

Prevalence of Typhoid Fever among Admitted Patients of Federal University of Lafia Teaching Hospital, Lafia, Nasarawa State: A Retrospective Observational Study

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Abstract

Typhoid fever remains a significant public health challenge in Lafia, Nasarawa State, with young adults disproportionately affected. This study investigated the prevalence, morbidity, and mortality of typhoid fever among admitted patients at the Federal University of Lafia Teaching Hospital (FULAFIA TH) from 2021 to 2025. A total of 72 cases were documented, with the highest morbidity observed in the 21–30 year age group (25 %) and pediatric population (0–10 years, 16.7 %). Mortality was concentrated in adults aged 21–40 years, with a case fatality rate (CFR) peaking at 27.8 % in the 21–30 age group. Annual trends revealed fluctuating CFRs, ranging from 0 to 18.8 %, suggesting variable clinical outcomes possibly linked to delayed presentation and antimicrobial resistance. The study underscores the urgent need for targeted public health interventions, including improved water infrastructure, early diagnostics, and student health programs to mitigate the burden of typhoid fever in Lafia.

Keywords: Typhoid fever, Prevalence, Morbidity, Mortality

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Introduction

Typhoid fever is one of the most important Public Health Problems in the world and especially in the developing countries. Despite that the disease is continuing to cause high morbidity and mortality in most developing countries of Sub Saharan Africa including Tanzania, many communities are living in very poor household hygiene and poor water supply. World health organization data indicate that there are almost 33 million people suffering from typhoid worldwide whereby over 400,000 cases are from Africa continent. However various literature reviews indicate that developing countries particularly in Sub Saharan continent continue to bear the burden of the disease despite of the various control measures.

Typhoid fever remains a major public health concern in many developing countries, particularly in sub-Saharan Africa, where poor sanitation, unsafe water supply, and inadequate hygiene practices continue to facilitate disease transmission. The disease, caused by *Salmonella Entericaserovar typhi*, contributes significantly to morbidity and mortality, especially

among vulnerable populations such as children and young adults.

Globally, millions of cases of typhoid fever are reported annually, with a substantial proportion occurring in low- and middle-income countries. In Nigeria, typhoid fever remains endemic and is frequently reported among hospital admissions, often presenting with severe complications due to delayed diagnosis and increasing antimicrobial resistance.

Edward [1] synthesizes prior typhoid models, notes the neglect of combined direct + environmental transmission, and presents a new model showing that typhoid persists via carriers and contaminated water. Control requires targeting both human and environmental pathways, with $R_0 < 1$ as the threshold for eradication. Guglielmi *et al.* [2] review ODE vs DDE vs spatial PDE epidemic models and identify the need for delay differential equations with spatial resolution. Their work bridges two literature strands — DDEs for temporal accuracy and reaction-diffusion/metapopulation models for spatial realism — to better simulate COVID-19 waves and intervention effects. Ivanoff *et al.* [3] open by situating typhoid fever



as a serious enteric disease caused by *Salmonella typhi*, spread mainly via infected food/water and close person-to-person contact. While rare in countries with good water/sewage systems, it remained endemic in Africa, Asia, and Latin America where sanitation was poor. The review was written for travelers and public health programs in endemic regions.

Karunditu *et al.* [4] review typhoid models and identify that excluding unprotected humans over-simplifies transmission. Their SUIR model demonstrates that the disease will persist as long as a large unprotected population exists, highlighting WASH and health education as critical interventions alongside medical treatment. Masasila and Ngeleja [5] review typhoid models and fill a gap by showing that health information dynamics are not neutral — they can increase or decrease R_0 depending on public adherence. Effective typhoid control requires pairing information with strategies that ensure behavior change. Musa *et al.* [6] review typhoid models and identify that public health education has been under-modeled. Their work provides a mathematical framework linking education intensity to R_0 and final epidemic size, showing that sustained education programs can be as critical as vaccination and sanitation for typhoid elimination. Mushayabasa *et al.* [7] reviewed typhoid models and showed prior work was dichotomized — either direct or indirect. Their SIIcR-B model established that carriers + environmental reservoir + direct transmission must be modeled together, because ignoring any one underestimates disease burden and compromises intervention design.

