

Socio-demographic and Lifestyle Characteristics of Patients Who Belong to Drug-Resistant Tuberculosis Categories: A Cross-Sectional Study from Banda District, Uttar Pradesh

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Background: Drug-resistant tuberculosis (DR-TB) is a major public health concern that threatens global tuberculosis control efforts. Sociodemographic and behavioral factors may influence the development and distribution of different DR-TB categories.

Objective: To assess the sociodemographic characteristics of DR-TB patients and determine the association between addiction status and DR-TB categories in Banda district, Uttar Pradesh.

Methods: A facility-based cross-sectional study was conducted in Banda district, Uttar Pradesh, from May 2024 to December 2024. A total of 130 drug-resistant tuberculosis (DR-TB) patients registered on the Nikshay portal under NTEP were included using total enumeration. Data were collected through household visits using a pre-tested semi-structured questionnaire after obtaining written informed consent. Health system assessment was performed at: 1 District Tuberculosis Centre; 2 Community Health Centres; 10 Primary Health Centres; and 18 Ayushman Bharat-Health and Wellness Centres using the Differentiated Tuberculosis Care Guidelines (2021). Data were analyzed using descriptive statistics and the Chi-square test, with $p < 0.05$ considered statistically significant.

Results: Among 130 drug-resistant tuberculosis (DR-TB) patients, the majority were aged 26 to 45 years (55.4%), male (55.4%), Hindu (76.2%), and belonged to nuclear families (74.6%). Most patients were from the lower middle socioeconomic class (72.3%), indicating a strong socioeconomic gradient in DR-TB distribution. Rifampicin-resistant TB was the predominant subtype, whereas MDR-TB and pre-XDR-TB were more common among lower socioeconomic groups. Addiction status showed a significant association with resistance patterns (χ^2 , $*p = 0.011$), suggesting that both socioeconomic disadvantage and behavioral factors contribute to the burden of drug-resistant tuberculosis.

Conclusion: DR-TB predominantly affected economically productive age groups and individuals from lower socioeconomic strata. Addiction-related behaviors were significantly associated with resistance patterns, highlighting the need for integrated socioeconomic and behavioral interventions to strengthen DR-TB control strategies.

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Drug-resistant tuberculosis, MDR-TB, Rifampicin-resistant TB, Socioeconomic status, Addiction, NTEP.

Introduction

Tuberculosis (TB) remains one of the oldest and most lethal infectious diseases, continuing to claim millions of lives annually. Houben and Dodd estimate that approximately 26% of the global population is infected with *Mycobacterium tuberculosis* (MTB).¹ In most individuals, however, the infection remains latent due to host immunologic control.^{2,3} Each year, more than 10 million new cases of TB are reported, with nearly 3 million deaths worldwide.⁴ Beyond its health burden, TB imposes substantial economic costs, reducing both

current productivity and future outputs. The World Health Organization (WHO)⁴ and several nations have pledged to eliminate TB by 2030, while India has set an ambitious target of achieving this goal by 2025. Although eradicating TB within the next 2 to 7 years is a formidable challenge, multiple stakeholders are actively working across diverse fronts to accelerate progress.

The COVID-19 pandemic highlighted both setbacks and opportunities in TB control. On one hand, TB case detection declined due to diversion of manpower and resources toward COVID-19 management. On the other hand, the rapid development of COVID-19 vaccines has

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provided optimism for expediting vaccine research and development for other infectious diseases, including TB.⁵ Managing MDR-TB treatment is complex and places significant strain on countries and their national health systems. High-quality management of the disease is essential for improving treatment outcomes for tuberculosis. Research conducted in various countries has revealed a wide range of factors influencing the treatment outcomes of MDR-TB. However, in India, there is limited reporting on these treatment outcomes and the factors associated with unfavourable results for drug-resistant tuberculosis. The increasing incidence of DR-TB complicates efforts to achieve the goals set forth in the end TB strategy by 203.¹⁴ MDR-TB is particularly concerning in countries heavily affected by tuberculosis, leading to poor treatment outcomes. The global treatment success rate for MDR/RR-TB is 63%, with a death rate of 15%.¹⁵ Effective treatment not only cures patients but also reduces disease transmission and prevents the emergence of drug-resistant strains. The factors influencing tuberculosis treatment outcomes serve as vital indicators of the success of TB control programs.¹⁶

Aim & Objective

- To assess the sociodemographic characteristics (age, sex, religion, family type, and socioeconomic class) of patients with drug-resistant tuberculosis.
- To determine the association between sociodemographic factors and addiction status with the distribution of drug-resistant tuberculosis categories (mono-resistant, rifampicin-resistant, MDR-TB, pre-XDR, and XDR).

Material and Methods

Type of Study

Cross-sectional study.

