

Evaluation of the Kano State Lassa Fever Surveillance System, 2015-2018 – Nigeria

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Abstract

Background

Lassa fever (LF) is one of the priority diseases under surveillance through the integrated disease surveillance and response system (IDSR). We evaluated the LF surveillance system against its set objectives and assessed its attributes.

Methods

We used cross-sectional study design. Forty-seven stakeholders involved in the surveillance system were interviewed using the Centers for Disease Control and Prevention's *Updated Guidelines for Evaluating Public Health Surveillance Systems*. The LF surveillance data from January 2015 to December 2018 were also analyzed. The attribute and objectives of the system were evaluated.

Results

Out of the 76 suspected cases recorded in kano state during the study period, only 54 samples were laboratory tested, 11 of them were confirmed positive with 9 deaths (case fatality rate of 82%). Confirmed cases were predominantly in Tudun Wada LGA (63.6%), while the age-group 20-39 years constituted 55% of the confirmed cases. There was male preponderance of cases (73%). The predictive value positive (PVP) was 14.5%. The surveillance system was however meeting its objectives of determining LF burden and detecting and characterizing cases and outbreak.

Conclusion

LF surveillance system in Kano was simple, flexible, stable, acceptable and timely. However, data was not representative. We recommended improved reporting from private and tertiary facilities and more personnel training and support to improve the system.

Background

Lassa fever is an acute viral hemorrhagic fever (VHF). The aetiologic agent is the Lassa virus which is a single-stranded RNA virus in the Arenavirus family. It is a zoonotic disease with associated high morbidity and mortality with economic and health security consequences.¹ An estimated 100,000 to 300,000 cases and 5000 related deaths occur annually in West Africa.²

In Nigeria from January 1 to July 7, 2019, a total of 2,959 suspected cases of Lassa fever were reported from the 22 states by the Nigeria Centre for Disease Control (NCDC). Of these, 615 were confirmed positive, 17 were probable and 2,327 were negative. During the same period, there were 139 deaths among the confirmed cases, giving a case fatality ratio of 22.6%. The age-group predominantly affected was 21-40 years and there was no sex preponderance.³

Lassa fever is an epidemic-prone disease for immediate notification in Nigeria. The exact incidence in Nigeria is unknown, but the case fatality rates range from 3–42%. Outbreaks occur during the dry season—November to April; however, in recent years, cases have also occurred during the rainy season. Kano State witnessed several outbreaks of Lassa fever with devastating consequences from 2015 to 2018. Data from the State Epidemiology Unit has revealed that a father and his son from Garun-malan LGA of the state died of Lassa fever in December 2015. In January of 2016, another two people were confirmed with the disease from Garun-malan and Dawakin-kudu LGAs of the state and later died. Similarly, in 2017, seven cases were confirmed in Tudun-wada LGA of the state and five of them died (CFR=71.4). The latter finding was also reported by Sule et.al in an “investigation of highly virulent Lassa fever in in Kano State”.¹ Periodic evaluation of public health surveillance systems is necessary to ensure that problems that are of public health importance are monitored efficiently and effectively. We therefore evaluated the Lassa fever surveillance system in Kano State to determine whether the surveillance system is achieving its objectives and also to assess the attributes of the system.^{1,4,5}

Methodology

Study setting

Kano State is located in the Northeastern Nigeria. The population of the state is over 13 million (2016), projected from the 2006 population census.⁶ The state is cosmopolitan in nature with various ethnic groups living peacefully with each other. Hausa is the main language in the state, but English remains the official language. The state has various professional groups and artisans; however, farming is the occupation of the majority of the people in the state. During harvest, the food crops are stored at home and local storage facilities where they can be exposed to rodents like rats that are vectors of Lassa fever.^{1,6}

Kano State government maintains an isolation centre at Yargaya Village along Wudil Road for the isolation and free treatment of the Lassa fever cases in the state. The State Ministry of Health under the Director of Public Health and Disease Control is responsible for Lassa fever control activities. Similarly, at the local government level, various disease surveillance and notification officers (DSNO) support their respective local governments areas (LGA) in case identification and investigation.

Study design

We conducted a cross-sectional study in which we reviewed surveillance record, conducted a survey, interviewed stakeholders and analyzed surveillance data. The survey was conducted among the disease surveillance and notification officers in the various local government areas of the state. Whereas the key informant interviews were conducted among the key stakeholders in the ministry comprising senior state officials and partners. The secondary analysis focused on the 2015-2018 surveillance data.

