# Age and Gender Specific Pulmonary and Extrapulmonary Tuberculosis in a Rural Area of Bangladesh

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**Abstract**

**Background:**
Tuberculosis (TB) remains a major public health concern in Bangladesh, with significant variability in its demographic, clinical, and management aspects.

**Objective:**
This study aims to assess the age and genderspecific burden of TB in a rural Bangladeshi population, emphasizing diagnostic approaches, symptom variation, and management strategies.

**Methods:**
This retrospective study was conducted from October 1, 2023, to September 30, 2024, at the Directly Observed Treatment, Short Course (DOTS) Centre of Kumudini Hospital, Mirzapur, Tangail, Bangladesh. A total of 429 participants (356 adults, 73 children) were diagnosed and managed under DOTS, with data collected via clinical evaluations, X-rays, MT, GeneXpert, FNAC, and ADA tests, and analyzed using SPSS 26.

**Results:**
Pulmonary TB (PTB) accounted for 53.85% of cases, with 37.30% bacteriologically confirmed and 16.55% clinically diagnosed. Extrapulmonary TB (EPTB) constituted 46.15% of cases, with cervical lymph node TB being the most prevalent subtype (83.33% of EPTB cases). Age distribution showed a higher burden of PTB in individuals aged >65 years (22.50% bacteriologically confirmed and 32.39% clinically diagnosed), whereas EPTB was most frequent among participants aged 25–<35 years (19.70%) and 35–<45 years (18.18%). Gender analysis revealed a male predominance in bacteriologically confirmed PTB (71.88%) and clinically diagnosed PTB (60.56%), while EPTB was more frequent in females (59.09%).

**Conclusion:**
The study reveals age and genderspecific disparities in TB, with older adults mainly affected by PTB and younger adults and females more prone to EPTB, highlighting the need for targeted strategies and improved healthcare access in high-burden areas.

**Keywords:** Tuberculosis, Rural Bangladesh, Pulmonary tuberculosis, Extrapulmonary tuberculosis, Age, Gender

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## Introduction:

Tuberculosis (TB) is a major global health issue, causing many illnesses and deaths. In 2021, it caused 1.6 million deaths and 10.6 million new cases worldwide, per the WHO.[1] TB is curable and preventable, yet it persists due to healthcare gaps and socioeconomic differences, especially in low- and middle-income countries.[1] The Sustainable Development Goals (SDG 3) and WHO's End TB Strategy seek to end the TB epidemic by 2030, focusing on vulnerable populations.[2] Achieving these goals requires understanding and specific methods to control TB in regions with high rates. Bangladesh is one of the 30 high TB burden countries identified by WHO.[3] The country faces unique challenges due to socioeconomic factors, healthcare access disparities, and population density. TB is more common in rural areas than in urban centers due to limited healthcare access, lack of awareness, and widespread poverty.[4] Rural populations in Bangladesh face high TB rates due to delays in diagnosis and treatment, worsened by

infrastructure issues and cultural stigma.[5] Despite progress from initiatives like DOTS, gaps in case detection and treatment adherence remain, indicating a need for new strategies to reach TB elimination goals.[6] Age-specific vulnerability to TB shows a complex pattern affected by biological and social factors. Young children are highly susceptible due to weak immune systems, leading to high mortality rates in LMICs like Bangladesh.[7] Older adults are also vulnerable due to declining immunity and existing health issues like diabetes and chronic obstructive pulmonary disease.[8] Studies show that older people are more affected by TB due to global aging trends and issues in managing TB in this group.[9,10] There is a need for specific data to create targeted TB prevention strategies. Research highlights the differences in TB burden between urban and rural areas, with cities having better healthcare resources while rural areas face delays in diagnosis, higher drug resistance, and limited access to care.[11] In Bangladesh, rural areas have higher rates of smear-positive TB and drug-resistant TB than urban areas.[12,13] Targeted community-based actions using informal healthcare providers and community health workers are needed to improve case detection and treatment adherence in these underserved regions.[14] Existing literature highlights the need to address latent TB infection (LTBI) and its progression to active TB, especially in vulnerable age groups.[7] Children and the elderly are critical for intervention due to their susceptibility to rapid disease progression and severe outcomes. Managing LTBI effectively, along with improving nutrition, vaccination coverage, and reducing indoor air pollution, can significantly reduce the TB burden in these populations.[8,15] This study aims to fill the knowledge gap regarding age and gender differences in the burden of TB in rural Bangladesh. It will identify TB prevalence patterns and factors involved in guiding targeted interventions. The results will help create public health strategies that align with national TB control and global elimination goals.

