



Association of Socio-Demographic Characteristics and Risk Factors with Treatment Outcomes and Quality of Life Among Multidrug-Resistant Tuberculosis Patients in Raichur District.

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Abstract

Background: Multidrug-resistant tuberculosis (MDR-TB) remains a major public health challenge because of prolonged treatment, drug toxicity, poor adherence, unfavourable outcomes, and impaired quality of life. Socio-demographic disadvantage, behavioural risk factors, comorbidities, and previous tuberculosis treatment may influence both therapeutic outcomes and patient well-being. Aim: To determine the association of socio-demographic characteristics and risk factors with treatment outcomes and quality of life among multidrug-resistant tuberculosis patients in Raichur district. Materials and Methods: A community-based cross-sectional study was conducted among 60 MDR-TB patients registered at the District Tuberculosis Centre, Raichur. Eligible patients were identified from programme records and interviewed using a pre-designed, pre-tested questionnaire. Data regarding socio-demographic characteristics, behavioural risk factors, comorbidities, previous tuberculosis treatment, adverse drug reactions, sputum conversion, and treatment outcomes were collected. Quality of life was assessed using the WHOQOL-BREF questionnaire across physical, psychological, social-relationship, and environmental domains. Continuous variables were expressed as mean±standard deviation, while categorical variables were summarized as frequencies and percentages. Associations were assessed using the Chi-square test, Fisher's exact test, Student's t-test, and odds ratios with 95% confidence intervals. A p-value <0.05 was considered statistically significant. Results: The mean age of participants was 39.8±11.4 years, and 65.0% were male. Rural residents constituted 63.3%, 58.3% belonged to the lower socioeconomic class, and 76.7% had previously received tuberculosis treatment. Smoking, tobacco chewing, alcohol consumption, diabetes mellitus, and HIV infection were present in 30.0%, 36.7%, 33.3%, 26.7%, and 8.3% of patients, respectively. Overall, 41 (68.3%) patients had favourable treatment outcomes, including 29 (48.3%) who were cured and 12 (20.0%) who completed treatment. Unfavourable outcomes occurred in 19 (31.7%) patients, comprising death in 13.4%, loss to follow-up in 10.0%, and treatment failure in 8.3%. Age above 40 years, diabetes, smoking, alcohol consumption, adverse drug reactions, and low quality of life were significantly associated with unfavourable outcomes. The mean overall WHOQOL-BREF score was 58.6±11.8. Good quality of life was observed in 56.7%, while 43.3% had poor quality of life. A favourable treatment outcome was associated with significantly higher odds of good quality of life (OR=4.23, 95% CI: 1.42-12.59; p=0.004), whereas diabetes and alcohol use were associated with poor quality of life. Conclusion: MDR-TB disproportionately affected socially and economically vulnerable adults and was frequently associated with previous tuberculosis treatment, behavioural risk factors, comorbidities, and undernutrition. Although most patients achieved favourable treatment outcomes, a considerable proportion experienced death, treatment failure, loss to follow-up, and impaired quality of life. Integrated management addressing clinical, nutritional, behavioural, and psychosocial determinants is required to improve treatment success and quality of life.

Keywords: Multidrug-resistant tuberculosis; Treatment outcome; Quality of life.

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INTRODUCTION

Multidrug-resistant tuberculosis (MDR-TB), defined as tuberculosis caused by *Mycobacterium tuberculosis* resistant to at least isoniazid and rifampicin, remains one of the greatest challenges to global tuberculosis control. Despite significant advances in tuberculosis diagnosis and treatment under the National Tuberculosis Elimination Programme (NTEP), MDR-TB continues to contribute substantially to morbidity, mortality, prolonged infectiousness, and economic burden, particularly in low- and middle-income countries. India accounts for the highest number of tuberculosis cases globally and

contributes a considerable proportion of MDR-TB cases, making effective management of these patients a national public health priority. The emergence of drug resistance is attributed to inadequate treatment adherence, irregular drug supply, inappropriate treatment regimens, delayed diagnosis, previous tuberculosis treatment, and poor infection control practices. These factors compromise treatment success and increase the likelihood of transmission within the community.^[1]

The management of MDR-TB is considerably more complex than drug-sensitive tuberculosis because it requires prolonged treatment with second-line anti-tubercular drugs that are associated with higher toxicity, increased cost, frequent adverse drug reactions, and comparatively lower treatment success rates. Consequently, many patients experience treatment interruption, default, treatment failure, relapse, or death. Treatment outcomes are influenced by several socio-demographic and behavioral determinants including age, gender, educational status, occupation, socioeconomic status, nutritional status, tobacco use, alcohol consumption, diabetes mellitus, HIV infection, and other comorbidities. Understanding the relationship between these factors and treatment outcomes is essential for developing targeted interventions that improve adherence and therapeutic success.^[2]

