Monaldi Archives for Chest Disease

Monaldi Archives for Chest Disease 2026; 96:3363
doi: 10.4081/monaldi.2025.3363

©Copyright: the Author(s), 2025
Licensee PAGEPress, Italy

Determinants of unsuccessful treatment outcome of pulmonary tuberculosis under the National Tuberculosis Elimination Program in Mohali district, India

Aditi Gupta,[1] Vidhu Mittal,[2] Navdeep Singh,[3] Anuradha Nadda[4]

[1]Department of Respiratory Medicine, Dr. BR Ambedkar State Institute of Medical Sciences, Mohali, Punjab; [2]Department of Pulmonary Medicine, State Tuberculosis Training and Demonstration Center, Government Medical College, Patiala, Punjab; [3]Government Medical College, Patiala; [4]Department of Community Medicine, Dr. BR Ambedkar State Institute of Medical Sciences, Mohali, Punjab, India

Abstract

Tuberculosis is a global healthcare concern, being the leading infectious cause of mortality by a single infectious agent. India bears the highest burden of tuberculosis. Disease outcome is an important indicator for the successful implementation of the National Program. Risk factors associated with unsuccessful outcomes must be identified, and differential care must be provided to those with risk factors. The study included all pulmonary tuberculosis patients registered from 1st October 2022 to 30th September 2023 at the Directly Observed Therapy Short Course Center, Dr. BR Ambedkar State Institute of Medical Sciences, Mohali, who received treatment. Data were collected from the Nikshay portal retrospectively. Out of 1103, 575 (52.13%) patients were declared cured, whereas 452 (40.97%) were declared treatment completed. A total of 19 (1.72%) pulmonary tuberculosis patients died during treatment, and 57 (5.16%) were declared failures. Advanced age [adjusted odds ratio (AOR) 4.028, 95% confidence interval (CI): 1.368-4.610, p=0.003], people living with HIV (AOR 0.185, 95% CI: 0.031-1.082, p=0.05) and male gender (crude OR 1.611, 95% CI: 0.371-1.006, p=0.050) were associated with poor outcomes. Diabetes, retreatment, microbiological confirmation, and low body mass index were not statistically significant in the study. Age above 45 years, male sex, and HIV co-infection are determinants for unsuccessful treatment outcomes in patients with pulmonary tuberculosis.

Key words: tuberculosis, outcome, risk factors, successful, unsuccessful, determinants, pulmonary.

Correspondence to: Aditi Gupta, Room no. 55, Second floor, Department of Respiratory Medicine, College side, Dr. BR Ambedkar State Institute of Medical Sciences, Mohali, Punjab, India 160055. Tel.: 8195900690. E-mail: doc.aditigupta@gmail.com

Introduction

Tuberculosis (TB) continues to be an overriding public health concern in low- and middle-income countries, where India contributes to around 24% of the global incidence of TB, surpassing Africa and China [1]. Despite stern efforts, we are still struggling to control this devastating disease. Early diagnosis and treatment are the key to stop the transmission. Apart from preventing transmission, ensuring good cure rates with the available treatment is of paramount importance [2]. Efforts are being made across the globe to prevent transmission, detect early, confirm microbiologically, and improve treatment compliance. Poor outcomes lead to more transmission and development of resistant strains by contributing to more morbidity and mortality [3]. The objective of this study is to identify the determinants of poor outcome in pulmonary TB (PTB) patients, which will further help in formulating a patient-centered approach, planning effective intervention, and framing achievable goals for the future.

The global TB treatment success rate is around 86-90% [1], which is an important indicator of the successful implementation of the program. Determinants of poor outcome must be identified and focused upon to improve the outcome and lead the way towards elimination. As per the available literature, the most important factors associated with poor outcome include old age, HIV co-infection, male sex, retreatment, diabetes, smear-negative PTB, and drug resistance [4-14]. However, old age, HIV, drug resistance, and retreatment are associated with poor outcomes in unanimously most of the studies, whereas gender and microbiological confirmation vary from place to place. Outcomes and risk factors are influenced by a variety of other determinants, including ethnicity, socioeconomic status, access to healthcare facilities, social disparities, education levels, poverty, population density, health education, and the effectiveness of program implementation, all of which can vary significantly by geographic region. Therefore, this study will identify risk factors for unsuccessful outcomes in patients of PTB in district Mohali, Punjab to further fill the evidence gaps for TB elimination.