Data collection

This evaluation was conducted in July 2019 using mixed methods data collection techniques. A standard semi-structured questionnaire was administered to 40 purposively selected disease surveillance and notification officers from the total 44 present in the various LGAs in the state to assess the surveillance system. Printed questionnaires were administered to the DSNOs. Data on socio-demographic characteristics, years of experience and attributes of the surveillance system were collected.

Key informants' interviews were conducted with 7 stakeholders (WHO National surveillance officer, WHO Surveillance officer-Kano Municipal, WHO Surveillance officer- Doguwa/Tudun-wada, State disease Surveillance and notification officer, State NSTOP Field coordinator, State Team Lead UNICEF, and the state data manager) to obtain their inputs in describing the system and assessing the key attributes of the system. These individuals were interviewed to complement the findings from the survey and to improve the chances that the eventual outcome of the evaluation is implemented. The questionnaire and key informant interview guide were adapted from the United States Centers for Disease Control and Prevention's 2001 *Updated Guidelines for Evaluating Public Health Surveillance Systems*. Lassa fever surveillance data consisting of epidemiological and laboratory variables were abstracted for the period January 2015 to December 2018.

Data analysis:

Quantitative data was entered into Microsoft Excel 2016. It was cleaned and summarized using frequencies and percentages in tables and charts. Findings from KII were summarized based on the thematic areas.

Results

Socio-demographic characteristics of respondents

Overall, 40 DSNOs were interviewed, thirteen (33%) of whom were less than 40 years of age. Thirty-seven (93%) of them had at least 15 years of work experience in surveillance activities. All of them were employees of the Kano State Ministry of Health and 28 (70%) of them were formally trained on Lassa fever surveillance activities.

Data collection and reporting system

The surveillance system in Kano State functions as in the other states in the country. This comprises surveillance officers at the state and LGA levels involved with information collection, collation and planning for the effective and efficient operation of the system. The actors include the State Epidemiologist and the Disease Surveillance and Notification Officer (DSNO) who coordinate and guide all the surveillance activities in the state. At the various LGAs are the designated DSNOs who are responsible for their various LGAs. They report to the State Epidemiology Unit. Data flows from the health facility or community levels, where the service providers record data of services provided into the appropriate data tools. The LGA DSNO collate these data from all the health facilities in his/her LGA and in-turn forward them to the state level, which can be on weekly or monthly basis using the IDSR 002

weekly reporting form or IDSR 003 monthly reporting form respectively. The data at each of these levels can only be accessed by authorized personnel, where it is used for decision making and feedback is given to the various levels in the system. The system utilizes both active and passive surveillance in detecting the suspected cases, where data regarding a particular disease can be either provider-initiated or health agency-solicited, respectively.

Availability of guidelines, documents, reporting tools

DSNOs were provided with the IDSR guidelines by the State Epidemiology Unit. They were observed in the offices of the various LGA DSNOs. The state also provides them with standard operating procedures for sample collection, packaging, storage, and transportation. All the respondents reported that they have the requisite IDSR reporting forms (IDSR 002 and IDSR 003). Other reporting tools provided to the DSNOs by the state include case investigation forms, line-list forms and adverse events following immunization reporting form. The tools were seen during supervisory visit in the offices of the DSNOs visited.

Surveillance system attributes

Simplicity

All the stakeholders reported that the data collection forms were easy to fill. Equally, the majority of them (92.5%) explained that the case definition for the Lassa fever was very clear and easy to comprehend. Despite the multiple levels of reporting, 26 (65%) of the respondents showed a good understanding of the scope of their assigned responsibilities in the system.

Flexibility

The Lassa fever surveillance system has been part of the integrated disease surveillance and response (IDSR) system. Similarly, change in the surveillance system operations is easily accommodated. The *Health Facility Active Surveillance Checklist* used by most surveillance officers incorporates surveillance of vaccine-preventable diseases with that of Lassa fever. The system adapts well to the newly revised national standard operation procedures for Lassa fever surveillance, monitoring and evaluation as it accommodates new variables.

Acceptability

The majority of the respondents (98%) were willing to continue with their data collection and collation activities; tools and case definitions were acceptable to all stakeholders. Thirty-eight of the respondents (95%) have been completely involved in Lassa fever surveillance activities and expressed that the system appreciates them for doing their work diligently.

Representativeness

The surveillance system collected data all year round with active case search intensification during outbreaks. Over the four-year period, all persons were reported from: all ages and sexes and from different location in the state. Cumulatively, 73% were males.