In addition to microbiological cure, the quality of life (QoL) of MDR-TB patients has emerged as an important indicator of comprehensive patient care. Patients undergoing MDR-TB treatment often suffer from physical limitations, psychological distress, social stigma, financial hardship, and reduced work productivity due to the prolonged disease course and adverse effects of treatment. These challenges adversely affect physical, psychological, social, and environmental domains of quality of life. The World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire provides a standardized and validated instrument to assess these multidimensional aspects of health-related quality of life. Evaluation of QoL enables healthcare providers to identify unmet psychosocial needs and design patient-centered interventions that complement clinical management.^{[3][4]}

Raichur district, Karnataka, continues to report a substantial burden of tuberculosis and MDR-TB. However, there is limited community-based evidence regarding the socio-demographic profile, associated risk factors, treatment outcomes, and quality of life among MDR-TB patients receiving treatment under the Programmatic Management of Drug-Resistant Tuberculosis (PMDT). Generating local evidence is important for identifying vulnerable population groups and strengthening district-level tuberculosis control strategies. Therefore, the present community-based cross-sectional study was undertaken to evaluate the association of socio-demographic characteristics and risk factors with treatment outcomes and quality of life among MDR-TB patients in Raichur district. The findings are expected to support policymakers and healthcare providers in planning comprehensive interventions aimed at improving treatment adherence, treatment success, and overall quality of life among patients with MDR-TB.^{[5][6]}

AIM

To determine the association of socio-demographic characteristics and risk factors with treatment outcomes and quality of life among multidrug-resistant tuberculosis patients in Raichur district.

OBJECTIVES

1. To study the socio-demographic characteristics and risk factors among multidrug-resistant tuberculosis patients.
2. To assess the treatment outcomes of multidrug-resistant tuberculosis patients receiving treatment under PMDT.
3. To evaluate the quality of life of multidrug-resistant tuberculosis patients and determine its association with socio-demographic characteristics and treatment outcomes using the WHOQOL-BREF questionnaire.

MATERIALS AND METHODS

Source of Data

The data were obtained from the registers of multidrug-resistant tuberculosis (MDR-TB) patients maintained at the District Tuberculosis Centre (DTC), Raichur. Eligible patients registered under the Programmatic Management of Drug-Resistant Tuberculosis (PMDT) were identified and contacted for participation in the study.

Study Design

A community-based cross-sectional study was conducted.

Study Location

The study was carried out in Raichur district, Karnataka, among MDR-TB patients registered under the District Tuberculosis Centre (DTC), Raichur.

Study Duration

The study was conducted over a period of one year from January 2017 to December 2017. Patients diagnosed and registered for MDR-TB treatment between January 2016 and May 2017 were included in the study.

Sample Size

A total of 60 multidrug-resistant tuberculosis patients fulfilling the eligibility criteria were included in the study.

Inclusion Criteria

- Patients diagnosed with multidrug-resistant tuberculosis and registered under the District Tuberculosis Centre, Raichur.
- Patients receiving treatment under PMDT.
- Patients aged 15 years and above.
- Patients who were willing to participate and provided written informed consent. (Adapted from the original methodology.)

Exclusion Criteria

- Patients who were unwilling to participate.
- Patients transferred out of Raichur district during the study period.
- Patients who died before they could be interviewed.
- Pediatric tuberculosis patients (0-14 years).

Procedure and Methodology

Prior permission was obtained from the District Tuberculosis Officer (DTO), Raichur. Eligible MDR-TB patients were identified from the PMDT register maintained at the District Tuberculosis Centre. With the assistance of the Senior Treatment Supervisor (STS), patients were traced to their residences. The objectives of the study were explained, and written informed consent was obtained before enrolment.

Information was collected using a pre-designed, pre-tested structured questionnaire. The questionnaire included socio-demographic details such as age, sex, education, occupation, marital status, family type, socioeconomic status, residence, housing conditions, and environmental factors. Information regarding behavioral risk factors including smoking, tobacco chewing, alcohol consumption, previous contact with tuberculosis patients, awareness regarding tuberculosis, sputum disposal practices, mask usage, and associated comorbidities such as diabetes mellitus, HIV infection, and psychiatric illness was also collected. Anthropometric measurements including height and weight were recorded using standardized techniques.

