

To Assess Knowledge Regarding Tuberculosis and its Associated Factors with Treatment Non-Adherence Among Pulmonary TB Patients at Kotri

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Keywords: Tuberculosis, Treatment Non-Adherence, Factors, Adherence, Knowledge.

Received on 25 Dec 2025

Accepted on 27 Jan 2026

Published on 07 Feb 2026

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Abstract

Background: Pulmonary Tuberculosis has been a significant worldwide health issue, as there are still high rates of non-adherence to treatment. This paper will examine socio-demographic and knowledge-related, interruption by drugs, and systemic elements that affect TB adherence in low-income rural communities, and the goal is to understand the gaps and provide an effective patient-centered approach.

Materials and Methods: An analytical cross-sectional study was conducted using a quantitative approach among 212 TB patients registered at a Directly Observed Treatment, Short-course (DOTS) center in Kotri, Sindh, Pakistan. Data were collected on demographics, socio-economic status, knowledge about TB, and self-reported adherence levels. Statistical analyses, including Chi-square

tests, were applied to assess associations between adherence and selected variables.

Results: The majority of participants (86.8%) demonstrated low (44.3%) or medium (42.5%) adherence, while only 13.2% achieved high adherence. The mean age of participants was 43.69 ± 10.2 years. Age did not show a significant relationship with adherence; however, non-adherence was strongly associated ($p < 0.001$) with male gender, marital status, low education, reduced family income, and rural occupation. Additionally, systemic barriers such as inadequate follow-up and lack of counseling significantly contributed to poor adherence.

Conclusion: The findings highlight that socio-demographic, economic, knowledge-related, and systemic challenges are strongly linked to poor TB treatment adherence. Addressing these through community-based, patient-centered interventions focusing on financial support, improved access to care, and enhanced health education is essential to improve adherence and reduce TB-related morbidity and mortality in high-burden regions such as Kotri, Sindh, Pakistan.

Introduction

Tuberculosis (TB) is one of the major health issues on the globe. It is estimated that 10.8 million individuals contracted TB in the world in 2025, equating to 134 cases per 100,000 population and 1.25 million deaths were reported in 2023.^[1] Pulmonary TB, caused by *Mycobacterium tuberculosis*, primarily affects the lungs but can spread systemically.^[2] The issue of non-adherence to anti-TB treatment is a severe challenge, as it causes treatment failure, increases mortality, continued transmission, and the development of drug-resistant TB strains.^[3] Effective management requires adherence rates above 90%. TB transmission occurs through airborne droplets, highlighting the urgency of early diagnosis and strict treatment adherence.^[4] Since 2000, global efforts have saved an estimated 79 million lives, though TB eradication by 2030 remains a key WHO and UN Sustainable Development Goal. Demographic, socioeconomic, psychological, and cultural factors affect non-compliance, which may manifest itself through irregular dosing, early discontinuation, or refusing of therapy, with the result of multidrug-resistant (MDR-TB) and extensively drug-resistant TB (XDR-TB).^[5] After COVID-19, TB has been reported as the most fatal infectious disease in the world.^[6] The WHO South-East Asia Region accounted for 45% of global TB cases in 2023, followed by Africa (24%) and the Western Pacific (17%). Twelve countries, including India, Indonesia, China, Pakistan, and Nigeria, represented 87% of the global burden.^[12] Risk factors such as undernutrition (0.96 million cases), alcohol use (0.75 million), smoking (0.70 million), HIV (0.61 million), and diabetes (0.38 million) further complicate outcomes.^[7] Nearly half of TB-affected households face catastrophic costs, exceeding 20% of annual income.^[8] Drug-susceptible TB is treated with a 6-month regimen of first-line drugs, while drug-resistant TB requires longer, more toxic, and costlier regimens.^[9] New shorter regimens, such as 4-month moxifloxacin-based and 6-month BPaL protocols, show promise but face implementation barriers.¹⁸ Adherence is hindered by side effects, pill burden, poor health literacy, mental health disorders, and substance use.^[10] In Pakistan, stigma significantly impedes treatment, with many concealing diagnoses due to fear of rejection or job loss.^[11] Logistical barriers, such as long travel distances, healthcare staff shortages, and drug stock-outs, further compromise adherence.^[12] Although Directly Observed Treatment Short-Course (DOTS) remains central, real-world challenges limit its acceptability. Digital adherence tools show potential but require technological access.^[13] The compliance is also influenced by poverty, unemployment, and housing instability where unfavorable drug reactions often lead to discontinuation. Nevertheless, there are still gaps in context specific data on high burden regions such as Sindh despite extensive research on the subject.^[14] Pakistan ranks among the top 30 high-burden countries, contributing 6% of the global TB burden, with 611,000 new cases reported in 2021.^[15] Non-compliance remains a problem because of poverty, malnutrition, low literacy, stigma, side effects, and systemic healthcare deficiencies.^[16] In 2022, 2.2 million new TB cases only happened because of undernutrition, and HIV, smoking, alcohol, and diabetes further weakened the outcome of the treatment.^[17] Addressing these multifactorial barriers is essential to improve adherence and reduce TB morbidity and mortality.

