

A Study on Sociodemographic Profile and Treatment Outcome of Pediatric Tuberculosis Patients

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Abstract:

Background: Tuberculosis (TB) remains a major public health problem in India and continues to contribute substantially to childhood morbidity and mortality. Information regarding the sociodemographic characteristics and treatment outcomes of pediatric tuberculosis patients is essential for strengthening tuberculosis control programmes.

Objectives: To assess the sociodemographic profile and treatment outcomes among pediatric tuberculosis patients attending a tertiary care hospital in Dehradun, Uttarakhand.

Methods: A hospital-based descriptive longitudinal study was conducted among 100 pediatric tuberculosis patients aged 0–14 years registered under the National Tuberculosis Elimination Programme (NTEP) from February 2025 to November 2025. Eligible patients were consecutively enrolled and followed up until completion of treatment. Data regarding sociodemographic characteristics, history of contact, and treatment outcomes were collected using a structured questionnaire and analysed using descriptive statistics.

Results: A total of 100 pediatric tuberculosis patients were included in the study. Females constituted 61% of cases and the highest proportion of patients (39%) belonged to the 1–5 years age group. Most patients belonged to nuclear families (74%), had illiterate parents or guardians (52%), and were from lower socioeconomic strata (93%). A history of contact with tuberculosis was present in 21% of patients, of whom 85.7% had contact with a sputum-positive adult tuberculosis patient. Regarding treatment outcomes, 91% completed treatment, 8% were declared cured, and 1% died, resulting in an overall treatment success rate of 99%. Among 10 patients with tuberculous meningitis, sequelae were observed in one patient.

Conclusions: Pediatric tuberculosis was more common among females and children aged 1–5 years. Most patients belonged to socioeconomically disadvantaged families. The high treatment success rate observed in the study reflects the effectiveness of NTEP services. Strengthening contact tracing, community awareness, early diagnosis, and timely treatment may further improve outcomes among children with tuberculosis.

Keywords: Pediatric Tuberculosis, Sociodemographic Profile, Treatment Outcome, NTEP, Childhood Tuberculosis.

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Introduction

Tuberculosis (TB) remains one of the most important public health problems worldwide. TB is a communicable disease caused by *Mycobacterium tuberculosis*. It is estimated that nearly one-third of the world's population is infected with the tubercle bacillus. According to the WHO Global Tuberculosis Report 2025, tuberculosis remains one

of the leading infectious causes of morbidity and mortality worldwide despite the availability of effective prevention and treatment strategies.[1] India bears the highest burden of TB globally, accounting for nearly one-fifth of the world's TB incidence. It ranks among the high TB burden

countries in terms of the number of incident cases.[2]

Most new TB cases and TB-related deaths occur in developing countries, where infection is often acquired during childhood. No other chronic childhood infection approaches TB in terms of its magnitude and impact. It remains one of the leading infectious causes of morbidity and mortality among children. Childhood deaths due to TB are usually associated with disseminated forms of the disease.[3]

TB is both a cause and a consequence of poverty and is more prevalent among socioeconomically disadvantaged populations. The majority of affected individuals are migrants, labourers, slum dwellers, and residents of rural, tribal, and underdeveloped areas. Poor living conditions, malnutrition, inadequate housing, and overcrowding facilitate the transmission of the disease. Children are particularly vulnerable to TB, which is often difficult to diagnose and, consequently, challenging to treat effectively. Pediatric TB largely reflects inadequate TB control among adults.[4]

The Directly Observed Treatment, Short-course (DOTS) strategy primarily aims to ensure effective treatment of adult TB patients and thereby reduce the transmission of infection within the community. [5,6] Although children with TB contribute minimally to disease transmission, pediatric TB remains an important cause of morbidity and mortality. Therefore, children should also be considered important beneficiaries of the DOTS strategy.[7]

The objective of the present study was to evaluate the sociodemographic profile and treatment outcomes of pediatric tuberculosis patients attending a tertiary care hospital.

Materials and Methods

Study Design and Setting: A hospital-based descriptive longitudinal study was conducted by the Department of Community Medicine, Government Doon Medical College, Dehradun, Uttarakhand, India, from February 2025 to November 2025. The study was carried out at the Tuberculosis Unit functioning under the National Tuberculosis Elimination Programme (NTEP) of the associated tertiary care teaching hospital.

