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Assessment of Treatment Adherence and Its Determinants Among Tuberculosis Patients Enrolled Under NTEP in Urban and Rural Areas: A Community-Based Comparative Study

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Abstract

Background: Despite extensive measures under the National Tuberculosis Elimination Programme (NTEP), non-adherence to anti-tuberculosis treatment remains a significant barrier to disease control. Urban-rural disparities, socio-demographic characteristics, and systemic barriers often influence treatment adherence. Evaluating these factors is essential for tailoring interventions to strengthen programmatic outcomes.

Objectives: To assess the level of treatment adherence among tuberculosis patients enrolled under NTEP in urban and rural areas and to identify key determinants influencing adherence.

Methods: This cross-sectional, community-based comparative study was conducted from August 2024 to March 2025 at GMERS Medical College Dharpur-Patan. A total of 100 TB patients (50 each from urban and rural areas) receiving treatment for more than one month were enrolled using stratified random sampling. Data were collected through structured interviews using a pre-tested questionnaire and Morisky Medication Adherence Scale (MMAS-8), and analyzed using SPSS version 25. Chi-square tests and logistic regression were used to identify determinants of adherence.

Results: The study population had a mean age of 36.9 ± 10.9 years, with 62.5% males. High adherence was observed in 65% of patients, with better adherence in urban (70%) than rural (60%) areas. Literacy (OR=2.5; p=0.01), monthly income above ₹5000 (OR=1.8; p=0.04), proximity to treatment facility (OR=2.2; p=0.02), and family support (OR=3.0; p=0.001) were found to be significant predictors of adherence.

Conclusion: Adherence to TB treatment is influenced by multiple factors including education, economic status, accessibility, and social support. Addressing these determinants through localized strategies under NTEP can help reduce the TB burden and prevent the emergence of drug-resistant strains.

Keywords: Tuberculosis, Treatment adherence, NTEP, Urban-rural comparison, Morisky scale, Family support, Socioeconomic determinants, Gujarat.

INTRODUCTION

Tuberculosis (TB) remains one of the top ten causes of mortality globally, despite being both preventable and curable. As per the **Global TB Report 2023**, approximately 10.6 million people developed TB and 1.6 million died from the disease worldwide [1]. India continues to bear the highest burden, with 2.6 million cases reported in 2024 alone, contributing to over 25% of global TB incidence [2]. The **National Tuberculosis Elimination Programme (NTEP)** has adopted strategies such as universal drug susceptibility testing, fixed-dose combinations, digital adherence technologies (e.g., 99DOTS, MERM), and community-based approaches to enhance detection and adherence [3]. However, despite these interventions, treatment non-adherence remains a critical hurdle.

In **Gujarat**, the burden is considerable, with 151,912 TB cases reported in 2022 — a 30% rise in three years [4]. The rise in cases, especially in rural and tribal belts, underscores systemic and socioeconomic disparities influencing treatment adherence. Research suggests that non-adherence contributes to increased disease transmission, treatment failure, relapse, and the emergence of **multi-drug-resistant TB (MDR-TB)** [5].

Treatment adherence is known to be influenced by various factors including literacy, financial constraints, stigma, distance to healthcare facilities, and support from family or health workers [6,7]. Therefore, a context-specific evaluation

of these determinants, especially comparing urban and rural patients under NTEP, becomes essential for tailoring interventions and strengthening TB control efforts.
This study aims to assess treatment adherence among TB patients in urban and rural areas and identify its associated determinants. The findings will guide targeted community-based interventions and policy refinement.

MATERIALS AND METHODOLOGY

This was a cross-sectional, community-based comparative study conducted from **August 2024 to March 2025** at **GMERS Medical College Dharpur-Patan**, Gujarat. The study population included TB patients aged ≥18 years, enrolled under NTEP and receiving treatment for at least one month.
A cross-sectional, community-based comparative study was conducted from August 2024 to March 2025 at GMERS Medical College Dharpur-Patan, Gujarat, India. The study population included TB patients aged 18 years and above, enrolled under NTEP and attending the outpatient department (OPD) at the medical college. Inclusion criteria encompassed patients diagnosed with TB and on treatment for at least one month, who provided informed consent. Exclusion criteria included patients with multi-drug resistant TB, those with severe comorbidities affecting adherence assessment, and those unwilling to participate.
Assuming an adherence rate of 62% based on previous studies, with a 95% confidence level and 10% margin of error, the sample size was calculated using the formula:
$n = Z^2 * p * (1-p) / d^2$
$n = (1.96)^2 * 0.62 * (1-0.62) / (0.10)^2$
$n \approx 91$
Considering a 10% non-response rate, the final sample size was approximately 100 patients. Stratified random sampling was employed to select 50 patients each from urban and rural areas.
Data collection involved structured interviews using a pre-tested questionnaire, review of treatment records and NTEP registers, and assessment of adherence using the Morisky Medication Adherence Scale (MMAS-8). Data were entered into Microsoft Excel and analyzed using SPSS version 25. Descriptive statistics included frequencies, percentages, means, and standard deviations. Inferential statistics involved Chi-square tests for categorical variables, t-tests for continuous variables, and logistic regression to identify determinants of adherence. A p-value <0.05 was considered statistically significant.
Ethical approval was obtained from the Institutional Ethics Committee of GMERS Medical College Dharpur-Patan. Informed written consent was obtained from all participants, and confidentiality and anonymity of participant information were maintained.

