

A Retrospective Analysis of GeneXpert-Detected Tuberculosis and Rifampicin Resistance in a DOTS Clinic of Yobe State University Teaching Hospital Damaturu, Yobe state, Nigeria.Banimoh, O, B.¹, Maktep, Y, D¹. Muhammed, S.¹ Joseph, I, .N. ², Gana,M,L.³¹Department of medical microbiology and parasitology, Yobe State University Teaching Hospital, Damaturu, Yobe State, Nigeria.²Department of Obstetrics and Gynaecology, yobe state university teaching hospital Damaturu, Yobe state, Nigeria.³Department of Community Medicine, Yobe State University Teaching Hospital, Damaturu, Yobe State, Nigeria.**Corresponding author: Dr Bello Ozovehe Banimoh, Email: drbellobanimoh@gmail.com**<https://dx.doi.org/10.4314yomj.v2i2.5>

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Abstract

Background: Tuberculosis (TB) remains a major public health problem in Nigeria, with increasing concerns about rifampicin-resistant TB (RR-TB). The Xpert MTB/RIF assay is routinely used for rapid detection of *Mycobacterium tuberculosis* (MTB) and rifampicin resistance in Directly Observed Treatment Short-course (DOTS) clinics, but local data from Yobe State are scarce. This study aimed to determine the prevalence of Xpert MTB/RIF-detected TB and rifampicin resistance among the DOTS clinic patients. **Methods:** A retrospective review of DOTS clinic and Xpert MTB/RIF registers was conducted from January 2023 to December 2025. *The study utilized only laboratory-based data. The laboratory samples were sputum specimens submitted for Xpert MTB/RIF assay.* All patients with presumptive TB who had Xpert testing during the study period were included. Data on age, sex, test date, MTB result, and rifampicin resistance were extracted. Data were analyzed using SPSS version 26.0 (IBM Corp, Armonk, NY, USA). Associations were assessed using chi-square or Fisher's exact tests. Multivariate binary logistic regression identified independent predictors. Statistical significance was set at $p < 0.05$. **Results:** Of 386 individuals with presumptive tuberculosis, MTB was detected in 153 (39.6%). Among MTB-positive cases, 33 (21.6%) had rifampicin resistance. Males constituted 63.5% of participants, and 25.9% were aged 21–30 years. On multivariate analysis, age 21–30 years (AOR = 2.31, 95% CI: 1.10–4.84, $p = 0.027$), age 31–40 years (AOR = 2.22, 95% CI: 1.02–4.83, $p = 0.045$), and male gender (AOR = 1.56, 95% CI: 1.01–2.43, $p = 0.046$) were independently associated with MTB detection. No significant predictors of rifampicin resistance were identified. **Conclusion:** There is a high burden of TB and considerable RR-TB among patients attending the DOTS clinic at YSUTH. Young adult males had higher odds of MTB detection. Findings highlight the need to strengthen TB control measures, expand rapid molecular diagnostics, and enhance RR-TB surveillance in Yobe State.

Keywords: Tuberculosis; Rifampicin resistance, Xpert MTB/RIF, Nigeria, DOTS, Retrospective study

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Introduction

Tuberculosis (TB) is an infectious disease caused by a highly contagious infectious bacterium called *Mycobacterium tuberculosis* with droplet inhalation as the major route of transmission (1). Tuberculosis (TB) remains a public health challenge in Nigeria and sub-Saharan Africa, Nigeria is known to be among the World Health Organization high TB burden countries (1). Despite the availability of highly effective treatment regimens and reliable rapid diagnostics, >10 million new cases of TB are estimated to occur every year (2).

A major obstacle to reducing the burden of tuberculosis (TB) is the ongoing transmission of infection (2). Most TB transmission studies rely on detecting *Mycobacterium tuberculosis* (MTB) from patient-derived samples such as sputum or bioaerosols generated by an active TB patient at a single time-point (2). However, a major limitation of this approach is that infectious individuals often remain undiagnosed for several weeks to months, during which transmission may occur across multiple community and healthcare settings (3). This makes it difficult to accurately identify locations and patterns of transmission. Consequently, reliance on point-in-time patient sampling may underestimate the true extent of transmission, contribute to sustained community spread, and delay targeted public health interventions (2). In this context, retrospective analyses of routinely generated diagnostic data, such as GeneXpert MTB/RIF results from DOTS clinics, provide valuable insights into trends in TB detection and rifampicin resistance, thereby supporting improved surveillance and programmatic TB control efforts (2). Rifampicin-resistant TB poses a serious threat to TB control due to poor treatment outcomes and increased transmission (3).

