RESEARCH PAPER

Patient Satisfaction with Tuberculosis Care in Public and Private Health Facilities in Lahore, Pakistan: A Multicenter Cross-Sectional Study

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ABSTRACT

Background Tuberculosis (TB) is a major public health challenge in developing countries, where patient satisfaction (PS) and perceived healthcare service quality influence treatment adherence and outcomes. This study assessed PS and perceived quality of healthcare services in public and private facilities.

Methods An analytical cross-sectional study was conducted among 330 pulmonary TB patients (18-75 years) receiving treatment under the Directly Observed Treatment Short-course (DOTS) program in Lahore, Pakistan. Participants were recruited from four public hospitals, one private hospital, and three TB association centers. Data were collected through structured face-to-face interviews assessing professional competence, facility experience, accessibility, and medicine availability. Reliability was assessed using Cronbach's alpha. Exploratory factor analysis (EFA) and multiple linear regression were performed to identify determinants of PS.

Results EFA extracted three factors: professional communication, facility competence, and accessibility/cost, explaining 72% of the total variance. Overall satisfaction was moderate to high, with no statistically significant difference between public and private facilities ($p > 0.05$). Regression analysis showed that facility experience (standardized $\beta = 0.587$, $p < 0.001$) and public sector facility services ($\beta = 0.290$, $p < 0.001$) were significant predictors of satisfaction, whereas cost burden was a significant negative predictor ($\beta = -0.215$, $p = 0.001$). The model explained 36% of the variance in satisfaction ($R^2 = 0.36$).

Conclusion Facility experience and healthcare service quality are key determinants of TB satisfaction. Strengthening patient-centered care and reducing financial barriers may improve perceived healthcare quality and support adherence within the DOTS program.

Keywords: Accessibility, DOTS program, Healthcare quality, Tuberculosis

How to cite this article: Yousaf R, Elengoe A, Riaz M, Bhullar M, Inam A. Patient Satisfaction with Tuberculosis Care in Public and Private Health Facilities in Lahore, Pakistan: A Multicenter Cross-Sectional Study. Int J Drug Deliv Technol. 2026;16(22s): 254-268. DOI: 10.25258/ijddt.16.22s.28

Source of support: Nil.

Conflict of interest: None

Introduction

TB continues to be one of the prominent global health challenges, particularly in low- and middle-income countries (LMICs), including Pakistan. High disease burden, under-resourced health care systems, delayed diagnosis, and suboptimal treatment contribute to transmission and the augmentation of drug-resistant strains. The World Health Organization's End TB

strategy offers a crucial framework focused on early detection, drug-susceptibility testing (DST), and patient-centered care. However, obstacles in healthcare access, PS, and service quality hinder effective control and elimination of TB [1].

The National TB Control Programme (NTP) implements the Directly Observed Treatment, Short-course (DOTS) strategy for increasing case detection and treatment coverage in Pakistan over the past decade. But patient perceptions for waiting time, medication availability, privacy, and facility infrastructure remained highly variable and often sub-optimal. The results of a mixed-methods study indicated that most of the patients in Khyber Pakhtunkhwa were satisfied with DOTS delivery; However, waiting areas, access to drinking water, and appointment scheduling were considered to be inadequate [2].

Patients often have direct and indirect out-of-pocket expenditures due to transportation, nutrition, and lost income during treatment, even with official delivery of antituberculosis treatment (ATT) and diagnostic services without charge under national TB programs. These hidden charges often lead to catastrophic health expenditures, compromising patient compliance and perceived effectiveness of treatment. The research studies carried out in Ethiopia and India reveal that despite free treatment, indirect costs, such as income loss and transportation, still constitute the largest part of the total economic burden of TB. Such financial burdens (FB) further decrease overall PS with healthcare quality [3][4].

Previous studies identified communication, waiting time, and service accessibility as major determinants of PS in TB care. Effective communication, reduced waiting time, and accessibility were acclaimed to have a strong association in the context of PS in Southwest Nigeria [5]. Another research conducted in Surabaya, Indonesia, using the Quality of Care as seen through the eyes of the patient (QUOTE TB-light) instrument identified professionalism, communication, and service accessibility as key determinants of PS [6].

