

25.	Do you think the forms capture the affected age group?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
26.	Do you think the system captures people from different locations of the state?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Stability

27.	Has the AFP surveillance system in the Sokoto state system ever been interrupted/non-functional?		
28.	a. Due to inadequate staff?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
a.	b. Inadequate funds?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
29.	Do you have dedicated staff for the following		
	a. Data recording	<input type="checkbox"/> Yes	<input type="checkbox"/> No
b.	b. Data storage	<input type="checkbox"/> Yes	<input type="checkbox"/> No
c.	c. Data transfer	<input type="checkbox"/> Yes	<input type="checkbox"/> No
d.	d. Data analysis	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Data quality

30.	How is the data entered?	<input type="checkbox"/> Manually	<input type="checkbox"/> Electronically
31.	Describe the level of completeness of data generated from the surveillance system		
	<input type="checkbox"/> Partially complete	<input type="checkbox"/> Always complete	

Declarations

Ethics approval and consent to participate

Ethics approval for this research work was granted by the Ethics and research committee of the Kebbi State Ministry of Health. Participants were adequately informed about the study, verbally. Confidentiality of their responses was assured; no personal identifiers were used on questionnaires. And we obtained written consent from participants.

Consent to publish

Not applicable

Availability of data and materials

The data for this study are available at the hands of the corresponding author, and the data are not shared with any third party. The six-year AFP data reviewed for this study was obtained from the Epidemiology Unit of the Kebbi State Ministry of Health. Other information obtained was from the use of a self-administered questionnaires, as well as KIs.

Competing interests

The authors declared that they have no competing interests.

Funding

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Authors' Contributions

HAB (Principal author): proposed, designed, and implemented the study, did the analysis and writing up of the manuscript. YM and BN made significant contributions to the conception and design of the proposal, analysis, and interpretation of data. They also critically edit and approved the final manuscript. LS and PUO, participated greatly in the cleaning and analysis of data, QGIS design.

All authors read and approved the final manuscript.