Early detection of TB and rifampicin resistance is therefore essential (3).

According to the World Health Organization, an estimated 10.6 million people developed TB globally in 2022, with over 1.3 million TB-related deaths (4). In 2023, an estimated 10.8 million individuals fell ill with TB. (5) The number of newly diagnosed and reported TB cases was 8.2 million, the highest ever recorded, the 2024 WHO Global TB Report highlights the return of tuberculosis (TB) as the leading infectious killer posing substantial public health threats (5).

Sub-Saharan Africa bears a disproportionate burden, largely driven by HIV co-infection and socioeconomic factors (6). Nigeria is among the eight countries that account for more than two-thirds of the global TB burden, with persistent challenges in case detection and treatment outcomes (4).

The early and accurate diagnosis of TB remains critical for disease control. However, conventional smear microscopy has limited sensitivity, particularly in patients with low bacillary loads, leading to missed or delayed diagnoses (7). Furthermore, undetected drug resistance contributes to ongoing transmission and poor treatment outcomes (7).

Since the revolutionary introduction of the Gene Xpert *Mycobacterium tuberculosis*/resistance to rifampicin (MTB/RIF) assay into the field of diagnostic techniques for Tuberculosis (TB), it has been gaining increasing popularity as it offers of MTB detection together with RIF–Resistance in almost two hours with high accuracy, allowing physicians to customize appropriate and accurate treatment regimens without time delay (8).

The GeneXpert MTB/RIF assay is a rapid molecular diagnostic tool recommended by the WHO for the detection of *Mycobacterium tuberculosis* and rifampicin resistance (8).

Although GeneXpert testing is routinely performed at the DOTS clinic of Yobe State University Teaching Hospital, systematic analysis of generated data has not been adequately documented. This study seeks to retrospectively analyze existing GeneXpert records to provide local evidence that will inform TB control strategies and drug-resistant TB surveillance.

This study aimed to retrospectively analyze GeneXpert-detected tuberculosis cases and rifampicin resistance patterns among patients attending the DOTS clinic at Yobe State University Teaching Hospital over a three year period.

Aim of the Study:

To assess the prevalence of GeneXpert-detected tuberculosis and rifampicin resistance among patients attending the DOTS clinic of Yobe State University Teaching Hospital.

Specific Objectives

1. To describe the sociodemographic characteristics of patients tested for TB
2. To determine the proportion of patients with GeneXpert-detected Mycobacterium tuberculosis.
3. To determine the prevalence of rifampicin resistance among GeneXpert-positive TB cases.
4. To determine factors associated with GeneXpert-detected MTB and rifampicin resistance

Methodology:

Study Design

This is a retrospective cross-sectional study.

Study Setting

The study was conducted at the Directly Observed Treatment Short-course (DOTS) clinic of Yobe State University Teaching Hospital, Damaturu, Yobe State, Nigeria.

Study Population

The study included all patients with presumptive tuberculosis who underwent GeneXpert MTB/RIF testing at the Directly

Observed Treatment Short-course (DOTS) clinic of Yobe State University Teaching Hospital, Damaturu, between January 2023 and December 2025. Patients with complete GeneXpert MTB/RIF results were included in the analysis, whereas records with incomplete or missing key information, including MTB detection or rifampicin resistance status, were excluded.

Study Period

January 2023 to December 2025.

Sample Size Determination

All eligible GeneXpert MTB/RIF records within the study period were included. All 386 eligible records meeting inclusion criteria during the study period were included, representing total sampling.

Data Collection Method

Data were extracted solely from laboratory-based records at the DOTS clinics of Yobe State University Teaching Hospital.

The primary source was the GeneXpert MTB/RIF laboratory register (paper-based and electronic) maintained in the TB laboratory. The secondary source for cross-checking demographic details was the accompanying GeneXpert laboratory request forms filled at the time of sputum sample submission. The laboratory specimens were sputum samples submitted for GeneXpert testing.

