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# PREVALENCE OF PAEDIATRIC TUBERCULOSIS AND TUBERCULOSIS-HIV CO-INFECTION IN SELECTED HOSPITALS WITHIN KATSINA METROPOLIS, KATSINA STATE, NIGERIA

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**ABSTRACT**

Children represent the second highest-risk group for tuberculosis (TB) in Nigeria, with Katsina State recording the highest prevalence (23%) and a notable recent increase of 42%. TB remains a major opportunistic infection in individuals living with HIV. However, data on paediatric TB and HIV co-infection in Katsina are limited. This study aimed to determine the prevalence of paediatric TB in selected hospitals within Katsina metropolis. A total of 128 children were randomly selected and screened for TB and rifampicin-resistant TB (RR-TB) using the Xpert MTB/RIF Ultra assay. HIV status was assessed using the Determine rapid diagnostic test. Six children tested positive for TB, yielding a prevalence of 4.7%. No cases of RR-TB were detected. The highest prevalence (66.7%) occurred among children aged 5–14 years, with equal distribution between males and females. None of the TB-positive children were co-infected with HIV. Despite existing control efforts, paediatric TB remains a public health concern in the study area, hence the need for strengthened health education, active case finding, and improved access to timely diagnosis and treatment to support TB eradication among children in Katsina.

**Keywords**: Paediatric Tuberculosis, Mycobacterium/TB Gene Xpert (MTB/RIF)

## INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis (MTB), and poses a significant threat to global health due to its high transmissibility. It is one of the 13 major causes of death worldwide (World Health Organisation (WHO) 2023). In 2023, an estimated 10.8 million people were infected with TB worldwide. In 2022 an estimated 1.3million children under 15 years develop TB annually and this accounts for 12% of cases globally. This figure may suggest that paediatric TB is underreported.

Africa is second in terms of TB prevalence across the continents with Nigeria and the Democratic Republic of Congo contributing two-thirds of the global TB burden (WHO, 2020). In Nigeria, a prevalence rate of 4.4% was recorded in 2020 which made the country to be ranked the second of five countries that accounted for more than 50% of global TB cases, after India with a prevalence of 17% (WHO, 2020).

In Nigeria, the prevalence of paediatric TB is 7.9%, making children the second most vulnerable group after those who are human immunodeficiency virus (HIV) positive. According to the Federal Ministry of Health (FMOH) (2019), 37% of TB infections occur in children aged less than five years.

Individuals who have weak immune systems from conditions such as HIV, malnutrition and those on immunosuppressive therapy are more susceptible to active TB upon exposure to MTB (Akanbi et al., 2019). Furthermore, the occurrence of HIV and TB co-infection increases the probability of developing active TB and poses challenges in the management of both diseases (Akanbi et al., 2019).

The utilisation of Xpert MTB/RIF diagnostic techniques has facilitated the identification of TB in paediatric populations (FMOH, 2019), indicating the dissemination of the illness within the community (Tilahun and Gebre-Selassie, 2016). The FMOH (2019) reported that the implementation of Xpert (MTB/RIF) in Katsina State led to significant improvements in TB detection in 2019. The use of Xpert (MTB/RIF) resulted in a significant rise of cases with over 361000 cases reported in 2023 out of which 9% were children and producing 26% increase from the cases in 2022 (Ogunniya et al., 2024) . This study aimed to investigate the prevalence of paediatric tuberculosis in selected hospitals within Katsina Metropolis, Katsina State, Nigeria.

## MATERIALS AND METHODS

### Study Design

The study was a prospective cross-sectional study, carried out in the three main referral hospitals of Katsina state; the Federal Teaching Hospital (FTH), General Hospital, and Turai Umaru Yaradua Maternity and Children Hospital, all located in Katsina Metropolis.

### Sample Size

The sample size was determined using an equation described by Naing et al. (2006) and a prevalence rate of 9.2 % of TB infection reported from a previous study in Gusau, North-west Nigeria by Ilah et al. (2018). The calculated sample size was 128. The participants were randomly recruited in the selected facilities.

### Ethical Approval

Both the Federal Teaching Hospital in Katsina's Ethical Research Committee and the Katsina State Ministry of Health's Health Research Ethical Review Committee granted their approval for this research (Ref. No. FMCNHREC.REG.N003/082012 and MOH/ADM/SUB/1152/1/544, respectively).