METHODOLOGY

Study Setting & Study duration: TB Sanatorium Hospital, Kotri, Sindh, from January to May 2025.

Study Design: An analytical cross-sectional study was conducted at the study at TB Sanatorium Hospital, Kotri, Sindh.

Sampling Technique: A non-probability purposive sampling technique was used.

Duration of the Study: The study was conducted January to May 2025.

Inclusion Criteria:

All Patients of Tuberculosis.

All Tuberculosis Patients who took anti-TB medication at least for one month.

Willing to participate and provide informed consent.

Exclusion Criteria:

TB Patients who were seriously ill and or unable to hear and speak will excluded.

Those unwilling to provide informed consent

RESULTS:

TABLE 1. SOCIO-DEMOGRAPHIC PROFILE OF THE STUDY PARTICIPANTS (n=212)

Variables	Frequency	Percentage
1.Age of Participants		
18-24 years	39	18.4%
25-31 years	21	9.9%
32-38 years	25	11.8%
39 > above	127	59.9%
Total	212	100.0%
2.Gender of Participants		
Male	148	69.8 %
Female	64	30.2 %
Total	212	100.0 %
3.Marital Status of Participants		
Un-married	42	19.8 %
Married	152	71.7 %
Divorced	5	2.4 %
Widow	13	6.1 %
Total	212	100.0 %
4.Educational Status		
Illiterate	128	60.4 %
Literate	84	39.6 %
Total	212	100.0 %
5.Family Income		
15k-20k	110	51.9 %
21k-25k	52	24.5%
26k and above	50	23.6%
Total	212	100.0%
6.Residence		
Rural	160	75.5%
Urban	52	24.5%
Total	212	100.0%
7.Distance from Residence to Health Facility		
5-10 km	51	24.1 %
11-20 km	34	16.0 %
21-30 km	28	13.2 %

>30 km	99	46.7%
Total	212	100.0%
8.Cost of Travel		
100-300 rupees	52	24.5%
400-600 rupees	51	24.1%
>1000 rupees	109	51.4%
Totals	212	100.0%

Table NO 1: Presents participants' socio-demographic characteristics. Most were above 39 years (59.9%), male (69.8%), and married (71.7%). A majority were illiterate (60.4%), and over half reported low family income of PKR 15,000–20,000 (51.9%). Most resided in rural areas (75.5%). Nearly half (46.7%) lived more than 30 km from a health facility, and more than half (51.4%) incurred travel costs exceeding PKR 1000.

Figure 1. Employment Status of the Study Participants (n=212)