Data for the period reviewed were collated essentially from primary and secondary public health facilities with little or no data from the tertiary health and the private health facilities in the state. All the respondents attested to the fact that the data tools used in the system captured information on the distribution of Lassa fever based on age, sex, location, the disease date of diagnosis and outcome of the disease.

Sensitivity

Thirty-six (90%) of the respondents believed that the surveillance system had the ability to detect cases of Lassa fever. Equally, the stakeholders believe that the system is sensitive enough to detect outbreaks at some LGAs in the state. In 2015, 2016 and 2017 outbreaks were detected at Garun-malan, Dawakin-kudu and Tudun-wada LGAs respectively. However, a substantial number of the respondents (78%), attested to the possibility of frequent cases of misdiagnosis.

Predictive value positive (PVP)

The Kano State Lassa fever surveillance system detected a total of 76 suspected cases of Lassa fever from 2015-2018. However, only 11 of them were found to be positive by RT-PCR, giving a PVP of 14.5%.

Stability

Data collected are managed both manually (63%) and electronically (37%). The state government provides most of the logistic resources for the operation of the system with support from partner agencies. The staffs are under the employment of the state primary health care management board posted to the various LGAs of the state. They can be transferred to the another LGAs after some years with little or no significant impact to the surveillance system. Suspected Lassa fever samples were sent to either Nigeria Centre for Disease Control (NCDC) laboratory at Abuja or Lagos State University Teaching Hospital laboratory for confirmation. This was supported by the state government and partners in the state. Similarly, stakeholders reported that occasionally, there were inadequate supply of drugs and other logistics.

Data quality

More than 95% (1073/1120 cells) of the fields in the line-list were filled correctly and were easy to comprehend. Variables like settlement, ward, date of symptom onset, date seen at facility, laboratory result and outcome were among the missed variables.

Timeliness

Thirty-seven (93%) of the respondents agreed that there is a written policy and agreement on the timeliness of data reporting. A majority of them (98%) succeeded in sending their report in good time usually within two weeks. However, more than half of them (60%) encountered challenges in sending data. Even collating data from their respective department may take more than two hours because most of the data is in hard-copy format. In the same vein, majority of them (85%) incurred an additional cost in

sending the data. In 2015, 2016, 2017 and 2018 annual reporting timeliness of 81.4%, 96%, 98.8% and 98.6% were recorded respectively. Which are higher than the 80% target set by the WHO.

Usefulness

All the respondents reported that surveillance data was very useful. Fifty-three percent of them believed that it is used in coordinating public health actions. This is typified by the outbreak that occurred at Kano in 2015. On December, 2015, the State Epidemiology Unit received a report of two suspected cases of Lassa fever admitted at the Aminu Kano Teaching Hospital, Kano (AKTH). Both cases had died on December 4. The Nigeria Field Epidemiology and Laboratory Training Programme (NFELTP) was notified. Residents were sent to the state to investigate and manage the outbreak.¹ The stakeholders reported using the surveillance data to detect an outbreak. This is evidenced by the cases of Lassa fever documented in 2015, 2016 and 2017 in the line-list of the state epidemiology unit. While 43% believed that it can be use in estimating the burden of the disease in terms of morbidity and mortality. This was found in the data from the epidemiology unit of the state, where the number of cases and mortalities were clearly documented. Stakeholders also reported that they used the surveillance data in planning.

Discussion

The Lassa fever surveillance system in Kano state was found to meet some of the key attributes of a good surveillance system. The system was found to be simple, flexible, and acceptable. However, some challenges were identified with the stability, representativeness, timeliness and sensitivity of the system. The state- level stakeholders (WHO National surveillance Officer, WHO surveillance focal persons, UNICEF state team lead, AFENET/CDC Field coordinator, State data manager and state Disease surveillance and notification officer) and LGA level officials (Disease surveillance and notification officers) confirmed that the system was simple, well-structured and flexible. The simplicity of the system stemmed from the ease of operation of the system which is due to availability efficient communication channels as well data tools. This is similar to the findings in studies from Edo, Ondo and Osun states of Nigeria.⁷⁻¹⁰ However, it is in contrast with the findings from studies conducted in Sierra-Leon, where the system is complex and difficult to operate.¹¹

