

Pattern of Childhood Tuberculosis in a particular Rural Area of Bangladesh

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ABSTRACT

Tuberculosis (TB) remains a significant cause of illness and death among children, especially those under 15 years old. Therefore, this study aimed to assess the types and distribution of childhood TB cases diagnosed at the DOTS center of Kumudini Hospital, a rural tertiary care facility in Mirzapur, Bangladesh. A retrospective cross-sectional study was conducted over the period from January to December 2023. Relevant demographic and clinical data were extracted from patient records and entered manually into Microsoft Excel. Descriptive statistical methods were applied to analyze the data. A total of 42 children were diagnosed. Among them, 26 (61.90%) were male and 16 (38.10%) were female. In terms of TB type, 50% had bacteriologically confirmed pulmonary TB, 40.48% had extra-pulmonary TB, and 9.52% were clinically diagnosed with pulmonary TB. The vast majority, 95.24%, were new cases, with only 4.76% being relapses. These findings revealed that childhood TB in this region predominantly affects older children and presents mostly as confirmed pulmonary TB. The high number of new cases underscores the urgent need for enhanced awareness, timely diagnosis, and community-driven TB control measures to reduce the disease burden among children in rural settings of Bangladesh.

1. Introduction

According to the World Health Organization (2023), tuberculosis (TB) is a bacterial infection caused by *Mycobacterium tuberculosis*, primarily affecting the lungs and transmitted through airborne particles expelled when an infected person coughs or sneezes. Although TB is preventable and curable with modern pharmacological treatments, it remains a leading cause of morbidity and mortality among children worldwide (World Health Organization, 2023; Dodd et al., 2017). Childhood tuberculosis has increasingly become a global public health concern. Diagnosing TB in children is particularly challenging, as it often presents with non-specific symptoms and lacks bacteriological confirmation in most cases, which complicates clinical identification and surveillance efforts (Marais & Graham, 2011). As a result, reliable data on childhood TB trends are scarce in the published literature, especially in resource-limited settings (Cruz & Starke, 2014). However, in regions where the adult TB burden is high, such as sub-Saharan Africa and South Asia, it is presumed that the incidence of childhood TB is also increasing (Yuen et al., 2014). The epidemiology and risk factors for TB in children can vary widely across geographic and socio-economic contexts, influenced by factors such as household exposure, malnutrition, poor ventilation, and HIV co-infection (Nelson & Wells, 2004). The WHO estimates that approximately 11% of all TB cases occur in children under 15 years of age, with the majority concentrated in low- and middle-income countries (LMICs) like Bangladesh (World Health Organization, 2022). Despite the significant burden of TB-related childhood mortality and morbidity, efforts to manage and prevent TB among children have historically received limited attention (Seddon & Graham, 2016).

In rural Bangladesh, TB continues to be a major health threat for children. Although national tuberculosis control efforts have advanced considerably, the diagnosis and treatment of childhood TB remain problematic due to atypical clinical presentations, difficulties in confirming bacteriological diagnosis, and limited access to appropriate diagnostic tools in peripheral health facilities (Hossain et al., 2013; National Tuberculosis Control Program, 2023). Environmental and systemic factors such as malnutrition, crowded living conditions, and delays in accessing healthcare further complicate the control of TB in rural areas (Ahmed et al., 2015). This study aims to assess the current pattern of childhood TB in a rural area of Bangladesh, focusing on demographic, clinical, and diagnostic characteristics of the cases reported at a rural tertiary hospital. By examining these patterns, the study intends to contribute to improved understanding and management of childhood TB within similar low-resource contexts.

2. Objectives

The primary objective of this study is

- to evaluate the types and distribution of childhood tuberculosis (TB) cases diagnosed in a tertiary care hospital located in a rural area of Bangladesh.

The specific objectives are:

- to analyze the age and sex distribution of childhood TB cases.
- to identify the proportion of pulmonary and extra pulmonary TB among children.
- to determine the proportion of bacteriologically confirmed, clinically diagnosed, and relapse cases.
- to assess the diagnostic methods used for confirming TB in children.
- to provide insights for future planning and awareness strategies to prevent childhood TB in rural communities.