Data were extracted using a structured data extraction checklist. Variables extracted were patient age, sex, date of sample testing, GeneXpert MTB detection result (detected/not detected), and rifampicin resistance status (detected/not detected/indeterminate). To ensure data quality and accuracy, 10% of the extracted records were independently validated by a second reviewer against the original laboratory register and request forms, with discrepancies resolved by consensus.

Laboratory Methods

GeneXpert MTB/RIF testing was performed as part of routine patient care according to the manufacturer's instructions(9). The assay

detects *Mycobacterium tuberculosis* complex DNA and mutations in the *rpoB* gene associated with rifampicin resistance (10). The diagnosis of tuberculosis and rifampicin resistance was based on results obtained from the GeneXpert MTB/RIF assay conducted at the DOTS clinic in accordance with the guidelines of the National Tuberculosis and Leprosy Control Programme (NTBLCP), Nigeria(9). The GeneXpert MTB/RIF assay is a World Health Organization-endorsed, cartridge-based nucleic acid amplification test routinely used under the NTBLCP for the detection of *Mycobacterium tuberculosis* complex and rifampicin resistance(9,11). All tests were performed as part of standard patient care by trained laboratory personnel prior to this study (11). The entire laboratory procedure was performed using biosafety measures according to the standard laboratory protocol. The interpretation of data from the MTB/RIF tests was software-based and not user-dependent (13). The researchers had no role in specimen collection, testing, or result generation. Data used for this study were extracted retrospectively from the DOTS clinic register without personal patient identifiers

Data Management and Analysis

Extracted data was anonymized and entered into a password-protected computer. Data analysis was performed using SPSS version 26. Descriptive statistics was used to summarize the variables. Associations between categorical variables were assessed using chi-square tests, with statistical significance set at $p < 0.05$.

Results:

Sociodemographic characteristics of the study population

A total of 386 individuals with presumptive tuberculosis (defined per National TB guidelines as individuals with cough ≥ 2 weeks with or without fever, weight loss, night sweats, or history of contact with a known TB case) (14), whose sputum samples

were tested using GeneXpert MTB/RIF assay were included in this analysis. Males constituted majority of the study population [245, 63.5%], while females accounted for 141 [36.5%]. The age of participants ranged from ≤ 20 to >60 years. The most represented age group was 21–30 years with 100 [25.9%] participants, followed by 31–40 years with 74 [19.2%]. Participants aged ≤ 20 years accounted for 61 [15.8%], 41–50 years 53 [13.7%], 51–60 years 50 [13.0%] and >60 years 48 [12.4%] [Table 1].

Prevalence of *Mycobacterium tuberculosis*

Of the 386 sputum samples tested, *Mycobacterium tuberculosis* [MTB] was detected in 153 samples, giving an overall prevalence of 39.6% [Table 2].

Prevalence of rifampicin resistance

Among the 153 GeneXpert MTB-positive cases, rifampicin resistance was detected in 33 cases, representing a prevalence of 21.6%, while 120 [78.4%] were rifampicin sensitive [Table 3].

Factors associated with MTB detection and rifampicin resistance

On bivariate analysis, there was no statistically significant association between age group and MTB detection [$p = 0.126$] or rifampicin resistance [$p = 0.898$]. Similarly, gender was not significantly associated with MTB detection [$p = 0.055$] or rifampicin resistance [$p = 0.713$], although a higher proportion of males [43.3%] had MTB detected compared to females [33.3%] [Table 4].

On multivariate binary logistic regression, after adjusting for gender, age groups 21–30 years [AOR = 2.31, 95% CI: 1.10–4.84, $p = 0.027$] and 31–40 years [AOR = 2.22, 95% CI: 1.02–4.83, $p = 0.045$] were independently associated with MTB detection compared to those aged >60 years as reference. Male gender was also independently associated with MTB detection [AOR = 1.56, 95% CI: 1.01–2.43, $p = 0.046$] compared to female gender [Table 5].

For rifampicin resistance, none of the variables assessed were significant predictors on multivariate analysis. Age group 21–30 years [AOR = 2.06, 95% CI: 0.40–10.57, $p = 0.387$], 31–40 years [AOR = 1.27, 95% CI: 0.22–7.25, $p = 0.787$] and male gender [AOR = 0.82, 95% CI: 0.35–1.91, $p = 0.684$] showed no significant association with rifampicin resistance [Table 5].

HIV status was documented on the laboratory request forms in only 1 case and was therefore excluded from bivariate and multivariate analyses due to substantial missing data and because it was not part of the study objectives.

