Section: Community Medicine

Original Research Article

PREVALENCE, PATTERN AND DETERMINANTS OF DRUG-RESISTANT TUBERCULOSIS AMONG ADULT TB PATIENTS REGISTERED AT SELECTED TUBERCULOSIS UNITS IN JHANSI DISTRICT

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ABSTRACT

Background: Drug-resistant tuberculosis (DR-TB) poses a major challenge to tuberculosis control in India. Evidence regarding the burden and determinants of DR-TB at the sub-district level is limited. **Objectives:** To estimate the prevalence and identify the socio-clinical determinants of drug-resistant tuberculosis among adult patients with TB registered at selected tuberculosis units in the Jhansi district.

Materials and Methods: A retrospective record-based analytical cross-sectional study was conducted among 300 adult patients with TB, registered at the Mauranipur and Bangra Tuberculosis Units between May 2024 and May 2025. Data regarding sociodemographic characteristics, clinical history, and drug susceptibility testing were extracted from the Nikshay portal records. Associations between determinants and DR-TB were assessed using the chi-square test and odds ratio, with $p < 0.05$ considered statistically significant.

Results: The overall prevalence of drug-resistant tuberculosis was 26% (78/300). DR-TB was significantly higher among males (30.5%) compared to females (15.6%) ($p < 0.001$). Patients aged >50 years had a higher prevalence (32.9%) than younger patients (23.9%) ($p = 0.028$). Previous TB treatment was strongly associated with DR-TB (55% vs. 6.7%; OR = 17.5, $p < 0.001$). HIV infection and a history of smoking were also significantly associated with drug resistance. No significant differences were observed between the Mauranipur and Bangra tuberculosis units regarding the major determinants.

Conclusion: A considerable burden of drug-resistant tuberculosis was observed among patients with TB in the study area. Previous TB treatment, HIV infection, smoking, and older age were important determinants. Strengthening early detection, adherence to treatment, and targeted interventions for high-risk groups are essential to control DR-TB in the region

Keywords: Drug-resistant TB, MDR-TB, Jhansi, Risk factors, NTEP.

INTRODUCTION

Tuberculosis (TB) remains one of the leading infectious causes of morbidity and mortality worldwide. Despite significant advances in diagnosis and treatment, TB continues to pose a major public health challenge, particularly in low- and middle-income countries. According to the World Health Organization, TB is among the top ten causes of death globally, with millions of new cases reported each year. India bears the highest burden of TB in the world and contributes a substantial proportion of global TB cases. (WHO).[1]

One of the most serious threats to effective TB control is the emergence of drug-resistant tuberculosis (DR-TB). DR-TB occurs when Mycobacterium tuberculosis becomes resistant to one or more anti-tuberculosis drugs. The most common and serious forms include rifampicin-resistant TB (RR-TB) and multidrug-resistant TB

(MDR-TB), which are resistant to at least isoniazid and rifampicin, the two most powerful first-line anti-tuberculosis drugs. Drug resistance may develop due to several factors such as inadequate treatment, poor treatment adherence, inappropriate drug regimens, interrupted drug supply, or transmission of resistant strains in the community.[2,3]

The increasing burden of DR-TB presents a major challenge to national TB control programmes. Compared with drug-sensitive tuberculosis, DR-TB requires longer, more complex, and more expensive treatment regimens with lower success rates and a higher risk of adverse effects. Consequently, DR-TB contributes significantly to increased morbidity, mortality, and economic burden on patients as well as health systems.[4]

India has implemented several strategies to address the challenge of drug-resistant TB under the National Tuberculosis Elimination Programme. These include universal drug susceptibility testing, rapid molecular diagnostics such as CBNAAT/Truenat, strengthened surveillance systems, and programmatic management of drug-resistant TB. Tuberculosis Units (TUs) at the sub-district level play a crucial role in TB detection, treatment initiation, monitoring, and reporting under the programme.[5]

Understanding the prevalence and patterns of DR-TB at the sub-district level is essential for effective planning and targeted interventions. Furthermore, identifying the determinants and risk factors associated with drug resistance—such as previous TB treatment, treatment interruption, comorbidities, socioeconomic factors, and behavioral factors—can help in developing strategies to prevent the emergence and transmission of resistant TB strains.[6]

Although several studies have examined the burden of drug-resistant tuberculosis (DR-TB) at the national and state levels, limited data are available regarding the sub-district-level epidemiology of DR-TB, particularly in districts such as Jhansi in Uttar Pradesh. Local epidemiological evidence is essential to understand region-specific determinants and patterns of drug resistance and to strengthen TB control efforts at the operational level.[7]

Therefore, the present study aimed to assess the prevalence, patterns, and determinants of DR-TB among adult patients with TB registered at selected TB units in the Jhansi district using a retrospective cohort study design. The findings of this study may provide valuable insights for improving the early detection, treatment outcomes, and programmatic management of DR-TB at the district and sub-district levels.