3. Literature Review

Tuberculosis (TB) in children remains a significant public health challenge in many developing countries, particularly in rural areas where healthcare access and infrastructure are limited. In high-prevalence nations, childhood TB accounts for approximately 10–15% of the total TB burden (World Health Organization [WHO], 2021). Bangladesh, one of the 30 high TB burden countries, faces unique challenges in the diagnosis and management of childhood TB due to socio-economic constraints, limited healthcare infrastructure, and inadequate community awareness. Several studies have identified disparities in the prevalence and management of childhood TB between rural and urban regions in Bangladesh. Rural areas tend to have higher rates of undiagnosed or late-diagnosed cases, primarily due to barriers such as limited access to healthcare services and insufficient diagnostic tools (Islam et al., 2020). Children in rural Bangladesh often present with nonspecific clinical symptoms, including prolonged fever, weight loss, persistent cough, and lymphadenopathy (Rahman et al., 2019). These nonspecific symptoms, along with the paucibacillary nature of the disease in children, contribute to diagnostic delays. Extra-pulmonary tuberculosis (EPTB), particularly tuberculous lymphadenitis, is more common among children in rural Bangladesh. This trend has been attributed to delayed diagnosis and inadequate *Bacillus Calmette–Guérin* (BCG) vaccination coverage (Rahman et al.,

2019). Traditional diagnostic methods, such as sputum microscopy, lack sensitivity in pediatric populations. Newer diagnostic tools, such as the GeneXpert MTB/RIF assay, have shown promise; however, their availability and utilization in rural settings remain limited (Chowdhury et al., 2020). In Bangladesh, the Directly Observed Treatment Short-Course (DOTS) strategy recommended by the WHO is the standard treatment protocol for TB, including childhood TB. Despite this, treatment adherence in rural regions often suffers due to socio-economic factors such as poverty, long distances to health centers, and limited caregiver education (Kabir et al., 2018). Community health workers play a crucial role in improving treatment adherence and follow-up care, indicating the need for targeted community-based interventions. In conclusion, childhood TB in rural Bangladesh is characterized by delayed diagnosis, a high burden of EPTB, and significant treatment challenges. There is an urgent need for improved diagnostic facilities, enhanced training of rural healthcare providers, and increased public awareness to address the burden of childhood TB in these areas.

4. Methodology

A retrospective cross-sectional study was carried out at the Directly Observed Treatment Short-Course (DOTS) center of Kumudini Hospital, a rural tertiary healthcare facility situated in Mirzapur, Tangail, Bangladesh. The study encompassed one year from January 1 to December 31, 2023. During this time, 299 tuberculosis (TB) cases were diagnosed using a combination of diagnostic methods, including Chest X-ray, GeneXpert MTB/RIF assay, Fine Needle Aspiration Cytology (FNAC), biopsy, and Adenosine Deaminase (ADA) test. From these cases, 42 were identified as childhood TB, defined as TB occurring in individuals under 15 years of age. These 42 pediatric cases were selected purposively for analysis. Relevant demographic and clinical data were extracted from patient records and entered manually into Microsoft Excel. Descriptive statistical methods were applied to analyze the data. This study was approved by the Ethical Review Committee of Kumudini School of Public Health (KSPH/Admin/08/2023) and conformed to the Declaration of Helsinki. Participation of the respondents was voluntary. Informed consent was sought from the respondents at the beginning of the survey, and participants could withdraw from the study at any time.

5. Operational Definitions

- **Childhood Tuberculosis (Child TB):** Tuberculosis occurring in individuals under 15 years of age.

- **Bacteriologically Confirmed Pulmonary TB:** TB diagnosed through the identification of *Mycobacterium tuberculosis* using laboratory techniques such as GeneXpert or sputum microscopy.
- **Clinically Diagnosed Pulmonary TB:** TB diagnosed based on clinical symptoms and radiological evidence in the absence of bacteriological confirmation.
- **Extra-Pulmonary TB:** TB infection occurring in organs other than the lungs, such as lymph nodes, pleura, abdomen, bones, or meninges.
- **New Case:** A patient who has never been treated for TB or has taken anti-TB drugs for less than one month.
- **Relapse Case:** A patient who was previously declared cured or treatment completed and is now diagnosed with a recurrent episode of TB.
- **DOTS:** Directly Observed Treatment Short-Course, a WHO-recommended TB control strategy involving supervised treatment adherence.