**Inclusion Criteria**
Children aged 0-14 years with symptoms of TB who attended the selected hospitals during the research period, and whose parents or guardians agreed to participate in the study and were able to provide stool or sputum samples were recruited.

**Exclusion Criteria**
Children whose parents or caregivers withdrew their consent and those who were unable to provide samples for the purpose of this research were excluded.

**Sociodemographic Characteristics**
The participants' relevant clinical and socio-demographic data were obtained from their medical records and/or from the records of their parents' and caregivers after obtaining their parents' /caregivers' written informed consent, and assuring them of confidentiality.

**Sample Collection**
Sputum or stool samples were collected in a sterile screw-capped container for Xpert MTB/RIF testing. Sputum samples were collected from children who could expectorate, while stools were collected from those who could not. Additionally, blood samples were aseptically collected in plain containers to screen for HIV.

**Xpert MTB/RIF Testing**
The samples collected were processed and subjected to Xpert Ultra (MTB/RIF) for screening in order to detect the presence of MTB, MTB/RIF resistance or its absence. The blood samples collected were centrifuged and serum was used for HIV screening using the first line screening kit; Determine™.

**Data Analysis**
The Stata statistical software was used to analyse the obtained data and the results were presented in tables, and figures.

## RESULTS AND DISCUSSION

**Prevalence of Paediatric TB and RIF Resistant TB among Subjects**
Among the 128 children recruited, six tested positives for TB using the Xpert DNA PCR, giving a prevalence of 4.7%. None had rifampicin resistance. Half of the positive cases were from the General Hospital, Katsina (50%), while the Federal Teaching Hospital and Turai Umaru Yar'adua Maternity and Children Hospital accounted for 33.3% and 16.7%, respectively (Figure 1).

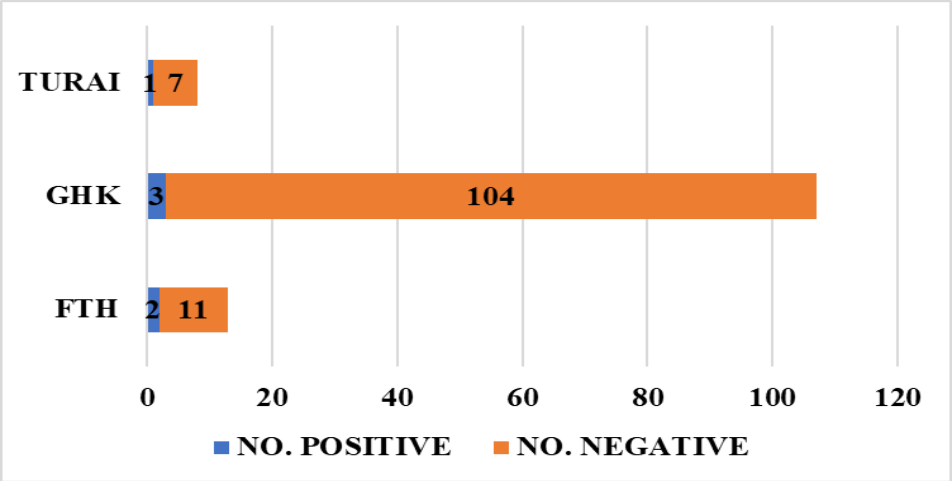


Figure 1: Distribution of Paediatric TB Cases in the Selected Hospitals in Katsina Metropolis

Key: TURAI: Turai Umaru Yar'adua Maternity and Children Hospital, Katsina; FTH: Federal Teaching Hospital; GHK: General Hospital, Katsina.

**Socio-Demographic Characteristics of the Subjects**
The socio-demographic characteristics of the subjects are summarized in Table 1. There were more females than males, and the predominant age group was 5-14 years, with a mean age of 6.13 ± 4.36 years.