Treatment outcome details were obtained from PMDT treatment records and categorized according to NTEP guidelines as cured, treatment completed, treatment failed, died, lost to follow-up, or treatment ongoing.

Quality of life was assessed using the WHOQOL-BREF questionnaire comprising 26 items covering four domains: physical health, psychological health, social relationships, and environmental health, along with two general questions assessing overall quality of life and general health. The responses were recorded according to WHO scoring guidelines.

Sample Processing

After completion of each interview, questionnaires were checked for completeness and consistency. Anthropometric measurements were verified, and treatment outcome details were cross-checked with PMDT treatment records. WHOQOL-BREF responses were scored according to the WHO manual, and domain scores were transformed to a 0-100 scale for analysis. Data were coded and entered into Microsoft Excel before statistical analysis.

Statistical Methods

The collected data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 25.0. Descriptive statistics were expressed as mean $\pm$ standard deviation for continuous variables and frequencies with percentages for categorical variables. Associations between socio-demographic characteristics, risk factors, treatment outcomes, and quality-of-life domains were evaluated using the Chi-square test or Fisher's exact test for categorical variables and the independent Student's *t*-test or one-way ANOVA for continuous variables. Pearson or Spearman correlation coefficients were used where appropriate. A *p*-value of <0.05 was considered statistically significant.

Data Collection

Data collection was performed through household visits using face-to-face interviews after obtaining written informed consent. Information on socio-demographic characteristics, behavioral risk factors, clinical history, treatment details, and quality of life was recorded using standardized study instruments. Anthropometric measurements were obtained using calibrated equipment following standard procedures. Treatment outcomes were extracted from PMDT records, while quality of life was assessed using the validated WHOQOL-BREF questionnaire. The completed questionnaires were reviewed daily for completeness and accuracy before data entry.

RESULTS

Table 1: Association of socio-demographic characteristics and risk factors with treatment outcomes and quality of life among multidrug-resistant tuberculosis patients in Raichur district (N=60)

Variable	Category	n (%) / Mean±SD	Test of significance	95% CI	p-value
Age (years)	Mean±SD	39.8±11.4	One-sample t=27.06	36.9-42.7	<0.001*
Treatment outcome	Favourable	41 (68.3)	$\chi^2=8.07$	55.1-79.0%	0.005*
	Unfavourable	19 (31.7)		21.0-44.9%	
Overall WHOQOL-BREF score	Mean±SD	58.6±11.8	t=38.54	55.5-61.7	<0.001*
Age >40 years with unfavourable outcome	Yes	14 (46.7)	$\chi^2=5.11$	OR=3.08 (1.07-8.87)	0.024*
Diabetes mellitus	Present	16 (26.7)	$\chi^2=4.36$	OR=2.89 (1.01-8.25)	0.037*
Smoking history	Present	18 (30.0)	$\chi^2=4.89$	OR=3.01 (1.09-8.29)	0.027*
Alcohol consumption	Present	20 (33.3)	$\chi^2=5.72$	OR=3.42 (1.24-9.42)	0.018*
BMI (kg/m ²)	Mean±SD	18.7±2.9	t=50.02	17.9-19.5	<0.001*
Low QoL (WHOQOL <50)	Yes	22 (36.7)	$\chi^2=6.81$	OR=3.64 (1.33-9.95)	0.011*

Table 1 summarizes the association between selected socio-demographic characteristics, risk factors, treatment outcomes, and quality of life among multidrug-resistant tuberculosis (MDR-TB) patients. The mean age of the study participants was 39.8±11.4 years (95% CI: 36.9-42.7), which was statistically significant ($t=27.06$, $p<0.001$). Overall, 41 (68.3%) patients had a favourable treatment outcome, whereas 19 (31.7%) experienced an unfavourable outcome, showing a statistically significant distribution ($\chi^2=8.07$, $p=0.005$). The mean overall WHOQOL-BREF score was 58.6±11.8 (95% CI: 55.5-61.7), indicating a moderate quality of life among participants and was statistically significant ($t=38.54$, $p<0.001$). Patients aged more than 40 years had significantly higher odds of experiencing an unfavourable treatment outcome (OR=3.08, 95% CI: 1.07-8.87; $p=0.024$). Similarly, the presence of diabetes mellitus (OR=2.89, 95% CI: 1.01-8.25; $p=0.037$), smoking history (OR=3.01, 95% CI: 1.09-8.29; $p=0.027$), and alcohol consumption (OR=3.42, 95% CI: 1.24-9.42; $p=0.018$) were significantly associated with poorer treatment outcomes. The mean body mass index (BMI) was 18.7±2.9 kg/m² (95% CI: 17.9-19.5), suggesting undernutrition among many patients and was statistically significant ($p<0.001$). Furthermore, 22 (36.7%) patients had low quality of life (WHOQOL score <50), which was significantly associated with adverse clinical characteristics (OR=3.64, 95% CI: 1.33-9.95; $p=0.011$).

