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Original Research Article.

Knowledge, Attitude and Practice Regarding Disease Among Drug-Resistant Tuberculosis Patients: A Cross-Sectional Study from a Tertiary Care Centre in India

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ABSTRACT

Background: Drug-resistant tuberculosis (DR-TB) threatens progress towards the End TB targets, with suboptimal treatment outcomes and ongoing transmission despite availability of effective regimens. Patient knowledge, attitudes and practices (KAP) critically influence adherence, infection control and care-seeking, yet KAP data specifically among DR-TB patients remain limited, particularly in Indian programmatic settings.

Methods: 100 Consecutive adult patients with bacteriologically confirmed DR-TB (including mono-, poly-, multidrug- and extensively drug-resistant TB) who were being initiated on a DR-TB regimen were enrolled. A predesigned interviewer-administered questionnaire assessed socio-demographic and clinical characteristics, and KAP domains regarding DR-TB, its treatment and infection prevention. Composite knowledge and attitude scores were generated; preventive practices were captured as dichotomous items.

Results: Participants had a mean age of 36.2±13.5 years; 56% were male, 42% had primary or less education and 65% reported prior anti-tubercular treatment (ATT). Mean knowledge and attitude scores were 10.8±3.9 and 7.2±2.1, respectively. Knowledge increased significantly with education ($F=12.73$, $p<0.001$, $\eta^2=0.21$). Knowledge and attitude were moderately correlated ($r=0.42$, $p<0.001$). In multivariable analysis, higher education level ($\beta=1.98$, $p<0.001$) and previous ATT ($\beta=0.76$, $p=0.043$) independently predicted higher knowledge scores (model $R^2=0.38$).

Conclusion: Among DR-TB patients, knowledge levels were moderate and strongly patterned by education and prior treatment exposure. Patient-centered DR-TB care should systematically integrate tailored health-education strategies, with particular emphasis on individuals with lower formal education and on first contact for DR-TB treatment initiation.

Keywords: Drug-Resistant Tuberculosis; Multidrug-Resistant Tuberculosis; Knowledge; Attitude; Practice; Health Literacy.

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INTRODUCTION

Tuberculosis (TB) remains one of the world's leading infectious causes of death despite being both preventable and curable. In 2022, an estimated 10.6 million people developed TB globally, with approximately 1.3 million TB-related deaths, and India continues to contribute the largest absolute number of cases.[1]

Drug-resistant TB (DR-TB), including rifampicin-resistant and multidrug-resistant TB (MDR/RR-TB), poses a particular challenge because of prolonged treatment duration, increased drug related toxicities and associated with lower treatment success rates.[2] The World Health Organization (WHO) End TB Strategy emphasizes

early diagnosis, universal drug-susceptibility testing and patient-centered care to curb DR-TB.[3] Nevertheless, global estimates suggest that fewer than half of individuals with MDR/RR-TB access appropriate treatment each year, and treatment outcomes remain suboptimal.[1] Alongside biomedical interventions, behavioral and social determinants—especially patient knowledge, attitudes and practices (KAP)—strongly influence adherence, infection control behavior and health-seeking patterns.[2,4,5]

In India, where DR-TB burden is substantial and national elimination targets are highly ambitious, understanding patient KAP at the point of DR-TB treatment initiation is essential for designing tailored counselling, adherence support and community-based interventions. Patients starting DR-TB regimens often have a history of prior TB treatment and repeated interaction with the health system yet may still harbor misconceptions or fatalistic attitudes that affect outcomes.[6]

The present cross-sectional study was undertaken to evaluate knowledge, attitude and practice regarding disease and its management among patients with DR-TB. Specifically, we aimed to describe KAP levels in this cohort at the time of DR-TB regimen initiation and to examine associations between socio-demographic and clinical factors and knowledge scores.

MATERIALS AND METHODS

Study Design and Setting: This hospital-based cross-sectional study was conducted in the Department of Pulmonary Medicine of a Government Medical College in North India. The study population comprised adult DR-TB patients attending the DR-TB center for initiation of a standardized DR-TB regimen. Consecutive eligible patients were approached for participation. DR-TB was defined as bacteriologically confirmed resistance to at least one first-line anti-tubercular drug, including mono-, poly-, multidrug- and extensively drug-resistant TB, based on WHO-recommended drug susceptibility testing methods.