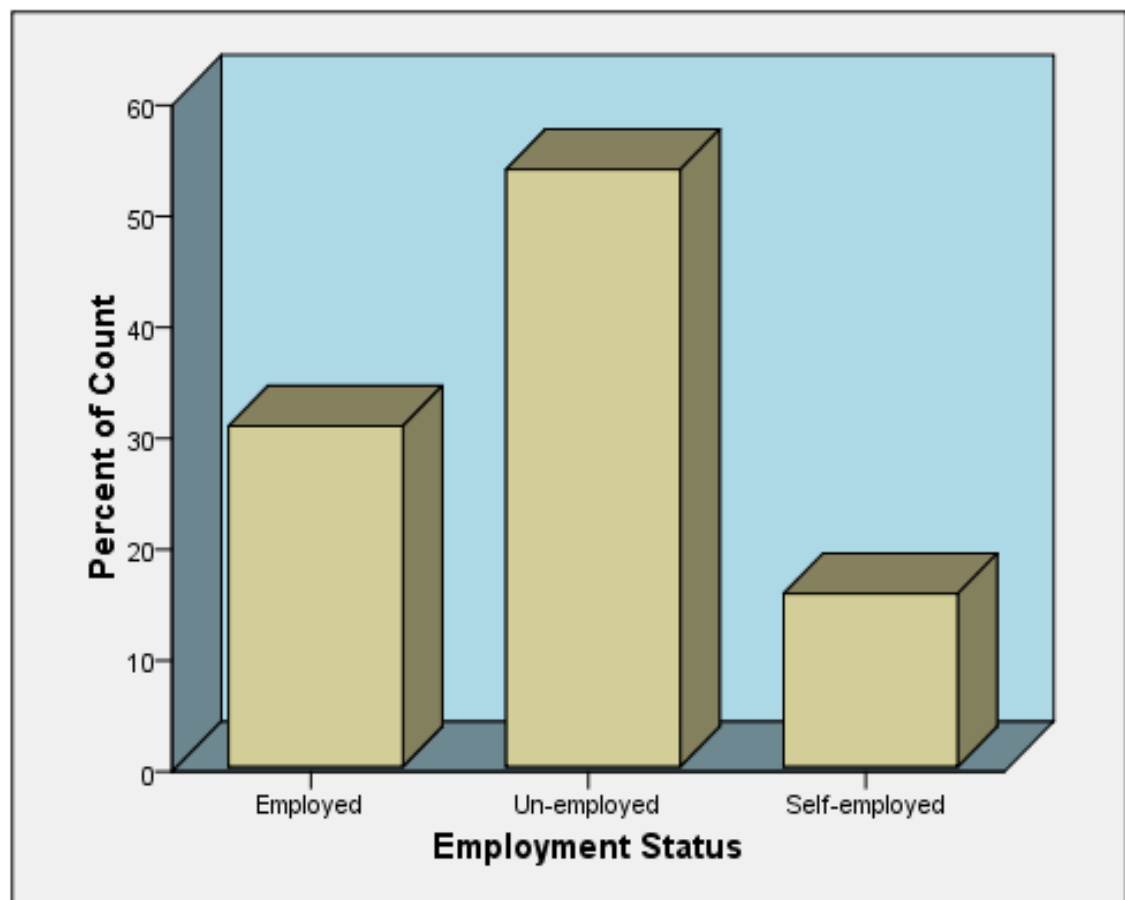


Figure No.1 showed the data of Employment status of the study participants that 114 (53.8%) were unemployed, 65 (30.7%) were employed, and 33 (15.6%) were self-employed. Unemployment may hinder treatment adherence by limiting financial resources for healthcare and transportation.

Table 2: Knowledge of the study Participants about Tuberculosis (n=212)

Items	Frequency	Percentage
1.Does a virus cause tuberculosis?		
No	130	61.3 %
Yes	82	38.7%
Total	212	100.0%

2.Is it possible to have TB without showing any symptoms?		
No	106	50.0 %
Yes	106	50.0 %
Total	212	100.0 %
3.Is TB typically treated with a single antibiotic?		
No	134	63.2 %
Yes	78	36.8 %
Total	212	100.0 %
4.Can someone with latent TB spread the disease to others?		
No	94	44.3 %
Yes	118	55.7 %
Total	212	100.0 %
5.Is a persistent cough one of the common symptoms of active TB?		
No	118	55.7 %
Yes	94	44.3 %
Total	212	100.0 %

Table no 2: The above table shows mixed knowledge regarding tuberculosis among the study participants. While 61.3% correctly identified that TB is not caused by a virus and 63.2% knew it is not treated with a single antibiotic, misconceptions remain common. Exactly half (50%) were aware that TB can occur without symptoms, and only 44.3% recognized a persistent cough as a common symptom of active TB. Furthermore, 55.7% incorrectly believed that latent TB can be transmitted to others.

Table 3: Overall Knowledge of the study participants about Tuberculosis (n=212)

Knowledge	Frequency	Percent
Poor Knowledge	141	66.5 %
Good Knowledge	71	33.5 %
Total	212	100.0 %

Table no 3: shows overall knowledge regarding Pulmonary Tuberculosis. Out of 212 participants, **141 (66.5%)** demonstrated poor knowledge about tuberculosis, while **71 (33.5%)** had good knowledge. This indicates that the majority of respondents lack adequate understanding of TB, which may contribute to challenges in prevention, early detection, and treatment adherence.

Table 4: Treatment Adherence Category of the study participants (n=212)

Adherence Category	Frequency	Percent
Low	94	44.3 %
Medium	90	42.5 %
High	28	13.2 %
Total	212	100.0 %

Table no 4: shows treatment adherence levels: 44.3% had low adherence, 42.5% medium, and only 13.2% high. This indicates substantial non-compliance, raising risks of treatment failure and drug resistance.