Table 2: Socio-demographic characteristics and risk factors among multidrug-resistant tuberculosis patients (N=60)

Variable	Category	n (%) / Mean±SD	Test of significance	95% CI	p-value
Age (years)	Mean±SD	39.8±11.4	t=27.06	36.9-42.7	<0.001*
Age group	<30 years	16 (26.7)	$\chi^2=9.54$		0.023*
	30-40 years	20 (33.3)			
	41-50 years	14 (23.3)			
	>50 years	10 (16.7)			
Gender	Male	39 (65.0)	$\chi^2=5.40$	51.6-76.4%	0.020*
	Female	21 (35.0)		23.6-48.4%	
Residence	Rural	38 (63.3)	$\chi^2=4.27$	50.0-75.0%	0.039*
	Urban	22 (36.7)		25.0-50.0%	
Education	Illiterate	18 (30.0)	$\chi^2=10.48$		0.015*
	Primary	15 (25.0)			
	Secondary	17 (28.3)			
	Higher	10 (16.7)			
Occupation	Unskilled worker	24 (40.0)	$\chi^2=8.33$		0.040*
	Skilled worker	14 (23.3)			

	Homemaker	13 (21.7)			
	Unemployed	9 (15.0)			
Socioeconomic status	Lower	35 (58.3)	$\chi^2=6.98$	45.1-70.5%	0.030*
Smoking	Yes	18 (30.0)	$\chi^2=4.80$	19.8-42.7%	0.028*
Tobacco chewing	Yes	22 (36.7)	$\chi^2=5.41$	25.0-50.0%	0.020*
Alcohol consumption	Yes	20 (33.3)	$\chi^2=5.72$	22.1-46.8%	0.018*
Diabetes mellitus	Present	16 (26.7)	$\chi^2=4.36$	16.8-39.9%	0.037*
HIV infection	Present	5 (8.3)	$\chi^2=41.67$	3.6-17.9%	<0.001*
Previous TB treatment	Yes	46 (76.7)	$\chi^2=17.07$	64.5-85.9%	<0.001*

Table 2 presents the socio-demographic profile and risk factors of the study participants. The mean age was 39.8±11.4 years (95% CI: 36.9-42.7), with statistical significance ($p<0.001$). The largest proportion of patients belonged to the 30-40 years age group (33.3%), followed by <30 years (26.7%), 41-50 years (23.3%), and >50 years (16.7%), with a significant age-group distribution ($\chi^2=9.54$, $p=0.023$). Males constituted the majority of the study population (65.0%), significantly outnumbering females (35.0%) ($\chi^2=5.40$, $p=0.020$). Most participants were residents of rural areas (63.3%) compared to urban areas (36.7%) ($\chi^2=4.27$, $p=0.039$). Regarding educational status, 30.0% were illiterate, 25.0% had primary education, 28.3% had secondary education, and only 16.7% had higher education, indicating a significant educational disparity ($p=0.015$). Unskilled workers represented the largest occupational group (40.0%), followed by skilled workers (23.3%), homemakers (21.7%), and unemployed individuals (15.0%) ($\chi^2=8.33$, $p=0.040$). More than half of the participants (58.3%) belonged to the lower socioeconomic class ($p=0.030$). Behavioral risk factors were common, with 30.0% reporting smoking, 36.7% tobacco chewing, and 33.3% alcohol consumption, all showing statistically significant distributions. Diabetes mellitus was present in 26.7% of patients ($p=0.037$), while HIV infection was observed in 8.3%, although its distribution was highly significant ($p<0.001$). Notably, 76.7% of patients had a history of previous tuberculosis treatment, highlighting previous treatment as an important risk factor for MDR-TB ($p<0.001$).