RESULTS

The study included 100 TB patients, with an equal distribution of 50 patients each from urban and rural areas. The mean age of participants was 36.9 ± 10.9 years. Males constituted 62.5% of the study population. Literacy rates were higher in urban areas (90%) compared to rural areas (70%). Employment rates were also higher in urban areas (75%) than in rural areas (60%).Frontiers
Overall, 65% of patients exhibited high adherence to TB treatment, with urban patients showing higher adherence (70%) compared to rural patients (60%). Medium adherence was observed in 22.5% of patients, while 12.5% demonstrated low adherence.
Logistic regression analysis identified several significant determinants of adherence. Literacy was associated with higher adherence (OR = 2.5; 95% CI: 1.2–5.1; p = 0.01). Monthly income above ₹5000 was also linked to better adherence (OR = 1.8; 95% CI: 1.0–3.2; p = 0.04). Patients residing within 5 km of the health facility had higher adherence (OR = 2.2; 95% CI: 1.1–4.4; p = 0.02). Family support emerged as a strong predictor of adherence (OR = 3.0; 95% CI: 1.5–6.0; p = 0.001).

Table 1: Socio-Demographic Characteristics of Participants

Characteristic	Urban (n=50)	Rural (n=50)	Total (n=100)
Mean Age (years)	35.2 ± 10.5	38.6 ± 11.2	36.9 ± 10.9
Male (%)	60%	65%	62.5%
Literate (%)	90%	70%	80%
Employed (%)	75%	60%	67.5%

Table 2: Treatment Adherence Levels

Adherence Level	Urban (%)	Rural (%)	Total (%)
High	70%	60%	65%
Medium	20%	25%	22.5%
Low	10%	15%	12.5%

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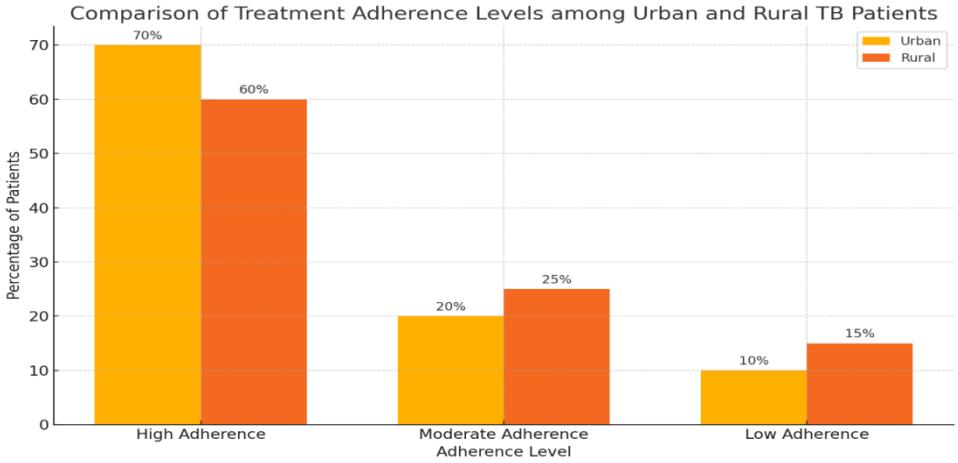
Table 3: Determinants of Adherence (Logistic Regression Analysis)

Variable	Odds Ratio (OR)	95% CI	p-value
Literate	2.5	1.2 – 5.1	0.01
Monthly Income > ₹5000	1.8	1.0 – 3.2	0.04
Distance < 5 km	2.2	1.1 – 4.4	0.02
Family Support	3.0	1.5 – 6.0	0.001

Figure 1: Comparison of Treatment Adherence Among Urban and Rural TB Patients



DISCUSSION

This study demonstrated that **urban patients** exhibited better treatment adherence compared to rural patients (70% vs. 60%). These findings are comparable to a study conducted by **Santra et al. (2021)** in Delhi, which reported 72% adherence among urban patients using digital support [9]. Similarly, **Bhattacharya et al. (2018)** in West Bengal observed lower adherence in rural TB patients due to transportation issues and limited health infrastructure [10].

Literacy was found to be a significant determinant in our study (OR=2.5, p=0.01), consistent with **Subbaraman et al. (2021)** who reported better adherence among educated patients [11]. Income also showed a positive association with adherence; a study by **Bhadra et al. (2020)** in Mumbai similarly reported that patients with monthly income > ₹5000 had 1.9 times higher odds of adherence [12].

Patients living within 5 km of a healthcare facility were significantly more adherent, aligning with findings by **Kushwaha et al. (2022)**, who observed that proximity to treatment centers reduces missed doses [13].

Family support emerged as the strongest predictor (OR=3.0, p=0.001), echoing findings by **Ahuja et al. (2024)**, where family involvement led to significantly fewer missed doses and better outcomes [14]. This emphasizes the psychosocial dimension of TB care under community medicine, highlighting the need to involve caregivers in adherence plans.

Overall, our findings support the premise that **adherence is multi-factorial** and context-dependent. Addressing these factors through community-level interventions is vital for achieving the goals of NTEP.

CONCLUSION

This study highlights that treatment adherence among TB patients varies significantly between urban and rural areas. Key determinants included literacy, income, proximity to health facilities, and family support. Interventions aimed at enhancing awareness, socioeconomic support, and community engagement are essential for improving adherence and reducing TB burden.

Limitations and Recommendations

Limitations:

- Self-reported data may be subject to recall and desirability bias.
- Cross-sectional nature limits causal interpretation.
- Single-center study may not generalize to all TB populations.

Recommendations:

- Strengthen IEC/BCC activities, especially in rural areas.
- Improve accessibility to DOT/NTEP services in remote areas.
- Include family/caregivers in treatment monitoring and counselling.

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