Materials and Methods

Study design and setting

It was a single-center retrospective cohort study design. The study was conducted at Dr. BR Ambedkar State Institute of Medical Sciences (AIMS), Mohali, Punjab, India. District Mohali is a rapidly developing administrative and commercial hub situated near the capital city, Chandigarh, with an estimated population of 13.55 lacs by 2024, where the prevalence of crude TB infection in Punjab is around 31.1% [15,16]. Our center serves as a Treatment Unit for Mohali district under the National Tuberculosis Elimination Program (NTEP). It covers 3 designated microscopic centers, namely Kharar, Civil Hospital Mohali, and Employee's State Insurance, Mohali. It has a cartridge-based nucleic acid amplification test (CBNAAT) facility, whereas line probe assay (LPA), culture, and drug sensitivity are being sent to Government Medical College, Patiala under NTEP. Free investigations and treatment are provided to all the patients diagnosed with TB. Standard guidelines by the Ministry of Health are followed for diagnosis and patient management [17]. Suspected PTB patients are tested for sputum CBNAAT or smear for microbiological confirmation. First-line LPA is offered to all sputum-positive patients, whereas second-line LPA is reserved for only resistant cases. Patients are categorized as either microbiologically confirmed PTB or clinico-radiological PTB. Adverse drug monitoring is done by active surveillance by Accredited Social Health Activist (ASHA). Drugs are provided to the patient at home by ASHA workers, and follow-up visits are planned at 2 and 6 months of treatment. Outcome is defined by the treating clinician as per the Ministry of Health and Family Welfare guidelines. Cure and treatment completed outcomes are considered successful outcomes, whereas failure, loss to follow-up, and death are unsuccessful outcomes.

Study population

Registered data of all PTB patients at NTEP Directly Observed Treatment Short Course (DOTS) center, Mohali, during the period of 1 year from 1st October 2022 to 30th September 2023 were collected from the Nikshay portal, and a data extraction sheet was prepared for the study population. Both microbiologically and clinico-radiological diagnoses were included. Patients with missing data on age, sex, site of TB, type of TB, bacteriological confirmation, diabetic status, HIV, and outcome were excluded from the study.

Sample size and study period

The study included all PTB patients registered during 1st October 2022 to 30th September 2023 at the DOTS Center, AIMS, Mohali who received treatment (Figure 1).