Table 3: Treatment outcomes of multidrug-resistant tuberculosis patients receiving treatment under PMDT (N=60)

Variable	Category	n (%)	Test of significance	95% CI	p-value
Treatment outcome	Cured	29 (48.3)	$\chi^2=42.58$	35.6-61.2%	<0.001*
	Treatment completed	12 (20.0)		11.6-32.2%	
	Lost to follow-up	6 (10.0)		4.7-20.1%	
	Treatment failure	5 (8.3)		3.6-17.9%	
	Died	8 (13.4)		6.9-24.3%	
Overall favourable outcome	Yes	41 (68.3)	$\chi^2=8.07$	55.1-79.0%	0.005*
Overall unfavourable outcome	No	19 (31.7)		21.0-44.9%	
Mean duration of treatment (months)	Mean±SD	21.3±3.8	t=43.45	20.3-22.3	<0.001*
Adverse drug reaction	Present	24 (40.0)	$\chi^2=5.40$	OR=2.98 (1.11-8.01)	0.020*
Sputum conversion within 6 months	Yes	45 (75.0)	$\chi^2=15.00$	62.8-84.3%	<0.001*

Table 3 describes the treatment outcomes of MDR-TB patients managed under the Programmatic Management of Drug-Resistant Tuberculosis (PMDT). Among the study participants, 29 (48.3%) patients were cured, while 12 (20.0%) completed treatment successfully, resulting in an overall favourable treatment outcome in 41 (68.3%) patients. Conversely, 19 (31.7%) experienced unfavourable outcomes, including 6 (10.0%) lost to follow-up, 5 (8.3%) treatment failures, and 8 (13.4%) deaths. The overall distribution of treatment outcomes was statistically significant ($\chi^2=42.58$, $p<0.001$), and favourable outcomes significantly exceeded unfavourable outcomes ($\chi^2=8.07$, $p=0.005$). The mean duration of treatment was 21.3±3.8 months (95% CI: 20.3-22.3), reflecting the prolonged therapy required for MDR-TB ($p<0.001$). Adverse drug reactions were documented in 24 (40.0%) patients and were significantly associated with treatment outcomes

(OR=2.98, 95% CI: 1.11-8.01; $p=0.020$). Encouragingly, 45 (75.0%) patients achieved sputum conversion within six months of treatment initiation, demonstrating effective bacteriological response under PMDT ($\chi^2=15.00$, $p<0.001$).

Table 4: Quality of life among multidrug-resistant tuberculosis patients and its association with socio-demographic characteristics and treatment outcomes using WHOQOL-BREF (N=60)

Variable	Category	Mean $\pm$ SD / n (%)	Test of significance	95 % CI	p-value
Physical health domain	Mean $\pm$ SD	56.2 $\pm$ 12.4	t=35.11	53.0-59.4	<0.001*
Psychological domain	Mean $\pm$ SD	57.4 $\pm$ 11.9	t=37.31	54.3-60.5	<0.001*
Social relationship domain	Mean $\pm$ SD	61.3 $\pm$ 13.1	t=36.20	57.9-64.7	<0.001*
Environmental domain	Mean $\pm$ SD	59.5 $\pm$ 10.8	t=42.67	56.7-62.3	<0.001*
Overall WHOQOL-BREF score	Mean $\pm$ SD	58.6 $\pm$ 11.8	t=38.54	55.5-61.7	<0.001*
Good QoL (≥ 60)	34 (56.7)	$\chi^2=1.07$	43.6-68.9%	0.301	
Poor QoL (<60)	26 (43.3)		31.1-56.4%		
Favourable treatment outcome with good QoL	29 (70.7)	$\chi^2=8.52$	OR=4.23 (1.42-12.59)	0.004*	
Diabetes associated with poor QoL	12 (75.0)	$\chi^2=5.18$	OR=3.51 (1.15-10.72)	0.023*	
Alcohol use associated with poor QoL	13 (65.0)	$\chi^2=4.64$	OR=3.06 (1.07-8.74)	0.031*	

* Statistically significant ($p < 0.05$).

Table 4 presents the quality of life (QoL) of MDR-TB patients as assessed using the WHOQOL-BREF questionnaire. The mean scores for the four WHOQOL-BREF domains were 56.2 $\pm$ 12.4 for physical health, 57.4 $\pm$ 11.9 for psychological health, 61.3 $\pm$ 13.1 for social relationships, and 59.5 $\pm$ 10.8 for environmental health. All domain scores were statistically significant ($p<0.001$), indicating measurable impairment across multiple aspects of quality of life. The overall WHOQOL-BREF score was 58.6 $\pm$ 11.8 (95% CI: 55.5-61.7; $p<0.001$), suggesting a moderate overall quality of life among patients undergoing MDR-TB treatment. Based on the overall score, 34 (56.7%) patients had good quality of life (score ≥ 60), whereas 26 (43.3%) had poor quality of life (score <60); however, this distribution was not statistically significant ($\chi^2=1.07$, $p=0.301$). Patients with favourable treatment outcomes were significantly more likely to report good quality of life (OR=4.23, 95% CI: 1.42-12.59; $p=0.004$). Diabetes mellitus was significantly associated with poor quality of life (OR=3.51, 95% CI: 1.15-10.72; $p=0.023$), and alcohol consumption was also identified as an important predictor of poorer quality of life (OR=3.06, 95% CI: 1.07-8.74; $p=0.031$). These findings indicate that successful treatment outcomes and the absence of comorbidities and unhealthy lifestyle factors contribute to better quality of life among MDR-TB patients.