Sampling Unit

Public and private health facilities.

Study Area

Banda district of Bundelkhand region of Uttar Pradesh

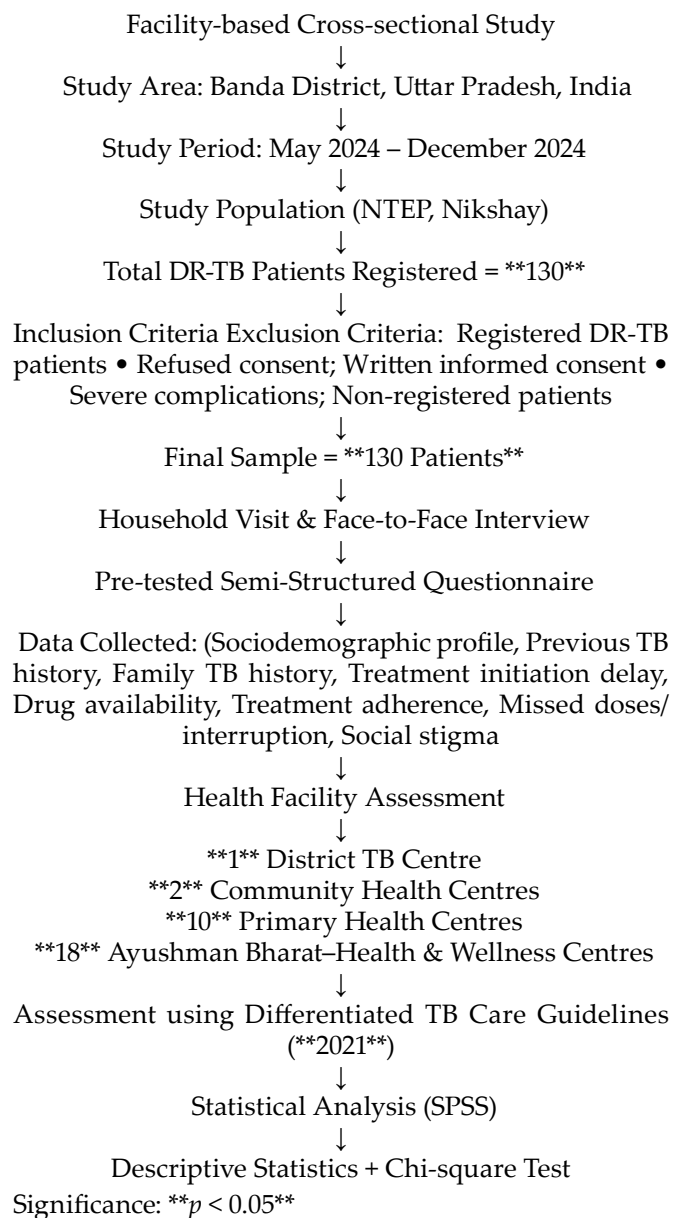
Study Population

All public health facilities (District Hospital, AB-HWC, PHC, CHC, and DH). All DR-TB registered patients in Nikshay portal under NTEP.

Ethical Approval

Ethical approval was taken from the institutional ethical review board at RDMC, Banda. (IEC/RDMC/Cert/18;

Date:24/08/2023)(Appendix) Participants were informed of the research objectives and assured that their identities would remain confidential. All participants provided written consent before taking part in the study.



Statistical Analysis

The data was entered in MS excel and descriptive analysis was done using short appropriate using microsoft excel.

Result

Distribution of Drug-Resistant Tuberculosis Cases by Sociodemographic Characteristics.

Table 1 shows the sociodemographic profile of 130 patients with drug-resistant tuberculosis (DR-TB), revealing that

the highest proportion belonged to the 26–45-year age group (72, 55.4%), followed by those aged <26 years (46, 35.4%), while only 12 (9.2%) were aged >45 years. Males predominated (72, 55.4%) over females (58, 44.6%). Most participants were Hindus (99, 76.2%), with Muslims comprising 31 (23.8%). The majority belonged to nuclear families (97, 74.6%), followed by joint (30, 23.1%) and three-generation families (3, 2.3%). Rifampicin-resistant tuberculosis (RR-TB) was the most frequent subtype, particularly among younger adults and individuals from nuclear families, suggesting that demographic characteristics may influence the distribution of drug-resistant tuberculosis. Distribution of drug-resistant tuberculosis cases according to socioeconomic class.