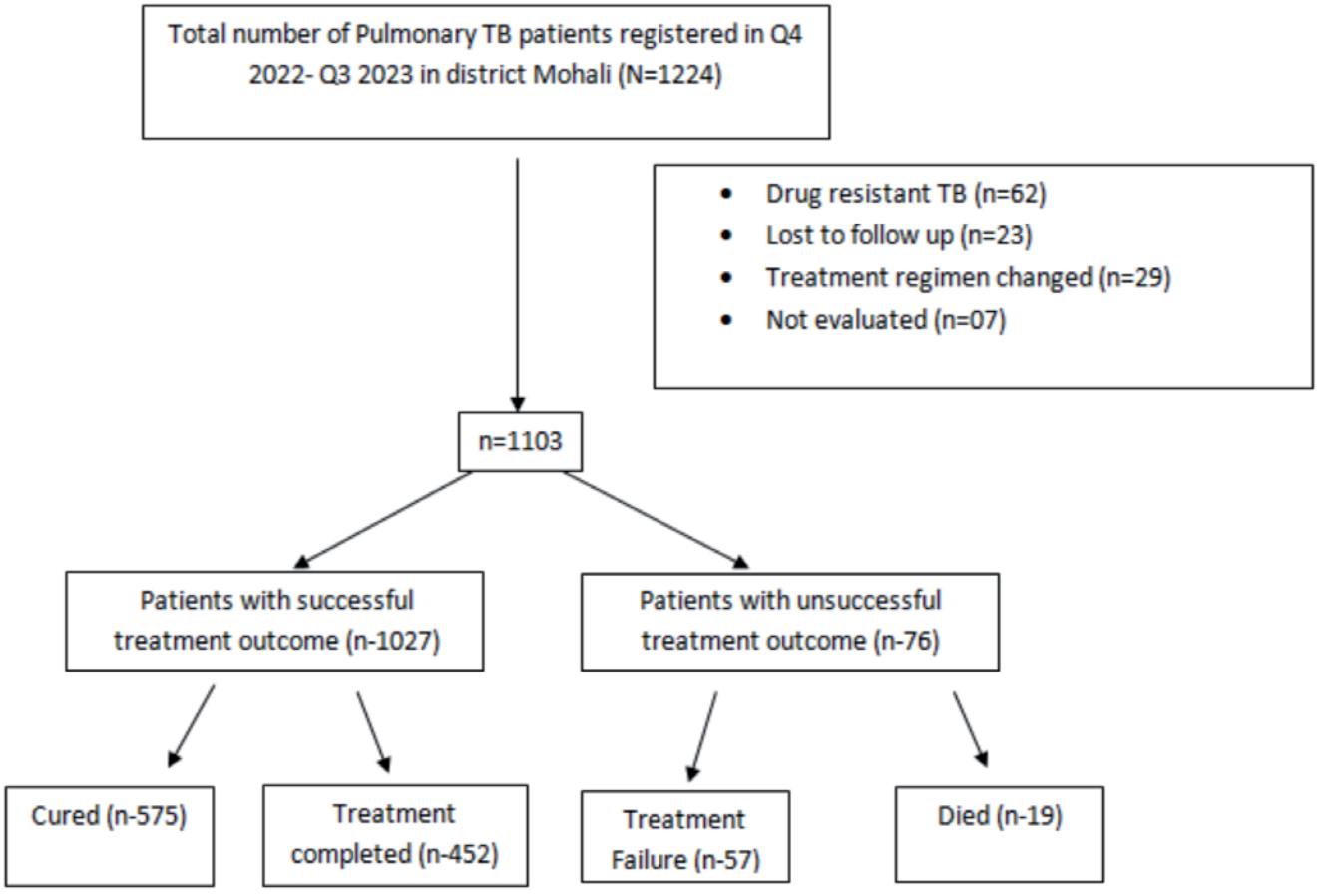


Figure 1. Flow diagram of case selection for analysis and their TB treatment outcomes in district Mohali, Q4 2022-Q3 2023 (n=1224). TB, tuberculosis.

Data collection, processing and analysis

Data were collected from the Nikshay portal at the DOTS Center, Mohali. Nikshay portal serves as a surveillance tool for NTEP, functioning as a real-time case-based web-based patient management system operational since 2012. Data entries were manually reviewed for consistency, and entries with missing data were excluded. The data were collected in two sections, with the first section containing information on socio-demographic characteristics of patients such as age, sex, residence, and treatment sites, and section two had information on clinical variables such as patient treatment category, site of TB, previous history of anti-tubercular treatment (ATT), microbiological confirmation, HIV test results, diabetic status, and treatment outcome.

Frequencies, proportions and standard deviations were used to describe the data. Univariable and multivariable logistic regression analyses were performed to determine the risk factors for unsuccessful TB treatment outcomes. Crude and adjusted odds ratios (AOR) were calculated, and $p<0.05$ was considered statistically significant.

Operational definitions [17,18]

PTB: any microbiologically confirmed or clinically diagnosed case of TB involving lung parenchyma or trachea-bronchial tree.

Microbiologically confirmed TB case: a presumptive TB patient with biological specimen positive for acid-fast bacilli or *Mycobacterium Tuberculosis* on culture, or through quality-assured rapid diagnostic molecular test.

Clinically diagnosed TB case: a presumptive TB patient who is not microbiologically confirmed but has been diagnosed with active TB by a clinician based on chest X-rays (CXR), histopathology, or clinical signs with a decision to treat the patient with a full course of ATT.

New case: a TB patient who has never had treatment of TB or has taken ATT for less than 1 month.

Previously treated patient: a patient who has received 1 month or more of anti-TB drugs in the past.

Cure: a bacteriologically confirmed TB patient at the beginning of treatment who was smear or culture-negative at the end of the complete treatment.

Treatment complete: a TB patient who completed treatment without evidence of failure or clinical deterioration but with no record to show that sputum smear or culture results in the last month of treatment were negative, either because tests were not done or because results are unavailable.

Treatment failure: a TB patient whose sputum smear or culture is positive at the end of the treatment.

Lost to follow-up: a TB patient whose treatment was interrupted for 1 consecutive month or more.

Not evaluated: a TB patient for whom no treatment outcome is assigned. This included former 'transfer out'.

Died: a TB patient who dies for any reason during the course of treatment.

Treatment success: a TB patient either cured or treatment completed.

Ethical consideration

Ethical approval was obtained from the Institutional Ethics Committee, AIMS, Mohali, before starting the study (AIMS/IEC-HR/2024/63). The need for patient consent was waived by the committee. All the data were kept confidential. All shared data were de-identified. Ethical considerations were followed in accordance with the Declaration of Helsinki.