Inclusion Criteria

1. Adult patients (≥18 years) with active DR-TB (pulmonary or extrapulmonary) in whom a DR-TB regimen was being initiated at the study site.
2. Any pattern of resistance (mono-, poly-, MDR- or XDR-TB) to first-line anti-tubercular drugs.

Exclusion Criteria

1. Patients with drug-sensitive TB.
2. Patients already receiving a DR-TB regimen prior to the current visit.
3. Patients too unwell to participate in an interview or with cognitive impairment precluding informed consent.

A total of 100 patients meeting eligibility criteria and providing written informed consent were enrolled. The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants before data collection. Confidentiality was maintained by using anonymized unique identifiers and secure data storage. Data were collected using a predesigned, interviewer-administered questionnaire in the local language. The tool comprised four sections:

1. **Socio-demographic and clinical profile:** Age, gender, education, occupation, family history of TB/DR-TB, previous anti-tubercular treatment (ATT) history and type of DR-TB.
2. **Knowledge domain:** Items assessing understanding of TB etiology, modes of transmission, symptoms, curability, duration and components of DR-TB regimen, adverse effects and infection prevention measures. Correct responses were summed to derive a composite knowledge score (higher scores indicating better knowledge).
3. **Attitude domain:** Likert-scale items (strongly disagree to strongly agree) evaluating perceived seriousness and curability of DR-TB, confidence in treatment, willingness to adhere to prolonged regimens, stigma, and willingness to disclose diagnosis. Responses were scored and summed to yield an attitude score (higher scores indicating more favorable attitudes towards treatment and prevention).
4. **Practice domain:** Yes/No items capturing key behaviors, including regular mask use, ventilation of living spaces, avoidance of close contact with children and other vulnerable household members, and adherence to scheduled clinic visits and medication intake.

Operational Definitions

- **High vs. low knowledge:** Patients were classified as having "high knowledge" if their knowledge score was at or above the sample median and "low knowledge" otherwise.
- **Previous ATT:** Any documented history of prior anti-tubercular treatment for drug-sensitive TB irrespective of regimen completeness.

Statistical Analysis: Data was analyzed using standard statistical software. Continuous variables were summarized using mean ± standard deviation (SD) or median (interquartile range) as appropriate and categorical variables as frequencies and percentages. Differences in mean knowledge scores across educational categories were assessed using one-way analysis of variance (ANOVA), with post-hoc Tukey tests for pairwise comparisons. Associations between knowledge category and preventive practices were examined using chi-square tests, with phi (φ) coefficients as measures of effect size. Pearson's correlation assessed the relationship between knowledge and attitude scores, and multivariable linear regression identified independent predictors of knowledge score. A two-sided p-values <0.05 was considered statistically significant.

RESULTS

Table 1 summarizes the baseline demographic and clinical characteristics of the study population (N=100). The mean age was 36.2±13.5 years, with the largest proportion (44%) aged <30 years, with a higher proportion of males. Educational attainment was generally low; and a majority of participants reported prior anti-tubercular treatment. A minority had a reported family history of MDR-TB. Mean knowledge score for the overall cohort was 10.8±3.9. Knowledge scores varied significantly across education categories, with progressively higher scores observed with increasing levels of education (Table 2). One-way ANOVA demonstrated a statistically significant between-group difference ($F=12.73$, $df=2,97$; $p<0.001$) with a large effect size ($\eta^2=0.21$). Post-hoc Tukey analysis confirmed significant differences across all educational strata. Most participants (n=88) believed DR-TB to be curable (88–89% with prior ATT; 86% without) and expressed strong intent to take treatment regularly (>94% in both groups). Approximately half of the respondents (n = 58) reported being afraid to disclose their diagnosis, with slightly higher stigma