DISCUSSION

The present study evaluated the socio-demographic profile, behavioural and clinical risk factors, treatment outcomes, and quality of life among 60 patients with multidrug-resistant tuberculosis (MDR-TB) in Raichur district. The findings demonstrated that MDR-TB predominantly affected adults in the economically productive age group, with a mean age of 39.8 $\pm$ 11.4 years. Approximately one-third of the participants were aged 30-40 years, while nearly two-thirds were male. Similar observations were reported by Dash et al. (2022)^[1] in southern Odisha, where MDR-TB predominantly affected young and middle-aged adults and males constituted the majority of cases. Sharma et al. (2020)^[2], in a record-based study from Delhi, also observed that most MDR-TB patients were adults of working age, highlighting the considerable social and economic consequences of the disease. The predominance of MDR-TB among economically productive individuals may be related to greater occupational exposure, mobility, delayed healthcare-seeking, tobacco and alcohol use, and previous inadequate tuberculosis treatment.

In the present study, 63.3% of patients were from rural areas, 30.0% were illiterate, 40.0% were unskilled workers, and 58.3% belonged to the lower socioeconomic class. These findings suggest that MDR-TB was concentrated among socially and economically vulnerable groups. Dash et al. (2022)^[1] similarly documented a substantial burden of MDR-TB among rural residents, individuals with limited education, and those from disadvantaged socioeconomic backgrounds. Poor socioeconomic conditions can promote delayed diagnosis, household crowding, undernutrition, difficulty in accessing healthcare facilities, and interruption of prolonged treatment. Socioeconomic disadvantage may also restrict the ability of

patients to travel regularly to treatment centres or maintain adequate nutrition during therapy. Sahasrabudhe et al. (2024)^[3] reported that patients with drug-resistant tuberculosis experienced substantial financial hardship, loss of employment, dependency on family members, stigma, and disruption of social functioning. These findings reinforce the need for nutritional, travel, counselling, and social-protection support alongside medical treatment.

Previous tuberculosis treatment was reported by 76.7% of the participants and was the most frequently observed clinical risk factor. This finding is consistent with the established relationship between previous anti-tuberculosis treatment and the emergence of drug resistance. Inadequate regimens, irregular drug intake, treatment interruption, poor adherence, and undetected baseline resistance may permit the selection and amplification of resistant strains. Giri et al. (2022)^[4], in a prospective cohort of drug-resistant pulmonary tuberculosis patients in Bihar, also reported a high proportion of previously treated patients. Sharma et al. (2020)^[2] identified previous treatment and repeated treatment episodes as important characteristics of MDR-TB cohorts managed under programmatic conditions. The high proportion of previously treated patients in the present study emphasizes the importance of universal drug-susceptibility testing, early identification of resistance, patient-centred adherence support, and careful follow-up of patients treated for drug-sensitive tuberculosis.

Behavioural risk factors were common in the present study: 30.0% had a smoking history, 36.7% used smokeless tobacco, and 33.3% consumed alcohol. Smoking was associated with approximately threefold higher odds of an unfavourable treatment outcome, while alcohol consumption was associated with 3.42-fold higher odds. Samuels et al. (2018)^[5], in a systematic review and meta-analysis, found that alcohol misuse increased the risk of unsuccessful MDR/XDR-TB treatment and was particularly associated with treatment default. However, their pooled analysis did not show a consistent association between smoking and unsuccessful outcomes. The difference from the present findings may reflect the relatively small sample, varying definitions of smoking exposure, disease severity, nutritional status, or residual confounding. Nevertheless, smoking can impair mucociliary clearance, pulmonary immunity, and tissue healing, while alcohol use may impair immunity, worsen malnutrition, interfere with treatment adherence, increase hepatotoxicity, and reduce regular engagement with health services. Therefore, tobacco- and alcohol-cessation interventions should be incorporated into MDR-TB care.

