

Factors associated with death among meningitis patients during the 2022-2023 epidemic in Jigawa State, Nigeria

Martin Ndinakie Yakum^{1,2}, Etienne Gignoux¹

¹ Epicentre (Paris) ² Training on Field Epidemiology in Humanitarian Contexts (FETCH)

BACKGROUND

- **Jigawa** is one of Nigeria's states in the **African meningitis belt** where epidemics of meningitis caused by *Neisseria meningitidis* A used to occur every 8 to 12 years, with attack rates of up to 1,000 cases per 100,000 inhabitants.
- The **MenAfriVacc** (meningococcal serogroup A polysaccharide conjugate vaccine), developed for the Meningitis Vaccine Project, was introduced in Nigeria with a **mass vaccination campaign in 2011** and added to the national routine immunization programme since then.
- The **last meningococcal A epidemic** that occurred in Jigawa State before the MenAfriVacc mass vaccination campaign, was in **2008-2009** and ended with 8,616 cases, 306 deaths, a case fatality ratio (CFR) of 3.6% and an attack rate of 181.9 per 100,000 people.
- The first **meningococcal epidemic** in Nigeria after the 2011 MenAfriVacc mass vaccination campaign started in **October 2022**.
- **Jigawa State** was the most heavily affected state, accounting for **86% of all cases nationwide**, with a worrisome **CFR of 8% by week 9 2023**. MSF supported the response with cases management in Gumel emirate, the epicentre of the outbreak, at one General Hospital and 3 PHCCs.
- Since this was the first major outbreak of meningitis in the state after the introduction of MenAfriVacc, coupled with the apparent higher case-fatality, it was important to make a detailed description of the epidemic and to assess factors associated with death among cases.

OBJECTIVES

- To describe the 2022/2023 meningitis epidemic in Jigawa state of Nigeria in terms of person, time and place.
- To assess factors associated with death among meningitis suspected cases reported during the 2022/2023 epidemic in Jigawa state.

METHODS

- Data of the 2022/2023 meningitis outbreak in Jigawa State (Nigeria) was obtained from state Ministry of Health, collected through the state's routine epidemiological surveillance system in place.
- We conducted a **descriptive analysis** of the epidemic in terms of person, time and place by estimating the attack rate and case-fatality per Local Government Area (LGA) affected and per age groups and by drawing epidemiological curve.
- Factors associated with death among all suspected cases were assessed using unconditional logistic regression. Predictors that had a p-value below 0.20 in bivariate analysis were included in a multivariate analysis to control for potential confounders. However, based on previous literature that holds that vaccine can reduce the risk of death, the vaccination status of patients was maintained in the final multivariate model even though the p-value in bivariate analysis was greater than 0.20.
- For each predictors, the value of Odds Ratio with the corresponding 95% confidence Interval and the p-value were reported for both bivariate and multivariate analysis. The threshold of statistical significance was set at p-value <0.05.
- Data was cleaned and analyzed using R version 4.3.

RESULTS

- The meningitis epidemic in Jigawa state lasted 30 weeks and accounted for **1508 cases** and **66 associated deaths** (CFR = 4.4%).
- The peak of the outbreak occurred in week 15, 2023 (Figure 1)
- The overall attack rate was 21 cases per 100 000 people. High attack rates were reported in Gagarawa, Maigatari and Sule Tankarkar LGAs.
- 233 cases were confirmed by culture. *Neisseria meningitidis* serogroup C was responsible for 97.0%