Mushayabasa [8] reviews typhoid models and identifies that screening for carriers and early infections was missing. His model demonstrates that optimal screening can significantly reduce R_c and is a cost-effective strategy for typhoid control when combined with treatment. Mushanyu *et al.* [9] focus on typhoid fever in resource-constrained settings, especially sub-Saharan Africa, where limited public health resources — few hospitals, scarce drugs, inadequate sanitation infrastructure — hamper control. They note that despite vaccines and antibiotics, typhoid persists because interventions cannot be deployed at scale due to budget, personnel, and facility constraints. Mushayabasa [10] reviews typhoid models and identifies that bilinear incidence and unlimited treatment are unrealistic. By introducing saturated incidence and saturated treatment, the paper shows that healthcare limits and behavioral change significantly affect R_0 , stability, and control strategies for typhoid. Mutua *et al.* [11] address co-infection of malaria and typhoid fever, which are both endemic and often concurrent in tropical regions, especially sub-Saharan Africa. The authors note that febrile patients in these areas are frequently misdiagnosed because malaria and typhoid share clinical symptoms, and co-infection complicate treatment and increases mortality. Despite epidemiological evidence of overlap, mathematical models had treated them separately. Nsutebu *et al.* [12] reviewed the diagnostic dilemma of typhoid vs malaria

and showed, via blood/stool culture, that only 2.5 % of febrile patients with “typhoid-compatible” symptoms actually had typhoid, versus 47 % with malaria. The study concluded that typhoid was over diagnosed in Cameroon due to symptom overlap and Widal test misuse.

Nyerere *et al.* [13] review typhoid models and show that ignoring screening leads to overestimation of control success. Their model demonstrates that screening combined with treatment significantly lowers R_0 and disease prevalence, even under saturated treatment conditions. Effective typhoid control requires active detection of cases/carriers, not just having drugs available. Peter *et al.* [14] review typhoid models and show that most either separate transmission routes or use constant interventions. Their model integrates direct and indirect transmission with five optimal controls, demonstrating that combined, time-varying strategies — especially education, sanitation, and treatment — are required to curtail typhoid effectively. Shaikh and Nisar [15] review classical integer-order typhoid models and identify that they ignore memory effects. They introduce a Caputo–Fabrizio fractional-order typhoid model, prove its well-posedness, and show that fractional dynamics better capture hereditary properties of disease spread. The work suggests fractional models can improve prediction and control planning for typhoid. Suhuyini and Seidu [16] review typhoid models and find that booster vaccination is under-modeled despite waning immunity. Their model shows that treatment plus booster vaccination is needed for sustained control, and that backward bifurcation means R_0 must be reduced sufficiently below 1 to eliminate typhoid.

Tilahun *et al.* [17] review single-disease and malaria–typhoid co-infection models, identify a gap for pneumonia–typhoid co-dynamics, and develop an optimal control model showing that combining typhoid prevention with pneumonia treatment is the most cost-effective strategy to curb the co-epidemic. WHO [18] position paper reviewed evidence on typhoid burden, vaccine safety/efficacy, and antimicrobial resistance. It re-emphasizes vaccination for typhoid control and, for the first time, prefers TCV for routine infant immunization from 6 months and catch-up to age 15, due to its better immunogenicity, younger age use, and longer protection. Yalwa *et al.* [19] considered (6) six compartmental typhoid model. They considered individuals with complications but without complications underlying chronic disease and individuals under hospital lockdown with ongoing health monitoring. In their findings, they observed as more individual are vaccinated and treated appropriately recovers and grow over time.

Despite its burden, there is limited hospital-based epidemiological data describing the distribution, severity, and outcomes of typhoid fever in Lafia, Nasarawa State. The Federal University of Lafia Teaching Hospital (FULAFIA TH), being a major referral center, provides an opportunity to evaluate the local disease burden and clinical outcomes.

The Federal University of Lafia Teaching Hospital serves as a referral center for patients in Lafia and surrounding communities, yet there is limited epidemiological data on the local burden of typhoid fever. Previous studies have largely focused on broader regional or national estimates, with insufficient attention to localized hospital-based data in Lafia. This gap limits effective planning of targeted interventions. This study aims to assess the prevalence and clinical outcomes of typhoid fever among admitted patients at FULAFIA Teaching Hospital. Specifically, the study seeks to:

1. Assess the demographic distribution of typhoid morbidity and mortality.
2. Calculate the case fatality rate across different age groups.
3. Identify annual trends in typhoid incidence and clinical outcomes.
4. Provide recommendations for effective prevention and control strategies in Lafia.