6. Findings and analysis

Out of 299 TB cases diagnosed in 2023, 42 (14.05%) were pediatric cases (under 15 years), while 257 (85.95%) involved adults. Among the children, 26 (61.90%) were male and 16 (38.10%) were female, indicating a male predominance. In terms of age distribution, 10 children (23.81%) were in the 0–<5 years age group, while the majority, 32 (76.19%), were aged 5–<15 years. Regarding the types of TB, 21 cases (50.00%) were bacteriologically confirmed pulmonary TB, 17 (40.48%) were extra-pulmonary TB, and 4 cases (9.52%) were clinically diagnosed pulmonary TB, suggesting that the most common form of TB in children was bacteriologically confirmed pulmonary TB. Furthermore, the majority of the pediatric TB cases (38 or 90.48%) were pulmonary, with only 4 cases (9.52%) being extra-pulmonary. Most of the cases (40 or 95.24%) were classified as new cases, while only 2 (4.76%) were identified as relapses. These findings highlight that childhood TB in this rural setting is predominantly pulmonary, affects older children more frequently, and is primarily composed of new cases, underscoring the need for early detection and stronger community-based TB awareness programs.

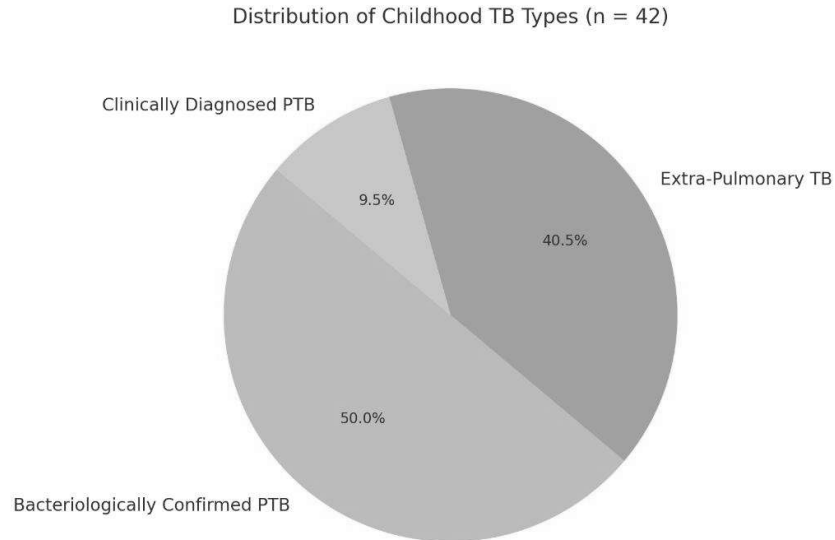


Figure 1. Distribution of Children by TB Types (n=42)

This figure shows that half of pediatric TB cases were bacteriologically confirmed pulmonary TB (50%), with clinically diagnosed pulmonary TB accounting for 40.5%, and extrapulmonary TB making up only 9.5%. The high proportion of confirmed pulmonary cases highlights the utility of laboratory diagnostics (e.g., GeneXpert) in this rural setting, while the relatively low extrapulmonary share may indicate under-detection of non-pulmonary forms.

Table 1: Distribution of TB Cases by adults and children (n=299)

Cases	Frequency	Percentages
Adult \geq 15 years	257	85.95
Child < 15 years	42	14.05
Total	299	100.00

Children constituted 14.1% of all TB cases diagnosed in 2023, aligning with the WHO's estimate that 10–15% of TB cases occur in those under 15. This underscores the importance of pediatric TB surveillance even within predominantly adult caseloads.

Table 2: Distribution of Child TB cases by sex (n=42)

Sex	Frequency	Percentages
Male	26	61.90
Female	16	38.10
Total	42	100.00

A clear male predominance (61.9%) was observed among pediatric TB cases. This may reflect gender-based differences in exposure, healthcare-seeking behavior, or sociocultural factors influencing access to diagnosis.

Table 3: Number and percentage of Child TB cases by age group (n=42)

Age	Frequency	Percentage
0- <5 years	10	23.81
5-<15 years	32	76.19
Total	42	100.00

The majority of childhood TB cases (76.2%) occurred in the 5–<15 years age group, suggesting that school-aged children bear a greater burden in this rural population than those under five.

Table 4: Distribution of Children by TB Types (n=42)

Types of TB Cases	Frequency	Percentage
Bacteriological Confirmed PTB	21	50.00
Clinical Diagnosed PTB	17	40.48
Extrapulmonary TB	4	9.52
Total	42	100.00

Pulmonary TB—both bacteriologically confirmed and clinically diagnosed—comprised over 90% of cases, with extrapulmonary TB accounting for less than 10%. This pattern may reflect both the actual epidemiology and greater diagnostic focus on pulmonary disease in the DOTS center.