The surveillance system was acceptable to the respondents as the majority of them (98%) were willing to continue with their work. Equally, tools and case definitions were acceptable to all the stakeholders. Thirty-eight of the respondents (95%) have been completely involved in Lassa fever surveillance activities and expressed that the system appreciates them for doing their work diligently. Similar finding was reported from Sierra Leone, where surveillance activity was accepted by health workers despite lack of inducement. Some of the reasons proposed include sense of service to humanity and opportunities to improve relationship with the communities.¹²

The surveillance system collated data all year round with active case search during outbreaks. During the study period, all persons were reported from all ages and sexes and from different areas of the state. Similarly, all the stakeholders confirmed that data tools used in the system captured information and

distribution of Lassa fever based on age, sex, location, date of diagnosis and disease outcome. However, the surveillance system collated data with little or no representation from the tertiary and private health facilities in the state. Therefore, the surveillance system was not a representation of all the health care facilities in the state. This could be because these facilities may not have a reliable and dedicated focal persons and most of the private facilities may tend to concentrate more on service provision which provides them with more revenue rather than participating in surveillance activities. Similarly, private facilities experience manpower challenges including shortages that make them have inefficient surveillance system in place. Consequently, lack of integration of the tertiary and private facilities within the state in the surveillance system could undermine the validity of the data reported for the state. Similar observations were also reported by a study conducted in the state by Visa et al.¹³

The system was considered to be sensitive enough to detect some foci of outbreaks in some of the LGAs in the state in 2015 to 2017. However, at the level of case detection, it was not consistently detecting significant number of cases as evident by only three cases in the whole of 2018. Although, this may likely arise from misdiagnosis due to similarities in symptoms with other commonly seen disease conditions in the health facilities like yellow fever and malaria. Many of the respondents (78%) have attested to this possibility of misdiagnosis. This is supported by the findings of Emperador et al., who reported high likelihood of missing or misdiagnosis of suspected Lassa fever cases because it shares similar symptoms with other endemic tropical diseases including malaria, typhoid fever and other viral hemorrhagic fevers.¹⁴

Furthermore, the system is fairly stable as significant proportion of the surveillance personnel from the focal persons at the health facility, DSNOs at the LGAs to the officials at the State Ministry of Health, were all under the employment of Kano State government with reliable job security. Similarly, full integration of the system with other diseases under surveillance has contributed to the stability of the system. Data collected were managed either manually (63%) or electronically (37%) at the LGA level. This may pose a serious threat in case of data lost or theft. The state government provided most of the logistics with support from the partner agencies in the state. From the key informant interview (KII), stakeholders revealed that they encounter challenges with transport, logistics and communication occasionally. This is similar to the report of Kaburi et al in Ghana, where the surveillance system was found to be relatively stable despite score of challenges.¹⁵

With respect to timeliness, the majority of the respondents (93%) agreed that there was a written policy and agreement on timeliness of data reporting. Substantial proportion of the respondents (98%) succeed in sending their report in good time, usually within two weeks despite some challenges inherent in the system including limited financial resources. The reporting rate at the different health facilities level was equally satisfying. However, it is difficult estimate the reporting rate because of missing and absent data entries in the line-list from different LGAs. The State Epidemiology Unit calculated timeliness and completeness for 2015, 2016, 2017 and 2018 as 81.4%/91.9%, 95.6%/98.8%, 98.8%/99.7% and 98.6%/99.7% respectively. The timeliness for the state has been reaching the minimum target set by the WHO of at least 80%. The state has received recognition in the year 2018 because of these achievements.

The completeness however has not reached the minimum target of 100% set by the WHO in all the years under study. However, there was continued improvement from 2016 to 2018 with the values almost reaching the desired target of 100%. The implication is the ability to detect and manage outbreak effectively and efficiently with improvement of the system.

Conclusion

The evaluation of the surveillance system has revealed that Lassa surveillance system in Kano was meeting its set objectives. The system was simple, flexible, stable, and acceptable with mostly fair data quality. However, data was not representative and the predictive value positive of the system was low. We recommended that tertiary and private health facilities should be obliged to cooperate with local and state health authorities on the collection of surveillance data. to improve representativeness. Equally, refresher training of health workers especially at the lower levels on case definitions and guidelines of Lassa fever will increase their skills in detecting cases and can improve PVP.