Table 5: Association Between Reasons for Non-Compliance and Treatment Adherence (n=212)

S.no	Items	Adherence Category			Total	P-Value
		Low	Medium	High		
01	Adverse drug side effects	7	14	8	29	< 0.000
02	Perceived improvement in symptoms before completion	9	29	7	45	
03	Treatment is not necessary as I am so old	25	30	4	59	
04	Appetite is influenced after taking drugs	28	10	9	47	
05	Forgetfulness or lack of treatment literacy	25	7	0	32	
Total		94	90	28	212	

Table no 5: shows a significant association between reasons for non-compliance and treatment adherence ($p = 0.000$). Adverse drug effects were common across all groups, especially medium adherence (48.3%). Symptom improvement (64.4%) and old age beliefs (50.8%) were also frequent in medium adherence patients, while appetite loss (59.6%) and forgetfulness (78.1%) were predominant in low adherence. These factors strongly influence adherence, particularly among low and medium groups.

DISCUSSION

Pulmonary tuberculosis (TB) is a major health issue worldwide, mainly because of the lack of compliance to drugs. This paper has looked at socio-demographic, knowledge based and systemic predictors of adherence among a low-income, rural population. The average age of the participants was 43.7 ± 10.2 years, and the results indicated a low (44.3) and medium (42.5) compliance in 86.8% of participants, and only 13.2% of the respondents had high compliance, as was observed in Ethiopia (2019).^[18] Age showed no significant association with adherence ($p=0.073$), contrasting with findings from Indonesia (2023).^[19] However, gender, marital status, and education were significantly associated with adherence, consistent with a Ghanaian study (2024). Men had higher rates of low adherence, possibly due to work-related pressures in patriarchal settings. Marital status showed an inverse relationship, with married participants reporting lower adherence, echoing findings by Nasrullah et al. (2023).^[20] This may reflect competing financial and familial responsibilities that limit treatment compliance. Educational status also demonstrated a strong association ($p<0.001$). Illiterate participants were concentrated in low- and medium-adherence groups, underscoring the role of poor health literacy. This aligns with knowledge assessments showing that 66.5% had inadequate understanding of TB symptoms and transmission. Family income and residence were likewise significant, with low-income and rural participants disproportionately represented in low adherence, reflecting travel costs (over PKR 1000 for half the sample) and high unemployment (53.8%). These findings support previous evidence from Lakara et al. (2025) and Tadesse et al. (2024), linking poverty, low education, and high travel costs with poor adherence.^[21] Systemic and psychosocial barriers also played a decisive role. Inadequate counseling, limited follow-up, and weak patient-provider communication were significantly associated with low adherence. Self-reported reasons included forgetfulness, adverse side effects, and premature treatment cessation due to perceived recovery. Cultural factors such as stigma and behavioral risks like smoking further compounded non-compliance. The research has been particularly meaningful because it points to the context-dependent patterns, especially the surprising negative correlation between marital status and adherence and the subtle influence of gender in a rural low-income environment. It is an all-

encompassing interpretation of barriers to adherence through the incorporation of socio-demographic, systemic, and cultural determinants. The results indicate some obvious policy implications. TB control programs should be increased in the form of patient-centered community-based models other than biomedical approaches. Such priorities should consist of financial and logistical assistance of low-income and rural patients, a stable supply of medication, and customized health education to enhance literacy and dispel myths. These measures are needed to enhance compliance and reduce the chances of therapy failure and resistance to drugs in high-burden areas.

CONCLUSION

This research demonstrates that adherence to TB treatment was low or medium in 86.8 percent of participants due to socio-demographic, economic, systemic, and psychosocial factors. The determinants were mainly male gender, marital status, low income, illiteracy, rural living, unemployment and high cost of transportation, which was reinforced by lack of follow-up, weak counseling, side effects of drugs, stigma, and misconceptions. These results emphasize the need of patient-based and community-based interventions that encompass the financial and geographic disadvantages and increase health literacy and ongoing support to boost adherence and decrease TB-related morbidity and mortality.

LIMITATIONS

The study was conducted at a single hospital-based DOTS center, with all participants from one geographic region. This limits the ability to generalize results to rural areas, other provinces, or different types of healthcare facilities, where socio-demographic and cultural factors may vary significantly. Restricted sample size with only 212 participants, the study may not fully capture the variability in adherence behaviors across diverse population groups, potentially affecting statistical power and limiting the broader applicability of the results.

RECOMMENDATIONS

Provide financial and logistical support through transportation subsidies, monthly stipends to offset lost wages, and easily accessible medications at local health posts. Implement targeted health education and counseling tailored to illiterate and low-literacy populations, emphasizing treatment importance, drug resistance risks, symptom management, and stigma reduction. Strengthen healthcare provider training to improve communication, empathy, consistent follow-up, and tailored guidance for specific patient groups, including men and married individuals.

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