

Determination of the Prevalence of Tuberculosis among Patients Attending Rivers State University Teaching Hospital (RSUTH)

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ABSTRACT

Tuberculosis (TB) is a communicable disease caused by the bacterium *Mycobacterium tuberculosis*. It is transmitted through airborne particles when individuals with active pulmonary TB cough, sneeze, or speak. Tuberculosis continues to pose a serious threat to public health in Nigeria, with Rivers State being a high-risk area owing to factors such as population density, urbanization and Human Immunodeficiency Virus/Tuberculosis (HIV/TB) co-infection rates. Despite the availability of diagnostic and treatment facilities at Rivers State University Teaching Hospital (RSUTH), there is limited evidence on the actual burden of *Mycobacterium tuberculosis* among patients accessing care at this tertiary institution. This study aimed to determine the prevalence of tuberculosis among patients attending Rivers State University Teaching Hospital (RSUTH). A total of one hundred and eighty-six (186) sputum samples were collected from patients (89 from children and 97 from adults) who presented themselves to RSUTH for tuberculosis screening. The sputum samples were examined using the GeneXpert technique (Cepheid). The results obtained showed that the prevalence rate of tuberculosis among patients who attended RSUTH was 14.5%. The prevalence rate within the children aged 0-14 years was 7.8%, while the prevalence rate within adult population was 20.6%. This study also showed that adults had a significantly higher TB infection rate than children ($p = 0.01$). In conclusion, this study confirms the high burden of tuberculosis within the study population, with a significant disparity in infection rates between adults and children. Necessary preventive measures like avoiding overcrowded space and good personal hygiene should be adopted to prevent the spread of tuberculosis disease.

Keywords: Overcrowding, Tuberculosis (TB), *Mycobacterium tuberculosis*, sputum, HIV/TB co-infection, GeneXpert technique.

Introduction

Tuberculosis (TB) is a communicable disease caused by the bacterium *Mycobacterium tuberculosis*, primarily affecting the lungs but capable of involving other organs. It is transmitted through airborne particles when individuals with active pulmonary TB cough, sneeze, or speak. TB has been a significant global health threat for centuries and continues to be one of the top ten causes of death worldwide, particularly in low- and middle-income countries. According to the World Health Organization (WHO, 2016) an estimated 10.6 million people fell ill with TB in 2022, and 1.3 million died, including 167,000 people living with HIV (Zheng *et al.*, 2024).

Nigeria is classified among the 30 high TB burden countries globally, contributing significantly to the global TB caseload. In 2022, Nigeria accounted for approximately 4.6% of the global TB burden, with an estimated 479,000 new TB cases and 157,000 TB-related deaths, including those co-infected with HIV (Nyaruba *et al.*, 2019). The Nigerian healthcare system faces numerous challenges, including underreporting, diagnostic gaps, limited access to healthcare services, and patient non-adherence to treatment protocols, all of which impede TB control efforts (Adane *et al.*, 2015).

Nigeria is among the 30 countries with the highest TB burden, with Rivers State being a high-risk area.

This is due to obvious risk factors such as rapid urbanisation, high population density, overcrowding, poverty. In addition to these, the high prevalence of HIV infection in Rivers State, increase the risk of TB transmission culminating in high HIV/TB co-infection rates and mortality.

Medical laboratory science plays a pivotal role in TB management through accurate diagnosis, drug susceptibility testing, and monitoring of treatment outcomes (Adane *et al.*, 2015). The introduction of molecular diagnostics such as GeneXpert MTB/RIF has significantly improved TB case detection, especially among HIV-positive individuals and those with drug-resistant TB. Nevertheless, access to these diagnostic tools remains limited in many rural and underserved areas (Diriba and Churiso, 2022).

Despite the availability of diagnostic and treatment facilities at Rivers State University Teaching Hospital (RSUTH), there is limited evidence or data on the actual burden of *Mycobacterium tuberculosis* among patients accessing care at this tertiary institution. This knowledge gap hampers effective surveillance, timely diagnosis, and appropriate resource allocation for TB control. Therefore, determining the prevalence of TB at RSUTH is essential to provide evidence that can guide targeted interventions, strengthen TB control strategies, and support efforts to reduce the disease burden in Rivers State. Establishing the prevalence of TB at RSUTH is justified because it will generate local epidemiological data that can inform health policy, strengthen case detection and improve treatment outcomes. The findings will also provide evidence for a more efficient allocation of resources, targeted interventions, and enhanced awareness programs aimed at reducing transmission and hence the need for this study.