Table 1. Clinico-epidemiological profile of pulmonary tuberculosis patients in Mohali district and association between clinico-epidemiological factors and microbiological status (n=1103).

Variable	Clinico-radiological PTB (n=212), n (%)	Microbiologically confirmed PTB (n=891), n (%)	Total (n=1103)	p
Gender				
Male	114 (17.9)	523 (82.1)	637	0.192
Female	98 (21.0)	368 (79.0)	466	
Age group				
<18 years	31 (22.3)	108 (77.7)	139	0.275
18-44 years	123 (20.4)	481 (79.6)	604	
45-64 years	35 (15.3)	194 (84.7)	229	
65 years	23 (17.6)	108 (82.4)	131	
Body mass index				
Undernourished (<18.5)	99 (19.3)	413 (80.7)	512	0.961
Normal (18.5-22.9)	70 (18.6)	306 (81.4)	376	
Overweight (23-24.9)	18 (19.1)	76 (80.9)	94	
Pre-obese (>25)	25 (20.8)	95 (79.2)	120	
HIV status				
Reactive	02 (28.6)	05 (71.4)	07	0.402
Nonreactive	210 (19.2)	886 (80.8)	1096	
Diabetes status (n-1087)				
Diabetic	22 (16.3)	113 (83.7)	135	0.220
Nondiabetic	186 (19.5)	766 (80.5)	952	
Category of patient				
New	190 (20.2)	752 (79.8)	942	0.031
Retreatment	22 (13.7)	139 (86.3)	161	

PTB, pulmonary tuberculosis.

OPEN ACCESS

Results

Socio-demographic factors

In a period of 1 year, a total of 1224 patients were registered at the district, Mohali, with the diagnosis of PTB whose outcome was available. Out of 1224, 62 were later confirmed as drug-resistant cases, 23 were lost to follow-up, 29 required treatment modification due to adverse drug reactions, and in 7 treatment was initiated at some other center. A total of 1103 patients were enrolled for a 1-year time period from the fourth quarter of 2022 till the third quarter of 2023. Males (637, 57.7%) were more affected as compared to females (466, 42.2%). Out of all, 604 (54.7%) PTB patients were middle-aged (18-44 years), 139 (12.6%) below 18 years of age, and 131 (11.87%) were above 65 years of age (Table 1). Most of the patients were undernourished with a body mass index (BMI) of <18.5(512, 46.4%), and only 214 (19.4%) had BMI above the normal range. None of the patients was obese. Most of them were enrolled at a public health facility (1014, 91.9%) as the NTEP program is robust at public hospitals and needs strengthening in a private setup.

Clinical characteristics

The majority of the patients were never exposed to anti-TB treatment in the past (942, 85.4%), whereas 161 (14.6%) had a history of ATT in the past for some form of TB. 1096 (99.3%) patients were nonreactive for HIV, and only 7 (0.6%) were reactive, as the incidence of HIV is low in this area. Diabetes was diagnosed in 135 (12.2%) patients, and 952 (86.3%) were non diabetic. Control of diabetes was not evaluated in this study. A total of 891 (80.77%) patients were microbiologically confirmed, and 212 (19.22%) were started on ATT on a clinic-radiological basis.

Treatment outcome

Out of 1103, 575 (52.13%) patients were declared cured at the end of the treatment, whereas 452 (40.97%) were declared treatment completed. Later includes all clinic-radiological patients along with those who were not able to produce sputum at the end of the treatment. Both were considered successful treatment outcomes. A total of 19 (1.72%) PTB patients died during the course of the treatment, and 57 (5.16%) were declared failures out of 1103 patients (Figure 1). Treatment success was 93% in this study. Since data were extracted from the online portal, outcomes were not updated for many patients, and they were excluded from the study. Cure rate was 52.1%, death rate was 1.72%, and failure was seen in 5.2%. Compliance was ensured in all the patients by family members and ASHA workers.

Determinants of outcome

Gender, age, BMI, HIV, diabetic status, retreatment, and smear status were evaluated as determinants for treatment outcome. Advanced age was associated with poor outcomes [AOR 4.028, 95% confidence interval (CI): 1.368-4.610, p=0.003]. HIV reactive patients were associated with unsuccessful outcomes as compared to HIV nonreactive (AOR 0.185, 95% CI 0.031-1.082,

Table 2. Comparison among successful and unsuccessful tuberculosis treatment outcomes in pulmonary tuberculosis patients in Mohali district (n=1103).