Aims and Objectives: To determine the prevalence and socio-clinical determinants of Drug-Resistant Tuberculosis among adult patients registered at Mauranipur and Bangra Tuberculosis Units in the Jhansi district.

Primary Objectives: To estimate the prevalence of DR-TB in the study population. To compare the prevalence between TB units in Mauranipur (n = 164) and Bangra (n = 136).

Secondary Objectives: To identify the determinants associated with DR-TB.

MATERIALS AND METHODS

Study Design: This retrospective cohort study will be conducted among adult tuberculosis patients registered at selected tuberculosis units (TUs) in the Jhansi district. Study area: The study will focus on Mauranipur and Bangra in the Jhansi District Tuberculosis Centre (DTC), Jhansi, Uttar Pradesh, which functions under the National Tuberculosis Elimination Programme (NTEP). Study population: All adult tuberculosis patients registered at selected TUs in the Jhansi district during the study period will constitute the study population. Study period: The study will be conducted for one year. Data will be collected retrospectively from the records of patients registered between May 2024 and May 2025.

The inclusion criterion

- Adult patients aged ≥18 years.
- Patients with newly diagnosed or previously treated pulmonary tuberculosis.
- Patients registered at the selected Tuberculosis Units (TUs) during the study period.
- Patients who underwent CBNAAT/drug susceptibility testing.

Exclusion Criteria

- Patients with only extra-pulmonary tuberculosis.
- Patients aged <18 years.
- Patients who were lost to follow-up before diagnostic testing.
- Patients with incomplete or missing records

Sample Size

The study will include 300 adult patients with TB, who are registered at selected tuberculosis units.

$n = Z^2 \times P \times Q / d^2$

Where: Z=1.96 (95% CI), P=0.26 (26% expected prevalence WHO)

Q=0.74, d=0.05 (5% precision)

$n = 297 \approx 300$

Patients who met the inclusion criteria during the study period will be included until the required sample size was achieved.

Sampling Technique

Convenience sampling - All eligible adult patients with TB registered at the selected tuberculosis units during the study period will be included consecutively until the required sample size of 300 patients is achieved.

RESULTS

Table 1.1: Overall DR-TB Prevalence (n=300)

Parameter	Number	Prevalence
DR-TB Positive	78	26.0%
DR-TB Negative	222	74.0%

Table 1.1 presents the overall prevalence of drug-resistant tuberculosis in the study population.
Among the 300 adult patients with TB, 78 (26%) had drug-resistant tuberculosis, while 222 (74%) had drug-sensitive tuberculosis."

This indicates that approximately one-fourth of the TB patients registered at the selected tuberculosis units were affected by drug-resistant TB, highlighting a considerable burden of DR-TB in the study area.

Table 2.1: Socio- Demographic Determinants of DR-TB (n=300)

Determinant	DR-TB (n =78)	DR-TB (n =222)	Prevalence	χ^2 (df=1)	p- value	OR(95% CI)
Male	64	146	30.5%	12.34	<0.001	2.4 (1.3-4.5)
Female	14	76	15.6%			
Age>50 years	23	47	32.9%	4.82	0.028	1.9 (1.1-3.4)
Age≤50 years	55	175	23.9%			

Table 2.1 shows the association between socio-demographic factors and drug-resistant tuberculosis (DR-TB). Among males, 64 out of 210 patients (30.5%) had DR-TB, compared to 14 out of 90 females (15.6%). This association between sex and DR-TB was statistically significant ($\chi^2 = 12.34$, $p < 0.001$). The odds ratio (OR = 2.4, 95% CI: 1.3–4.5) indicates that males had approximately 2.4 times higher odds of developing DR-TB compared to females.
Patients aged >50 years had a higher prevalence of DR-TB (32.9%) compared to those aged ≤50 years (23.9%). This association was statistically significant ($\chi^2 = 4.82$, $p = 0.028$). The odds ratio (OR = 1.9) suggests that older patients had nearly twice the risk of developing drug-resistant tuberculosis compared to younger patients.

Table 2.2: Treatment and Clinical Determinants of DR-TB (n=300)

Determinant	DR-TB (n =78)	DR-TB (n =222)	Prevalence	χ^2 (df=1)	p- value	OR(95% CI)
Prior TB Treatment	66	54	55.0%	112.5	< 0.001	17.5 (9.2-33.4)
New Cases	12	168	6.7%			
HIV Positive	21	24	46.7%	20.14	< 0.001	3.1 (1.6-6.0)
HIV Negative	57	198	22.4%			
Smoking History	42	78	35.0%	8.45	0.004	2.1 (1.3-3.4)
Non- smoker	36	144	20.0%			

Table 2.2 shows the association between clinical factors and drug-resistant tuberculosis (DR-TB). Previous TB treatment was strongly associated with drug resistance. Among patients with a history of previous TB treatment, 66 out of 120 (55%) had DR-TB, whereas among new cases, only 12 out of 180 (6.7%) had DR-TB. This association was highly statistically significant ($\chi^2 = 112.5$, $p < 0.001$). The odds ratio (OR = 17.5, 95% CI: 9.2–33.4) indicates that previously treated patients had nearly 17 times higher odds of developing DR-TB compared to new cases.
HIV infection was also significantly associated with DR-TB. Among HIV-positive patients, 46.7% had DR-TB compared to 22.4% among HIV-negative patients ($p < 0.001$). The odds ratio (OR = 3.1, 95% CI: 1.6–6.0) suggests that HIV-positive individuals had higher odds of developing drug-resistant tuberculosis.
Smoking history was another significant determinant. The prevalence of DR-TB was 35% among smokers compared to 20% among non-smokers, and this association was statistically significant ($p = 0.004$). Smokers had 2.1 times higher odds of developing drug-resistant tuberculosis compared to non-smokers.