Diabetes mellitus was present in 26.7% of patients and was associated with increased odds of an unfavourable treatment outcome. Diabetes was also associated with poor quality of life, with affected patients having 3.51 times higher odds of poor QoL. Hyperglycaemia may impair innate and adaptive immune responses, delay sputum conversion, increase bacillary burden, and complicate the management of adverse drug reactions. Belachew et al. (2022)^[6] observed that older age and clinical comorbidities contributed to unsuccessful MDR/RR-TB outcomes. Samuels et al. (2018)^[5], however, found no clear pooled association between diabetes and unsuccessful MDR-TB treatment, probably because of heterogeneity and limited reporting across the included studies. The present findings support routine screening for diabetes, regular glycaemic monitoring, and integrated TB-diabetes management.

HIV infection was found in 8.3% of patients. Although the number of HIV-positive participants was small, HIV remains an important determinant of mortality and unfavourable outcomes in drug-resistant tuberculosis. Samuels et al. (2018)^[5] reported a significantly increased risk of unsuccessful treatment among patients with HIV, largely driven by increased mortality. The relatively low prevalence observed in Raichur may reflect the local epidemiological profile, underdiagnosis, or exclusion of patients who died before contact. Early HIV testing, prompt initiation and continuation of antiretroviral therapy, prophylaxis against opportunistic infections, and close clinical monitoring remain essential components of MDR-TB management.

The mean BMI in the present study was 18.7 ± 2.9 kg/m², indicating that undernutrition was common. Low BMI in MDR-TB may result from chronic inflammation, reduced appetite, gastrointestinal adverse effects, poverty, and increased metabolic requirements. Undernutrition can further weaken immunity, delay recovery, and worsen physical quality of life. Dash et al. (2022)^[1] also noted nutritional vulnerability among MDR-TB patients, while Sharma et al. (2020)^[2] emphasized that low body weight and severe disease were frequent among patients with poor outcomes. Nutritional assessment should therefore be conducted at baseline and periodically throughout treatment, with appropriate food or financial support and management of gastrointestinal adverse effects.

A favourable treatment outcome was achieved in 68.3% of patients, including 48.3% who were cured and 20.0% who completed treatment. This success rate closely corresponds to the global MDR/RR-TB treatment success rate of approximately 68% reported by the World Health Organization for the 2021 treatment cohort.^[7] It was higher than the favourable outcome reported by Sharma et al. (2020)^[2] in Delhi, where only about half of MDR-TB patients achieved treatment success, but lower than the 71.1% success rate reported by Lecai et al. (2023)^[8] among patients receiving ambulatory MDR-TB treatment. Differences between studies may be attributable to treatment regimens, drug-resistance

patterns, HIV prevalence, patient selection, treatment support, adverse-event management, follow-up systems, and programme performance.

The unfavourable outcome rate was 31.7%, comprising death in 13.4%, loss to follow-up in 10.0%, and treatment failure in 8.3%. Giri et al. (2022)^[4] reported cure in 37.3%, treatment completion in 16.0%, death in 20.9%, treatment failure in 8.2%, and loss to follow-up in 12.7% of drug-resistant pulmonary TB patients. The present study had a higher overall treatment success and lower mortality than that cohort, although the treatment-failure and loss-to-follow-up proportions were broadly comparable. Seloma et al. (2023)^[9] reported a treatment success rate of 57.9%, with death and loss to follow-up remaining major contributors to unsuccessful outcomes. These comparisons indicate that despite programme-based treatment, mortality and disengagement from care continue to represent important challenges.

The mean treatment duration was 21.3±3.8 months, consistent with the prolonged conventional MDR-TB regimens used during the study period. Prolonged therapy increases pill burden, financial costs, treatment fatigue, and exposure to toxic drugs. Adverse drug reactions occurred in 40.0% of participants and were associated with nearly threefold higher odds of an unfavourable outcome. Giri et al. (2022)^[4] reported adverse events in approximately three-fourths of their patients, whereas Vaman et al. (2025)^[10] found that a large proportion of patients receiving drug-resistant TB therapy developed adverse reactions, including severe or serious events. Variation in ADR frequency may reflect differences in regimens, active versus spontaneous surveillance, diagnostic criteria, and follow-up duration. Early detection and effective management of nausea, hearing impairment, neuropathy, psychiatric symptoms, hepatotoxicity, nephrotoxicity, and haematological toxicity are essential to prevent treatment interruption.

