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Epidemiological Investigation of a Yellow Fever Confirmed Case in a Southwest State of Nigeria, 2023

BY

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Abstract

This epidemiological investigation examines a confirmed case of yellow fever in Oyo State, Nigeria, focusing on Irepodun, Alabata ward of Akinyele Local Government Area (LGA). A Rapid Response Team (RRT) engaged relevant stakeholders, conducted active case searches, and assessed vaccination coverage, knowledge levels, and Long-Lasting Insecticide Treated Net (LLIN) usage in the area.

A 39-year-old female with symptoms of fever and jaundice reported to a primary healthcare facility, testing positive for yellow fever. Despite prior vaccination in 2020, the patient had no travel history outside Oyo State but reported contact with animals. Akinyele LGA's profile revealed vaccination coverage disparities, with yellow fever coverage at 85.4%. Active case searches uncovered one additional suspected case, highlighting the importance of surveillance.

Survey results indicated that 70% of Alabata ward residents were vaccinated against yellow fever. Knowledge gaps were evident, with only 20% demonstrating good knowledge of yellow fever. LLIN usage was suboptimal, with 45% having access, 25% using them, and 20% sleeping under them.

These findings emphasize the need for targeted vaccination campaigns, enhanced health education, and LLIN promotion to combat rising yellow fever cases, especially among vulnerable populations, in Oyo State, Nigeria.

Keywords: *Yellow fever, long-lasting insecticide threated net, vaccination, surveillance, active case search*

INTRODUCTION

Yellow fever is a severe acute viral hemorrhagic illness caused by virus that belongs to the genus flavivirdae. It is transmitted by various species of infected mosquitos including *Haemogogus and Aedes spp* (WHO, 2020). The Aedes spp is the vector responsible for transmission in Africa (Monath & Vasconcelos, 2015). Despite yellow fever being a vaccine-preventable disease, it continues to cause severe morbidity and mortality, particularly in African countries (WHO, 2020; Nwachukwu et al., 2020). Between January 2021 to December 2022, a total of 40 deaths was reported among 203 confirmed and 252 probable cases given rise to a case-fatality ratio of 9% in 13 African countries (WHO, 2023).

The burden of yellow fever is estimated to cause about 84,000-170,000 serious cases and 29,000-60,000 deaths in Africa (Garske et al., 2014). It is also estimated that about 15% of infected persons might develop severe symptoms and 20-50% of the people whose illness advance to hepatorenal failure will die (WHO, 2019). The re-emergence of yellow fever in 2017 triggered a continuous increase in the number of confirmed cases in the country despite various vaccination efforts. The outbreak in Nigeria is said to have followed the trend of cases reported in various African countries such as

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Angola and Democratic Republic of the Congo (Nwachukwu et al., 2020).

The burden of yellow fever has also increased in Oyo State over the past eight years. A study conducted by Bassey et al. (2022) reported that between 2014 to 2020, Oyo State has reported a total of 9 confirmed cases of yellow fever and a total of 240 suspected cases. Further, they reported an upward trend of in the incidence of yellow fever per 100,000 population from 0% in 2013 to 3.5% and 5.6% in 2019 and 2020 respectively.

As a form of a global strategy to reduce the mortality and morbidity of yellow fever, the Eliminating Yellow Fever Epidemics (EYE) strategy was launched in Nigeria in April 2018 (WHO, 2018). Although the impact of this intervention has being felt in terms of vaccination coverage, early detection, and reporting of cases which shows the strength of the surveillance system in Nigeria, however, the increasing number of confirmed cases remains a serious concern.
This paper describes the outbreak of yellow fever in a rural community called Irepodun in Oyo State. We also conducted a vaccination survey to determine the vaccination coverage within the community. Further, we conducted a survey to determine the level of knowledge of yellow fever and prevention practices of the community members.

METHODOLOGY

This study employed a cross-sectional descriptive outbreak investigation of a yellow fever case reported in Oyo state, a Southwestern State in Nigeria. The case tested positive on the 10th of July 2023 and Investigation was conducted on the 11th of July 2023. The case was reported in Irepodun, Alabata ward of Akinyele Local Government Area (LGA).

