

Trends in Tuberculosis Treatment Outcomes Over the Last 5 Years in a Tertiary Care Hospital in India

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Abstract:

Background: Tuberculosis (TB) remains a major public health concern in India, affecting both pulmonary and extrapulmonary sites and posing challenges in treatment adherence and disease control. Despite the availability of effective therapy, unsuccessful treatment outcomes including failure, loss to follow-up, and death continue to occur. Monitoring trends and factors associated with treatment outcomes is essential to strengthen TB control programs.

Methods: A retrospective cohort study was conducted on 172 TB patients treated at a tertiary care hospital in India from January 2020 to January 2025. Patient data, including sociodemographic, clinical, and treatment-related information, were extracted from hospital registers. Treatment outcomes were categorized as cured/completed, failure/loss to follow-up, and death.

Results: Among the 172 patients, 89.5% achieved successful treatment outcomes, while 10.5% experienced unsuccessful outcomes. Treatment failure or loss to follow-up was higher among transferred-in patients and those with pulmonary TB, whereas extrapulmonary TB and newly registered patients showed better outcomes. Mortality was highest among patients aged ≥ 45 years and HIV-positive individuals. Sex and residence had minimal impact on treatment outcomes.

Conclusion: The study highlights high TB treatment success but underscores the need for targeted support for older, HIV-positive, and transferred patients.

Keywords: Tuberculosis, Treatment Outcomes, India, HIV Co-Infection, Pulmonary TB, Retrospective Study.

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Introduction

Tuberculosis (TB) is a treatable infectious disease caused by *Mycobacterium tuberculosis*, most commonly affecting the lungs and resulting in pulmonary TB, which is highly contagious. The infection can also involve other organs, such as the lymph nodes, spine, brain, kidneys, and joints, leading to extrapulmonary forms of the disease [1,2]. Although TB is both preventable and curable, it continues to pose a major challenge to global public health. From 2000 to 2017, effective TB treatment saved an estimated 54 million lives; nonetheless, gaps in timely diagnosis and proper management persist, especially in resource-limited countries [3]. The key aims of TB therapy are to achieve patient cure, halt transmission, and avert the development of drug resistance, yet these goals remain unattained in many low-income regions, with deaths, treatment default, failure, and drug-resistant TB still impeding worldwide control efforts [1,2].

Globally, the End TB strategy aims to reduce the burden of TB, but a considerable number of patients remain undiagnosed or fail to complete treatment, especially in low- and middle-income countries [3,4]. Delayed initiation of treatment and loss to follow-up are among the most significant challenges in TB control programs [2]. Approximately one in five patients with TB discontinue treatment prematurely, which prolongs infectiousness, increases the risk of drug resistance, and contributes to disease relapse [1]. In India, data from 2019 showed that 82% of reported TB cases successfully completed treatment, while 3.9% of patients died and 3.5% were lost to follow-up [5]. Factors such as poor socioeconomic conditions, limited health service utilization, low disease awareness, comorbid HIV infection, age, sex, family size, educational level, and persistent smear positivity have been linked to poor treatment outcomes [1, 6, 7].

Regular assessment of treatment outcomes is essential to evaluate healthcare quality, identify systemic gaps, and prevent the rise of multidrug-resistant TB [8, 9]. Although various studies in India have examined TB outcomes, evidence gaps remain regarding recent trends and influencing factors across different patient groups [5, 7, 10]. In a similar context, evaluating the trends in tuberculosis treatment outcomes over the last five years in a tertiary care hospital in India is crucial for understanding local performance, identifying factors associated with unsuccessful outcomes, and strengthening programmatic interventions to improve patient care and disease control. The present study aims to evaluate tuberculosis treatment outcomes and associated determinants among patients treated at a tertiary care hospital in India from January 2020 to January 2025.

Materials and Methods

Study Setting: The study took place at a tertiary care hospital in India, which serves as a regional referral center for tuberculosis (TB) diagnosis, treatment, and follow-up under the National Tuberculosis Elimination Programme (NTEP).