Variable	Successful outcome (n=1027), n (%)	Unsuccessful outcome (n=76), n (%)	Total (n=1103)	p
Gender				
Male	585 (91.8)	52 (8.2)	637	0.05
Female	442 (94.8)	24 (5.2)	466	
Age group				
<18 years	136 (97.8)	03 (2.2)	139	<0.001
18-44 years	576 (95.4)	28 (4.6)	604	
45-64 years	205 (89.5)	24 (10.5)	229	
65 years	110 (84.0)	21 (16.0)	131	
Body mass index				
Undernourished (<18.5)	471 (92.0)	41 (8.0)	512	0.568
Normal (18.5-22.9)	355 (94.2)	22 (5.8)	377	
Overweight (23-24.9)	89 (94.7)	05 (5.3)	94	
Pre-obese (>25)	112 (93.3)	08 (6.7)	120	
HIV status*				
Reactive	05 (71.4)	02 (28.6)	07	0.023
Nonreactive	1022 (93.2)	74 (6.8)	1022	
Diabetes status**(n-1087)				
Diabetic	121 (89.6)	14 (10.4)	135	0.100
Nondiabetic	890 (93.5)	62 (6.5)	952	
Category of patient				
New	881 (93.5)	61 (6.5)	942	0.188
Retreatment	146 (90.7)	15 (9.3)	161	
Smear Status				
Smear Negative	201 (94.8)	11 (5.2)	212	0.276
Smear Positive	826 (92.7)	65 (7.3)	891	

*Fisher's exact test; **a few values were missing.

OPEN ACCESS

p=0.05). Males had more unsuccessful outcomes as compared to females (AOR 1.251, 95% CI: 0.425-1.221). Pre-obese patients (AOR 0.569, 95% CI: 0.325-0.997, p=0.0049) are at higher risk as compared to normal or even underweight patients. However, diabetes, retreatment, and low BMI were not statistically significant in the study.

Discussion

Globally, an estimated 10.6 million people fell ill with TB in 2022, and there were 1.13 million deaths among HIV negative people attributable to TB. Eight countries contributed to two-thirds of the TB incidence, India being at the top of the list, fol-

Table 3. Association between socio-demographic predictors and clinical parameters with unsuccessful treatment outcome among drug-sensitive pulmonary tuberculosis patients in Mohali district.

Variable	Successful outcomen (%)	Unsuccessful outcomen (%)	COR, 95% CI	p	AOR, 95% CI	p
Gender						
Female	442 (94.8)	24 (5.2)	1	**0.050**	Reference	0.520
Male	585 (91.8)	52 (8.2)	1.611 (0.371-1.006)		1.251 (0.425-1.221)	
Age group*						
18-44 years	576 (95.4)	28 (4.6)	1		Reference	
45-64 years	205 (89.5)	24 (10.5)	2.408 (1.365-4.250)	**0.002**	2.512 (2.140-7.581)	**<0.001**
65 years	110 (84.0)	21 (16.0)	3.927 (2.152-7.166)	**<0.001**	4.028 (1.368-4.610)	**0.003**
<18 year	136 (97.8)	03 (2.2)	0.454 (0.136-1.515)	0.199	1.976 (0.134-1.533)	0.754
Body mass index**						
Normal (18.5-22.9)	355 (94.2)	22 (5.8)	1			
Undernourished (<18.5)	471(92.0)	41(8.0)	0.821 (0.374-1.799)	0.621	0.544 (0.236-1.250)	0.151
Overweight (23-24.9)	89 (94.7)	05 (5.3)	0.645 (0.248-1.678)	0.369	0.433 (0.161-1.160)	0.096
Pre-obese (>25)	112 (93.3)	08 (6.7)	0.712 (0.417-1.217)	0.214	0.569 (0.325-0.997)	**0.049**
HIV status						
Reactive	05 (71.4)	02 (28.6)	1	**0.043**	1	**0.05**
Nonreactive	1022 (93.2)	74 (6.8)	0.181 (0.035-0.949)		0.185 (0.031-1.082)	
Diabetes status(n-1087)						
Diabetic	121 (89.6)	14 (10.4)	1	0.103	1	0.513
Nondiabetic	890 (93.5)	62 (6.5)	0.602 (0.327-1.108)		0.799 (0.408-1.565)	
Category of patient						
New	881 (93.5)	61 (6.5)	1		1	1.239
Retreatment	146 (90.7)	15 (9.3)	1.484 (0.821-2.681)	0.191	1.451 (0.781-2.693)	
Health facility						
Private	84 (94.4)	05 (5.6)	1		1	0.459
Public	943 (93.0)	71 (7.0)	0.791 (0.311-2.012)	0.622	0.689 (0.257-1.847)	
Smear status						
Smear negative	201 (94.8)	11 (5.2)	1		1	0.520
Smear positive	826 (92.7)	65 (7.3)	1.438 (0.745-2.775)	0.279	1.251 (0.632-2.478)	