Medicine availability and stock-outs are the leading causes for dissatisfaction and non-adherence. Annually, more than 60% of first-line TB treatment centers in Ethiopia reported stock-outs of at least one key ATT medicine. So, patients were unable to rely on public services, forcing them to purchase medicines privately, increasing FB and undermining confidence in public healthcare programs [7].

According to a quasi-experimental study in India, pharmacist-led patient education can substantially improve treatment outcomes. By helping patients understand appropriate dosing and potential adverse effects, such counselling interventions have been associated with improved adherence [8]. As per the reviews of clinical pharmacy services conducted globally, adverse event monitoring, medication counselling, and patient education are among the best ways to increase adherence and PS [9].

Lastly, the two critical yet interdependent factors interaction of accessibility and cost governs the perceived service effectiveness. Increased accessibility leads to higher satisfaction, despite controlling for clinical quality indices [10][11].

PS in TB is a multidimensional factor influenced by service quality (e.g., communication, waiting time, infrastructure), FB and accessibility. These factors influence perceived treatment effectiveness and may impact adherence and treatment outcomes.

Though prior studies have examined PS, FB, or service quality individually, few have assessed these factors in combination with perceived treatment effectiveness, particularly across both public and private DOTS-affiliated facilities in Pakistan. This gap needs to be bridged for improving patient-centered TB care and national TB control strategies.

Thus, this multicenter study assessed perceptions of healthcare service quality and treatment effectiveness of TB patients in public and private DOTS-affiliated facilities in Lahore, Pakistan. Through identification of key determinants of PS this study aims to provide evidence that can inform policy interventions and improve patient-centered TB care experience, compliance, and treatment outcomes within the national TB control framework.

Methods

Study design, study duration, and setting

A multicenter analytical cross-sectional study was conducted between September 2023 and 2024. The selection of TB centers was based on Directory of TB Centers (Ministry of National Health Services, 2001) and Pakistan Anti-Tuberculosis Association (PATA), 1955 [12][13]. Out of the 50 available centers, the healthcare facilities were selected based on higher patient turnover and representation of various socioeconomic groups. Data was collected from four public hospitals (Sir Ganga Ram Hospital, Social Security Hospital, Mayo Hospital,

and Services Hospital), one private hospital (University of Lahore Teaching Hospital), and three Lahore District TB Association centers (33-F, Gulberg II, 28 Nisbat Road, and Kaura Pind Walton, Lahore).

Participants' eligibility and recruitment

Participants were recruited from each facility with a predetermined quota until the total sample size of 330 was reached through convenience sampling due to accessibility and feasibility. They were approached through face-to-face interviews by the principal investigator at the selected health facilities. Each interview lasted approximately 45-50 minutes. Eligible participants included patients aged 18 to 75 years with a confirmed diagnosis of pulmonary TB, established through clinical, radiological, or laboratory examination. Only patients receiving TB diagnosis and treatment at the selected public and private hospitals, and TB associations were included. Patients were excluded if they were pregnant or had extrapulmonary TB, other conditions of the respiratory system, or coexisting comorbidities such as diabetes mellitus, cardiovascular diseases, renal diseases, or hepatic diseases.

Sample size estimation

The sample size for this study was determined by the standard formula for a cross-sectional study:

$n = Z^2Pq/d^2$

Here, n = minimum sample required, Z = standard normal deviate corresponding to a 95% confidence interval (1.96), P = estimated proportion of TB in Pakistan (0.30), q = complementary probability (1 – p), and d = desired precision level, set at 0.05. Substituting these values into the formula yields:

$n = 1.96^2. 0.30. (1-0.30)/ 0.05^2 = 322$

After adjusting for a small non-response rate, the sample size was set at 329 participants. Considering the estimated proportion of TB in Pakistan, a total of 330 TB patients were included in this study.