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Figures

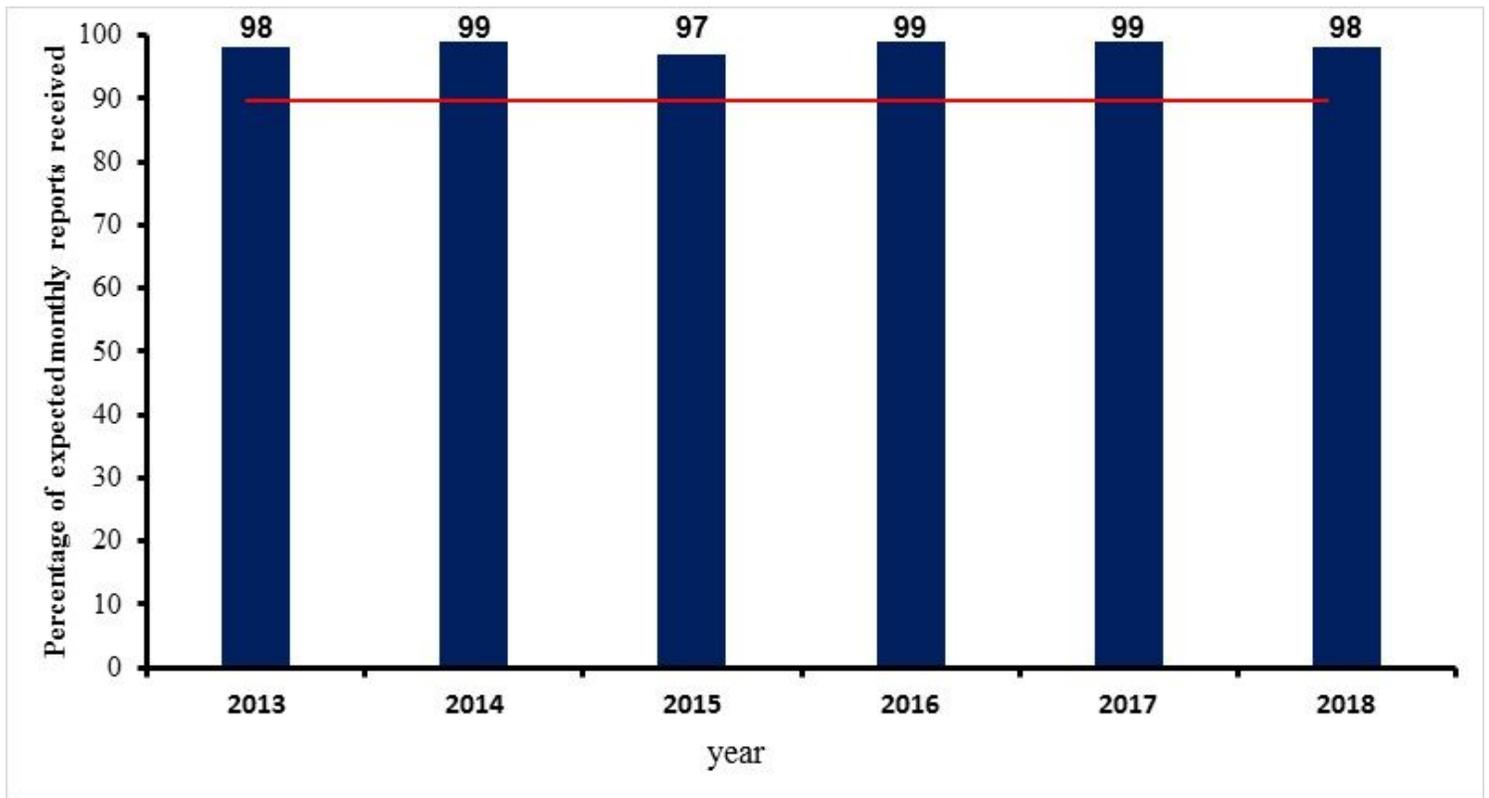


Figure 1

showing the percentage of all monthly reports received

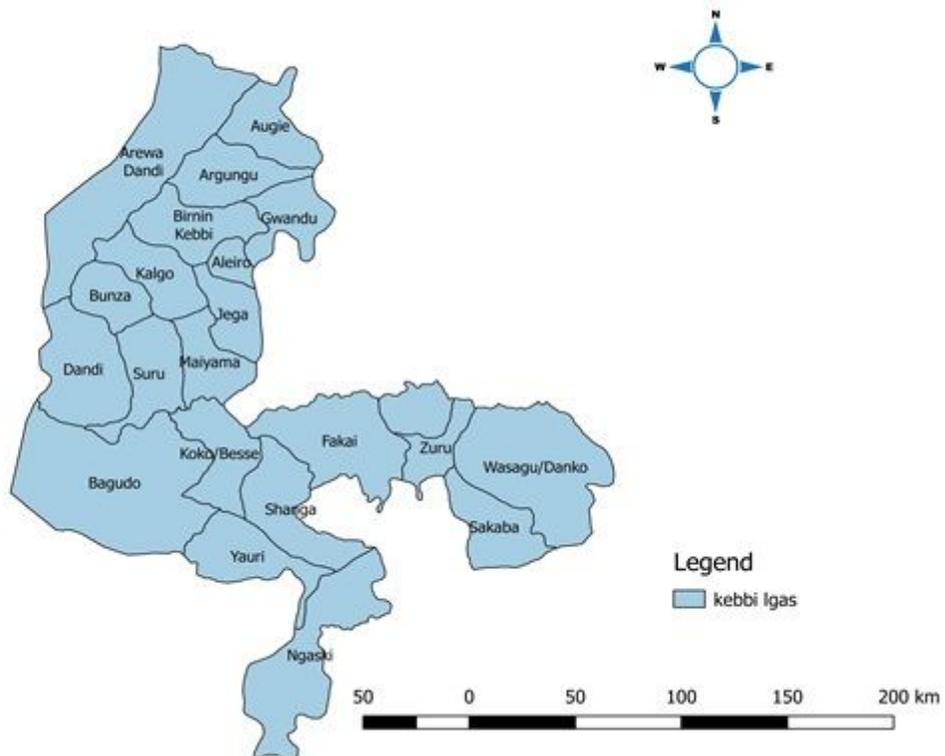


Figure 2

Map of Kebbi State showing all the LGAs where AFP surveillance is ongoing The above figure is the map of Kebbi State, showing all the Local Governments involved in AFP surveillance. The map depicts that all the 21 LGAs were reporting throughout the review.