Socio-demographic characteristics of individuals with presumptive TB whose sputum samples were tested using Xpert MTB/RIF (N=386)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	245	63.5
Female	141	36.5
Age group (years)		
≤20	61	15.8
21–30	100	25.9
31–40	74	19.2
41–50	53	13.7
51–60	50	13.0
>60	48	12.4

Table 2: Prevalence of MTB among presumptive TB cases (Objective 1) (N=386)

GeneXpert MTB result	Frequency (n)	Percentage (%)
Detected	153	39.6
Not detected	233	60.4
Total	386	100.0

Table 3: Prevalence of rifampicin resistance among MTB-positive cases (Objective 2) (N=153)

Rifampicin resistance	Frequency (n)	Percentage (%)
Detected	33	21.6
Not detected	120	78.4
Total	153	100.0

Table 4: Bivariate association between socio-demographic variables and MTB detection and rifampicin resistance (Objective 3)

Variable	MTB Detected n (%)	MTB Not Detected n (%)	RIF Resistant n (%)	RIF Not Resistant n (%)	p-value (MTB / RIF)
Age group					0.126 / 0.898 *
≤20	24 (39.3)	37 (60.7)	5 (20.8)	19 (79.2)	
21–30	47 (47.0)	53 (53.0)	12 (25.5)	35 (74.5)	
31–40	34 (45.9)	40 (54.1)	6 (17.6)	28 (82.4)	
41–50	20 (37.7)	33 (62.3)	4 (20.0)	16 (80.0)	
51–60	14 (28.0)	36 (72.0)	4 (28.6)	10 (71.4)	
>60	14 (29.2)	34 (70.8)	2 (14.3)	12 (85.7)	
Gender					0.055 / 0.713 *
Male	106 (43.3)	139 (56.7)	22 (20.8)	84 (79.2)	
Female	47 (33.3)	94 (66.7)	11 (23.4)	36 (76.6)	

* Fisher's exact test / Chi-square test. HIV status excluded due to incomplete documentation and not being part of study objectives.

Table 5: Multivariate binary logistic regression analysis of factors associated with MTB detection and rifampicin resistance (Objective 3)

Variable	MTB B AOR	95% CI	p-value	RIF AOR	95% CI	p-value
Age group (years)						
≤20	1.709	0.757 – 3.859	0.197	1.544	0.256 – 9.314	0.636
21–30	2.305	1.098 – 4.842	0.027	2.058	0.401 – 10.614	0.387

					10.56 8	
31–40	2.21 6	1.017 –	0.04 5	1.27 2	0.223 –	0.78 7
		4.830			7.247	
41–50	1.56 0	0.673 –	0.30 0	1.43 0	0.221 –	0.70 8
		3.613			9.248	
51–60	1.05 3	0.434 –	0.91 0	2.40 3	0.361 –	0.36 4
		2.552			15.98 0	
>60	1 (Ref)	–	–	1 (Ref)	–	–
Gender						
Male	1.56 4	1.007 –	0.04 6	0.82 2	0.354 –	0.68 4
		2.429			1.908	
Female	1 (Ref)	–	–	1 (Ref)	–	–

AOR: Adjusted Odds Ratio; Ref: Reference category; CI: Confidence Interval

DISCUSSION

The study assessed the prevalence of GeneXpert-detected tuberculosis and rifampicin resistance among patients attending the DOTS clinic of Yobe State University Teaching Hospital, Yobe State, Nigeria. The findings revealed a high prevalence of tuberculosis and a considerable burden of rifampicin resistance among MTB-positive patients, consistent with the epidemiological profile of high TB-burden regions in Africa (15,16).

The prevalence of GeneXpert-detected MTB observed in this study was 39.6%, which is higher than the 22.7% reported in a 9-year retrospective study conducted in Maiduguri, North-East Nigeria, where diagnosis was based primarily on sputum examination (16). Similarly the prevalence obtained in this study was higher than that obtained in a study conducted in National Tuberculosis and Leprosy Training center and referral hospital Zaria north west Nigeria where a prevalence of 23.0% was obtained (17). a significantly lower prevalence was further recorded in a cross sectional study in a District Hospital, North East Ethiopia with a geneXpert detected prevalence of 8.98% (18). Another study conducted in west Bengal India recorded a prevalence of 20.70 % which is

also lower than the prevalence obtained in this study (19).