Materials and Methods

Research design

This study adopted a retrospective descriptive research design to assess the prevalence of typhoid fever among admitted patients at the Federal University of Lafia Teaching Hospital (FULAFIA TH). The design enabled the researcher to analyze already existing hospital records over a specified period (2021–2025) to determine patterns of morbidity, mortality, and case fatality rates.

Study area

The study was conducted at the Federal University of Lafia Teaching Hospital (FULAFIA TH), located at Shendam Road, PMB 07, Lafia, Nasarawa State, Nigeria whose coordinates are 8.505824, 8.488416 (Fig. 1). It was formerly Dalhatu Araf Specialist Hospital (DASH) before it was upgraded to a teaching hospital. The hospital serves as a major referral center providing healthcare services to residents within Lafia and surrounding communities.

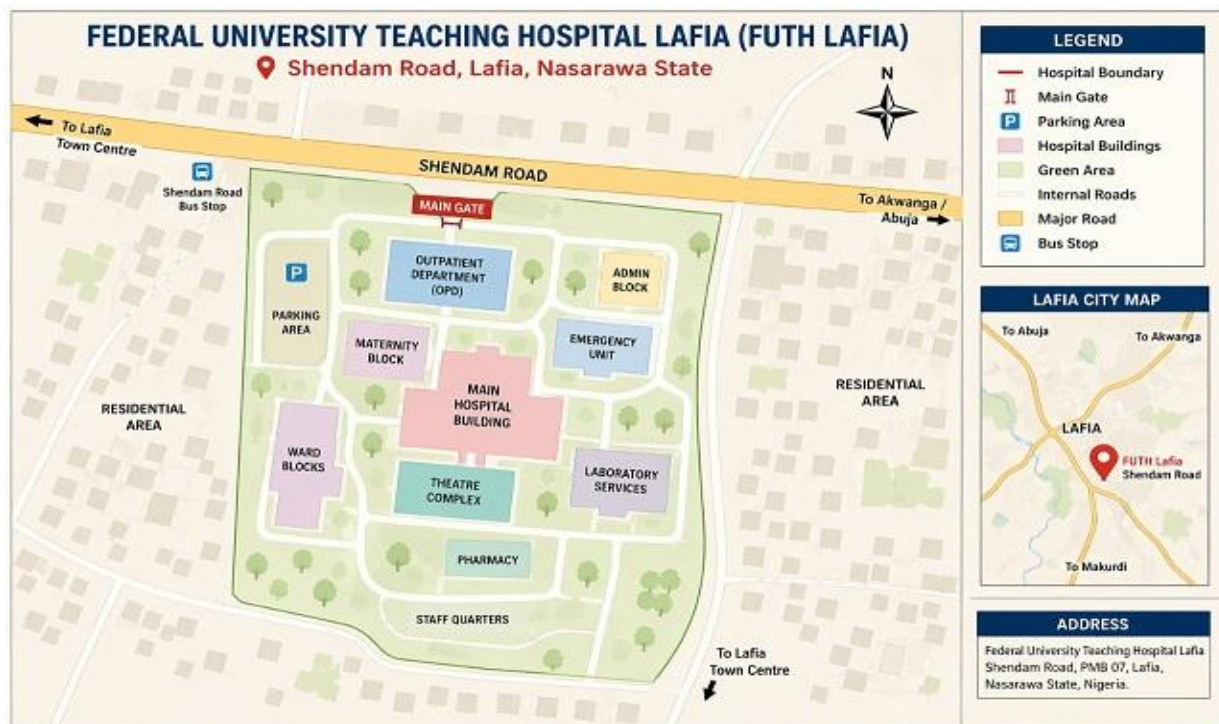


Figure 1: Map of Federal University of Lafia Teaching Hospital (Source: Google Image)

Study population

The study population comprised all patients admitted to FULAFIA TH with a confirmed diagnosis of typhoid fever between 2021 and 2025.

Inclusion and exclusion criteria

The inclusion criteria include patients with laboratory confirmed typhoid fever, complete demographic and clinical records. While the exclusion criteria include incomplete records and clinically suspected and clinical records.

Sample size and sampling technique

A total of 72 confirmed cases were included. A total enumeration sampling technique was used, where all eligible cases within the study period were analyzed.