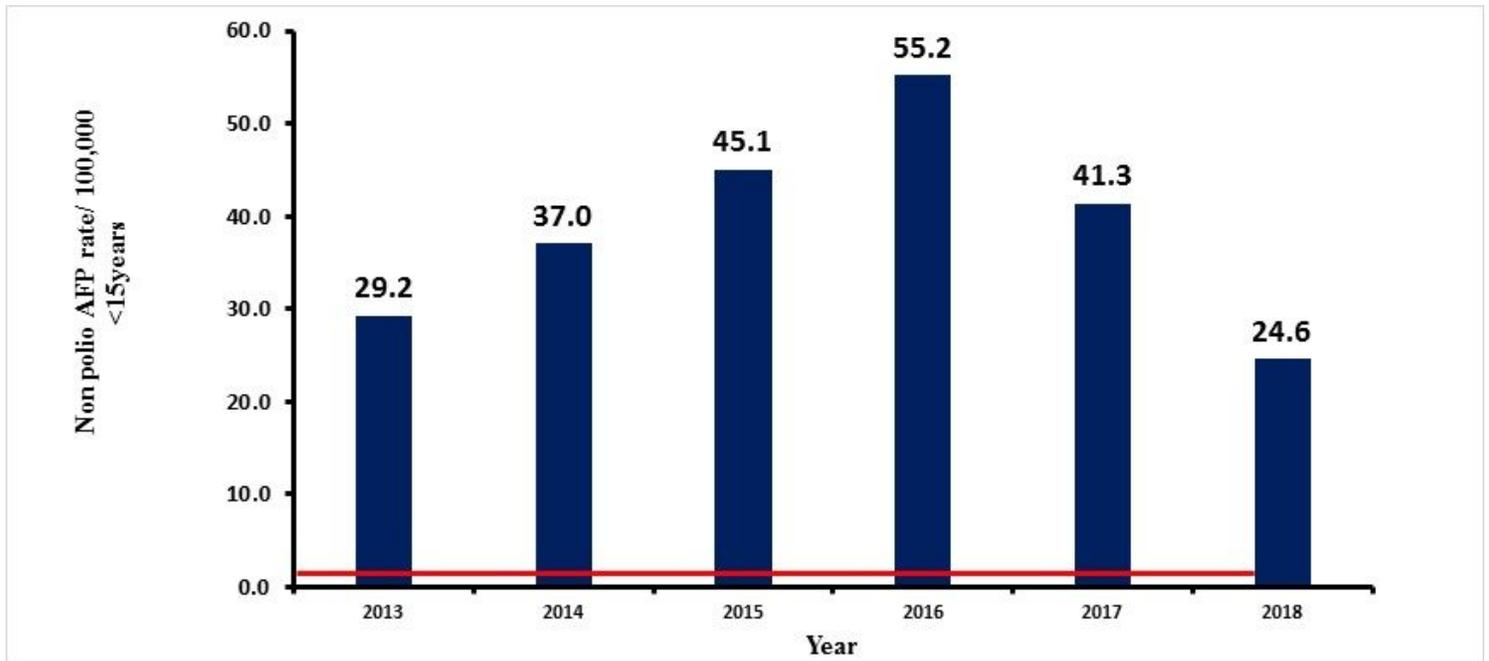


Figure 3

Distribution of Non-polio AFP rate between 2013 and 2018 in Kebbi State

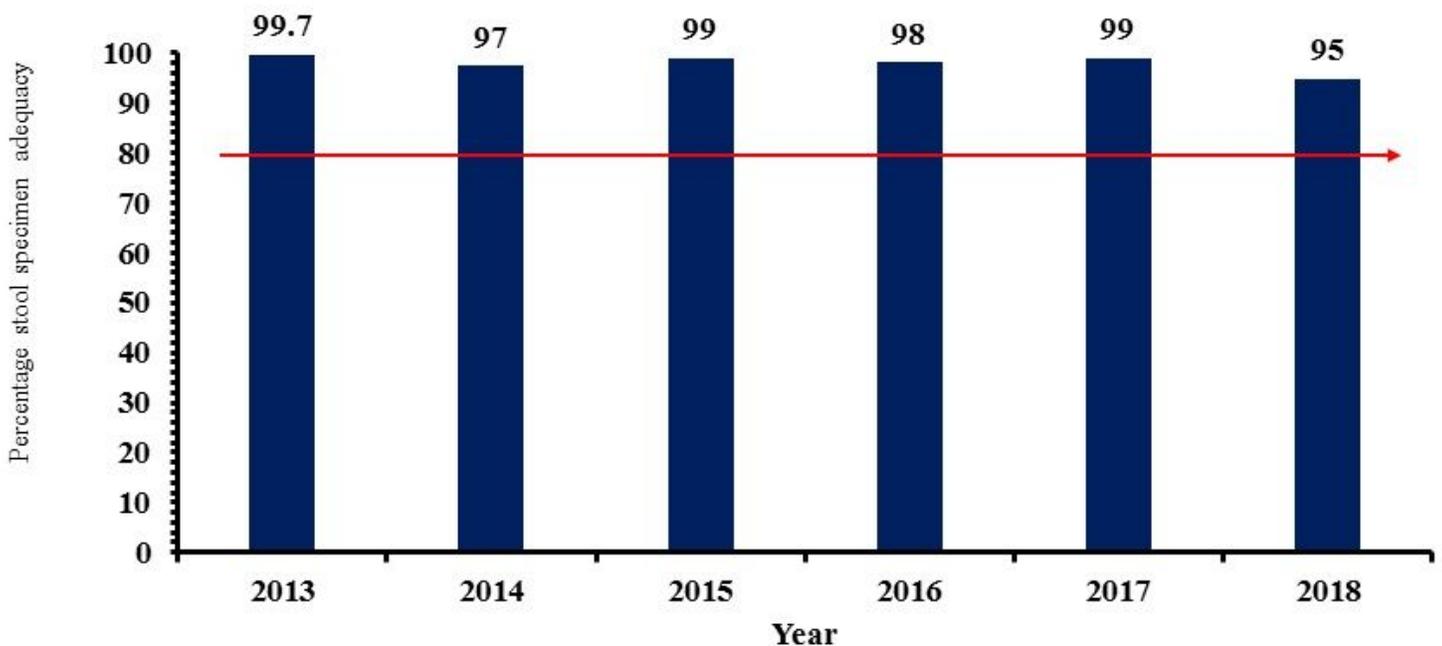