**Table 1: Socio-Demographic Distribution of Paediatric TB Patients Attending Selected Hospitals in Katsina Metropolis**

| Variables | n = 128 (%) | Positive TB (%) | Negative TB (%) | P-value |
|---|---|---|---|---|
| ***Gender*** | | | | |
| Male | 55(43) | 3(50) | 52(43.2) | 0.797 |
| Female | 73(57) | 3(50) | 7(56.8) | |
| ***Age*** | | | | |
| 0-4 | 61(47.7) | 2(3.3) | 56(47.5) | 0.499 |
| 5-14 | 67(52.3) | 4(6.0) | 62(52.5) | |
| ***Settlement*** | | | | |
| Rural | 27(21.1) | 3(11.1) | 20(17) | 0.075 |
| Urban | 101(78.9) | 3(3.0) | 98(83) | |

**Discussion**

The prevalence of paediatric tuberculosis (TB) observed in this study was 4.7%, aligning closely with previous findings from Gusau, 4.8% in North-western Nigeria (Mado et al. (2017), and 4.5% from Cameroon (Chiabi et al. (2023). However, a lower prevalence of 2.3% was noted in India (Kumar et al., 2020). On the other hand, higher rates have been documented in South-western Nigeria (Alao et al., 2023), North-central Nigeria (Bello et al., 2021), and Ethiopia (Mirutse et al., 2019).

No cases of rifampicin-resistant TB (RR-TB) were recorded among participants in this study. This finding is consistent with that of Garba et al. (2020), where no RR-TB were recorded among paediatric patients in Sokoto, North-western Nigeria. In contrast, Alao et al. (2023) documented a 2.8% prevalence of RR-TB among MTB-positive children in South-western Nigeria.

There was no significant difference observed in TB prevalence between male and female children in the study. However, previous studies reported a higher prevalence among boys in Gusau (Bello et al. (2021), Nasarawa, and Zaria (Mubarak et al. (2020) consistent with the findings of Abdulkadir and Ibrahim (2018) in Zuru, North-western Nigeria. Our study found no significant difference in TB prevalence across different paediatric age groups.

Our results are in contrast to the previous studies in Sokoto where girls were discovered to have a higher prevalence of TB compared to boys Garba et al. (2020). Furthermore, a female predominance was reported in Ghana (Osei et al. (2020) and Chiabi et al. (2023). These variations where boys seem to be more affected than girls for complex reasons that are not clearly understood Peer et al., (2023).

Other factors that can cause the disparity include immune system differences where the female immune system is stronger than the male or where females have a stronger immune system than males (Gupta et al., 2022). Higher incidences of Paediatric TB in boys than girls were recorded in high income countries among immigrants in Spain and the United Kingdom (Opina et al., 2016). Furthermore, none of the children diagnosed with TB in this study tested positive for HIV. This likely reflects the low HIV prevalence in Katsina State, estimated at around 1%. Supporting this, Ibrahim et al. (2020) reported 0% and 2.78% HIV prevalence among children aged 0–4 and 5–14 years, respectively, in Zuru, Kebbi State. A low prevalence of HIV-TB co-infection in Kano North west Nigeria reported a prevalence 10.5% which is lower than 21.6% in Lagos and 24.8% in Calabar even though these rates vary across regions in the country.

However, Chiabi et al. (2023) reported a 22.1% HIV co-infection rate among children with TB in Bamenda, Cameroon. Even higher rates have been documented in Ghana (40%, Aryee et al., 2018), South-western Nigeria (14.7%, Ogbudebe et al., 2018), Abuja (19.5%, Okechukwu, 2011), and again in Ghana (30.1%, Osei et al., 2020). These discrepancies likely reflect regional variations in overall HIV prevalence, with North-western Nigeria generally exhibiting much lower rates.

Finally, the prevalence of TB in urban and rural settlements were not significant as shown. However, in Brazil a high TB prevalence among urban children in Ceará was reported (Sousa et al.2022). This contrast may be due to methodological differences—Sousa's study was community-based with a larger sample size, while our study was hospital-based with a comparatively smaller cohort.

**CONCLUSION**

Despite ongoing efforts to control tuberculosis, this study demonstrates that paediatric TB remains a significant public health concern in North-western Nigeria. This underscores the urgent need to strengthen health education, enhance contact tracing, ensure early and accurate diagnosis, and improve access to effective treatment—all critical steps toward the eventual elimination of the disease.

Furthermore, pediatric Tuberculosis is major threat to child health worldwide. Therefore, due to the rise in global migration it has become necessary for clinicians in countries with low incidence of the disease to increase awareness. It is necessary for clinicians to encourage vaccination with BCG at birth to all children whose parents originated from countries where the disease is endemic.

Such efforts would limit the spread of the disease and limit morbidity and mortality associated with pediatric TB. Further studies in Pediatric TB are essential to determine the appropriate medication in children. However this can only be successful when funds are provided for such studies. In addition to health campaigns to communities where access to health care is a limited.

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