The aim of this study therefore was to determine the prevalence of tuberculosis among patients attending Rivers state university teaching hospital (RSUTH).

Materials and Methods

Study area and Study Population

This Study was conducted in Rivers State University Teaching Hospital, in Port Harcourt, located in Southern Nigeria, within Latitude 4° 42' 00"to 4° 57'

03" North and Longitude 6° 53' 11" to 7° 8' 49" East, occupying an area of approximately 369 km² (WHO, 2023).

Study Design

The study is a cross sectional study and randomly selected from one hundred and eighty six (186) comprising of eighty nine (89) children and ninety seven (97) adults from both gender.

Selection Criteria

Inclusive Criteria

Subjects who reside in Port Harcourt; Patient must be attending Rivers State University Teaching Hospital; Subjects who are not on antituberculosis drugs two weeks before the commencement of the study.

Exclusive Criteria

Patients already on anti-TB treatments; and subjects that do not reside in Port Harcourt.

Ethical Approval

Ethical approval was sought by the ethical committee in the Rivers State University Teaching Hospital Port Harcourt.

Data Collection

A patient form containing questionnaires like age, sex, gender, and residence was given to a patient to fill. An identification number or laboratory number was assigned to link the form with the sample to avoid mix up. Patients were instructed to cough deeply (not saliva) and expectorate into a sterile leak-proof container. Stool was used as a sample for children who could not produce sputum.

Laboratory Analysis for *M. Tuberculosis*

Cepheid GeneXpert (GeneXpert XVI R2, 16modules, 10-color system) was used for analysis of the samples. A specific sample reagent known as Xpert MTB/RIF sample reagent or buffer was added to the container containing the sputum sample and it was mixed properly and carefully. It was allowed to incubate for 15 minutes.

The cartridge was then loaded by transferring a measured volume of the treated sample into the GeneXpert cartridge. The cartridge was placed into the GeneXpert machine and was allowed to read. When it was done reading, the machine made a beep sound and the results were displayed on the computer screen (Sigal et al., 2018).

Statistical Analysis

The percentage and chi square analysis was done using Graph pad prism software version 9.0.

Results

Table 1 shows the prevalence of tuberculosis among children attending Rivers State University Teaching Hospital (RSUTH). Among children under 5 years, 3 (42.86%) were infected and 25 (30.49%) were uninfected out of 28 examined. For ages 5-10 years, 2 (28.57%) were infected and 27 (32.93%) uninfected out of 29 examined, while ages 11-14 years had 2 (28.57%) infected and 30 (36.59%) uninfected out of 32 examined. The p-value of 0.7920 derived indicates there is no significant difference in tuberculosis prevalence across the age groups.

Table 1: Prevalence of Tuberculosis among Children Attending Rivers State University Teaching Hospital (RSUTH)

Age Group	Total No. Examined	Total No. Infected n (%)	Total No. Uninfected n (%)	Chi Square (χ^2)	P-value
< 5 years	28	3 (42.86)	25 (30.49)		
5-10 years	29	2 (28.57)	27 (32.93)		
11-14 years	32	2 (28.57)	30 (36.59)		
Total	89	7 (7.8)	82 (92.1)	0.4664	0.7920

Table 2 showed the prevalence of tuberculosis among adults attending Rivers State University Teaching Hospital (RSUTH). Among adults between 15-30 years, 9 (45%) were infected and 21 (27.27%) uninfected out of 30 examined. For ages 31-45, 6 (30%) were infected and 28 (36.36%) uninfected out of 34 examined, while in 46-65 years, 5 (25%) were infected and 28 (36.36%) uninfected out of 33 examined. The p-value of 0.3013 derived indicates there is no significant difference in tuberculosis prevalence between these adult age groups.

Table 3 revealed that the comparison of tuberculosis prevalence between children and adults attending RSUTH. Among the 89 children, 7 (25.93%) were infected and 82 (51.57%) uninfected, while out of 97 adults, 20 (74.07%) were infected, the total number of prevalence is (14.5%) and 77 (48.43%) uninfected. The p-value of 0.0136 derived indicates a statistically significant difference in TB prevalence between children and adults. This also indicates adults have a significantly higher TB infection rate compared to children in this population.