Abbreviations

AFENET: Africa Field Epidemiology Training Network

AKTH: Aminu Kano Teaching Hospital, Kano

CFR: Case fatality rate

DSNOs: Diseases Surveillance and Notification Officers

IDSR: Integrated Diseases surveillance and Response System

KII: Key informant interview

LF: Lassa fever

LGA: Local Government Area

NCDC: Nigeria Centre for Diseases Control

NFELTP: Nigeria Field Epidemiology and Laboratory Training Programme

NSTOP: National stop transmission of Polio

PVP: Predictive Value Positive

RT-PCR: Reverse transcription polymerase chain reaction

UNICEF: United Nations Children's Fund

VHF: Viral Hemorrhagic Fever

WHO: World Health Organization

Declarations

Ethical approval and consent to participate

Ethical approval was obtained from Kano State Ministry of Health (approval number: MOH/OFF/799/TI/1441). Informed consent was sought from all the respondents using an approved informed consent form.

Consent for Publication

Not applicable

Availability of data and materials

Datasets used and analyzed during the current study may be available from the corresponding author upon reasonable request.

Competing interest

The authors declare that they have no competing interests.

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No funding was received for this study.

Authors' Contributions

UYU conceived, designed and implemented the study. IMB and MAA were involved in the study design, guided and supervised implementation. UYU prepare the manuscript. MSB, CDU, MAA and ST provided valuable edits on the context, methodology and findings. UYU and ST analyzed the data. MSB and CDU revised the manuscript for intellectual contents. All authors interpreted the results and revised the report. All authors read and approved the final manuscript.