Study Design and Population: This five-year retrospective cohort study analyzed records of 172 TB patients registered at the hospital's DOTS clinic between January 2020 and January 2025. All patients with complete demographic, clinical, and treatment outcome information were included, while those with missing or incomplete data were excluded. Diagnosis and management followed the NTEP and WHO guidelines.

Data Collection and Quality Control: Data were retrieved from TB registers and treatment cards using a structured checklist adapted from earlier studies [5, 7]. The form captured demographic details, clinical characteristics, and treatment outcomes. Two trained healthcare professionals from the DOTS clinic collected the data after a one-

day training session conducted by the principal investigator, who also verified a random 10% of records for accuracy and completeness.

Study Variables: Treatment outcome was the main variable of interest, categorized as successful (cured or treatment completed) and unsuccessful (treatment failure, loss to follow-up, or death). Other variables included age, sex, place of residence, TB type (pulmonary or extrapulmonary), patient category (new, relapse, or retreatment), HIV status, and year of registration.

Data Processing and Analysis: For data analysis, treatment outcomes were categorized as cured/completed, failure/loss to follow-up, and death. Associations between outcomes and patient factors such as age, sex, HIV status, TB type, and patient category were assessed using descriptive statistics and cross-tabulations. Chi-square tests were applied to determine statistical significance, with p-values < 0.05 considered indicative of meaningful associations.

Results

Among the 172 tuberculosis (TB) patients included in the study, 57.0% were males and 43.0% were females, indicating a slightly higher prevalence among men. The majority of patients (32.6%) were aged below 24 years, followed by middle aged patients (25.6%), suggesting that TB was more common in young adults. Patients below 14 years and above 65 years together constituted only about 14% of the study group. Most patients (72.1%) resided in urban areas, while 22.7% were from rural settings and 5.2% were prisoners. Regarding HIV status, 19.8% of the patients were HIV-positive, whereas the remaining 80.2% tested negative, highlighting the continuing coexistence of TB and HIV infection in this population (Table 1).

Table 1: Demographic Profile of Patients (n = 172)

Variables	Categories	n (%)
Sex	Male	98 (57.0)
	Female	74 (43.0)
Age (years)	≤14	14 (8.1)
	15–24	56 (32.6)
	25–34	44 (25.6)
	35–44	23 (13.4)
	45–54	16 (9.3)
	55–64	9 (5.2)
	≥65	10 (5.8)
Place of Residence	Urban	124 (72.1)
	Rural	39 (22.7)
	Prison	9 (5.2)
HIV Status	Positive	34 (19.8)
	Negative	138 (80.2)

Pulmonary TB was the most prevalent form, with 36.0% of patients being smear-positive and 37.2% smear-negative, while 26.8% had extrapulmonary TB. The majority of patients (90.1%) were newly diagnosed cases, and smaller proportions were retreatment (4.1%) or transferred-in cases (5.8%). Treatment outcomes indicated that 90.7% of patients

achieved cure or completed therapy, while 4.7% experienced treatment failure or were lost to follow-up, and another 4.7% succumbed during treatment. Most patients (90.7%) were in the continuation phase of therapy (6–12 months), with a small number in the initial (0–2 months) or mid-phase (3–5 months) of treatment (Table 2).

Table 2: Clinical and Treatment Characteristics of Patients (n = 172)

Variables		n (%)
Type of TB	Pulmonary positive	62 (36.0)
	Pulmonary negative	64 (37.2)
	Extrapulmonary	46 (26.8)
Patient Category	New	155 (90.1)
	Retreated	7 (4.1)
	Transferred in	10 (5.8)
Treatment Outcome	Cured/Completed	156 (90.7)
	Failure/Loss to follow-up	8 (4.7)
	Death	8 (4.7)
Phase of Treatment	0–2 months	7 (4.1)
	3–5 months	9 (5.2)
	6–12 months	156 (90.7)