Study Population: The study included pediatric tuberculosis patients aged 0–14 years who were diagnosed with tuberculosis and registered under NTEP during the study period.

Sample Size: Considering the study duration, availability of pediatric tuberculosis patients at the

study centre, and feasibility of follow-up for treatment outcome assessment, all eligible pediatric tuberculosis patients aged 0–14 years who were registered under the National Tuberculosis Elimination Programme (NTEP) and fulfilled the inclusion criteria were consecutively enrolled during the study period. A total of 100 pediatric tuberculosis patients were included in the study

Sampling Technique: A consecutive sampling technique was employed. All eligible pediatric tuberculosis patients fulfilling the inclusion criteria were consecutively enrolled until the required sample size of 100 participants was achieved.

Inclusion Criteria

- Pediatric tuberculosis patients aged 0–14 years.
- Patients registered under NTEP and initiated on anti-tubercular treatment.
- Patients whose parents or guardians provided informed consent for participation.

Exclusion Criteria: Patients whose parents or guardians did not provide consent for participation in the study.

Data Collection: After obtaining written informed consent from parents or guardians, eligible participants were enrolled in the study. Data regarding sociodemographic characteristics, educational status of parents or guardians, socioeconomic status, history of contact with tuberculosis patients, and type of tuberculosis were collected using a structured pretested questionnaire.

Patients were followed throughout the treatment period and assessed for treatment outcomes according to NTEP guidelines. Clinical improvement was evaluated based on resolution of symptoms, weight gain, improvement in appetite, and relevant clinical and laboratory findings.

Statistical Analysis: Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics version 26. Descriptive statistics were used to summarize the data. Categorical variables were expressed as frequencies and percentages. Selected 95% confidence intervals were calculated for key proportions. The results were presented using tables and appropriate descriptive measures.

Results

A total of 100 pediatric tuberculosis patients were enrolled. Among them, most of the cases (61%) were females. 39% cases were males. Majorities of the cases (39%) were in age group of 1-5 years. Second common (31%) age group was 11-14 years. Majorities of cases were Hindus (63%) and Muslims (31%).

Table 1: Age wise distribution of pediatric tuberculosis patients.

Age group (Years)	Male	Female	Total
<1	1 (2.6)	1 (1.6)	2 (2.0)
1–5	17 (43.6)	22 (36.1)	39 (39.0)
6–10	10 (25.6)	18 (29.5)	28 (28.0)
11–14	11 (28.2)	20 (32.8)	31 (31.0)
Total	39 (100.0)	61 (100.0)	100 (100.0)

Among the 100 pediatric tuberculosis patients studied, the majority (39%) belonged to the 1–5 years age group, followed by 11–14 years (31%) and 6–10 years (28%). Only 2% of cases were observed in children aged less than 1 year. Females (61%)

outnumbered males (39%) across all age groups. These findings indicate that pediatric tuberculosis was most commonly diagnosed among children aged 1–5 years, with a relatively higher proportion of female patients in the study population.

Table 2: Religion wise distribution of pediatric tuberculosis.

Religion	Number of cases	Percentage
Hindu	63	63%
Muslim	31	31%
Christian	4	4%
Others	2	2%
Total	100	100%

The majority of pediatric tuberculosis patients were Hindus (63%), followed by Muslims (31%).

Christians and other religions constituted 4% and 2% of the study population, respectively.

Table 3: Distribution of pediatric cases according to type of family (N=100).

Type of family	Number of cases	95% CI
Nuclear	74(74%)	65.4–82.6
Joint	26(26%)	17.4–34.6
Total	100(100%)	—

The majority of pediatric tuberculosis patients (74%) belonged to nuclear families, while 26% belonged to joint families.

Table 4: Distribution of patients according to educational status of parents/guardian.

Educational status	Number of cases	Percentage
Illiterate	52	52%
Primary school certificate	24	24%
Middle school certificate	11	11%
High school certificate	7	7%
Intermediate or post high school diploma	4	4%
Graduate or postgraduate	2	2%
Total	100	100%

More than half of the parents/guardians (52%) were illiterate. Only 2% had attained graduate or postgraduate education.

