ORIGINAL ARTICLE

Patient Profile and Treatment Outcomes of Pediatric Drug-Resistant Tuberculosis: A Cross-Sectional Study from Western Uttar Pradesh

Ravi Bandhu, Sanjeev Kumar, Seema Jain, Ganesh Singh, Neelam S Gautam
Department of Community Medicine, Lala Lajpat Rai Memorial Medical College, Meerut, Uttar Pradesh

CORRESPONDING AUTHOR
Dr Ravi Bandhu, Department of Community Medicine, Lala Lajpat Rai Memorial Medical College, Meerut, Uttar Pradesh 250004
Email: ravi.bandhu@gmail.com

CITATION
Bandhu R, Kumar S, Jain S, Singh G, Gautam NS. Patient Profile and Treatment Outcomes of Pediatric Drug-Resistant Tuberculosis: A Cross-Sectional Study from Western Uttar Pradesh. Indian J Comm Health. 2025;37(6):1036-1040. https://doi.org/10.47203/IJCH.2025.v37i06.024
ARTICLE CYCLE
Received: 11/08/2025; Accepted: 25/11/2025; Published: 31/12/2025

ABSTRACT
Background: The increasing number of Drug-Resistant Tuberculosis presents a growing public health challenge especially for high TB burden country like India. Children represent a vulnerable group often underdiagnosed and undertreated. **Aim & Objective**: This study evaluates the social and clinical characteristics of paediatric patients with drug-resistant TB and estimate the treatment outcomes . Methods and Material: This cross-sectional study was conducted during September 2023 to August 2024 across 10 Tuberculosis Units. A total of 160 children (≤15 years) diagnosed with DR-TB and registered under NTEP were enrolled in study. Statistical analysis used: Demographic and clinical data, drug resistance profiles, and treatment outcomes were collected via structured questionnaire and analysed with Epi Info. **Results**: Among the 160 patients, 53.1% were aged 11–15 years and 54.9% were male. Over half belonged to the lower middle socioeconomic class; 50.7% lived in slum areas. Fever (66.3%) was the most common symptom. Multidrug-resistant TB constituted 36.1% of cases. Treatment success (cured plus completed) reached 80%. A significant association was identified between drug resistance type and treatment outcome (p=0.001), with MDR-TB and mono-rifampicin resistance linked to poorer outcomes. **Conclusions**: Pediatric DR-TB predominantly affects older children from socio-economically disadvantaged backgrounds and crowded living conditions, necessitating enhanced diagnostics, individualized treatment, and strengthened support systems to improve outcomes.

KEYWORDS
MDR-TB in Children, Pediatric Drug-Resistant Tuberculosis, Clinical Profile

INTRODUCTION
Tuberculosis (TB) continues to be one of the world's most challenging infectious diseases, particularly in low- and middle-income countries such as India. While major progress has been made in TB control, the emergence of drug-resistant tuberculosis (DR-TB) poses a new threat. Children, particularly in high-burden areas, are highly susceptible to both infection and disease progression but are often underdiagnosed and undertreated.(1)

India accounts for the majority burden of TB globally, with nearly 25–30% of global TB cases.(2) MDR-TB cases are increasingly being reported among paediatric populations, often due to transmission from adults with DR-TB in the same household. Understanding the local epidemiological trends and resistance patterns is crucial for optimizing early diagnosis, strengthening treatment protocols, and improving patient outcomes.(3)

The term Multidrug-resistant tuberculosis (MDR-TB) refers to strains of the bacteria that demonstrate resistance to both rifampicin and isoniazid, the two primary first-line medications, it complicates therapy and requires longer, more toxic, and costlier regimens. Diagnostic difficulties in children—especially due to paucibacillary disease and inability to produce sputum—further worsen outcomes.(4)

The diagnosis of DR-TB in children is extremely challenging. Traditional indicators from sputum samples are less valid since very young children frequently cannot generate sputum and have low bacillary loads. Therefore, clinical suspicion, contact tracing, and application of newer molecular diagnostic techniques have become increasingly important. (5)

Aim & Objective(s)

- To study the socio-demographic and clinical profile of children diagnosed with drug-resistant tuberculosis.
- To evaluate the treatment outcomes of paediatric DR-TB patients based on the criteria established by the National Tuberculosis Elimination Program (NTEP).

MATERIAL & METHODS

This cross-sectional study was carried out at 10 Tuberculosis Unit of district Meerut between September 2023 and August 2024.

All paediatric patients (≤15 years) diagnosed with DR-TB and registered under NTEP during the study period were eligible. Children whose parents/guardians refused consent were excluded.