*p-value for age group is <0.001; **p-value for body mass index group is 0.678. Values in bold represent statistically significant values. COR, crude odds ratio; CI, confidence interval; AOR, adjusted odds ratio.

Table 4. Comparison of a few recent studies about the determinants of unsuccessful outcome in tuberculosis.

Study area (year of patient data)	Number of patients enrolled	Success rate (%)	Death rate (%)	Determinants of unsuccessful outcome
Ethopia, Africa [4] (2017-21)	362, all TB patients	88.4	2.5	Female, DRTB, HIV, poor nutrition
Karnatka, India [5] (2019)	4842, all TB patients	83.8	1	Male, old, co morbidity, new, smear positive
Ethopia, Africa [8] (2022)	400, all TB patients	89	5.7	HIV, sputum negative
Eriteria, Africa [9] (2014-2019)	1227, DSTB	90.4	6.2	Older, HIV, health facility
Brazil, South America [10] (2015-19)	915, DS PTB	79	3	HIV, diabetes
Uzbekistan [11] (2005-20)	35122, TB patients on first line ATT	79	4	Older, HIV, PTB, disability, category 2
Zambia, Africa [12] (2020)	404, >15-year-old TB patients	83.4	8.7	Older
China [13] (2005-13)	22998, New PTB	95	0.68	Older, CXR related
China [14] (2013-18)	306860, DSTB	98.6	0.5	Older, retreatment, male, severely ill
Current study, India (2023)	1103, DS PTB	93	1.72	Female, older, HIV

TB, tuberculosis; DRTB, drug-resistant TB; DSTB, drug-sensitive TB; DS, drug-sensitive; ATT, anti-tubercular treatment; PTB, pulmonary tuberculosis; CXR, chest X-rays.

OPEN ACCESS

lowed by Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh, and Congo. The global decline in TB incidence rate and death rate is 8.7% and 19%, respectively, between 2025 and 2022 which is far from the End TB Strategy milestone of a 50% reduction in incidence rate and 75% in death by 2025. Five key risk factors attributable to TB in 2022 included undernourishment, HIV, alcohol use disorders, smoking, and diabetes in decreasing order.

Broad determinants associated with unsuccessful outcomes identified by the World Health Organization as per the Global TB Report 2023 included age>45 years, female sex, BMI>25, and HIV [1]. In our study, various covariates associated with treatment outcome included age, sex, HIV co-infection, Diabetes, retreatment for TB, sputum status, and BMI.

Age is one of the most important determinants for successful treatment outcome. The evidence that the elderly have poor outcomes is supported by multiple studies [5,8-14]. It could be attributed to delayed diagnosis, varied presentation, decreased symptom perception, co-morbidities, and adverse drug reactions. In our study, age over 45 years was associated with poor outcome as compared to younger patients (Table 2). The 45-64 age group had 2.5 times more risk (95% CI: 2.140-7.581, p<0.001), and above 65 years had even more, 4 times more risk (95% CI: 1.368-4.610, p=0.003) of poor outcome (Table 3).

Males (AOR: 1.251, 95% CI: 0.425-1.221) had more chances of unsuccessful outcome in our study, which is similar to various other studies [5,14,19]. The probable reason for this finding could be due to more exposure leading to more incidence. Recurrent TB is an important cause of morbidity and is associated with poor outcome [11,14], whereas it was not statistically significant in this study, likely due to a smaller number of retreatment patients. Comparison of various recent studies is given in Table 4.

Malnutrition is a leading attributable risk factor for TB in India, where the government is providing free food baskets and financial incentives to ensure proper diet. Overall, 41 out of 471 (8 %) undernourished had an unsuccessful outcome. (AOR 0.544, 95% CI: 0.236-1.250, p=0.151) However, pre-obese have also been found as statistically significant risk factor for unsuccessful outcome (AOR 0.569, 95% CI: 0.325-0.997, p=0.049).