Table 2: Prevalence of Tuberculosis among Adults Attending Rivers State University Teaching Hospital

Age Group	Total No. Examined	Total No. Infected n (%)	Total No. Uninfected n (%)	Chi Square (χ^2)	P-value
15-30 years	30	9 (45.00)	21 (27.27)		
31-45 years	34	6 (30.00)	28 (36.36)		
46-65 years	33	5 (25.00)	28 (36.36)		
Total	97	20 (20.6)	77 (79.4)	2.399	0.3013

Table 3: Comparison of Tuberculosis Prevalence between Children and Adults Attending RSUTH

Subjects	Total No. Examined	Total No. Infected n (%)	Total No. Uninfected n (%)	Chi Square (χ^2)	P-value
Children	89	7 (25.93)	82 (51.57)		
Adults	97	20 (74.07)	77 (48.43)		
Total	186	27 (14.5)	159 (85.5)	6.084	0.0136

Discussion

Tuberculosis (TB) has contributed to be a significant disease burden and economic loss worldwide and in Nigeria. In this study, the overall prevalence of tuberculosis (TB) among participants was 14.5%. This finding is lesser than that of Ugwu *et al.* (2021) who reported an overall TB prevalence of 21.3% in Enugu. This difference within Nigeria suggests that local factors, like population density, access to healthcare, or specific community outbreaks, can greatly change the impact of the disease. This study's finding is also lesser than the prevalence of 16.5% reported by (2) and 32.2% reported by (1) with both studies carried out in Ethiopia. Also in Ethiopia, Diriba and Churiso (2022) reported an overall prevalence of 26.8% which is higher than this study. Diriba and Churiso, (2022) attributed their finding to illiteracy, cigarette smoking, khat chewing, vaccination, close contact, and being positive for HIV. In two studies from Ethiopia, one study found 16.5% while another found a very high prevalence of 32.2%. This large gap between two studies in the same country could be due to many reasons, such as one study being in a high-risk area like a crowded hospital or a remote community with little healthcare, while the other was in a more general area.

On the other hand, the 14.5% overall prevalence in this study is higher than that of Adhikari *et al.* (2022) who reported a 9.9% prevalence of Tuberculosis in Nepal. The researchers in Nepal connected their lower prevalence to contributing factors like poor nutrition, low living standards due to poverty, and having a family member who also had TB. This reveals social and economic conditions play a crucial role in the spread of TB. The results from these various studies show that the prevalence of tuberculosis (TB) is a significant but uneven health problem across different parts of the world, and even within the same country. The difference in prevalence in the various studies could be due to variation in methodology (the use of culture or GeneXpert) for detection of tuberculosis, study participants, study period, sample size, geography and TB control and prevention practices. These findings reveals TB is not a disease with one single global or national prevalence rate but deeply tied to local and geographical context. The understanding of these differences, the contributing factors to TB spread, and the use of accurate testing

tools are all crucial steps in creating effective plans to control and reduce tuberculosis.

In this study, there was no significant association between children and adults' age groups and TB infection respectively. This is similar with studies conducted in different areas that reported no association between age and TB infection (Diriba and Churiso, 2022). However, different studies reported higher prevalence of TB in age groups ranging from 16 to 45 years (Adane *et al.*, 2025). This apparent contradiction in findings suggests that the connection between age and TB is influenced by social and economic factors that vary from one community to another. In settings where studies found high prevalence in the 16-45 age group, this is likely because this segment of the population is the most economically and socially active.

Furthermore, there was a significant difference in TB prevalence between children and adults which indicates adults have a significantly higher TB infection rate compared to children in this population. However, 42.86% of tuberculosis infected children in this study were under 5 years. Zheng *et al.* (2024) equally reported pulmonary tuberculosis (PTB) patients were significantly younger and associated with higher hospitalization frequency with children aged 1–4 years exhibiting higher risk of PTB and TB meningitis, and children aged 5–12 years had higher risk of extrapulmonary tuberculosis (EPTB) which supports the findings of this study. The notably high infection rate among children under five years old in this study is a serious public health concern.

Conclusion

This study confirms a high burden of tuberculosis within the study population, with a significant disparity in infection rates between adults and children. The alarming prevalence rate among children under five signifies active community transmission and exposes there are critical gaps in current tuberculosis prevention strategies in the study area. These findings highlight the urgent need to enhance contact tracing and provide preventive therapy to vulnerable child contacts of infected adults. Also, tuberculosis control programs must be designed for specific communities such as awareness campaigns, improving testing, nutrition and housing.

Competing Interests

Authors declared that No competing interests exist.

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