To calculate the sample size, following formula was used: n = (Z2 ×p ×Q) / d2

Taking the prevalence(p) of Drug resistance Tuberculosis as 11.67%(6) at 95% CI and 5% error margin, the calculated sample size was 159 which was rounded off to 160. From each TB unit ,16 DR-TB patients of paediatric age group were selected for the study.

A pre-tested semi-structured questionnaire was used to document socio-demographic details, clinical profile, type of TB, drug resistance pattern, and treatment outcomes. Physical examination and anthropometry were conducted. Treatment outcomes were recorded from patient cards (cured, treatment completed, failure, died, lost to follow-up, transferred out).

Data collected were entered into Microsoft Excel and subsequently analysed using Epi Info (v7.2.6.0). Categorical variables, including drug resistance profile, treatment outcome, and other relevant factors, were summarized as frequencies and percentages. Associations between categorical variables were assessed using the chi-square (χ^2) test. Results were deemed statistically significant only when the calculated p-value fell below 0.05.

Ethical approval: Study obtained clearance from the Institutional Ethics Committee vide letter no. letter No./SC-1/2025/2956. Written informed consent was taken from parents/guardians.

RESULTS

The study sample comprised of 160 children diagnosed with drug-resistant tuberculosis. More than half of the enrolled children (53.1%) belonged to the 11–15 years age group. This was followed by children aged 6–10 years and those 5 years or younger, who accounted for 23.8% and 23.1% of the total cases, respectively. Males slightly predominated, accounting for 54.9% of cases. Regarding socio-economic status classified by the BG Prasad scale (March 2024), more than half of the patients (55.0%) belonged to the lower middle class, followed by 20.6% in the middle class, and 18.2% in the lower class; only a small minority were from the upper and upper middle classes (3.1% each). Half of the patients (50.7%) resided in slum areas, while 29.3% were from urban non-slum areas and 20.0% from rural settings. (Table 1)

Table 1: Socio-demographic Profile of Pediatric DR-TB Patients (n=160)

Factor	Category	Frequency (N)	Percentage (%)
Age group (years)	0–5	37	23.1
	6–10	38	23.8
	11–15	85	53.1
Sex	Male	88	54.9
	Female	72	45.1
Socio-economic class (B.G. Prasad, March 2024)	Upper (>9130)	5	3.1
	Upper Middle (4565–9129)	5	3.1
	Middle (2739–4564)	33	20.6
	Lower Middle (1369–2738)	88	55.0
	Lower (<1369)	29	18.2
Residence	Urban	47	29.3
	Rural	32	20.0

Factor	Category	Frequency (N)	Percentage (%)
	Slum	81	50.7
Birth order	1st	55	34.3
	2nd	59	37.1
	≥3rd	46	28.6
Family type	Nuclear	47	29.1
	Joint	113	70.9

Family characteristics showed that the majority of children were from joint families (70.9%), with birth order predominantly second (37.1%) and first (34.3%), whereas those of third or higher birth order accounted for 28.6%.

The clinical profile indicated that fever (66.3%) and cough (54.9%) were the most commonly reported symptoms. Nutritional complaints such as failure to gain weight (23.1%) and weight loss (21.3%) were frequently observed. Other symptoms included chest pain (16.3%), neck swelling suggestive of lymphadenopathy (6.9%), abdominal pain (3.8%), and headache (3.1%). (Note: Symptoms data were collected as multiple responses.) (Table 2)

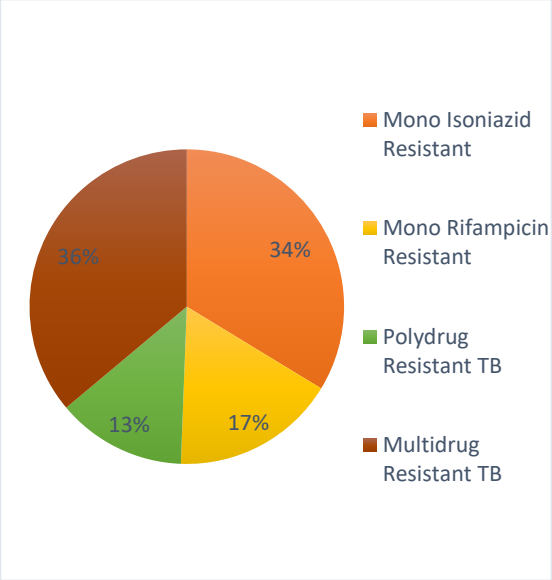
Table 2: Clinical Profile of Pediatric DR-TB Patients (n=160) *