A Rapid Response Team (RRT) was constituted comprising the State Epidemiologist, State Disease Surveillance and Notification officer, expert from World Health Organization (WHO), and Nigeria Centre for Disease Control and Prevention. The team conducted advocacy visits to relevant stakeholders at the state, LGA, and community level. The advocacy visits to the community leaders facilitated the engagement of community members in the response activities.

Active case search (ACS) for suspected yellow fever cases was conducted in Iredoun settlement and other settlements in Alabata ward of Akinyele LGA by the RRT. The case definition for suspected case of yellow fever was in synchrony with the national yellow fever guideline. The case definition for active case search was set to be; any person with acute onset of fever and jaundice appearing within 14 days of onset of first symptoms and/or general body weakness, vomiting, bleeding from any part of the body (NCDC, 2019).

House-to-house method was employed during the community ACS. Questions were asked to identify members of the household with history of fever and Jaundice. Comprehensive information of all suspected case that met the standard case definition for yellow fever were line-listed. The team also conducted an extensive active case search at three (3) health facility located at Alabata ward an its environment. A retrospective review of health facility records was conducted from the period of January 1 to July 11, 2023. Suspected cases that meet the standard case definition for yellow fever were line-listed.

A survey was conducted to determine the vaccination coverage in Alabata ward. We also conducted a survey to determine the level of knowledge of yellow fever in the locality and the prevention practices adopted. A systematic sampling method of alternate houses was adopted to identify does that will participate in the study, starting from the health facility that reported the case and subsequently moving in a clockwise direction.

RESULTS

Case Report

A 39-year-old female reported to a primary health care facility at Irepodun, Alabata on the 10th of April 2023 with symptoms such as fever and Jaundice. The date of symptoms onset was said to be 7th of April 2023. Venous blood sample was collected and sera extracted for laboratory investigation. The sera was triple packaged, stored at +2 to + 8 °C, and transported to the Laboratory via a professional courier company. Following the yellow fever testing algorithm, the sample tested positive when subjected to a Plaque Reduction Neutralization Test (PRNT) conducted by the WHO regional Laboratory IP Dakar, Senegal.

Detailed interview using the Case Investigation Form for yellow fever revealed that the patient was vaccinated against yellow fever in 2020 during the yellow fever vaccination campaign. No travel history outside the Oyo State was established, however, the patient visited an area close to her settlement before the onset of symptoms. The patient also reported contact with chicken and goat.

LGA Profile and Vaccination Coverage

Akinyele LGA has a total population of 393,138 with 12 Wards and 910 settlements. The LGA has 30 public health facilities and four (4) private health facilities. However, a total of 27 public facilities and 5 private facilities provides routine immunization services. According to the State health record, between January to June 2023, the pentavalent coverage in Akinyele LGA was 59.2% and 68.6% in Oyo State, while Measles vaccine coverage was 90.6% in Akinyele LGA and 65.1% in Oyo State. The yellow fever vaccine coverage is 85.4% in Akinyele LGA and 66.1% in Oyo State. Likewise, the LGA record revealed that 5,136 children less than one year old are unvaccinated against yellow fever in Akinyele LGA and a total of 169,772 in Oyo State. The proportion of suspected yellow fever cases for which a blood sample was collected is 2% in Akinyele LGA and 17% in Oyo State.

Active Cases Search

Result of active case search in Alabata ward revealed one (1) suspected case of yellow fever. The date of symptoms onset was said to be 22nd March 2023 with symptoms such as fever and jaundice. The suspected case was recorded and entered into the national database. During the community ACS, the RRT sensitized the community leaders, members, and

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informants on the surveillance of Yellow Fever and how to recognize suspected cases. Information Education and Communication (IEC) materials on how to identify yellow fever cases were distributed at the community.

There was no suspected case seen during the health facility ACS. Each member of the team signed the visitors book at the health facility to ensure a proper record of the response activities. Likewise, the healthcare workers were sensitized on yellow fever case detection and reporting. IEC materials were also distributed at the health facilities.