Data source

The data used in this study were secondary data obtained from hospital records, including admission registers, patient case files and laboratory confirmation records. No new experimental procedures were



conducted. All data analyzed were routinely collected clinical records from the hospital.

Data collection procedure

Data were extracted manually from hospital records using a structured data collection form. The following variables were collected include age, number of confirmed cases, number of deaths and year of admission.

Variables of the study

The variables are independent variable which is the age group of patients and the dependent variables used are morbidity (number of cases), mortality (number of deaths), cases fatality rate and annual incidence of typhoid fever.

Method of data analysis

Data collected were analyzed using descriptive statistics. Frequencies and percentages were used to summarize the data. Case Fatality Rate (CFR) was calculated using the formula:

$$CFR (\%) = (\text{Number of deaths} / \text{Number of confirmed cases}) \times 100$$

Results were presented using tables and charts to show distribution across age groups and years.

Ethical consideration

Ethical approval was obtained from the hospital management with reference number (FUTHREC/677). Confidentiality of patient information was maintained by ensuring that no personal identifiers were included in the data collection process.

Results and Discussion

The results presented in this study were derived from retrospective analysis of hospital records obtained from the Federal University of Lafia Teaching Hospital. No experimental or laboratory procedures were conducted by the researchers. All findings are based on documented clinical and laboratory-confirmed cases recorded within the study period.

Demographic distribution of typhoid morbidity and mortality

The demographic analysis reveals a disproportionate burden of typhoid fever across different age cohorts at the Federal University of Lafia Teaching Hospital (FULAFIA TH). A total of 72 cases were documented during the study period. The data indicates that the highest prevalence of typhoid morbidity occurred in the 21–30 age group, which accounted for 18 cases (25 % of total morbidity). This was closely followed by the pediatric population (0–10 age group) with 12 cases (16.7 %) (Fig. 2).

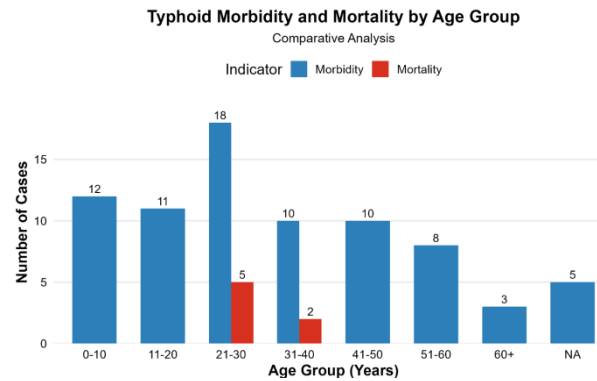


Figure 2: Distribution of typhoid morbidity and mortality across age groups

Significantly, mortality was exclusively concentrated within the young to middle-aged adult populations. The 21–30 and 31–40 age brackets were the only groups to record fatalities, with 5 and 2 deaths respectively. This concentration suggests that while the disease affects all ages, the clinical outcomes are markedly more severe in the 21–40 year range (Table 1).

Table 1: Distribution of typhoid morbidity and mortality by age group

Age Group	Morbidity (Cases)	Mortality (Deaths)
0–10	12	0
11–20	11	0
21–30	18	5
31–40	10	2
41–50	10	0
51–60	8	0
60+	3	0
Total	72	7

Case fatality rate (CFR) by age group

To evaluate the clinical severity and risk associated with different life stages, the Case Fatality Rate (CFR) was calculated. The findings demonstrate a sharp peak in the 21–30 age group, which exhibited a CFR of 27.8 % (Fig. 3). This indicates that nearly one out of every four patients in this age group succumbed to the infection. The 31–40 age group followed with a CFR of 20 %. In stark contrast, all other age categories (0–20 and 41–60+) maintained a 0 % CFR, suggesting a unique vulnerability or perhaps a delay in seeking medical intervention among the young adult population in Lafia.