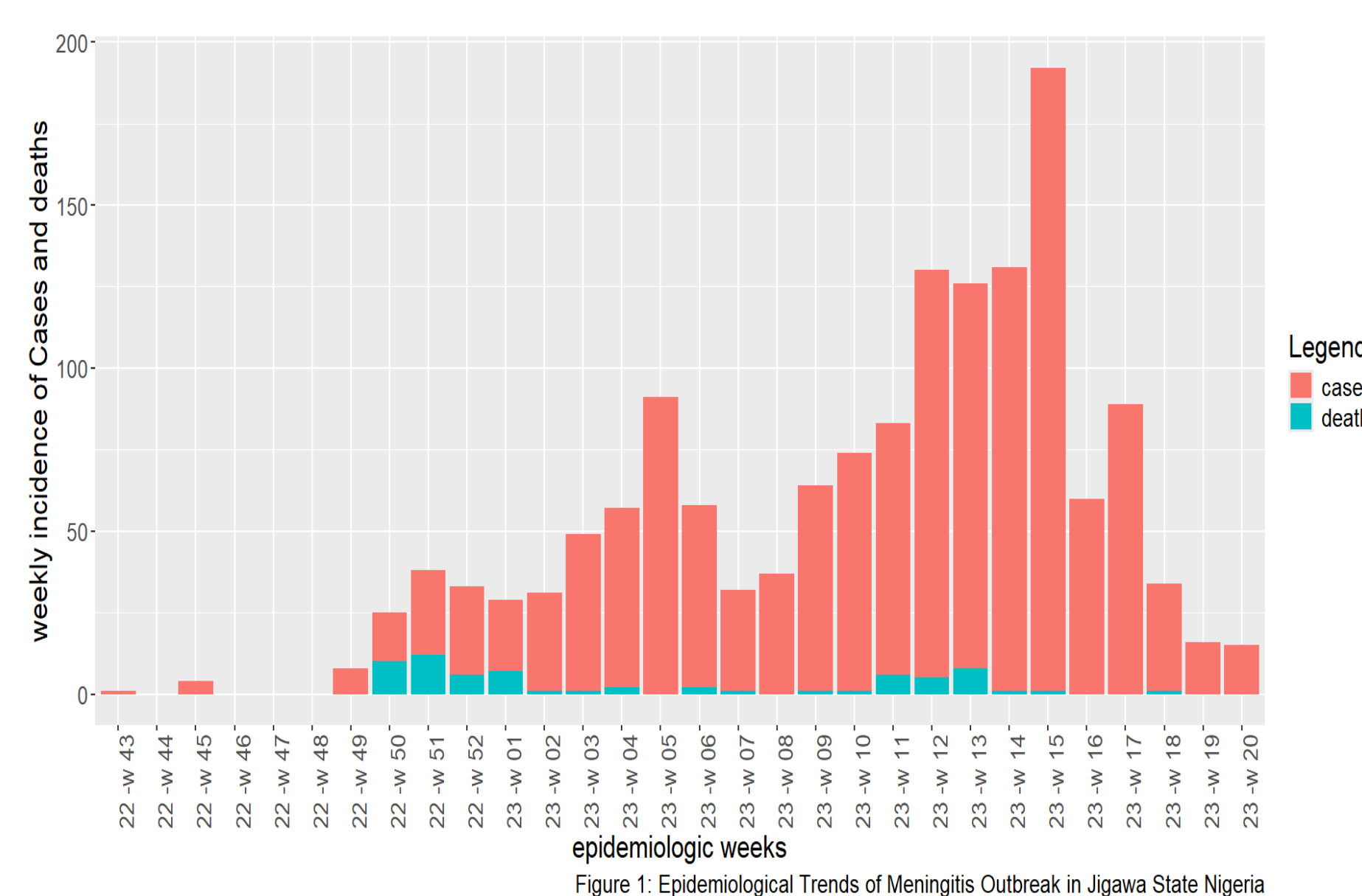


Figure 1: Epidemiological Trends of Meningitis Outbreak in Jigawa State Nigeria

- Children aged 2-14 years was the most affected age group in terms of both attack rate and CFR (Table 2).
- Males were more affected than females (817 males and 691 females, 54.1%, *p-value* = 0.001), but case fatality was not significantly different (Table 4).

Table 2: Attack rate and CFR per age groups

Age groups	Population	Number of cases	Number of deaths	AR per 100000 persons	CFR (%)
<2 yrs	494896	23	0	4.6	0.00
2-4 yrs	636295	191	11	30.0	5.76
5-14 yrs	1908884	775	40	40.6	5.16
15-29 yrs	1908884	351	12	18.4	3.42
30-44 yrs	1131190	109	2	9.6	1.83
45 yrs or more	989792	49	1	5.0	2.04
Missing age	N/A	10	0	N/A	0.00

Source: Line list from the state Government

Table 3: bivariate analysis of variables included in the model

Variables		#Patients	#Deaths	#Alive	CFR
sex	Female	691	26	660	3.76
	Male	817	40	775	4.90
inpatient management	Yes	976	19	951	1.95
	No	532	47	484	8.83
Vaccination status (at least one dose)	Yes	91	3	88	3.30
	No	1417	63	1347	4.45
sample collected and tested	Yes	238	5	233	2.10
	No	1270	61	1202	4.80

- Only 6% of the patient had received at least one dose of vaccine against meningitis.
- Patients that were older or hospitalized or who had received at least one dose of vaccine against meningitis were significantly associated with decrease odds of death (Table 4).

Table 4: Factors associated with death among meningitis patients in Jigawa state, Nigeria.

Predictors	Bivariate Analysis			Multivariate Analysis		
	OR	95% CI	p-value	OR	95% CI	p-value
Sex (M/F)	1.32	0.80 – 2.20	0.285			
age	0.97	0.94 – 1.00	0.050	0.96	0.93 – 0.99	0.010
Inpatient (Yes/No)	0.20	0.12 – 0.35	<0.001	0.18	0.10 – 0.32	<0.001
Vaccinated against meningitis (Y/N)	0.73	0.18 – 2.03	0.605	0.31	0.07 – 0.88	0.046
Sample tested(Y/N)	0.43	0.15 – 0.97	0.069	0.84	0.28 – 2.07	0.733

CONCLUSIONS

- The meningitis outbreak in Jigawa was caused by meningococcal serogroup C and the epicentre for the outbreak in Jigawa was in the Gumel emirate LGAs (Gumel, Gagarawa, Maigatari and Sule Tankarkar).
- The most affected population age group was children aged between 2 years to 14 years both in terms of attack rate and case-fatality ratio.
- Patients who had received at least one dose of meningitis vaccine and those who were managed as inpatient as well as older patients were significantly less likely to die from the infection. Suggesting the importance of vaccination and inpatient management of cases.
- The relationship between inpatient management and death can not be conclusive in this study because cases that did not come to the health facility but captured by the surveillance system were registered as 'outpatients'. However, such cases are related to access to care than the mode of management, but we could not distinguish this from the database.
- Giving changing of meningococcal serogroup responsible for the outbreak compared to previous outbreaks, we recommend the use of multivalent meningitis vaccine that includes serogroup C for routine and mass immunization in the Jigawa and surrounding vicinities.
- In case of any outbreak in places with limited access to care, we recommend to consider the age of the patient and their vaccination status in the decision of the mode of management (inpatient or outpatient).
- We also recommend estimating the true incidence and mortality related to meningitis in Jigawa can be useful to know the true burden of the outbreak in terms of attack rate and CFR and can partially inform us about the capacity of the routine surveillance in place.