Symptom	Frequency (N)	Percentage (%)
Fever	106	66.3
Cough	88	54.9
Weight loss	34	21.3
Failure to gain weight	37	23.1
Chest pain	26	16.3
Neck swelling (lymphadenopathy)	11	6.9
Abdominal pain	6	3.8
Headache	5	3.1

*Multiple response table

The drug resistance profile in Figure 1 shows a worrying spectrum: Multidrug-resistant TB (MDR-TB) constituted the largest single group at 36.1%, followed closely by mono–isoniazid resistance (33.7%), while mono–rifampicin resistance was observed in 16.9% and polydrug resistance (resistance to more than one first-line drug but not meeting the definition of MDR) in 13.3%. This distribution implies that over one-third of cases had resistance to both key drugs (INH and RIF), but an equally substantial proportion had isolated INH resistance, which can be missed if reliance is placed solely on rifampicin-based rapid tests (e.g., using RIF as a surrogate marker). The presence of polydrug resistance further underscores heterogeneity in resistance patterns, suggesting prior inadequate treatment or transmission of partially resistant strains.

Figure 1 : Pie chart showing Distribution of study participants



Treatment outcomes for the 160 patients revealed that 42.5% were cured and 37.5% completed treatment, resulting in an overall treatment success rate of 80%. Unfavourable outcomes included treatment failure in 5.0% of cases, death in 4.4%, and loss to follow-up in 10.6%. (Table 3)

Table 3: Treatment Outcomes of Pediatric DR-TB Patients (n=160)

Outcome	Frequency (N)	Percentage (%)
Cured	68	42.5
Treatment completed	60	37.5
Treatment failure	8	5.0
Died	7	4.4
Lost to follow-up	17	10.6

Table 4 presents the association between the type of drug resistance and treatment outcomes among 160 paediatric DR-TB patients. The overall distribution revealed 128 (80%) treatment successes and 32 (20%) unfavourable outcomes across the cohort. Statistical analysis confirmed a significant association between drug resistance type and treatment outcome ($\chi^2 = 15.30$, df = 4, $p = 0.001$), indicating that resistance profiles play a crucial role in determining prognosis among paediatric DR-TB patients.

Table 4: Association between drug resistance pattern and treatment success

Drug Resistance Category	Treatment Success (n, %)	Unfavourable Outcome (n, %)	Total	P-value
MDR-TB	43 (74.1%)	15 (25.9%)	58	χ^2= 15.30
Mono-isoniazid resistant	52 (96.3%)	2 (3.7%)	54	df = 4
Mono-rifampicin resistant	17 (63.0%)	10 (37.0%)	27	p-value= 0.001
Polydrug resistant	16 (76.2%)	5 (23.8%)	21	
Total	128	32	160	

DISCUSSION

This study provides a comprehensive overview on the socio-demographic and clinical characteristics, as well as treatment outcomes, of 160 paediatric patients with drug-resistant tuberculosis (DR-TB) in a North Indian.

Consistent with earlier studies, we found that DR-TB was more prevalent among older children (11–15 years)(7). There was a slight male preponderance (males 55%), supporting observations that increased social exposure with age and possible healthcare-seeking behavior differences may influence the epidemiology of paediatric DR-TB.(8)

Additionally, majority patients belonged to lower middle and middle socio-economic classes, as seen in other Indian cohorts, highlighting the strong association between TB risk and disadvantaged socio-economic status.(9)

A notable proportion of patients resided in slum areas or came from joint families, indicating possible links between overcrowding, poor living conditions, family structure, and increased transmission risk, which mirrors the findings of studies analysing both adult and paediatric TB populations.(10)

Clinically, fever and cough were the most frequently reported symptoms, with significant numbers also presenting with nutritional complaints, such as failure to gain weight and weight loss. These findings are largely in agreement with previous Indian reports emphasizing the non-specific presentation of DR-TB in children and the importance of maintaining a high index of suspicion, especially among malnourished individuals. (11)

Regarding drug resistance, multidrug-resistant TB (MDR-TB) constituted a considerable fraction of cases, alongside significant numbers exhibiting mono-isoniazid, mono-rifampicin, and polydrug resistance. Such diversity in resistance patterns is comparable to findings from paediatric DR-TB studies in Mumbai and other Indian cities and underscores the importance of comprehensive resistance testing over reliance on rifampicin-based screening alone.(10)

