Standardization of Death Rate: Implications for Variability in Mortality and Age-Distribution of Lassa fever in Ondo State, Nigeria.

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Background

- Lassa fever (LF) remains a significant public health threat due to burden of infection and outbreak overwhelming the health system.
- Ondo State since 2016 has persistently recorded Lassa fever, having the highest yearly incidence and pronounced mortality.
- This study aim is to gain insights into Lassa fever mortality (death) in Ondo State.

Methods

- We conducted a retrospective review of disease surveillance data and mortality register from 2019 – 2024.
- WHO World Standard Population Distribution, based on world average population between 2000 - 2025.
- Poisson distribution parameter (x^2/v) was used to summarize variation of Lassa fever mortality.
- The U.S. NCHS framework was used to standardize mortality statistics and generate conservative estimate across age groups.
- We employed Population projection model (exponential model) to compute the life expectancy.

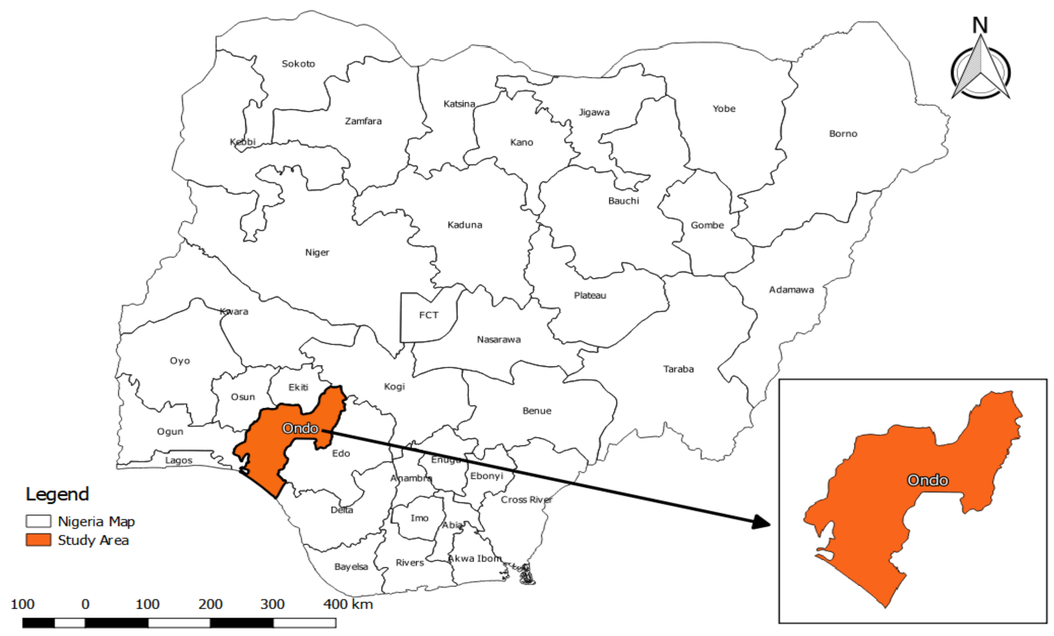

Fig. 1: Map of Nigeria and the Study Area

Results

Direct standardization-Age adjusted rate for mortality Population strata of Lassa fever: Ondo State 2019 - 2024

Age-group	Study Population: Death	Study Population: Population	Standard Population (WHO World, 2000-2025)	Age-specific death rate	Age-adjusted death rate[5]	Variability and Control for differences in Age-group: Standard Error of percent[4]	Relative Standard Error[2]	Relative CI width[3]	95-percent[6] confidence limits
	di	*pi*	Pi	*ri = di/pi*	*Ei = ri ** Pi	$\sqrt{Wsi^2 * Ri^2/Di}$	RSE=(1/$\sqrt{di}$) **100*	width/*Ei *100*	% (95% CI)
0-4	18	748184	8860	2.41	0.21	5.0	23.6	92.4	-
5-14	10	1493081	17290	0.67	0.12	3.7	31.6	124.0	-
15-24	30	1244666	16690	2.41	0.40	7.3	18.3	71.6	0.4 (0.3 – 0.5)
25-34	46	908551	15540	5.06	0.79	11.6	14.7	57.8	0.8 (0.6 – 1.0)
35-44	60	622559	13740	9.64	1.32	17.1	12.9	50.6	1.3 (1.0 – 1.7)
45-54	53	430896	11410	12.30	1.40	19.3	13.7	53.9	1.4 (1.0 – 1.8)
55-64	47	224687	8270	20.92	1.73	25.2	14.6	57.2	1.7 (1.2 – 2.2)
65-74	39	123486	5170	31.58	1.63	26.2	16.0	62.8	1.6 (1.1 – 2.1)
75-84	18	61694	2430	29.18	0.71	16.7	23.6	92.4	-
85+	18	34107	640	52.78	0.34	8.0	23.6	92.4	-
Total	**339**	**5891912**	**100000**			**31.3**	**3.61**	**63.4**	**7.3 (5.2 - 9.4)**
[1]Crude Rate per 100,000				**5.75**					
Standardized Rate per 100,000					**8.80**				