The disparity in the prevalence is understandable knowing well the genexpert detection is considered more sensitive than sputum examination alone (20). Morealso, a meta-analysis conducted in Ethiopia on the prevalence of Mycobacterium tuberculosis and rifampicin-resistant strains using the GeneXpert MTB/RIF assay reported an overall prevalence of 15%, which is significantly lower than the 39.6% prevalence observed in the present study (21). The higher prevalence that is recorded in this study can be attributed to differences in study setting, population characteristics, TB burden, healthcare access, and diagnostic practices between the two countries (5,14). Additionally, the present study was conducted in a tertiary healthcare facility where patients are more likely to present with advanced disease or strong clinical suspicion of tuberculosis, thereby increasing the likelihood of MTB detection (5,16,21).

This finding indicates a substantial burden of tuberculosis among clinically suspected patients presenting to the DOTS clinic in the study population, consistent with reports from Nigeria that have documented a persistently high prevalence and increasing trend of tuberculosis cases over the years (15).

Furthermore, the high positivity rate may be attributed to the use of GeneXpert testing primarily among symptomatic individuals with strong clinical suspicion of pulmonary tuberculosis, thereby increasing the likelihood of bacteriological confirmation (22).

Similar high MTB detection rates have been reported in several hospital-based studies in Nigeria and other high TB-burden countries in sub-Saharan Africa, reflecting the persistent endemicity of tuberculosis in the region, Nigeria remains one of the countries with the highest TB burden globally and is among the WHO high-burden countries for

tuberculosis, TB/HIV, and multidrug/rifampicin-resistant TB (14).

The relatively high prevalence observed in this study further emphasizes the importance of rapid molecular diagnostic techniques such as GeneXpert MTB/RIF in improving early diagnosis and prompt initiation of treatment (15,19). The World Health Organization continues to recommend molecular rapid diagnostic tests as the initial diagnostic test for tuberculosis because of their superior sensitivity and ability to simultaneously detect rifampicin resistance (23).

The prevalence of rifampicin-resistant tuberculosis among confirmed TB cases 21.6%, which

is concerning and suggests a substantial burden of drug-resistant TB in the study population. This is significantly higher than the overall prevalence of 5.01% reported by Amin et al. in a national health facility-based survey conducted in Egypt (24). Several factors may account for this difference in the disparity of prevalence, Egypt and Nigeria differ considerably in their tuberculosis epidemiology, healthcare infrastructure, and burden of drug-resistant TB such that Egypt has a lower overall TB burden and better TB control indicators compared with Nigeria, which remains one of the WHO high-burden countries for tuberculosis and drug-resistant tuberculosis. More also, the Egyptian study was a national survey involving multiple health facilities and a larger, more representative population, whereas the present study was conducted in the DOTS Clinic of a tertiary referral hospital where more severe, complicated, previously treated, or treatment-failure cases may be concentrated (24). Such referral bias could increase the observed prevalence of rifampicin resistance (1,14,24).

The prevalence of rifampicin-resistant tuberculosis (RR-TB) recorded in this study is comparable to a similar one year retrospective study reported at a tertiary care

hospital in West Bengal, India, where an RR-TB prevalence of 20.86% among confirmed TB cases was documented using the GeneXpert MTB/RIF assay (19). Although the prevalence reported in the Indian study was slightly lower than the 21.6% observed in the present study, the similarity in findings may reflect comparable burdens of drug-resistant tuberculosis among patients presenting to tertiary healthcare facilities, where more complicated and high-risk TB cases are often managed (19).

Furthermore, the prevalence of rifampicin-resistant tuberculosis (RR-TB) observed in this study (21.6%) is relatively lower than 23.4% reported by Olusola Adedeji Adejumo and colleagues among GeneXpert-confirmed tuberculosis patients in a secondary referral hospital in Lagos, Nigeria (25).

The similarity in prevalence estimates despite a relative differences in geographical location and study period may reflect the persistent burden of drug-resistant tuberculosis in Nigeria as a whole (15). Both studies were conducted in referral healthcare facilities where patients with severe disease, treatment failure, relapse, or suspected drug-resistant tuberculosis are more likely to present, thereby increasing the likelihood of detecting rifampicin resistance (15,25). Furthermore, the comparable findings may indicate ongoing challenges in tuberculosis control, including delayed diagnosis, treatment interruption, inadequate treatment adherence, and continued transmission of resistant *Mycobacterium tuberculosis* strains within the community (15,25).