Questionnaire development

A structured, interviewer-administered questionnaire was used to assess how TB patients perceived effectiveness and quality of healthcare services. It consisted of two parts: (1) Socio-demographic data and (2) patient-perceived healthcare quality domains. The Socio-demographic part collected data regarding gender, age, education, occupation, marital status, family type (nuclear or joint), area of residence (urban or rural), and monthly household income. The variables were used to describe the study population and were intended to be the potential covariates between demographic attributes, PS, and perceived healthcare quality.

The second part measured seven domains that encapsulate key constructs of TB care quality. The patients were prompted to respond using dichotomous (Yes/No/At times) and 5-point Likert-scale items (Strongly Agree to Strongly Disagree), with higher scores indicating a more positive perception of healthcare quality. The Health Services and TB Control Program domain Cronbach's $\alpha = 0.758$ measured the awareness, participation, and perception among patients about community-based activities in TB prevention and control. Similarly, in Public Sector Health Facilities and Services, with Cronbach's $\alpha = 0.742$, issues concerning access to TB prevention and treatment services were discussed, including medicine availability and pharmacy services.

The domain of Physician Interaction and Medication had a Cronbach's $\alpha = 0.578$. It assessed the physician-patient interactions and medical consultations. The domain of Costs and Medication Availability had Cronbach's $\alpha = 0.695$ it evaluated treatment expenses and the availability of free anti-TB medications. The Pharmacist Guidance domain had a Cronbach's $\alpha = 0.655$. It assessed the pharmacist counseling and guidance on medication adherence, and its use in both public and private healthcare settings. PS and Health Facility Experience domains with Cronbach's α of 0.758 and 0.920, respectively, were used to assess the general satisfaction of patients being treated by TB treatment services. It was based on components like professional communication, facility environment, quality of the medication, cost-effectiveness, and the availability of health insurance.

A panel of subject-matter experts reviewed it for content validity and contextual appropriateness. The questionnaire was pilot tested on a group of 50 TB patients at Sir Ganga Ram Hospital in Lahore to assess clarity, reliability, and feasibility. Minor modifications were made based on pilot feedback. The final version demonstrated an acceptable to excellent level of reliability with Cronbach's alpha values ranging between 0.578 and 0.920, as can be seen in Table 2.

Data analysis

Statistical analysis was carried out using IBM SPSS, Version 27. First, descriptive statistics were computed to summarize the sociodemographic characteristics of the participants as well as their answers to the questionnaire. The delineation of categorical variables was done with the help of frequencies and their corresponding

percentages, and the composite scores for each domain were calculated by summing Likert-scale items summarized using means and standard deviations. Cronbach's alpha was used to measure the internal consistency of the questionnaire about the subscales. In case of those subscales, which had few items, Spearman-Brown and Guttman Split-Half Coefficients were computed to further determine the internal stability and coherence. Subscales with Cronbach's alpha values of 0.60 or higher were considered to demonstrate acceptable reliability in line with recommendations for exploratory research. Nevertheless, slightly lower values of coefficients, such as Cronbach's $\alpha = 0.578$ were kept since they were theoretically relevant and thus presented acceptable thresholds of reliability within validation contexts. The EFA was used to compute the construct validity to ascertain the underlying dimensional structure of the questionnaire. Principal axis factoring with Promax rotation was used in light of theoretical anticipations about related factors. To determine the sampling adequacy and the data suitability to perform the factor analysis, Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were used. Extracted factors were in accordance with the eigenvalues that were greater than one, and the scree plot test was referred to verify. The retained items had factor loadings of 0.4 or greater and items that had a theoretical significance to the construct.

The review of inter-factor correlations was then made to determine construct distinctiveness and permitted conceptual overlap across dimensions. The sociodemographic variables were used to make comparisons in groups to determine how they are associated with the perceptions of patients regarding healthcare quality. Binary variables (gender and family type) were analyzed using independent samples t-tests, and categorical variables (age, education, occupation, and facility type) were analyzed using one-way analysis of variance (ANOVA). A p-value below 0.05 was considered statistically significant. Pearson's chi-square test was used to test the associations of categorical variables.