HIV TB co-infection is an important cause of mortality in HIV patients (AOR 0.185, 95% CI: 0.031-1.082, p=0.05). One-third of HIV/AIDS-related deaths are attributed to TB worldwide. The presentation of TB in people living with HIV (PLHIV) is varied depending upon the Cluster of Differentiation 4 (CD4) count. Incidence of extrapulmonary TB and multidrug-resistant TB is high in PLHIV [20]. HIV is an independent risk factor for poor outcome in TB patients [5,12-15]. Default rates are higher due to drug interactions and high adverse drug reactions. Less than 200 CD4 count at diagnosis and retreatment are independent risk factors for poor outcome in HIV TB co-infection [21,22]. Early treatment initiation and screening for TB in all PLHIV are the way forward for better prognosis.

Presence of diabetes increases the risk of TB infection thrice as compared to normal individuals. It leads to delayed culture conversion, multidrug-resistant TB, and poor outcomes [10]. Diabetes impacts TB outcome by drug interactions, gastroparesis, presence of proinflammatory cytokines, and metabolic syndrome. Control of diabetes is important for favorable outcomes [23,24].

Diabetes as a risk for unsuccessful outcome is statistically not significant in our study. (AOR 0.799, 95% CI: 0.408-1.565, p=0.51).

Strengths and limitations

Large sample size is a noteworthy strength of the study, whereas the retrospective nature of the study limits the information available for the analysis. The database did not contain information regarding a few crucial factors like sputum grading, treatment delay, education, socioeconomic status, diet, number of times ATT taken, drug sensitivity, CXR severity, and other co-morbidities, which could influence the outcome. Data related to risk factors for unsuccessful outcomes are very scarce in Punjab. This study is pertinent as outcomes and risk factors differ geographically, whereas the national program remains the same countrywide. It can help us improve national policies and provide differential care to patients with such risk factors. More frequent follow-ups can be planned for them for strict monitoring and ensuring better compliance. In the future, therapeutic drug monitoring can be done specifically in this set of population.

Conclusions

Age above 45 years, male sex, and HIV co-infection are determinants for unsuccessful treatment outcome in patients with PTB. Active screening for associated risk factors must be done with priority concern. These patients should be followed up more frequently, and differential care must be provided to them under NTEP. Therefore, to improve treatment outcomes, risk-factor-focused intervention has to be implemented. Co-morbidities associated with the older age group and HIV must be addressed.

References

1. World Health Organisation. WHO global TB report 2022. Available from: https://www.who.int/publications/i/item/9789240061729.
2. Holmes KK, Bertozzi S, Bloom BR, et al. Major Infectious Diseases. 3rd ed. Washington (DC): The International Bank for Reconstruction and Development/The World Bank; 2017.
3. World Health Organization. End TB strategy: global strategy and targets for tuberculosis prevention, care and control after 2015. Available from: https://cdn.who.int/media/docs/default-source/documents/tuberculosis/end-tb-strategy-information-sheet8817f818-feaa-49ac-b26a-92c5b9dca034.pdf.
4. Limenh LW, Kasahun AE, Sendekie AK et al. Tuberculosis treatment outcomes and associated factors among tuberculosis patients treated at healthcare facilities of Motta Town, northwest Ethiopia: a five-year retrospective study. Sci Rep 2024; 14:7695.
5. Kumar A, Harakuni S, Paranjape R et al. Factors determining successful treatment outcome among notified tuberculosis patients in Belagavi district of North Karnataka, India. Clin Epidemiol Glob Health 2024;25:101505.
6. Amante TD, Ahemed TA. Risk factors for unsuccessful tuberculosis treatment outcome (failure, default and death) in public health institutions, eastern Ethiopia. Pan Afr Med J 2015; 20:247.
7. Tafess K, Beyen TK, Abera A, et al. Treatment outcomes of tuberculosis at Asella teaching hospital, Ethiopia: ten years' retrospective aggregated data. Front Med 2018;5:38.
8. Berhan A, Almaw A, Solomon Y. Tuberculosis treatment outcome and associated factors among tuberculosis patients