**Methods:**

This retrospective study took place at the Directly Observed Treatment, Short Course (DOTs) Centre of Kumudini Hospital in Mirzapur, Tangail, Bangladesh, from October 1, 2023, to September 30, 2024 after approved by the Institutional Ethics Committee. The research aimed to assess the burden of tuberculosis (TB) among different age groups in a rural Bangladeshi population, including 429 cases with 356 adults and 73 children (≤15 years). Participants were registered through clinical diagnoses using various diagnostic methods, such as chest X-rays, MT Test, GeneXpert, FNAC, biopsies, and ADA tests, tailored to their age and clinical presentation. Adult participants received further investigations when needed. The DOTs center provided essential treatment and management for all TB cases, highlighting its role in TB control. Data were systematically collected from patient files for demographic, diagnostic, and clinical analysis using SPSS version 26, allowing insights into age-specific, gender-specific, and clinical variations in TB burden.

**Results:**

The study involved 429 participants of various ages. Most were over 65 years old (17.02%), while the smallest group was children aged 0–5 years (3.96%) (p<0.001). The majority identified as Muslim (85.78%) (p<0.001)., and male participants outnumbered females (55.71% vs 44.29%, p=0.036). Most patients were from the outpatient department (76.92%) (p<0.001) (Table-I).

**Table-I: Distribution of Study Population Based on Basic Characteristics (n=429)**

| Basic Characteristics | no. (%) | p-value |
|---|---|---|
| **Age group (Years)** | | |
| 0-<5 | 17(3.96) | |
| 5-<10 | 20(4.66) | |
| 10-<15 | 36(8.39) | |
| 15-<25 | 52(12.12) | |
| 25-<35 | 63(14.69) | <0.001 |
| 35-<45 | 67(15.62) | |
| 45-<55 | 54(12.58) | |
| 55-<65 | 47(10.96) | |
| >65 | 73(17.02) | |
| **Religion** | | |
| Muslim | 368(85.78) | |
| Hindu | 60(13.99) | <0.001 |
| Buddhist | 1(0.23) | |
| **Gender** | | |
| Male | 239(55.71) | 0.036 |
| Female | 190(44.29) | |
| **Source of Patients** | | |
| OPD | 330(76.92) | <0.001 |
| IPD | 99(23.08) | |

GeneXpert testing was a key diagnostic tool, detecting Mycobacterium tuberculosis (MTB) in 30.30% of participants, with 2.33% showing rifampicin resistance, 16.32% of reports showed no MTB detection (p<0.001). Acid-fast bacillus (AFB) microscopy had positive results in 18.65% of cases, while 25.64% were negative (p=0.032). Chest X-rays indicated TB in 58.28% of participants, with significant findings (p<0.001). The Mantoux test (MT) was positive in 9.32% and negative in 4.66% (p=0.045). Fine needle aspiration cytology (FNAC) found TB in 16.32% of cases (p<0.001). Other advanced techniques showed lower detection rates. ESR studies noted elevated levels in 11.66% versus 4.66% with normal ESR (p=0.034). GeneXpert stool tests confirmed MTB in 1.17% of cases, with 3.50% showing no detection (p=0.147) (Table-II).

**Table-II: Distribution of Study Population Based on Diagnostic Approaches (n=429)**

| Diagnostic Approach | no. (%) | p-value |
|---|---|---|
| **GeneXpert** | | |
| MTB Not Detected | 70(16.32) | |
| MTB Detected | 130(30.30) | <0.001 |
| RIF Resistant Not Detected | 90(20.98) | |
| RIF Resistant Detected | 10(2.33) | |
| **AFB Microscopy** | | |
| Positive | 80(18.65) | |
| Negative | 110(25.64) | 0.032 |
| **Chest X-Ray** | | |
| Suggestive of TB | 250(58.28) | <0.001 |
| Normal or Non-Specific Findings | 182(42.42) | |
| **Mantoux Test** | | |
| Positive | 40(9.32) | 0.045 |
| Negative | 20(4.66) | |
| **FNAC Report** | | |
| Positive for TB | 70(16.32) | <0.001 |
| Negative | 30(6.99) | |
| **Pleural Fluid Study** | | |
| Positive for TB | 15(3.50) | |
| Negative | 25(5.83) | 0.083 |
| **Biopsy Report** | | |
| Positive | 12(2.80) | 0.121 |
| Negative | 10(2.33) | |
| **CT Scan Report** | | |
| Suggestive of TB | 22(5.13) | 0.061 |
| Normal or Non-Specific Findings | 20(4.66) | |
| **ESR** | | |
| Elevated ESR | 50(11.66) | 0.034 |
| Normal ESR | 20(4.66) | |
| **Stool for GeneXpert** | | |
| MTB Detected | 5(1.17) | 0.147 |
| MTB Not Detected | 15(3.50) | |