Figure 4

Stool adequacy of AFP cases reported in Kebbi State, 2013-2018

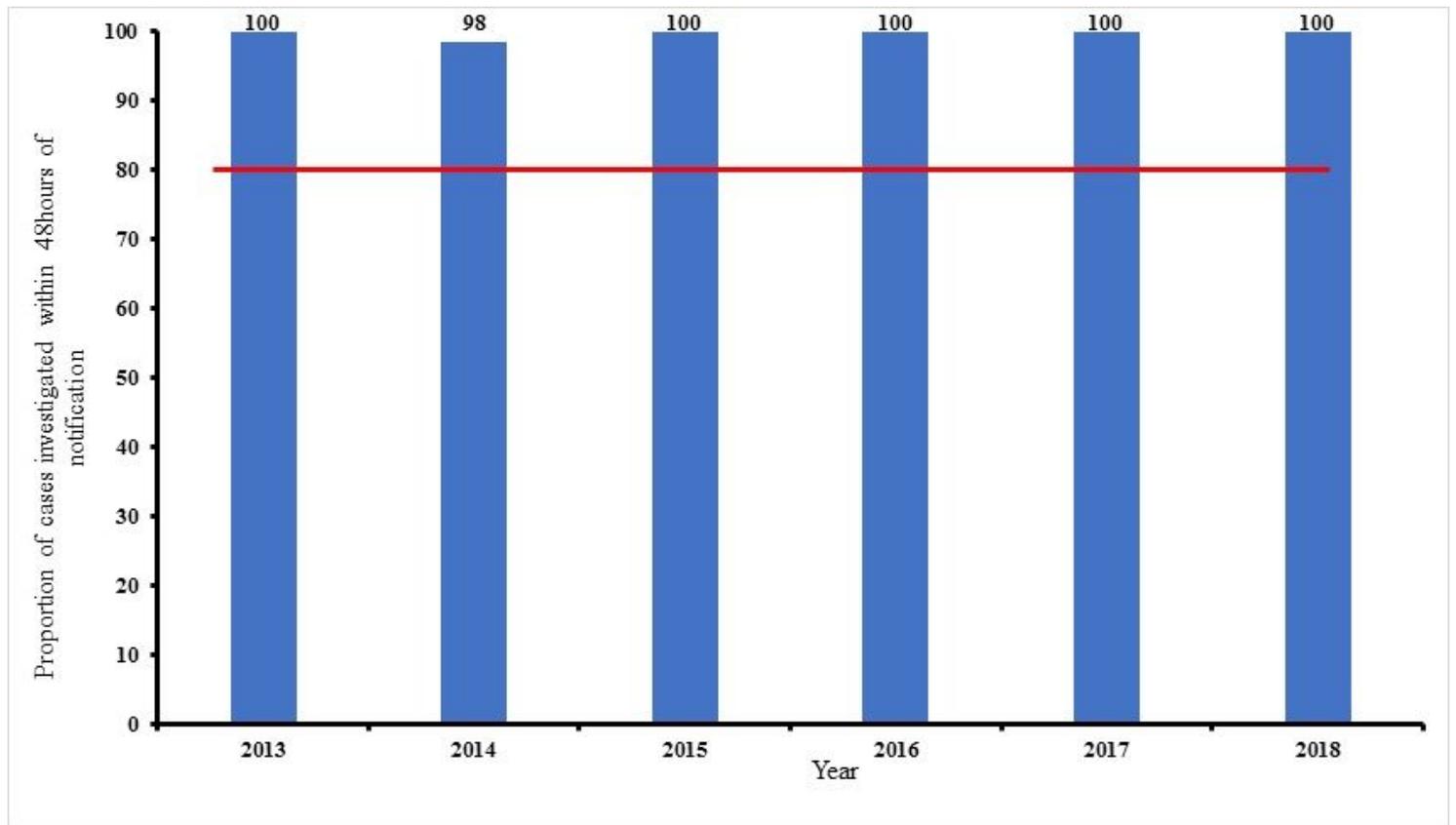


Figure 5

Timeliness of case investigation of