Survey of Vaccination coverage at Alaba Ward
Number of persons Sampled: 180
Number of persons vaccinated against yellow fever: 126

Table 1: Age Group of Vaccination Coverage by evidence at Alabata ward, Akinyele LGA.

Age group	Card only		History		Combine	
	# vacc.	%	# vacc.	%	# vacc.	%
months	23	43	7	10	30	24
>59 months	31	57	65	90	96	76
Total	54	100	72	100	126	100

**Vacc: Vaccination*

The result of the survey revealed a total vaccination coverage of yellow fever to be 70% at Alabata ward. Out of the 180 people sampled in this study, 126 were vaccinated against yellow fever. A total of 54 persons were able to show vaccination card among which 23 (43%) were children 9 month to 59-month-old while 31 (57%) were above 59-month-old. Seventy-two (72) people were able to prove vaccination through history among which 7 (10%) were children 9 month to 59-month-old while 65 (90%) were above 59-month-old.

Survey of Level of Knowledge of Yellow Fever and Prevention Practices

Table 2.0: Socio-Demographic Characteristics of Respondents

Variables	Respondents in the study N=40	
	Frequency (N)	Percentage (%)
Settlement		
Rural	40	100.0
Gender		
Male	3	7.5
Female	37	92.5
Religion		
Islam	23	57.5
Christianity	17	50.7
Level of education		
None	5	12.5
Primary	11	27.5
Secondary	20	50.0
Tertiary	4	10.0
Marital status		
Married	40	100.0
Occupation		
Trader	35	87.5
Farmer	5	12.5

The demographic description shows that majority of respondents in this study were female 37 (92.5%) with Islam being the most practiced religion 23 (57.5%). Most of the respondents had secondary education 20 (50.0%) and majority engage in traders as a form of occupation 35 (87.5%).

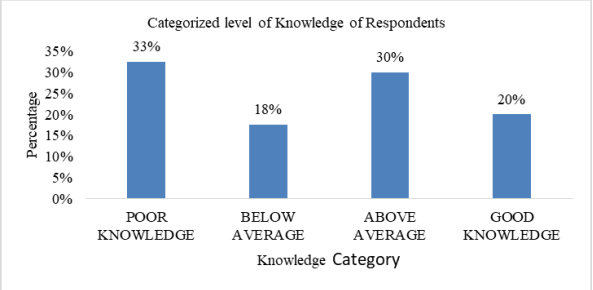

Figure 1.0: Categorized level of Knowledge of Respondents

Table 3.0: Frequency Distribution for Knowledge of Respondents

S/N	Knowledge of Yellow Fever	Respondents in this study N=40			
		YES	%	NO	%
1	Yellow fever is a hemorrhagic fever	10	25.0	30	75.0
2	Yellow fever is caused by a virus	20	50.0	20	50.0
3	Yellow fever can spread from person to person	22	55.0	18	45.0
4	Yellow fever can be transmitted by infected mosquito	23	57.5	17	42.5
5	Yellow fever is not a preventable disease	21	52.5	19	47.5
6	Yellowness of the eye is an indication of	28	70.0	12	30.0

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	yellow fever				
7	Final phase of yellow fever can result in bleeding from the body orifice	9	22.5	31	77.5
8	People infected with yellow fever can infect mosquito	10	25.0	30	75.0
9	Symptoms of yellow fever include fever and jaundice	23	57.5	17	42.5

Result shows that only 20% of the respondents had good knowledge of yellow fever. Majority 33% of the respondents had poor knowledge of yellow fever while 30% had a knowledge above average (figure 1.0). A total of 30 (75%) respondents did not know that yellow fever is a viral hemorrhagic fever and 20 (50%) did not know that disease is caused by a virus. Likewise, 31 (77.5%) did not know that the final phase of disease can lead to bleeding from the body orifice (Table 3).