The distribution of tuberculosis (TB) cases by anatomical site highlighted that pulmonary tuberculosis (PTB) accounted for 53.85% of cases, with 37.30% being bacteriologically confirmed (PTB B+) and 16.55% clinically diagnosed. Extrapulmonary tuberculosis (EPTB) constituted 46.15% of cases, indicating a substantial burden of non-pulmonary forms of TB (p<0.001). Among EPTB cases (n=198), cervical lymph node TB was the most common subtype, representing 83.33% of EPTB cases. Other forms of EPTB included tubercular pleural effusion (6.06%), skin TB (4.55%), wound TB (2.02%), bone TB (1.52%), gland TB (1.01%), inguinal TB (1.01%), and spine TB (0.51%). While cervical lymph node TB demonstrated a clear predominance, the distribution of rarer forms of EPTB did not reach statistical significance (p>0.05) (Table-III).

**Table-III: Distribution of TB Cases according to anatomical site involved (n=429)**

| TB Cases | no. (%) | p-value |
|---|---|---|
| PTB (B+) | 160(37.30) | |
| PTB (Clinically Diagnosed) | 71(16.55) | <0.001 |
| EPTB | 198(46.15) | |
| **EPTB (n=198)** | | |
| Tubercular Pleural Effusion | 12(6.06) | |
| Bone TB | 3(1.51) | |
| Cervical Lymph Node TB | 165(83.33) | |
| Gland TB | 2(1.01) | 0.092 |
| Inguinal TB | 2(1.01) | |
| Skin TB | 9(4.55) | |
| Wound TB | 4(2.02) | |
| Spine TB | 1(0.51) | |

The distribution of tuberculosis (TB) cases shows clear differences between males and females. For pulmonary TB, males had 71.88% of confirmed cases, while females had 28.13%. In contrast, for extrapulmonary TB, females accounted for 59.09% of cases, and males 40.91% (Table-IV).

**Table-IV: Gender-Based Distribution of TB Cases (n=429)**

| TB Cases | Gender | |
|---|---|---|
| | Male no. (%) | Female no. (%) |
| PTB (B+) (n=160) | 115(71.88) | 45(28.12) |
| Clinically diagnosed PTB (n=71) | 43(60.56) | 28(39.44) |
| EPTB (n=198) | 81(40.91) | 117(59.09) |

The age-based distribution of tuberculosis (TB) showed differences in different age groups. For bacteriologically confirmed pulmonary TB (PTB B+), the highest rates were in those over 65 years (22.50%), followed by 55–<65 years (18.13%) and 45–<55 years (16.88%). Younger groups (0–<5, 5–<10, and 10–<15 years) had much lower rates. Clinically diagnosed PTB was also highest in the >65 years group (32.39%). Extrapulmonary TB (EPTB) had the highest rates in those aged 25–<35 years (19.70%) and 15–<25 years (17.17%), while older adults aged >65 years contributed 7.07% (Table-V).

**Table-V: Age-Based Distribution of TB Cases (n=429)**

| Age group (Years) | PTB (B+) (n=160) no. (%) | Clinically diagnosed PTB (n=71) no. (%) | EPTB (n=198) no. (%) |
|---|---|---|---|
| 0-<5 | 3(1.88) | 6(8.45) | 8(4.04) |
| 5-<10 | 3(1.88) | 4(5.63) | 13(6.57) |
| 10-<15 | 6(3.75) | 2(2.82) | 28(14.14) |
| 15-<25 | 15(9.38) | 3(4.23) | 34(17.17) |
| 25-<35 | 18(11.25) | 6(8.45) | 39(19.70) |
| 35-<45 | 23(14.38) | 8(11.27) | 36(18.18) |
| 45-<55 | 27(16.88) | 11(15.49) | 16(8.08) |
| 55-<65 | 29(18.13) | 8(11.27) | 10(5.05) |
| >65 | 36(22.50) | 23(32.39) | 14(7.07) |

Differences in TB symptoms were observed between adults and children showed. In adults (n=356), fever was reported by all (100.00%), with night sweats (98.88%) and weight loss (92.98%) following. Cough occurred in 36.80%, and rare symptoms included lumps (30.90%). For children (n=73), fever had an unusual reporting rate of 104.11%. Night sweats appeared in 64.38%, and weight loss in 56.16%. Cough was more common in children (52.05%) compared to adults. Breathlessness was less frequent in children (12.33%), and rare symptoms were absent, while lumps were more frequent in children (43.84%) (Table-VI).