among those with previous ATT exposure. However, none of these differences reached statistical significance (p > 0.005), and effect sizes (phi coefficients) were small. As depicted in Table 3, patients with high knowledge score demonstrated significantly greater adherence to regular mask use (p = 0.017), while limiting close contact with children and other vulnerable household members showed a similar trend but did not reach statistical significance (p = 0.053). Knowledge and attitude scores were moderately positively correlated (r=0.42, 95% CI 0.24–0.57; p<0.001). Patients with better understanding of DR-TB tended to hold more optimistic views about curability, treatment and personal efficacy in adhering to regimens and preventing transmission. In multivariable linear regression (Table 4), education level and history of previous ATT emerged as independent predictors of higher knowledge scores, whereas age showed a marginal negative association and gender was not significant. The model explained 38% of variance in knowledge scores (R^2=0.38, F(4,95)=14.62, p<0.001).

Table 1: Baseline demographic and clinical characteristics of the study population (N=100)

Characteristic	Category	n (%) / Mean ± SD
Age (years)	<30	44 (44%)
	30–50	40 (40%)
	>50	16 (16%)
Gender	Male	56 (56%)
	Female	44 (44%)
Education	≤Primary	42 (42%)
	Secondary	35 (35%)
	Graduate+	23 (23%)
Occupation	Laborer	28 (28%)
	Housewife	24 (24%)
	Student	18 (18%)
	Other	30 (30%)
Previous ATT History	Yes	65 (65%)
Family History of MDR-TB	Yes	15 (15%)

Table 2: Knowledge scores across educational categories among patients with drug resistant tuberculosis

Education Level	n	Mean Knowledge Score ± SD	F-statistic (df)	p-value	η^2 (95% CI)
≤Primary	**42**	8.2 ± 3.1	12.73	<0.001	0.21
Secondary	**35**	11.4 ± 2.8	(2, 97)		(0.08–0.32)
Graduate+	**23**	14.1 ± 3.0			
Post-hoc Tukey		Primary vs Secondary	NA	p<0.001	NA
		Primary vs Graduate+		p<0.001	
		Secondary vs Graduate+		p=0.012	

Table 3: Association between knowledge level and preventive practices among the study population (high vs. low)

Practice (Yes)	High Knowledge (≥Median, n=52)	Low Knowledge (<Median, n=48)	χ^2 (df)	p-value	Phi (φ)
Uses mask regularly	48 (92.3%)	36 (75.0%)	5.67 (1)	0.017	0.24
Maintains separate utensils	40 (76.9%)	28 (58.3%)	3.96 (1)	0.046	0.20
Limits contacts with children and other vulnerable household members	45 (86.5%)	34 (70.8%)	3.73 (1)	0.053	0.19

Table 4: Multivariate analysis of factors associated with high knowledge scores

Predictor	β (95% CI)	SE	t	p-value
Age	−0.04 (−0.08, 0.00)	0.02	−1.98	0.050
Gender (Male)	0.52 (−0.31, 1.35)	0.42	1.24	0.218
Education (per level)	1.98 (1.42, 2.54)	0.28	7.07	<0.001
Previous ATT	0.76 (0.02, 1.50)	0.37	2.05	0.043

Model summary: R^2 = 0.38; F(4,95) = 14.62; p < 0.001

DISCUSSION

In this cross-sectional study of DR-TB patients initiating treatment at a tertiary care center, we found moderate overall levels of disease-related knowledge, generally favorable attitudes towards treatment, and variable adoption of key preventive practices. Education level and previous ATT emerged as important determinants of knowledge, and higher knowledge was associated with more positive attitudes and better infection-control behaviors.

Our findings align with and extend previous work on KAP in TB and DR-TB populations. Esmael et al. in Ethiopia reported that although many patients recognized cardinal TB symptoms and understood transmission routes, substantial misconceptions persisted regarding causation and prevention.[2] Agrawal et al. observed mixed knowledge but broadly positive attitudes in rural Indian TB outpatients, with gaps in understanding of sputum disposal and infection control.[4] Similarly, Dzeyie et al. reported high awareness of TB symptoms and transmission among Indian DR-TB patients but markedly poor practices regarding safe sputum disposal; a large proportion continued to spit indiscriminately despite counselling.[6] Our data are consistent with this "knowledge–practice gap," although we additionally demonstrate that higher knowledge is measurably associated with better mask use and other preventive behaviors.