Table 4.0: Prevention Practice with the use of Long-Lasting Insecticide Treated Net (LLIN)

S/N	Use of Long-Lasting Insecticide Treated Net	Respondents in this study N=40			
		YES	%	NO	%
1	Do you have long-lasting insecticide-treated net	18	45.0	22	55.0
8	Do you use long-lasting insecticide-treated net	10	25.0	30	75.0
9	Did you sleep under your long-lasting insecticide-treated net last night	8	20.0	32	80.0

The results revealed that only 45% of the respondents had Long Lasting Insecticide Treated Net (LLIN), out of which just 25% use the LLIN and only 20% slept inside the net the night before conducting this study (Table 4).

DISCUSSION

The confirmed case of yellow fever reported in this study is indicative of a strong surveillance system in Akinyele LGA and Oyo state at large. This study further established the fact that the case definition for yellow fever as stipulated in the national guideline is sensitive enough to help healthcare workers and surveillance officers identify suspected cases of yellow fever (NCDC, 2019). The study further revealed essential epidemiological information about the confirmed case such as outbreak setting, vaccination history, and travel history. This information is said to be vital as it helps to characterize the situation surrounding the case and possible exposure (Nwachukwu et al., 2020). One suspected case recorded during community active case search is suggestive of the fact that symptomatic cases are not presenting at the health facility thereby increasing the possibility of a full-blown outbreak.

In this outbreak investigation, we assessed the vaccination coverage in Akinyele LGA to effectively characterize the cause of the outbreak. This is because vaccination against yellow fever has been identified as a significant method for transmission prevention (Awoyale et al., 2021). The state health record showed a vaccination coverage of 85.4% in Akinyele LGA between January to June 2023. This is optimal when compared with the World Health Organization (WHO) recommendation of 80% (WHO, 2023). Further, the vaccination survey conducted among 180 residents during outbreak investigation revealed a coverage of 70% at Alabata ward. This is a positive indication of vaccination efforts in the area although not optimal. However, it's important to note that only 43% of those who could provide vaccination cards were children aged 9 months to 59 months, while 57% were older individuals. Moreover, 10% of those who could confirm their vaccination through historical records were children aged 9 months to 59 months, with 90% being older individuals. This discrepancy in vaccination coverage among different age groups suggests the need for targeted vaccination campaigns, especially for children, who are particularly vulnerable to yellow fever.

The assessment of the level of knowledge about yellow fever revealed concerning gaps in understanding among the respondents. Only 20% of the participants demonstrated good knowledge of yellow fever, while the majority (33%) had poor knowledge, and 30% had knowledge levels above average. These findings are consistent with a study in Ethiopia by Inusah et al. (2023), which also indicated low knowledge level regarding yellow fever, especially concerning its mode of transmission. Alarmingly, a substantial portion of respondents (75%) in this study did not know that yellow fever is a viral hemorrhagic fever, and 50% were unaware that it is caused by a virus. Additionally, 77.5% of respondents did not know that the final phase of the disease can lead to bleeding from body orifices. These knowledge gap mirrors the findings from studies in Ethiopia by Legesse et al. (2018) and Ghana by Inusah et al. (2023) which highlighted low awareness of the cause of yellow fever and its transmission vectors.

Findings regarding LLIN usage are also concerning. Only 45% of the respondents reported having access to LLINs, and among those with access, just 25% reported using them. Furthermore, only 20% of the respondents slept inside the LLIN the night before the study. These finding is similar to the study conducted by Endale et al. (2020) where they

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reported low usage of LLIN compared to other methods of preventing yellow fever.

CONCLUSION AND RECOMMENDATION

This study sheds light on the concerning increase in suspected and confirmed yellow fever cases in Oyo State, Nigeria. The findings reveal significant disparities in vaccination coverage, knowledge levels, and Long-Lasting insecticide-treated net (LLIN) usage among the surveyed population in the Alabata ward. These disparities underscore the urgent need for targeted public health interventions to address the challenges posed by yellow fever in the region. it is therefore essential to implement targeted vaccination campaigns, enhance health education efforts, and promote the consistent use of Long-Lasting Insecticide Treated Nets (LLINs) to address the increasing cases of yellow fever, particularly among vulnerable populations, in Oyo State, Nigeria.

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