Table 2 shows the socioeconomic distribution of drug-resistant tuberculosis (DR-TB) among 130 patients demonstrated a marked predominance in the lower socioeconomic strata. Most patients belonged to the lower middle socioeconomic class (Class IV; 94, 72.3%), followed by the lower class (Class V; 20, 15.4%). The middle class (Class III) accounted for 13 patients (10.0%), whereas only 2 (1.5%) and 1 (0.8%) patient belonged to the upper middle (Class II) and upper (Class I) socioeconomic classes, respectively. Multidrug-resistant tuberculosis (MDR-TB) and pre-extensively drug-resistant tuberculosis (Pre-XDR-TB) were predominantly observed among patients from lower socioeconomic groups. These findings

suggest a strong association between socioeconomic deprivation and the burden of drug-resistant tuberculosis, underscoring the influence of poverty, limited healthcare access, overcrowding, malnutrition, and poor treatment adherence on the development and transmission of drug-resistant TB.

Association of Addiction Status with Drug-Resistant Tuberculosis Categories

Table 3 presents the association between addiction status and drug-resistant tuberculosis categories among 130 participants. Of these, 91 patients were classified as low-resistance (H mono + RR TB) and 39 as high-resistance (MDR, PreXDR, XDR). Smoking was reported in 7 patients, with 14.3% showing high resistance. Alcohol use was present in 13 patients, of whom 23.1% had resistant TB. Tobacco accounted for the largest subgroup (n = 52), with 24.1% in the resistant category. Notably, nonaddicted patients (n = 58) demonstrated the highest proportion of resistance at 42.9%, suggesting that factors beyond addiction contribute to drug resistance. Overall, the chi-square test revealed a statistically significant association between addiction and resistance pattern ($p = 0.011$). These findings highlight that behavioural risk factors such as smoking, alcohol, and tobacco use are linked to higher TB drug resistance, while resistance among nonaddicted individuals underscores the multifactorial nature of TB resistance.

Table 1: Sociodemographic profile of patients with different types of drug-resistant tuberculosis (N = 130)

	<i>H. Mono (n=2)</i>		<i>R.R. TB(n=89)</i>		<i>MDR- TB(n=36)</i>		<i>Pre XDR(n = 3)</i>		<i>XDR (n = 0)</i>		<i>Total</i>	
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>
AGE												
<26 Yr	0	0.0 0	31	67.3 9	14	30.4 3	1	2.1 7	0	0.0 0	4 6	100.0 0
26–45	1	1.3 8	51	68	18	25	2	2.7 7	0	0.0 0	7 2	100.0 0
>45	1	8.3 3	7	58.3 3	4	33.3 3	0	0.0 0	0	0.0 0	1 2	100.0 0
Sex												
Male	2	2.9 0	54	78.2 6	15	20.8 3	1	1.3 8	0	0.0 0	7 2	100.0 0
Female	0	0.0 0	35	60.3 4	21	36.2	2	3.4 4	0	0.0 0	5 8	100.0 0
Religion												
Hindu	2	2.0 2	70	70.7 0	25	25.2 5	2	2.0 2	0	0.0 0	9 9	100.0 0
Muslim	0	0.0 0	19	61.2 9	11	35.3 8	1	3.2 2	0	0.0 0	3 1	100.0 0
Family type												
Nuclear	2	2.6 7	67	89.3 3	26	6.67	2	1.3 3	0	0.00	9 7	100.0 0
Joint	0	0.0 0	19	63.3 3	10	33.3 3	1	3.3 3	0	0.00	3 0	100.0 0
Third generation	0	0.0 0	3	100.00	0	0.00	0	0.0 0	0	0.00	3	100.0 0

Table 2: Distribution of drug-resistant tuberculosis cases according to socioeconomic class

I (Upper class 9098 and above)	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00	1	100.00
II (Upper middle class 4549–9097)	0	0.00	2	100.00	0	0.00	0	0.00	0	0.00	2	100.00
III (Middle class 2729–4550)	1	7.69	9	69.23	3	23.08	0	0.00	0	0.00	13	100.00
IV (lower middle class 1365–2728)	1	1.25	64	80.00	27	16.88	2	1.88	0	0.00	94	100.00
V (Lower class below 1365)	0	0.00	14	70.00	5	25.00	1	5.00	0	0.00	20	100.00

Table 3: Association of Addiction Status with Drug- Resistant Tuberculosis Categories

	<i>H.Mono (n=2)</i>		<i>R.R. TB (n=89)</i>		<i>MDR- TB (n=36)</i>		<i>Pre XDR (n = 3)</i>		<i>XDR (n=0)</i>		<i>Total</i>		<i>p-value</i>
	N	%	N	%	N	%	N	%	N	%	N	%	
Addiction													
Smoking	0	0.00	6	85.71	0	0.00	1	14.29	0	0.00	7	100.00	<i>p</i> =.0110
Alcohol	0	0.00	10	76.92	3	23.08	0	0.00	0	0.00	13	100.00	
Tobacco	2	3.70	39	72.22	11	24.07	0	0.00	0	0.00	52	100.00	
None	0	0.00	34	57.14	22	37.14	2	5.71	0	0.00	58	100.00	

Note: *P*value (0.011) was obtained using a 2×2 chisquare test, comparing (club1=H mono + RR TB)verses.(club2=MDR/PreXDR/XDR) groups(club1 and club 2) across addiction status(addiction vs no addiction).