reported AFP cases between 2013-2018

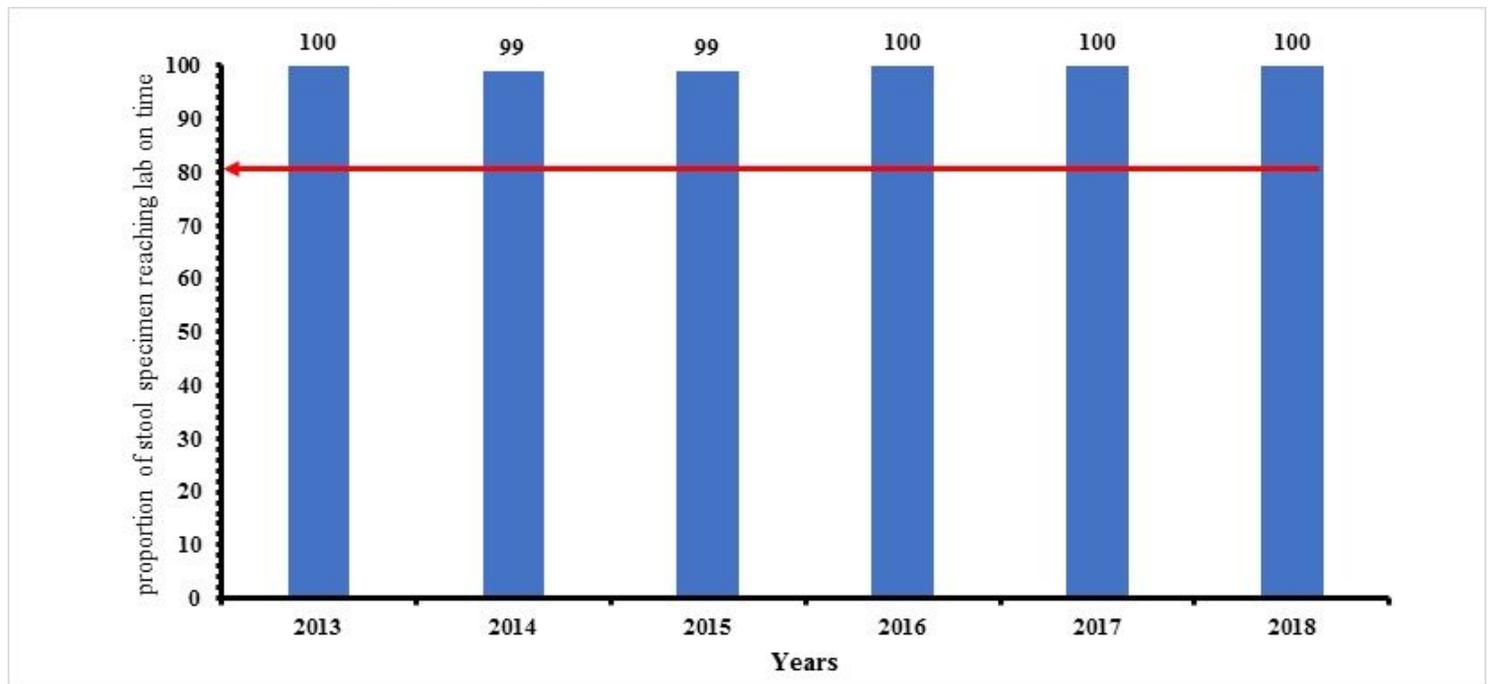


Figure 6

Timeliness of stool sample arriving the lab on time, Kebbi State, 2013-2018