Lastly, significant predictors of PS were also found through the analysis of multiple linear regression, once more, using $p < 0.05$ as the level of significance.

Through this method of analysis, the overall assessment of the questionnaire's psychometrics was achieved.

Ethical considerations

Ethical approval was obtained from Lincoln University College, Malaysia (Reference No. LUC/RMC/2023/014). All participants were informed verbally about the study objective and procedures; written informed consent was taken before participation ensuring confidentiality and anonymity. Administrative permission to conduct the study was also granted by the public and private hospitals, along with the Lahore District Tuberculosis (T.B.) Associations in Pakistan.

Results

Socio-demographic Characteristics

330 TB patients participated in the study. Most were male (64.8%) and married (71.2%), with the largest age group being 55-64 years (21.2%). Over half (62.7%) lived in joint families, and the majority (70.3%) belonged to lower-income households. Most participants resided in urban areas (79.1%) and received treatment primarily from public hospitals (68.8%) (Table 1).

Table 1. Demographic characteristics of participants

Demographic characteristics	Frequency (Percentage) N = 330 n (%)
Gender	
Male	214 (64.8)
Female	116 (35.2)
Age groups (Years)	
18-24	59 (17.9)
25-34	68 (20.6)
35-44	42 (12.7)
45-54	65 (19.7)
55-64	70 (21.2)
65-75	26 (7.9)
Marital status	
Single	95 (28.8)
Married	235 (71.2)
Family type	
Nuclear	123 (37.3)
Joint	207 (62.7)
Qualification	
Illiterate	108 (32.7)
Under matriculation	127 (38.5)
Matriculation (10th Grade)	30 (9.1)
Intermediate (12th Grade)	37 (11.2)

Graduation	28 (8.5)
Average monthly income	
Lower Class (< 50,000 PKR/ month)	232 (70.3)
Middle Class (50,000-100,000 PKR/ month)	98 (29.7)
Occupation	
Unemployed	153 (46.4)
Student	37 (11.2)
Police official	8 (2.4)
Factory worker	52 (15.8)
Factory owner	3 (0.9)
Retired	16 (4.8)
Security guard	20 (6.1)
Teacher	7 (2.1)
Driver	30 (9.1)
Mechanic	4 (1.2)
Area of residence	
Urban	261 (79.1)
Rural	69 (20.9)
Treating Facility Type	
Public hospital	227 (68.8)
Private hospital	43 (13)
TB association center	60 (18.2)
N = Total number of participants	

Reliability analysis of the questionnaire

The "Health Facility Experience" domain, showed high internal consistency (α = 0.920 across 12 items) while the subscales containing fewer items for physician interaction and pharmacist guidance showed more modest reliability (α = 0.578 and 0.655, respectively). Additionally, split-half reliability testing using Spearman-Brown and Guttman coefficients ranged from 0.587 to 0.703 (Table 2).

Table 2. Reliability analysis of the questionnaire subscales (N=330)

Subscale / Domain	No. of items	Cronbach's α	Spearman-Brown	Guttman split-half
Health services and health facilities	4	0.758		
Public Sector Health Facilities and Services	3	0.742		
Physician interaction and medication	2	0.578	0.592	0.587
Cost burden	2	0.659	0.659	0.659
Medication availability	2	0.695	0.702	0.695
Pharmacist guidance	2	0.655	0.703	0.655
PS	4	0.758		
Health facility experience	12	0.920		

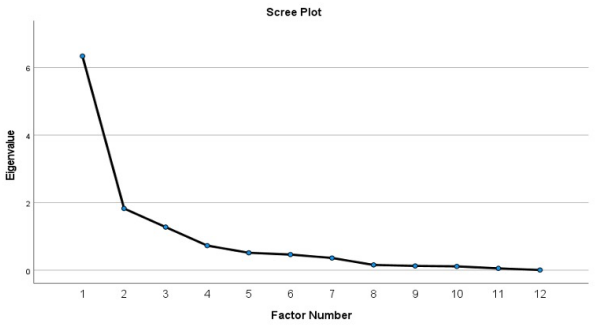
Note: Split-half reliability (Spearman-Brown and Guttman) was computed only for sub-scales consisting of two items. Higher scores correspond to greater satisfaction.