**Table-VI: Symptom Variation Among Adults and Children (n=429)**

| Symptoms | Adults (n=356) no. (%) | Children (n=73) no. (%) | p-value |
|---|---|---|---|
| Cough | 131(36.80) | 38(52.05) | |
| Fever | 356(100.00) | 73(100.00) | |
| Night Sweats | 352(98.88) | 47(64.38) | |
| Weight Loss | 331(92.98) | 41(56.16) | <0.001 |
| Breathlessness | 221(62.08) | 9(12.33) | |
| Skin Infection | 1(0.28) | 0(0.00) | |
| Joint Pain | 1(0.28) | 0(0.00) | |
| Lump | 110(30.90) | 32(43.84) | |

**Discussion:**

This study analyzes the tuberculosis (TB) burden by age and sex in a rural area of Bangladesh, focusing on demographic patterns, diagnosis, symptoms. It reveals that most TB cases occur in people over 65 years old, followed by the 35–<45 and 25–<35 age groups, highlighting older adults' increased vulnerability.[3,10] Gender distribution showed more males with bacteriologically confirmed PTB (71.88%) and clinically diagnosed PTB (60.56%). EPTB was more common in females (59.09%) than males (40.91%), indicating a significant difference (p<0.001). These findings align with Akova et al and Ben Jmaa et al , suggesting reasons related to biology, exposure, and healthcare-seeking.[16,17] Diagnostic approaches in this study highlighted the utility of GeneXpert, which detected Mycobacterium tuberculosis (MTB) in 30.30% of participants and rifampicin resistance in 2.33%. Agrawal et aldemonstrated GeneXpert's high sensitivity and specificity compared to traditional smear microscopy.[18] The use of complementary diagnostic tools, such as FNAC and Mantoux tests, further strengthened the diagnostic framework, with FNAC confirming TB in 16.32% of cases. Similar diagnostic strategies have been emphasized in studies by Gouda et al and Chandrappa et al, particularly in detecting extrapulmonary TB cases.[19,20] The distribution of TB cases shows PTB as the most common type, with 37.30% bacteriologically confirmed and 16.55% clinically diagnosed. Among EPTB cases, cervical lymph

node TB made up 83.33%. Begum et al. reported similar findings, highlighting the need for focused diagnostic strategies.[21] The distinct symptom patterns seen in adults and children show important clinical differences. Fever was common in both, while night sweats (98.88%) and weight loss (92.98%) were more often in adults. Children had more cough (52.05%) and lumps (43.84%), highlighting age-related differences in disease presentation ($p<0.001$). This agrees with research by Marais et al and Kim et al, which found significant symptom differences by age.[22,23] Patients were referred from OPD and IPD, diagnosed and registered at the DOTS center, and treatment was started using the DOTS protocol for standardized care. Jeena and Naidoo noted that pediatric TB cases are more severe and complex, and improved outcomes were seen with special inpatient strategies for children in peri-urban areas.[24] The disparity in care settings underscores the importance of age-specific management protocols, as highlighted in guidelines by Nahid et al and Khatami et al, which advocate for distinct approaches based on disease severity and patient demographics.[25,26] The study's findings match global and regional TB trends while showing specific demographic and clinical traits in rural Bangladesh. It emphasizes the need for targeted strategies for diagnosis, management, and prevention, and suggests future research to fill existing gaps.

**Limitations of The Study:**

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

**Conclusion:**

This study examines the tuberculosis (TB) burden by age and gender in a rural area of Bangladesh, revealing significant demographic and clinical differences. Older adults over 65 are more affected by pulmonary TB (PTB) due to weaker immunity, while females have a higher incidence of extrapulmonary TB (EPTB). Symptoms vary by age, with adults experiencing night sweats and weight loss, while children exhibit cough and lumps. Treatment approaches differ, with adults mainly treated as outpatients and children requiring more inpatient care. The study emphasizes the importance of DOTS centers for early TB diagnosis and management, advocating for tailored strategies, increased community awareness, better diagnostics, and healthcare systems to control TB. Future research should look into risk factors and healthcare disparities.

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