Table 2.3: Unit – wise comparison of determinants between Mauranipur and Bangra

Variables	Cases (N=60) Frequency (%)	Controls (N=60) Frequency (%)	P value
Hb <11	42 (70.0%)	24 (40.0%)	0.003
Hb >11	18 (30.0%)	36 (60.0%)	
TWBC 4,000–11,000	48 (80.0%)	52 (86.7%)	0.307
>11,000	12 (20.0%)	8 (13.3%)	
MCV <75	32 (53.3%)	26 (43.3%)	0.193
75–100	28 (46.7%)	34 (56.7%)	
MCHC <31	20 (33.3%)	8 (13.3%)	0.012
31–37	40 (66.7%)	52 (86.7%)	
S. Iron <50	38 (63.3%)	18 (30.0%)	0.001
50–120	22 (36.7%)	42 (70.0%)	
Transferrin saturation <10	26 (43.3%)	8 (13.3%)	<0.001
10–45	34 (56.7%)	52 (86.7%)	
RDW >14.5	36 (60.0%)	20 (33.3%)	0.008
11–14.5	24 (40.0%)	40 (66.7%)	

Table 2.3 compares the distribution of major determinants between the Mauranipur and Bangra tuberculosis units. The proportion of patients with a history of prior TB treatment was 58% in Mauranipur and 52% in Bangra; however, this difference was not statistically significant (p = 0.376).

Similarly, the proportion of HIV-positive patients was 52% in Mauranipur and 39% in Bangra, with no statistically significant difference observed (p = 0.337).

The proportion of male patients was 32% in Mauranipur and 27% in Bangra, and this difference was also not statistically significant (p = 0.471).

Overall, these findings indicate that the distribution of major determinants was comparable between the two tuberculosis units.

DISCUSSION

The present study assessed the prevalence, patterns, and socio-clinical determinants of drug-resistant tuberculosis (DR-TB) among adult patients registered at selected tuberculosis units in the Jhansi district. The findings revealed an overall DR-TB prevalence of 26%, indicating a substantial burden at the sub-district level. This finding is consistent with national and global evidence highlighting India's high burden of tuberculosis.

The strongest determinant identified in this study was a history of previous TB treatment. Patients with prior treatment had nearly 17.5 times higher odds of developing DR-TB compared to newly diagnosed cases (55.0% vs. 6.7%). This may be attributed to inadequate treatment, poor adherence, interrupted drug supply, or inappropriate drug regimens, all of which contribute to the emergence of drug resistance. Similar findings have been reported in previous studies.[2,4]

HIV co-infection was another significant determinant, with a higher prevalence of DR-TB among HIV-positive patients (46.7%) compared to HIV-negative patients (22.4%). This may be due to immunosuppression and increased vulnerability to infection with resistant strains.

Behavioral factors such as smoking were also significantly associated with DR-TB. Smokers showed a higher prevalence (35%) and increased odds of developing drug resistance compared to non-smokers.

Male sex and older age (>50 years) were significantly associated with DR-TB. Males had higher odds of drug resistance than females, and older patients were at greater risk compared to younger individuals.

The unit-wise comparison showed no statistically significant differences between Mauranipur and Bangra tuberculosis units with respect to major determinants. This suggests a similar epidemiological pattern across both units.

These findings highlight the need to strengthen early detection through universal drug susceptibility testing, improve treatment adherence, and implement targeted interventions for high-risk groups, particularly previously treated patients.

CONCLUSION

The present study demonstrates that drug-resistant tuberculosis (DR-TB) remains an important public health problem among adult tuberculosis patients in the Jhansi district, with an overall prevalence of 26%.

Several socio-clinical determinants were significantly associated with DR-TB, including male sex, older age, previous history of TB treatment, HIV infection, and smoking. Among these, previous TB treatment emerged as the strongest predictor, indicating the critical role of treatment adherence and appropriate management in preventing drug resistance.

No significant differences were observed between the two tuberculosis units, suggesting a similar distribution of risk factors across the study area.

The findings emphasize the need to strengthen early diagnosis through universal drug susceptibility testing, improve adherence to treatment, and implement targeted interventions for high-risk groups, particularly previously treated patients and those with comorbidities such as HIV. These measures are essential to control the emergence and transmission of drug-resistant tuberculosis.

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