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Figures

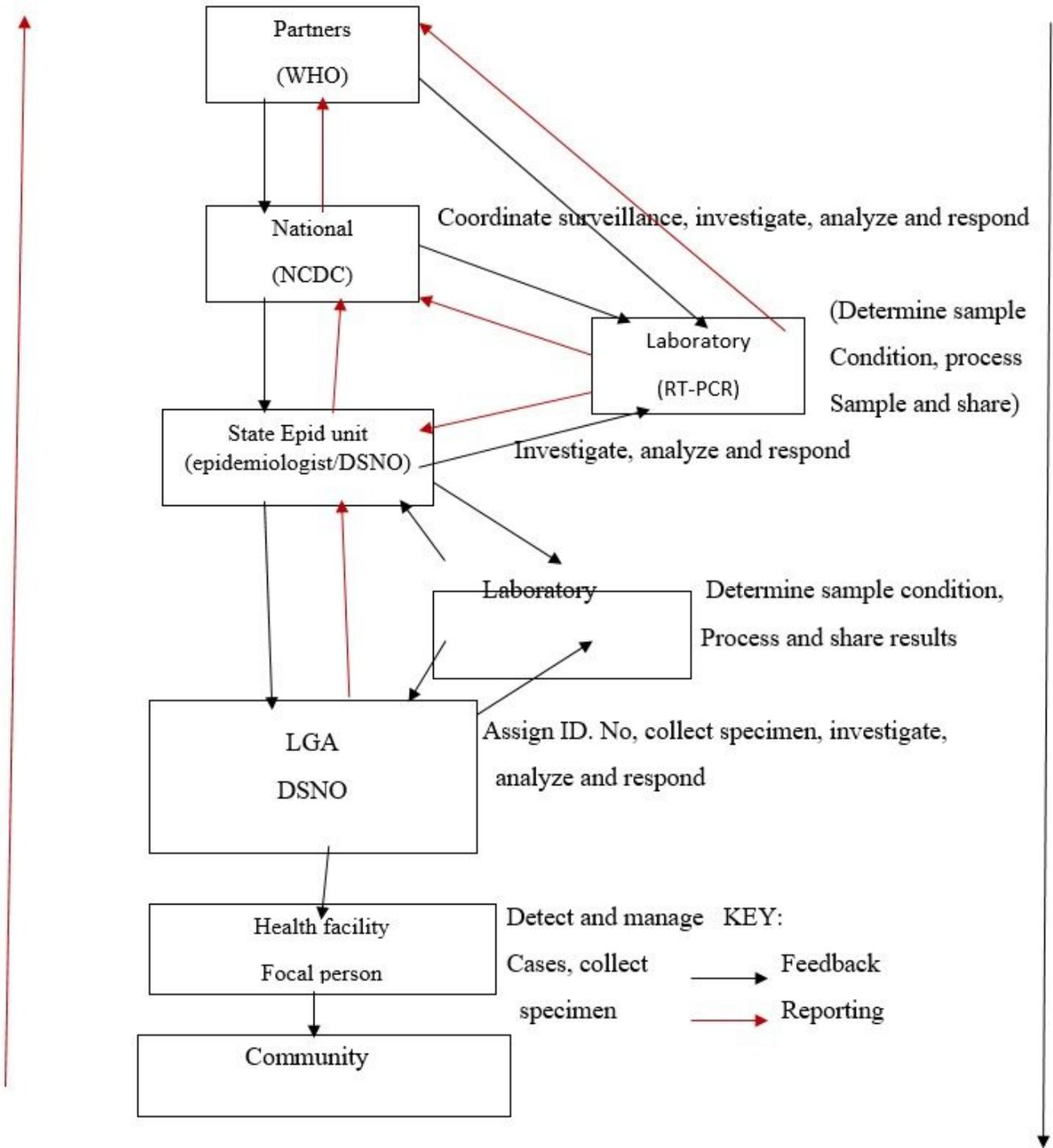


Figure 1

Flow chart of Lassa fever Surveillance activities in Kano State

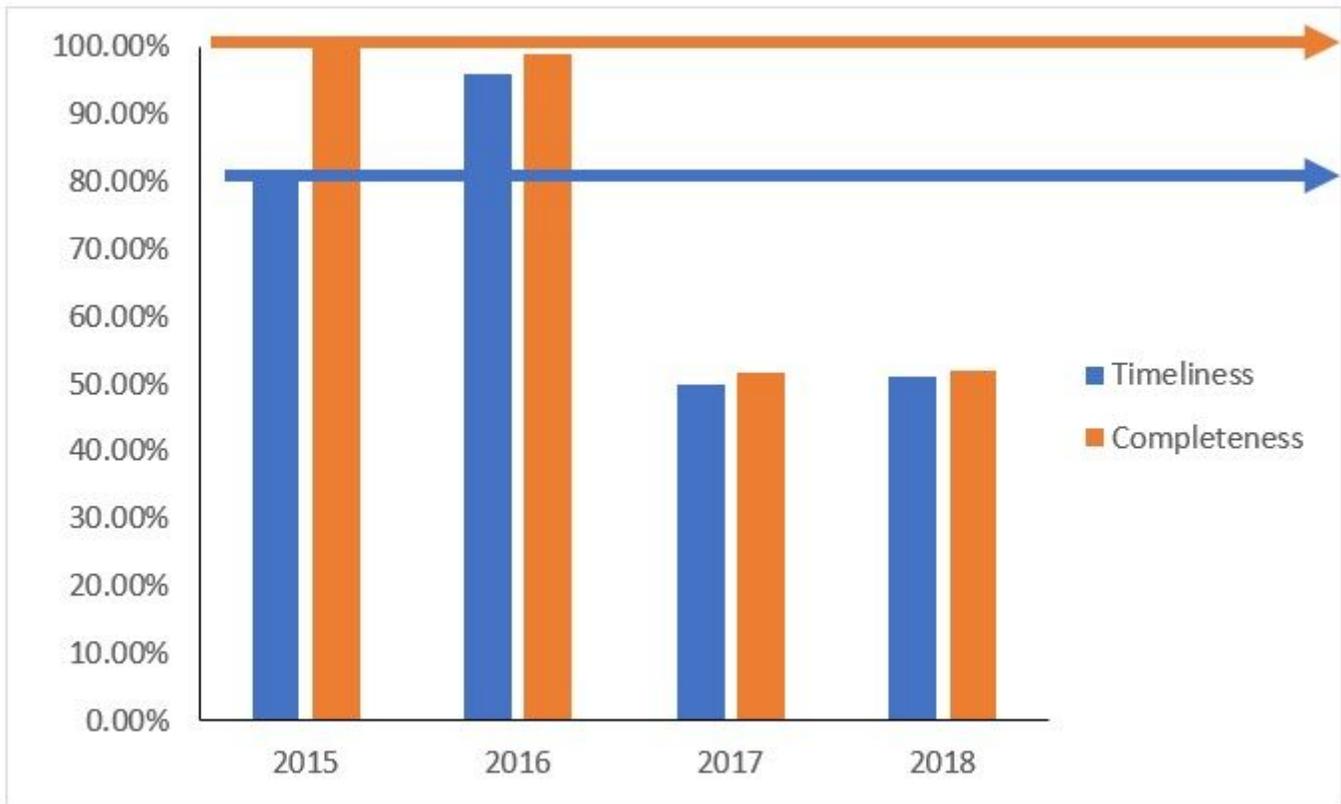


Figure 2

Timeliness and completeness of Lassa fever in Kano state Nigeria, 2015-2018

Supplementary Files

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