Overall, the discrepancy in this study is most plausibly explained by referral bias rather than a true community surge. As a tertiary referral center, Yobe State University Teaching Hospital concentrates treatment failures, relapses, and complicated TB/HIV cases referred from peripheral DOTS centers, a phenomenon known to overestimate resistance (26). A tertiary facility study in Uganda reported 32.4% RR-TB and

concluded that being conducted at a tertiary referral facility might have overestimated the prevalence of RR owing to referral bias,(27) Furthermore, similar Sahelian and Nigerian referral hospital studies have reported comparable high rates; the rate of detection of *M. tuberculosis* by GeneXpert was 42% and frequency of rifampicin resistance was 20% in Maradi, Niger.(28) Therefore, our 21.6% should be interpreted as a facility-based burden at tertiary level rather than state population prevalence.

The socio-demographic characteristics of the participants showed that males constituted the majority of the study population, accounting for 63.5% of participants. This male predominance is consistent with findings from previous TB studies conducted in Nigeria and globally, similar to this study, there was a marginal to significant male predominance among GeneXpert positive cases in all the studies (15,16,19,24,25), where tuberculosis has consistently been reported to occur more frequently among males than females (20). The reasons for this gender disparity may include greater occupational exposure, increased social interaction, smoking, alcohol use, delayed health-seeking behavior, and differences in healthcare access among males (15,16,19,24,25,29). Biological and immunological factors may also contribute to increased susceptibility among men (29).

The mean age of participants in this study shows that the slightest proportion of participants belonging to the 21–30 years age group, this is in keeping with others similar publication reporting male preponderance indicating that tuberculosis predominantly affects individuals within the economically productive age group (8,9,13,17,24,25).

Although gender did not achieve conventional statistical significance at the bivariate level, male participants demonstrated a higher proportion of MTB positivity compared with females this is consistent with several studies.(13,16,21,24)

Conclusion, this study demonstrated a high prevalence of GeneXpert-detected tuberculosis and a considerable burden of rifampicin resistance among MTB-positive patients attending the DOTS clinic of **Yobe State University Teaching Hospital**. Male gender and younger adult age groups were independently associated with MTB detection, while no significant predictors of rifampicin resistance were identified. These findings underscore the need for strengthened tuberculosis control measures, expansion of rapid molecular diagnostic services, improved adherence monitoring, and enhanced surveillance for drug-resistant tuberculosis in the region.

Limitation; This study has several limitations. First, as this study relied solely on laboratory registers and request forms, clinical information such as patient category [new/relapse/retreatment], treatment history and final treatment outcomes could not be retrieved. Second, HIV status was poorly documented with only 1 positive case, precluding meaningful assessment of TB/HIV association. This may reflect incomplete recording rather than true low prevalence. The absence of detailed clinical, socioeconomic, and behavioral variables limited the assessment of additional factors associated with *Mycobacterium tuberculosis* (MTB) detection and rifampicin resistance. Third, the relatively small number of HIV-positive and rifampicin-resistant cases may have reduced the statistical power of some analyses and limited the precision of the estimates obtained.

Although the study covered multiple years, temporal trend analysis was not performed. This decision was based on the relatively small annual sample sizes, particularly for rifampicin-resistant tuberculosis cases, which could have generated unstable estimates and unreliable year-to-year comparisons. Consequently, trend analysis was avoided to minimize the risk of

overinterpreting findings derived from underpowered data.

Despite these limitations, the study provides valuable local epidemiological evidence on the burden of tuberculosis and the pattern of rifampicin resistance among presumptive tuberculosis patients in Yobe State, thereby contributing important information for tuberculosis control and surveillance efforts in the region.

Informed Consent

Individual informed consent was waived because the study involves retrospective analysis of routinely collected data with no direct patient interaction.

Confidentiality

All data was anonymized prior to analysis. No patient names or unique identifiers were collected. Access to data was restricted to the research team only.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of Yobe State University Teaching Hospital (YSUTH/HREC/EA/020). The study was conducted in accordance with the Declaration of Helsinki and national ethical guidelines.

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This study was self-funded.

Conflict of Interest

The investigators declare no conflict of interest.

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