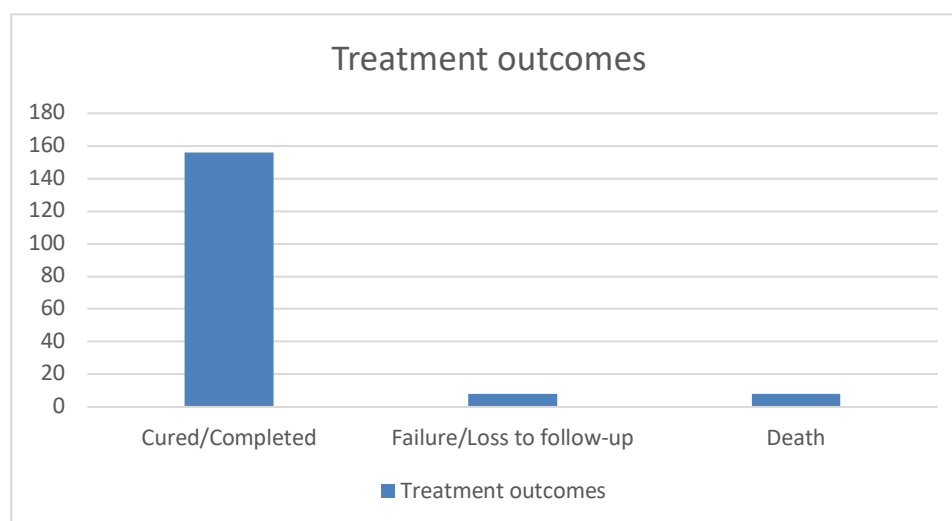


Figure 1: Patient distribution as per treatment outcomes.

The analysis of factors associated with treatment outcomes among 172 TB patients showed that treatment success was highest among new cases (90.3%) and patients with extrapulmonary TB (91.3%). Males and females had similar cure rates (89.8% vs. 89.2%). Patients aged ≥ 45 years and those who were HIV-positive experienced higher mortality (12.8% and 14.7%, respectively)

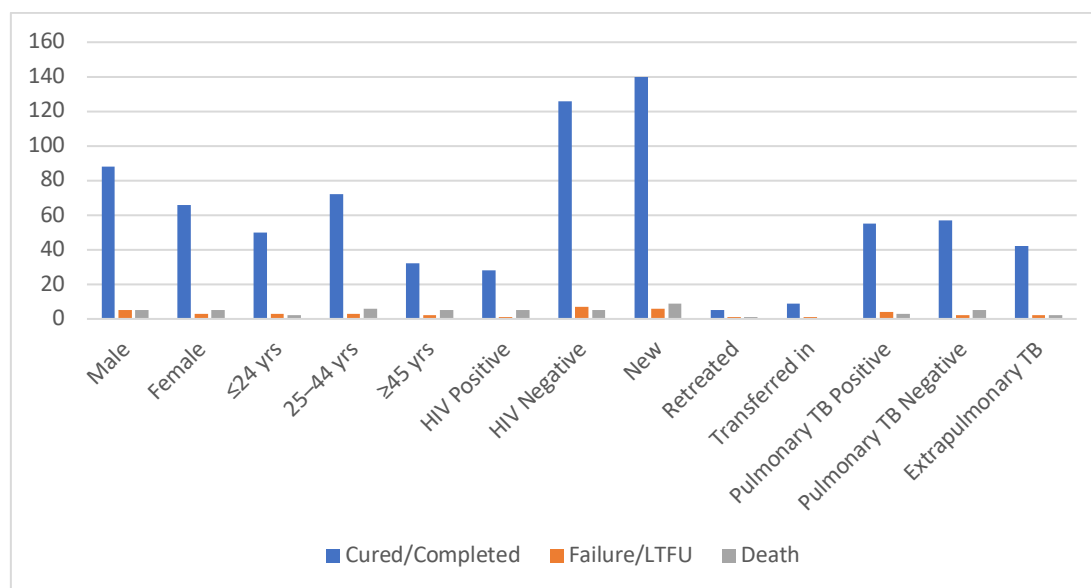
compared to younger or HIV-negative patients. Transferred-in and retreatment patients had a higher proportion of treatment failure or loss to follow-up. Overall, age, HIV status, and patient category appeared to influence TB treatment outcomes, while sex, residence, and TB type had less pronounced effects (Table 3).