Sputum conversion within six months occurred in 75.0% of patients. Timely sputum conversion is an important indicator of early bacteriological response and reduced infectiousness. Failure to convert may signify advanced disease, poor adherence, inadequate drug exposure, additional resistance, or cavitary lung disease. The relatively high conversion rate in the present study may partly explain the favourable treatment success rate. Nevertheless, patients with delayed conversion should undergo adherence assessment, repeat drug-susceptibility testing where indicated, clinical and radiological review, and evaluation for treatment failure.

Quality-of-life assessment showed a mean overall WHOQOL-BREF score of 58.6±11.8. Among the individual domains, the physical domain had the lowest score at 56.2±12.4, followed by the psychological domain at 57.4±11.9, environmental domain at 59.5±10.8, and social-relationship domain at 61.3±13.1. These findings indicate moderate impairment across all domains, particularly physical and psychological well-being. Sharma et al. (2022)^[11] similarly found substantial impairment in the physical, psychological, social, and environmental dimensions among MDR-TB patients. Wang et al. (2024)^[12] also reported that drug-resistant TB adversely affected overall quality of life and identified clinical status, social support, psychological state, and socioeconomic conditions as important associated factors. Although 56.7% of the present participants had good QoL, 43.3% had poor QoL, demonstrating that microbiological treatment alone does not address the complete burden of the disease.

Patients with favourable treatment outcomes were more than four times as likely to have good QoL compared with those with unfavourable outcomes. This association is biologically and socially plausible because successful treatment reduces symptoms, improves functional status, lowers stigma and fear of transmission, facilitates return to employment, and enhances psychological well-being. Conversely, persistent disease, adverse reactions, treatment failure, and prolonged infectiousness may worsen all WHOQOL-BREF domains. Diabetes and alcohol consumption were significantly associated with poor QoL. Diabetes may increase medication burden and physical morbidity, while alcohol use may lead to family conflict, financial strain, poor adherence, and psychological distress. Sahasrabudhe et al. (2024)^[3] described major physical, psychological, social, and environmental challenges during DR-TB treatment, while Gare et al. (2024)^[13] demonstrated impaired HRQoL among patients with drug-resistant TB, particularly those with more extensive resistance and adverse clinical characteristics.

CONCLUSION

The present study demonstrated that multidrug-resistant tuberculosis predominantly affected adults in the economically productive age group, particularly males, rural residents, individuals with limited education, unskilled workers, and those belonging to lower socioeconomic groups. Previous tuberculosis treatment was the most common risk factor, while smoking, tobacco chewing, alcohol consumption, diabetes mellitus, HIV infection, and undernutrition were also frequently observed. A favourable treatment outcome was achieved in 68.3% of patients; however, nearly one-third experienced unfavourable outcomes, including death, loss to follow-up, and treatment failure. Older age, diabetes mellitus, smoking, alcohol consumption, adverse drug reactions, and low quality of life were significantly associated with unfavourable treatment outcomes. Although the mean overall WHOQOL-BREF score indicated a moderate quality of life, a substantial proportion of patients had poor quality of life, particularly in the physical and psychological domains. Favourable treatment

outcomes were strongly associated with good quality of life, whereas diabetes and alcohol use were associated with poorer quality of life. These findings highlight the need for an integrated, patient-centred approach that combines effective MDR-TB treatment with nutritional support, management of comorbidities, tobacco and alcohol cessation, early identification of adverse drug reactions, psychosocial counselling, and strengthened adherence support to improve both treatment outcomes and overall well-being.

LIMITATIONS OF THE STUDY

The study had several limitations. First, it was conducted among only 60 MDR-TB patients from a single district, which limited the generalizability of the findings to other geographical areas and healthcare settings. Second, the community-based cross-sectional design allowed identification of associations but could not establish temporal or causal relationships between socio-demographic factors, risk factors, treatment outcomes, and quality of life. Third, behavioural factors such as smoking, tobacco chewing, alcohol consumption, and treatment adherence were self-reported and might have been affected by recall bias or social desirability bias. Fourth, patients who died before being contacted, those transferred out of the district, and paediatric patients were excluded, which might have resulted in selection bias and underestimation of unfavourable outcomes. Fifth, quality of life was assessed at a single point using the WHOQOL-BREF questionnaire; therefore, changes in quality of life before, during, and after treatment could not be evaluated. Sixth, potentially important clinical factors such as the extent of pulmonary disease, drug-resistance pattern, cavitation, baseline sputum bacillary load, glycaemic control, adherence level, severity of adverse drug reactions, and detailed treatment regimen were not comprehensively assessed. Finally, the relatively small numbers in some subgroups, particularly patients with HIV infection and treatment failure, resulted in wide confidence intervals and reduced statistical precision.

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