The findings of this study highlight a statistically relevant relation between the pattern of drug resistance and treatment outcomes in children with drug-resistant tuberculosis. Notably, children with MDR-TB and mono-rifampicin resistance experienced considerably higher rates of unfavourable outcomes, including treatment failure, death, or loss to follow-up, compared to those with mono-isoniazid resistance and polydrug resistance. These results align closely with previous studies conducted in India, where treatment success rates for paediatric MDR-TB have varied from around 62% to over 80%.(12)

CONCLUSION & RECOMMENDATION

The study highlights a significant burden of drug-resistant tuberculosis among children in North India, predominantly affecting older children from socio-economically disadvantaged and residing in slums. To improve control of paediatric DR-TB, efforts must focus on strengthening early case detection through expanded use of child-friendly molecular diagnostics and universal drug susceptibility testing. Programmatic enhancements should prioritize training healthcare providers in paediatric TB recognition and management, ensuring uninterrupted availability of paediatric drug formulations, and integrating robust patient support systems. Further research is encouraged to evaluate the impact of newer oral regimens and explore strategies to close existing notification gaps in childhood tuberculosis.

LIMITATION OF THE STUDY

The study's cross-sectional design limits the ability to establish temporal causality. Conducted across 10 units in one district, the findings may not be fully generalizable nationwide.

RELEVANCE OF THE STUDY

This study highlights a high prevalence of isolated Isoniazid resistance (33.7%) among children in Western Uttar Pradesh. This is a critical finding, as standard Rifampicin-based screenings (like CBNAAT) may miss these cases.

AUTHORS CONTRIBUTION

All authors have contributed equally.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil

CONFLICT OF INTEREST

There is no conflict of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

REFERENCES

1. Thakur G, Thakur S, Thakur H. Status and challenges for tuberculosis control in India – Stakeholders' perspective. Indian J Tuberc [Internet]. 2020 Oct 12; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7550054/
2. TB incidence. Available from: https://www.who.int/teams/global-programme-on-tuberculosis-and-lung-health/tb-reports/global-tuberculosis-report-2024/tb-disease-burden/1-1-tb-incidence. Accessed on 23/11/2024
3. Chowdhury K, Ahmad R, Sinha S, Dutta S, Haque M. Multidrug-Resistant TB (MDR-TB) and Extensively Drug-Resistant TB (XDR-TB) Among Children: Where We Stand Now. Cureus. 2023 Feb 18;15(2):e35154.
4. Tuberculosis: Multidrug-resistant (MDR-TB) or rifampicin-resistant TB (RR-TB) [Internet]. Available from: https://www.who.int/news-room/questions-and-answers/item/tuberculosis-multidrug-resistant-tuberculosis-(mdr-tb)
5. Thomas TA. Tuberculosis in children. Pediatr Clin North Am. 2017 Aug;64(4):893–909.
6. Swathi KMP, Desai U, Joshi JM. Clinical profile of drug resistant tuberculosis in Pediatric Population, India. Eur Respir J [Internet]. 2017 Dec 6 ;50(suppl 61). Available from: https://publications.ersnet.org/content/erj/50/suppl_61/PA2756
7. Kumari A, Sharma PK, Kansal D, Bansal R, Kumari S. Socio-demographic profile of multi-drug resistant tuberculosis patients and its association with severity of adverse drug reactions in DOTS plus centre at tertiary hospital in Himachal Pradesh, India. Int J Basic Clin Pharmacol. 2018 Nov 24;7(12):2342–6.
8. Mauskar AV, Gopan A. Clinical profile of pulmonary tuberculosis and MDR TB in children at tertiary medical institute. Int J Contemp Pediatr. 2019 Oct 21;6(6):2571–6.
9. Zaidi I, Sarma PS, Khayyam KU, Toufique Ahmad Q, Ramankutty V, Singh G. Sociodemographic factors affecting knowledge levels of tuberculosis patients in New Delhi. J Fam Med Prim Care. 2024 Nov;13(11):5152–8.
10. Kallarakal JS, Cency B. Clinical and socio-demographic profile, drug sensitivity pattern and treatment outcome of drug resistant DR TB patients registered for treatment at a tertiary care centre in South India. Panacea J Med Sci. 2022 Nov 28;12(3):607–14.
11. Goyal A, Shah I, Patankar N, Chilkar S. Clinical profile of children with pulmonary Tuberculosis. Clin Epidemiol Glob Health. 2014 Apr;2(1):24–7.
12. Shetty NS, Bodhanwala M, Shah I. Outcome of drug resistant tuberculosis in Indian children. Trop Doct. 2022 Jan;52(1):90–4.