Table 5: Distribution of patients according to socioeconomic status (modified Kuppaswamy classification).

Socioeconomic status	Number of cases	Percentage
Upper class	0	0%
Upper middle	5	5%
Lower middle	35	35%
Upper Lower	58	58%
Lower	2	2%
Total	100	100%

Most patients (58%) belonged to the upper-lower socioeconomic class, followed by the lower-middle

class (35%). Only 5% belonged to the upper-middle class, while none belonged to the upper class.

Table 6: Distribution of patients according to history of contact with tuberculosis patients (N=100).

History of contact	Number of cases	95% CI
Yes	21(21%)	13.0–29.0
No	79(79%)	71.0–87.0
Total	100 (100.0)	—

A history of contact with tuberculosis was present in 21% of pediatric patients, while 79% had no

identifiable history of contact with a tuberculosis patient.

Table 7: Distribution of adult contacts according to sputum status among patients with history of contact (N=21)

Sputum status	Number (%)	95% CI
Sputum positive	18 (85.7)	70.7–100.0
Not known	3 (14.3)	0–29.3
Total	21 (100.0)	—

Among the 21 pediatric tuberculosis patients with a history of contact, 18 (85.7%) had contact with a

sputum-positive adult tuberculosis patient, while the sputum status was not known for 3 (14.3%) contacts.

Table 8: Treatment outcomes according to type of tuberculosis among pediatric patients (N=100)

Treatment Outcome	Pulmonary TB n (%) (n=60)	Extrapulmonary TB n (%) (n=40)	Total n (%)	95% CI
Treatment completed	51 (85.0)	40 (100.0)	91 (91.0)	85.4–96.6
Cured	8 (13.3)	0 (0.0)	8 (8.0)	2.7–13.3
Death	1 (1.7)	0 (0.0)	1 (1.0)	0–2.9
Total	60 (100.0)	40 (100.0)	100 (100.0)	—

Among the 100 pediatric tuberculosis patients, 91 (91.0%; 95% CI: 85.4–96.6) completed treatment, while 8 (8.0%; 95% CI: 2.7–13.3) were declared cured. One patient died during treatment, resulting in a mortality rate of 1.0% (95% CI: 0–2.9). All patients with extrapulmonary tuberculosis completed treatment successfully. Among pulmonary tuberculosis patients, treatment was

completed in 51 (85.0%) patients, 8 (13.3%) were cured, and 1 (1.7%) died. The overall treatment success rate (treatment completed plus cured) was 99.0%, indicating highly favourable treatment outcomes among pediatric tuberculosis patients managed under the National Tuberculosis Elimination Programme (NTEP).

Table 9: Outcome among patients with tuberculous meningitis (n=10)

Outcome	Number (%)	95% CI
Recovered without sequelae	9 (90.0)	71.4–100.0
Developed neurological sequelae	1 (10.0)	0–28.6
Total	10 (100.0)	—

Among the 10 patients diagnosed with tuberculous meningitis, 9 (90.0%) recovered without any neurological sequelae, while 1 (10.0%) developed neurological sequelae in the form of motor deficit. These findings indicate favourable outcomes among most patients with tuberculous meningitis following anti-tubercular treatment.

Discussion

Tuberculosis remains a major public health problem globally and continues to contribute substantially to childhood morbidity and mortality, particularly in developing countries such as India. [1–3]

In the present study, the majority of pediatric tuberculosis patients (39%) belonged to the 1–5 years age group, followed by the 11–14 years age

group (31%) and the 6–10 years age group (28%). Similar findings were reported by Sushama Bai et al., who observed that 49.5% of pediatric tuberculosis cases occurred among children aged 1–5 years.[9] However, Arora et al. [6] and Sharma et al. [7] reported that the majority of cases belonged to the 11–14 years age group, accounting for 51.1% and 55.1% of cases, respectively. Similar observations regarding the predominance of tuberculosis among younger children were also reported by Sharada et al. [13] and Newton et al. [12]

Females constituted 61% of the study population, while males accounted for 39%. Similar findings were reported by Sharma et al., who observed that 61.7% of pediatric tuberculosis patients were females.[7] Indumathi et al. also reported a female

predominance, with a male-to-female ratio of 0.8:1.[14]