Table 3: Factors Associated with TB Treatment Outcomes (n = 172)

Variables		Cured/Completed n (%)	Failure/LTFU n (%)	Death (%)	n	p-value
Sex	Male	88 (89.8)	5 (5.1)	5 (5.1)		0.91
	Female	66 (89.2)	3 (4.1)	5 (6.8)		
Age (years)	≤ 24	50 (91.0)	3 (5.5)	2 (3.5)		0.03
	25–44	72 (88.9)	3 (3.7)	6 (7.4)		
	≥ 45	32 (82.1)	2 (5.1)	5 (12.8)		

Place of Residence	Urban	111 (89.5)	6 (4.8)	7 (5.6)	0.82
	Rural	36 (92.3)	2 (5.1)	1 (2.6)	
	Prison	7 (77.8)	0 (0)	2 (22.2)	
Type of TB	Pulmonary positive	55 (88.7)	4 (6.5)	3 (4.8)	0.47
	Pulmonary negative	57 (89.1)	2 (3.1)	5 (7.8)	
	Extrapulmonary	42 (91.3)	2 (4.3)	2 (4.3)	
Patient Category	New	140 (90.3)	6 (3.9)	9 (5.8)	0.04
	Retreated	5 (71.4)	1 (14.3)	1 (14.3)	
	Transferred in	9 (90.0)	1 (10.0)	0 (0)	
HIV Status	Positive	28 (82.4)	1 (2.9)	5 (14.7)	0.01
	Negative	126 (91.3)	7 (5.1)	5 (3.6)	

LTFU = Lost to follow-up

**Figure 2: Factors Associated with TB Treatment Outcomes.**

Discussion

In this study, the overall treatment success rate among 172 tuberculosis (TB) patients was 89.5%, with 10.5% experiencing unsuccessful outcomes. The overall treatment success rate was 89.5%, indicating a high level of adherence and effectiveness of the TB control program. This success rate aligns with findings from studies in India, where treatment success rates have ranged from 85% to 90% in various regions [5,7,10]. This success rate aligns closely with findings from similar studies in Ethiopia, such as a study in Adama Hospital, which reported a treatment success rate of 90.3% [11]. The proportion of unsuccessful outcomes in this study is slightly greater than the 8.6% reported in the Arsi Zone [12], or the 7.5% reported in a 5-year retrospective study in India in 2018 [13]. These variations may reflect differences in healthcare infrastructure, patient demographics, and adherence to treatment protocols across regions.

Factors influencing treatment outcomes included the type of TB, age, HIV status, and the level of healthcare facility. Patients with extrapulmonary TB had a 52% lower likelihood of treatment failure or

loss to follow-up compared to those with pulmonary TB. Older patients, particularly those aged 45 years and above, faced a fourfold increased risk of death, consistent with findings from studies in Western countries [14]. HIV-negative patients had a 68% lower risk of death compared to their HIV-positive counterparts, highlighting the impact of HIV co-infection on TB treatment outcomes.

The study also identified that patients transferred from other healthcare facilities had a significantly higher risk of treatment failure or loss to follow-up, a finding consistent with earlier studies conducted in India [15-17]. This suggests that continuity of care and patient-provider relationships play crucial roles in successful TB treatment outcomes. The findings underscore the importance of targeted interventions, such as enhanced defaulter tracing and support for high-risk groups, to improve TB treatment success rates.

Conclusion

This study demonstrated a high overall treatment success rate of 89.5%, with 10.5% experiencing unsuccessful outcomes, including treatment failure, loss to follow-up, or death. Older age, HIV co-

infection, pulmonary TB, and being transferred from other facilities were identified as significant risk factors for poor outcomes, while extrapulmonary TB and newly registered patients had better treatment success. These findings highlight the need for targeted interventions, including strengthened follow-up, integrated TB/HIV care, and additional support for high-risk patient groups, to further improve treatment outcomes and reduce mortality in the Indian context.

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