Discussion

The age distribution of DR- TB patients in our study indicates that most cases occur among younger adults, particularly 20 to 29 years (37.7%) and 30 to 39 years (29.2%). This pattern is consistent with Kumar Gudesh *et al.* (2024),⁶ who reported 74.8% of cases in the 19–35 age group, and Sharma Nandini *et al.*,⁷ noting 56.2% in the 15–29 range. Adolescents (10 to 19 years) also contributed significantly, while older groups showed fewer cases. These findings highlight that DR- TB predominantly affects economically productive populations (14 to 50 years).

Gender distribution showed a slight male predominance (55.4% males *vs.* 44.6% females), aligning with Viswanathan Vivek (2025)⁸ (male:female ratio 1.2:1), Kumar Gudesh *et al.* (2024)⁶ (1.9:1), and Kulkarni Suhas Gauri *et al.* (2020),⁹ who reported 66% male MDR- TB patients.

Socioeconomic analysis revealed Class IV (lower middle class) as the most affected (72.3%), followed by Class V (15.4%). This mirrors Kumar Gudesh *et al.* (2024)⁶ (65.1% upper-lower class) and Pimpaldara Rajesh *et al.* (2017),¹⁰ who found TB concentrated in lower (60%) and middle (36%) classes.

Further analysis showed that individuals aged <26 years (46 cases) had 67.4% rifampicin resistance, while those aged 26 to 45 years (72 cases) had 87.9% rifampicin resistance. Similar findings were reported by Giri VP *et al.* (2022)¹¹ (60.4% aged 20–44, median 27.6 years).

Our findings illustrates varying rates of Rif.-resistant (R.R.) and (MDR) tuberculosis (TB) among individuals with different addiction profiles. Among smokers (7 total), 85.71% had R.R. TB and 14.29% Pre-XDR. Patients with alcohol addiction (13 total) displayed 76.92% R.R. TB and 23.08% MDR-TB, while those with tobacco use (52 total) showed 72.22% R.R. TB and 24.07% MDR-TB. Interestingly, even among individuals with no addiction (58 total), there were significant proportions of drug resistance, with 57.14% R.R. TB, 37.14% MDR-TB, and 5.71% pre-XDR.

The present study demonstrated that 94 of 130 (72.3%) drug-resistant tuberculosis (DR-TB) patients belonged to the lower middle socioeconomic class, with an additional 20 (15.4%) from the lower class, indicating a predominance among socioeconomically disadvantaged populations. In contrast, Vadakunnel *et al.* (2025) 17 reported that among 192 patients, MDR-TB constituted 68.2% and RR-TB 31.8%, with shorter regimens achieving a higher treatment success rate (63.2 *vs.* 56.8%).

Research has consistently highlighted the link between substance use and poor TB outcomes. A systematic and meta-analysis by Chiang *et al.* (2018)¹² confirmed that “tobacco smoking is an independent risk factor for drug-resistant TB, with smokers being more prone to developing DR-TB compared to non-smokers. The combined impact of ‘smoking’ & ‘alcohol’ misuse

has been shown to worsen TB treatment outcomes". Furthermore, Thomas BE *et al* (2019)¹³ study revealed that "past and current smokers who also misused alcohol faced a markedly higher risk of unfavourable outcomes, such as treatment failure, recurrence, and mortality. This emphasizes the compounded adverse effects of multiple substance use on TB management."

Conclusion

This cross-sectional study highlights the significant role of sociodemographic and behavioral factors in shaping the epidemiology of drug-resistant tuberculosis (DR-TB). Younger adults (20 to 45 years) constituted the majority of rifampicin-resistant cases, underscoring the vulnerability of economically productive age groups. Male patients predominated overall, while females demonstrated a relatively higher burden of multidrug-resistant TB. Lower socioeconomic classes, particularly class IV, carried the greatest share of resistance, reflecting the social gradient in TB distribution.

Addiction status showed a statistically significant association with drug-resistant tuberculosis categories. Patients with smoking, alcohol, and tobacco use were more likely to fall into high-resistance groups (MDR/PreXDR), while nonaddicted individuals also demonstrated substantial resistance, indicating multifactorial influences. The chi-square test ($p = 0.011$) confirms that behavioral risk factors contribute to the burden of drug-resistant TB. These findings emphasize the need for integrated TB control strategies that address both pharmacological management and behavioral interventions, particularly targeting addiction, to reduce the progression and transmission of resistant forms of tuberculosis.

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