The majority of patients in the present study belonged to nuclear families (74%), while 26% belonged to joint families. Most parents or guardians were illiterate (52%), whereas only 2% were graduates or postgraduates. Similar findings were reported by Thakor et al., who observed that childhood tuberculosis was more common among children from socioeconomically disadvantaged families.[4] Sushama Bai et al. also reported that 55.8% of pediatric tuberculosis patients belonged to lower socioeconomic groups.[9] In the present study, 58% of patients belonged to the upper-lower socioeconomic class and 35% belonged to the lower-middle class, indicating that 93% of patients were from lower socioeconomic strata. Tuberculosis continues to be strongly associated with poverty, overcrowding, malnutrition, and poor living conditions. [3,11]

A history of contact with tuberculosis was present in 21% of patients, whereas 79% had no identifiable contact history. Among patients with a history of contact, 85.7% had contact with sputum-positive adult tuberculosis patients. Similar observations were reported by Ruchi and Thakur, who highlighted the importance of household exposure in childhood tuberculosis.[5] Singh et al. reported a high prevalence of tuberculosis infection among children residing in households with adults suffering from pulmonary tuberculosis, emphasizing the role of close household exposure in disease transmission.[10] Newton et al. also emphasized the importance of household contacts in the transmission of tuberculosis among children.[12]

In the present study, the overall treatment success rate was 99%, with 91% of patients completing treatment, 8% being declared cured, and only one death (1%) recorded. Among pulmonary tuberculosis cases, treatment success was achieved in 59 of 60 patients (98.3%), whereas all 40 extrapulmonary tuberculosis patients successfully completed treatment. Similar favourable treatment outcomes were reported by Sharma et al., who observed a treatment completion rate of 94.9% and a mortality rate of 0.3% among pediatric tuberculosis patients managed under the DOTS strategy.[7] Kabra et al. also reported satisfactory treatment outcomes among children receiving anti-tubercular treatment.[16]

Among the 10 patients diagnosed with tuberculous meningitis, neurological sequelae were observed in only one patient (10%) in the form of motor deficit, whereas nine patients (90%) recovered without residual deficits. Similar findings were reported by Indumathi et al., who observed that approximately 86% of children recovered without sequelae following anti-tubercular therapy.[14]

The findings of the present study indicate that pediatric tuberculosis predominantly affects younger children, females, and those belonging to socioeconomically disadvantaged families. Despite the favourable treatment outcomes observed, continued efforts toward early diagnosis, contact tracing, nutritional support, community awareness, and timely treatment initiation remain essential for achieving the goals of the National Tuberculosis Elimination Programme and the WHO End TB Strategy. [2,18,19]

Limitations

This study was conducted at a single tertiary care centre with a relatively small sample size. The findings may not be generalizable to all pediatric tuberculosis patients in the community. In addition, causal relationships could not be established because of the descriptive study design.

Conclusions

The present study highlights that pediatric tuberculosis continues to be an important public health problem, particularly among children from socioeconomically disadvantaged backgrounds. The majority of cases occurred among children aged 1–5 years and females. Most patients belonged to nuclear families, had illiterate parents or guardians, and were from lower socioeconomic strata, reflecting the social and economic vulnerabilities commonly observed among pediatric tuberculosis patients.

A history of contact with an adult tuberculosis patient was present in a considerable proportion of cases, and most identified contacts had sputum-positive pulmonary tuberculosis. These findings reinforce the importance of early detection and treatment of infectious adult tuberculosis cases, effective contact tracing, and screening of household contacts to prevent transmission to children.

The study demonstrated favourable treatment outcomes, with a high treatment success rate and very low mortality, indicating the effectiveness of NTEP services in the management of pediatric tuberculosis. Although most patients with tuberculous meningitis recovered without sequelae, the occurrence of neurological deficits in a small proportion of cases highlights the importance of early diagnosis and prompt initiation of treatment.

Strengthening community awareness, improving health-seeking behaviour, enhancing contact investigation, addressing social determinants of health, and ensuring timely diagnosis and treatment may further improve treatment outcomes and contribute towards the goal of tuberculosis elimination in India.

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