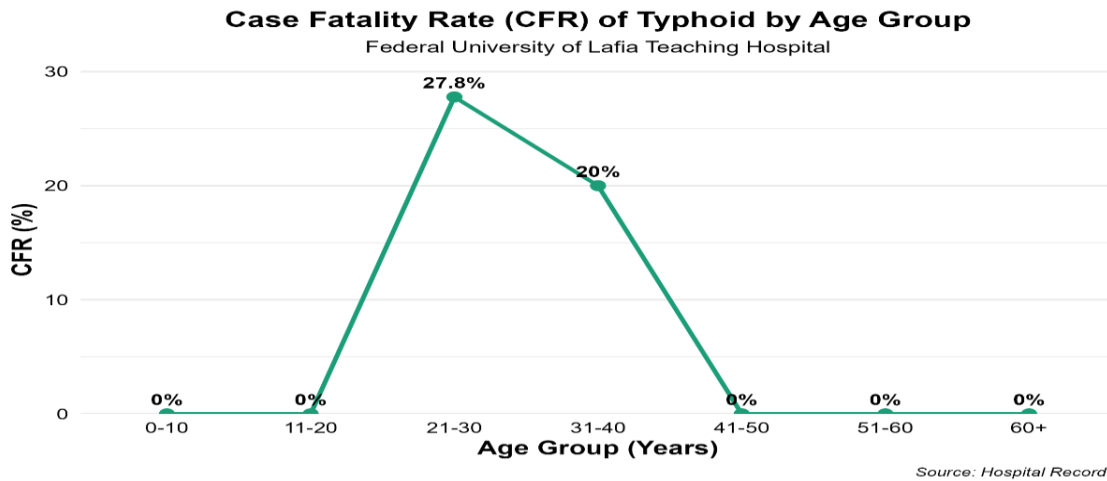


Figure 3: Age-specific case fatality rate at FULAFIA Teaching Hospital annual trends in typhoid incidence (2021–2025)

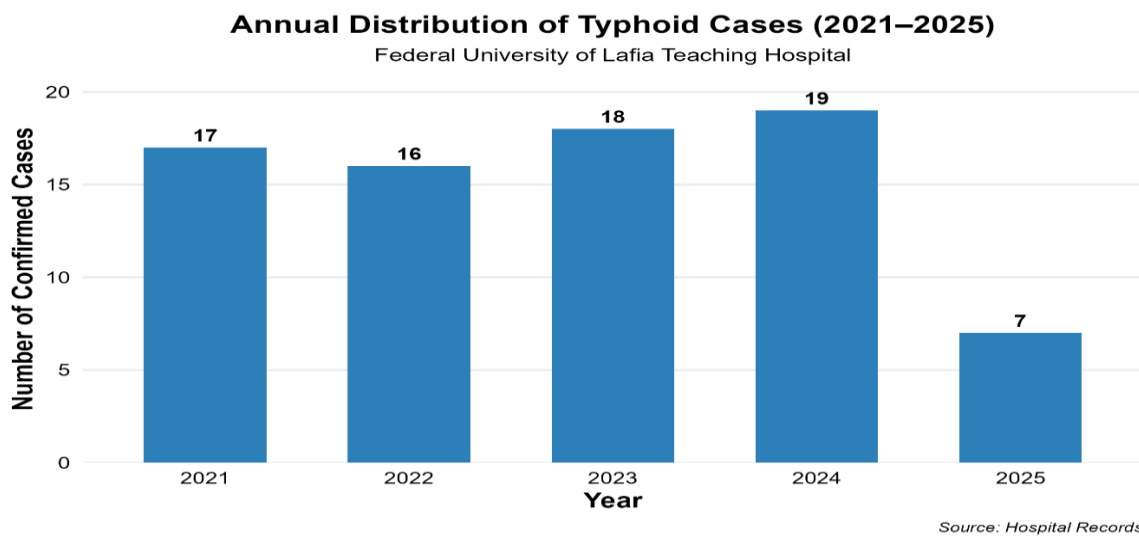


Figure 4: Annual trends of confirmed typhoid cases (2021–2025)