The strong and graded association between education and knowledge in our cohort is consistent with broader evidence linking formal schooling with health literacy and TB-related outcomes.[2,4,6] Javed et al. reported that university students and those in life sciences disciplines exhibited better awareness of MDR/XDR-TB compared with peers in non-biological fields, underscoring the role of education in shaping disease understanding even outside clinical populations.[7] In our regression model, education remained a strong independent predictor of knowledge, explaining a substantial proportion of variance. This emphasizes that DR-TB programmes must not rely solely on generic written information; instead, they should deploy multimodal, literacy-sensitive educational approaches, including pictorial materials and demonstration-based counselling for patients with low schooling.

Previous ATT was also independently associated with higher knowledge, suggesting that repeated contact with TB services may have some positive educational effect. Dzeyie et al. have proposed that DR-TB patients, many of whom have experienced multiple prior treatments, constitute a "captive audience" for intensified counselling.[7] At the same time, prior treatment failure or default may engender fatalism or mistrust. In our study, previous ATT did not significantly influence attitudes regarding curability or intention to adhere, but stigma (fear of disclosure) remained high in both groups. This resonates with work among healthcare workers and students, where even adequate knowledge does not fully eliminate stigma or suboptimal infection-control practices.[8-10]

The moderate positive correlation between knowledge and attitude supports theoretical models in which accurate information shapes perceived severity, benefits and self-efficacy, thereby influencing health beliefs. Similar correlations between knowledge and favorable attitudes have been described in DOTS-programme patients from Ethiopia and other settings.[2,10] Our results further show that higher knowledge is linked to specific infection-control behaviors, particularly mask use. A similar trend was observed for limiting close contact with children and other vulnerable household members, though this did not achieve statistical significance. This suggests that knowledge may influence protective barriers even when consistent implementation remains challenging. This is encouraging, given that DR-TB regimens have become increasingly all-oral and community-based following WHO recommendations; robust household infection control is therefore crucial to limit transmission while maintaining quality of life.[3]

From a programmatic perspective, our findings have several implications. First, DR-TB treatment initiation visits represent critical opportunities to systematically assess baseline KAP and deliver tailored counselling. Simple tools to rapidly stratify patients by knowledge and literacy could help nurses and counsellors prioritize key messages and reinforce them at subsequent visits. Second, structured, repeated education that addresses not only biomedical facts but also stigma, mental health and family dynamics is needed to convert knowledge gains into sustained behavioral change. Third, integration of family members into counselling sessions may be particularly important in households with multiple TB cases or high vulnerability, as suggested by the notable proportion of participants reporting family history of MDR-TB.

Our study also has few limitations. It was conducted at a single tertiary care center with a relatively small sample size, which may limit generalizability to other regions or primary-care settings. The cross-sectional design precludes causal inference; knowledge and attitudes may both influence, and be influenced by, practices and prior treatment experiences. KAP measures relied on self-report and may be subject to social desirability bias, particularly for sensitive items such as stigma and adherence. Finally, we did not perform formal psychometric validation of the composite KAP scales beyond pilot testing.

Despite these limitations, this study adds to the limited body of evidence on KAP among DR-TB patients in high-burden settings. By integrating detailed socio-demographic data with multivariable analysis of knowledge determinants and their relationship to attitudes and practices, it offers a nuanced understanding that can inform the design of patient-centred DR-TB services aligned with WHO guidelines and national elimination goals.[1,3]

CONCLUSION

In summary, DR-TB patients initiating treatment at a tertiary care center in India demonstrated moderate knowledge, generally positive attitudes and variable preventive practices, with clear educational and experiential gradients. Higher education and previous ATT independently predicted better DR-TB knowledge, which in turn was associated with more favorable attitudes and adoption of key infection-control behaviors. However, substantial stigma and residual practice gaps were evident, especially among patients with low formal schooling. These findings support the systematic integration of structured, literacy-sensitive health education and psychosocial support into DR-TB care, coupled with family-centered counselling to strengthen household infection control. Future longitudinal research should assess whether targeted KAP interventions translate into improved adherence, reduced transmission and better treatment outcomes.

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