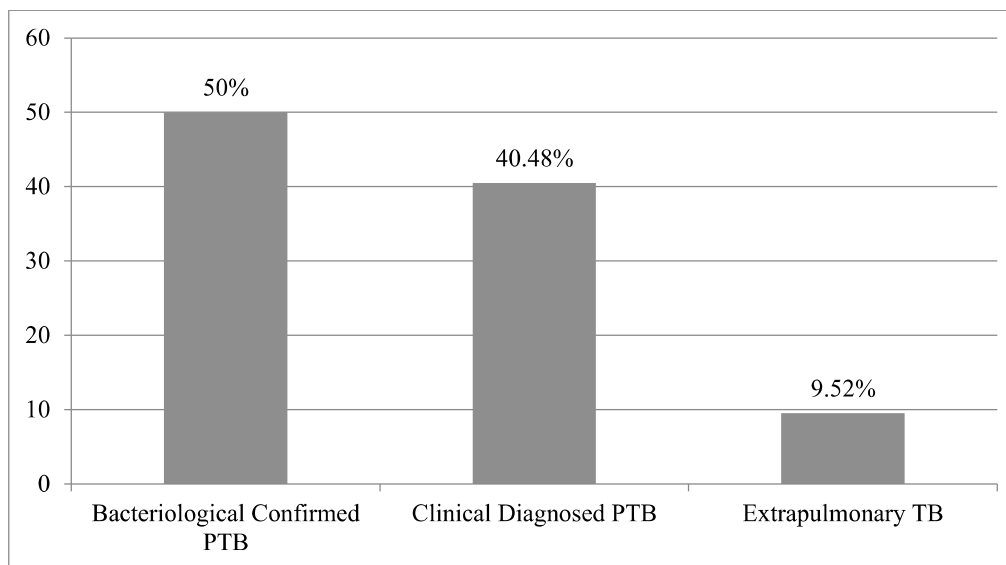


Figure 2. Distribution of Children by TB Types (n=42)

The visual representation corroborates Table 4, emphasizing that half of the cases were laboratory-confirmed pulmonary TB, and highlights potential gaps in detecting extrapulmonary TB.

Table 5: Distribution of Children by Types of TB cases (n==42)

Types of TB cases	Frequency	Percentage
Pulmonary	38	90.48
Extra pulmonary	4	9.52
Total	42	100.00

When grouped broadly, pulmonary TB overwhelmingly predominates (90.5%). Efforts to strengthen extrapulmonary TB diagnosis—such as expanded use of biopsy and FNAC—could improve detection of nodal, pleural, or other forms.

Table 6: Distribution of children by New and Relapse Case (n=42)

Type of cases	Frequency	Percentage
New Case	40	95.24

Relapse Case	2	4.76
Total	42	100.00

The very high proportion of new cases (95.2%) indicates effective primary case finding, while the small relapse rate (4.8%) underscores the need for ongoing adherence support to further minimize recurrence.

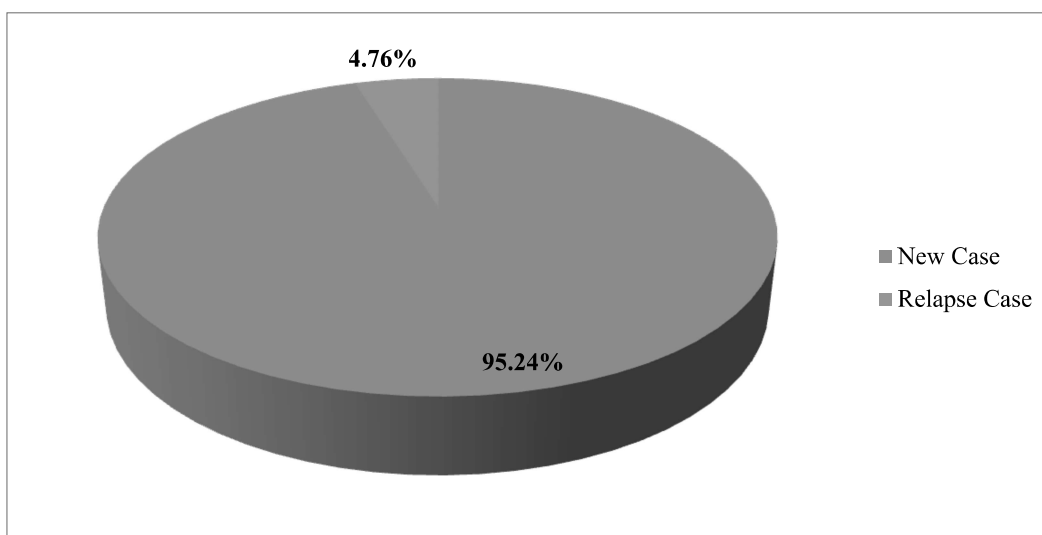


Figure 3: Distribution of children by New and Relapse Case (n=42)

This chart visually reinforces that nearly all pediatric cases are newly detected, pointing to successful initial notification but also highlighting an opportunity to monitor and support those at risk of treatment default or relapse.