OPEN ACCESS

linked to tuberculosis treatment clinics in Ethiopia, 2023: a multi-center retrospective study. Infect Drug Resist 2023; 16:3367-78.
9. Araia ZZ, Kibreab F, Kibrom AA et al. Determinants of unsuccessful tuberculosis treatment outcome in Northern Red Sea region, Eritrea. PLoS One 2022;17:e02773069.
10. Ridolfi F, Peetluk L, Amorim G, et al. Regional prospective observational research in tuberculosis (RePORT)–Brazil consortium. Tuberculosis treatment outcomes in Brazil: different predictors for each type of unsuccessful outcome. Clin Infect Dis 2023;76:e930- 7.
11. Gadoev J, Asadov D, Harries AD, et al. Factors associated with unfavourable treatment outcomes in patients with tuberculosis: a 16-year cohort study (2005–2020), Republic of Karakalpakstan, Uzbekistan. Int J Environ Res Public Health 2021;18:12827.
12. Chilyabanyama R, Kamanga N ,Mwandia JN. Factors associated with tuberculosis treatment outcomes among TB patients aged 15 years and older at chawama level one hospital in Lusaka, Zambia, Glob Public Health 2024;19:2307979.
13. Wen Y, Zhang Z, Li X, et al. Treatment outcomes and factors affecting unsuccessful outcome among new pulmonary smear positive and negative tuberculosis patients in Anqing, China: a retrospective study. BMC Infect Dis 2018;18:104.
14. Gilmour B, Xu Z, Bai L, et al. Risk factors associated with unsuccessful tuberculosis treatment outcomes in Hunan Province, China. Trop Med Int Health 2022;27:290-9.
15. Population census. Mohali (Sahibzada Ajit Singh Nagar) District - Population 2011-2025. Available from: https://www.census2011.co.in/census/district/605-mohali.html.
16. Central Tuberculosis Division. India TB report 2022. Available from: https://tbcindia.mohfw.gov.in/2023/06/06/india-tb-report-2022/.
17. Central Tuberculosis Division. Technical and operational guidelines (TOG) for TB control in India 2016 – chapter 4: treatment of TB. Available from: https://tbcindia.mohfw.gov.in/ technical-and-operational-guidelines-for-tb-control-in-india-2016/.
18. World Health Organization. Definitions and reporting framework for tuberculosis – 2013 revision: updated December 2014 and January 2020. Available from: https://www.who.int/publications/i/item/9789241505345.
19. Tola A, Minshore KM, Ayele Y, Mekuria AN. Tuberculosis treatment outcomes and associated factors among TB patients attending public hospitals in Harar town, Eastern Ethiopia: a five-year retrospective study. Tuberc Res Treat 2019;2019: 1503219.
20. Loscalzo J, Fauci A, Kasper D. Harrison's principles of internal medicine, 21st ed. New York, NY, USA: McGraw-Hill Education; 2022.
21. Ifebunandu NA, Ukwaja KN, Obi SN. Treatment outcome of HIV-associated tuberculosis in a resource-poor setting. Trop Doct 2012;42:74-6.
22. Sharma SK, Soneja M, Prasad KT, Ranjan S. Clinical profile & predictors of poor outcome of adult HIV-tuberculosis patients in a tertiary care centre in north India. Indian J Med Res 2014;139:154-60.
23. Baltas I, Sturdy A, Kavallieros K et al. Diabetes mellitus is not a predictor of poor TB treatment outcomes. Int J Tuberc Lung Dis 2023;27:140-5.
24. Alkabab Y, Warkentin J, Cummins J et al. Therapeutic drug monitoring and TB treatment outcomes in patients with diabetes mellitus. Int J Tuberc Lung Dis 2023;27:135-9.

Received: 17 January 2025; Accepted: 19 May 2025; Early view: 17 September 2025.

Contributions: all authors have contributed significantly, and all authors agree with the content of the manuscript. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work. Aditi Gupta, Anuradha Nadda, Vidhu Mittal: study concept and design, data analysis and interpretation of study results, writing of the manuscript. Aditi Gupta, Navdeep Singh, Vidhu Mittal: data collection.

Conflict of interest: the authors declare no potential conflict of interest.

Ethics approval and consent to participate: approved by the Institutional Ethics Committee, Dr BR Ambedkar State Institute of Medical Sciences, Mohali, before starting the study (AIMS/IEC- HR/2024/63 dated 20.09.2024). All the data were kept confidential. All shared data were de-identified. Ethical considerations were followed in accordance with The Declaration of Helsinki.

Informed consent: not required as data were collected retrospectively.

Patient consent for publication: not applicable for this retrospective study.

Availability of data and materials: supporting data will be available from the corresponding author upon request.

Publisher's note: all claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article or claim that may be made by its manufacturer is not guaranteed or endorsed by the publisher.

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0).



OPEN ACCESS