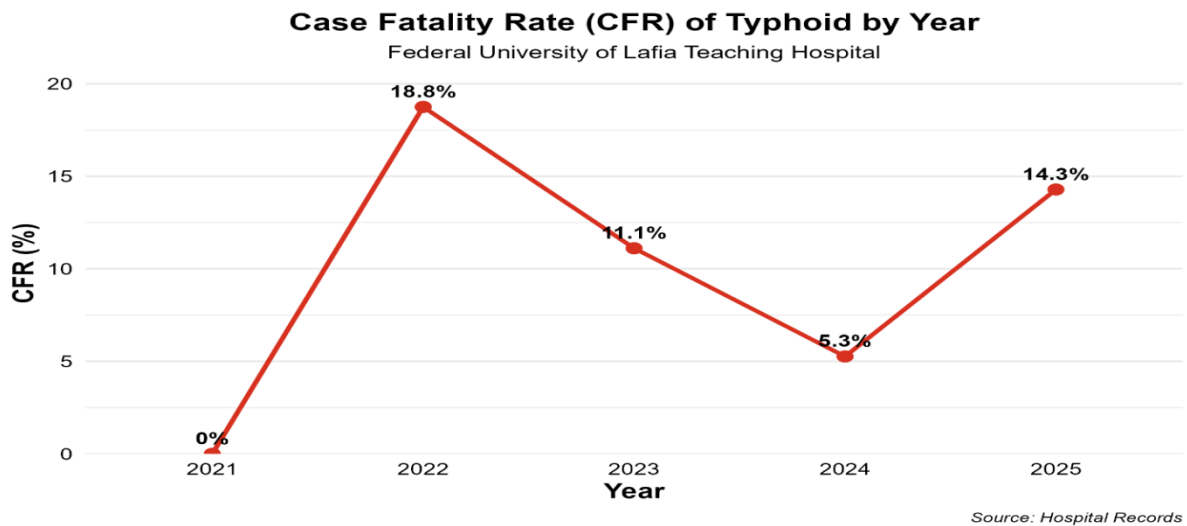


Figure 5: Fluctuations in annual case fatality rates



The longitudinal data from 2021 to 2025 show that typhoid fever remains endemic within the region. Between 2021 and 2024, the annual incidence remained high and relatively stable, fluctuating between 16 and 19 confirmed cases (Fig. 4). The peak incidence was recorded in 2024 with 19 confirmed cases. While the data for 2025 shows a drop to 7 cases, this may reflect a partial reporting period rather than a definitive decline in transmission.

The annual CFR data highlights significant volatility in treatment outcomes. Although 2021 recorded zero mortality, a dramatic surge occurred in 2022 (18.8 % CFR). While the rate trended downward toward 2024 (5.3 %), the recent rebound in 2025 to 14.3 % is a concerning indicator of shifting disease dynamics or healthcare challenges (Fig. 5, Table 2).

Table 2: Annual case fatality rate and total cases (2021–2025)

Year	Confirmed Cases	Case Fatality Rate (%)
2021	17	0
2022	16	18.8
2023	18	11.1
2024	19	5.3
2025	7	14.3

The results of this study underscore a significant public health challenge at the Federal University of Lafia Teaching Hospital. The high morbidity and mortality observed in the 21–30 age group (CFR 27.8 %) is particularly alarming. This demographic typically represents the most productive segment of the population, often consisting of university students and mobile young professionals. Their high infection rate may be linked to lifestyle factors common in university environments, such as frequent consumption of street food and reliance on potentially contaminated community water sources.

The zero percent mortality observed in the 0–10 age group, despite high morbidity (12 cases), suggests that pediatric cases may be identified and managed more aggressively or that parental supervision leads to earlier clinical presentation. Conversely, the high CFR in adults (21–40) might be a result of “self-medication” practices—common in Nigerian urban centers—which can mask symptoms until intestinal perforation or other severe complications occur.

The annual trends reveal a concerning pattern: while the number of cases peaked in 2024, the severity (CFR) was highest in 2022 and has surged again in 2025. This fluctuation in fatality rates, despite relatively stable case numbers, suggests that environmental factors, such as seasonal flooding or changes in the local water table in Lafia, may be influencing the virulence of *Salmonella typhi*. Furthermore, the rising CFR in 2025 could indicate the emergence of antimicrobial resistance, a

growing global threat that makes standard treatment regimens less effective.

Conclusion

This study demonstrates that typhoid fever remains a significant cause of morbidity and mortality among admitted patients at FULAFIA Teaching Hospital, with a disproportionately high burden among young adults aged 21–40 years. The observed variation in case fatality rates across years suggests inconsistencies in disease severity, healthcare access, or treatment outcomes.

The study contributes localized hospital-based epidemiological evidence, which is currently limited in Lafia. This represents a novel contribution, as it provides age-specific mortality patterns and temporal trends essential for targeted interventions. The findings highlight the urgent need for improved access to clean water, early diagnosis and treatment, public health awareness programs, monitoring of antimicrobial resistance.

Conflict of interest: The authors declare no conflict of interest.

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