7. Discussion

The findings of this study align with the global and national epidemiological patterns of childhood tuberculosis (TB). According to the study findings, childhood TB accounted for 14.05% of the total TB cases, which is consistent with the World Health Organization's estimate that children represent approximately 10–15% of the overall TB burden in high-prevalence countries like Bangladesh (WHO, 2023). This highlights the significant contribution of childhood TB to the national TB control challenge. This study shows that there is a male predominance (61.90%) among the child TB cases, which concurs with findings from similar studies conducted in India (Tsai et al., 2013). However, this contrasts with other research indicating a higher

prevalence among females or a more balanced sex distribution (Karim et al., 2012). These discrepancies may be influenced by sociocultural factors, healthcare-seeking behaviors, and possibly biological differences that warrant further investigation within the Bangladeshi context. The age distribution of TB cases, with the majority (76.19%) in the 5 to <15 years age group, differs from other studies, such as Hasan (2019), which reported a larger proportion of cases in younger children under five years. This variation may be attributable to differences in study settings; our study was conducted in a large tertiary hospital (Kumudini Hospital) in a rural area, whereas Hasan's work was conducted in a smaller secondary-level hospital. Environmental factors, demographic variations, and differing levels of community awareness and health service accessibility could explain this difference, emphasizing the need for more localized epidemiological studies. Regarding TB types, this study found that 50% of childhood TB cases were bacteriologically confirmed pulmonary TB, 40.48% clinically diagnosed pulmonary TB, and 9.52% extra-pulmonary TB. These proportions differ from other Bangladeshi studies, such as Qamruzzaman et al. (2025), which reported a higher incidence of extra-pulmonary TB in urban settings. This suggests potential variations between rural and urban epidemiology of childhood TB, possibly due to differences in healthcare access, diagnostic capabilities, and vaccination coverage. The predominance of pulmonary TB cases in our study may reflect better detection capacity for pulmonary disease or under diagnosis of extra-pulmonary forms in rural settings. This study revealed that 95.24% of childhood TB cases were new cases is encouraging and indicates effective case detection and registration within the studied population. However, the presence of relapse cases, albeit small (4.76%), highlights the need for continued monitoring and support to ensure treatment adherence. Overall, these results emphasize the persistent challenges in childhood TB diagnosis and management in rural Bangladesh, including limitations in bacteriological confirmation, diagnostic delays, and demographic disparities. Strengthening TB control efforts tailored to rural contexts, improving diagnostic infrastructure, and increasing community awareness are critical to reducing childhood TB morbidity and mortality.

8. Conclusion

This study highlights that childhood tuberculosis remains a significant public health concern in rural Bangladesh, with the majority of cases occurring among children aged 5 to under 15 years. Bacteriologically confirmed pulmonary tuberculosis is the most common form observed, and most cases are new rather than relapse. These findings underscore the ongoing burden of childhood TB and the challenges in early detection and management, particularly in rural settings. Addressing these challenges

is critical to improving childhood TB outcomes and advancing national TB control efforts.

9. Recommendations

1. **Enhance Community Awareness:** Implement targeted awareness programs in rural communities to educate caregivers and families about the signs, symptoms, and importance of early diagnosis and treatment of childhood TB.
2. **Strengthen Diagnostic Capacity:** Improve access to and availability of advanced diagnostic tools, such as GeneXpert MTB/RIF, at rural healthcare facilities to facilitate timely and accurate diagnosis of both pulmonary and extrapulmonary TB in children.
3. **Tailored TB Control Strategies:** Develop and implement context-specific TB control interventions that address the unique socio-economic and environmental factors influencing childhood TB in rural Bangladesh.
4. **Further Research:** Conduct comparative studies to explore differences in childhood TB patterns between rural and urban settings, and between secondary and tertiary healthcare centers, to inform evidence-based policy and practice.
5. **Improve Treatment Adherence Support:** Strengthen the role of community health workers and caregivers in supporting treatment adherence to reduce relapse cases and improve treatment outcomes among children with TB.

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