[1]Demographer set a lower limit of 5 per 1000 for Crude Death Rate (CDR) as a strong suggestive of incomplete death registration.
[2]Data are statistically unreliable because sample size was <20 event or relative Standard Error was >0.23 (23%), Age-adjusted rate would be suppressed.
[3]Relative CI width is greater than 130%. Estimate would be suppressed.
[4]Standard error of the age-adjusted death rate S(AADR) is the square root of the multiplication of standard weights and variance of the age-specific death rate.
The NCHS suggested at least 20-25 deaths over all age groups before even attempting to standardize using the direct method.
[5]Estimated total number of Lassa fever mortality was rounded down to the nearest 100,000 persons.
[6]NOTES: CI is confidence interval. The proportion estimate and its lower and upper confidence bounds, respectively, Relative Standard Error and Relative CI width are expressed in percentage points. Numbers in the table are subject to rounding.
NOTE: Results were interpreted based on U.S National Centre for Health Statistics (NCHS) framework
SOURCE: Surveillance database and mortality register

- The mortality recorded across all age groups showed pronounced variations.
- The differences were adjusted for to generate a prevalence estimate of 7.3% (5.2 - 9.4) around the parameter.
- Ondo State growth rate for LF shows a decrease in the rate of mortality across all ages; however, the age specific growth rate shows that age 25-29 and 60-64 years are on the rise and tends to double in the year 2030 if the current growth rate persists.

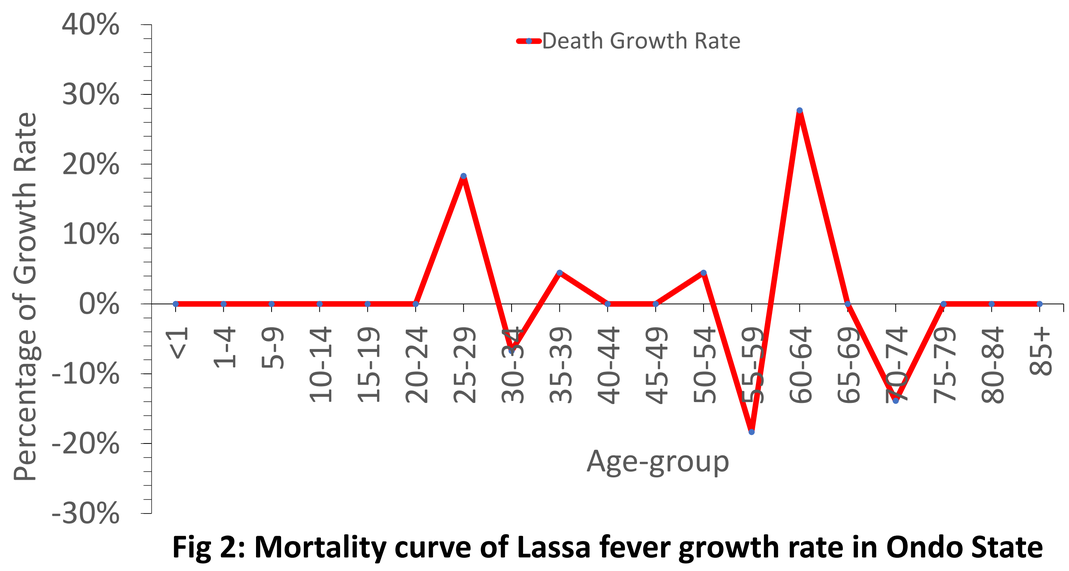

Fig 2: Mortality curve of Lassa fever growth rate in Ondo State

- The life table shows that the life expectancy at birth is 45.93 years (ℓ_x = 9.19) and that a man aged 15 years has about 61.5% chances of dying before his 60th birthday.

Conclusions and Recommendations

We found an unusual increase in the confirmed cases and significant variation in deaths among the age groups, with related reduction in life expectancy. Hence, enhanced disease surveillance and early medical countermeasures might minimize the mortality rates from LF outbreak.

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