EFA of the Health Facility Experience Domain

The construct validity of "Health Facility Experience" domain was tested through EFA by means of principal axis factoring with Promax rotation. In addition, the data were suitable for factor analysis with a significant Bartlett's Test of Sphericity ($\chi^2 = 4413.19$, $p < 0.001$) and an acceptable sampling adequacy measure (KMO = 0.607). Based on eigenvalues and the scree plot trajectory (Figure 1), three factors that cumulatively explained 72% of the variance (Factor 1:50.8%; Factor 2: 13.3%; Factor 3: 8%) were retained.

These were conceptually classified into "Professional communication and Guidance," "Facility Competence and Counselling," and "Accessibility and Cost." The items demonstrated values ranging from 0.46 to 0.96. The inter-factor correlations were moderate, ranging from 0.26 to 0.57; hence, oblique rotation was employed to demonstrate a complicated yet coherent construct.

Figure 1.



Scree plot of the eigenvalues and the inflection points used to determine the three-factor solution for the "Health Facility Experience" domain.

Sociodemographic Variations in Health Facility Experience

The outcomes of the independent sample t-test are shown in Table 3. Large differences in facility experiences were consistently observed across demographic groups. Satisfaction with professional behavior and experience of the facility was significantly higher among married women ($p < 0.001$), with moderate-to-large effect sizes. Also, participants with joint families reported greater perceived professional and social support, that were significant at < 0.001 as well as moderate effect sizes. There were no significant differences by area of residence; however, rural residents tended to report slightly higher perceived barriers in terms of access and cost ($p = 0.059$, small effect size).

Table 3. Independent Sample T-test across Health Facility Experience Factors

Domain/ Factor	Category	t (df)	p-values	Interpretation
Professional Conduct	Male Female	5.09 (143.4)	<0.001	Females reported significantly higher professional conduct.
Facility Experience and Service Delivery	Male Female	-10.44 (152.3)	<0.001	Females perceived greater facility competence and counseling quality.
Access and Cost	Male Female	-12.55 (327.4)	<0.001	Females rated accessibility and affordability significantly higher.
Professional Conduct	Single Married	-4.53 (308.30)	<0.001	Married participants reported significantly higher professional conduct compared to single participants.
Facility Experience and Service Delivery	Single Married	-4.35 (324.13)	<0.001	Married participants had significantly better facility experience and service delivery compared to single participants.
Access and Cost	Single Married	-0.40 (146.32)	0.689	No significant difference was observed in accessibility and costs between married and single participants.
Professional Conduct	Nuclear family Joint family	-3.69 (307.65)	<0.001	Participants from joint families reported significantly higher professional

				support than those from nuclear families.
Facility Experience and Service Delivery	Nuclear family Joint family	-6.47 (295.42)	<0.001	Participants from joint families had significantly better facility experience and service delivery compared to those from nuclear families.
Access and Cost	Nuclear family Joint family	1.19 (243.74)	0.237	No significant difference in access and cost-related support between joint and nuclear family participants.
Professional Conduct	Urban Rural	-1.21 (328)	0.225	No significant difference in professional conduct between urban and rural participants.
Facility Experience and Service Delivery	Urban Rural	1.25 (328)	0.212	Urban and rural participants reported comparable experiences with facility services; no significant difference was found.
Access and Cost	Urban Rural	-1.91 (114.52)	0.059	Rural participants reported slightly better access and affordability, though the difference was not statistically significant.

Socio-Demographic Differences in Perceived Quality of TB Care

Welch's ANOVA revealed noteworthy distinctions in professional conduct, facility experience, service delivery, and access/cost among the demographics, with all p-values below 0.001. The less educated and unemployed younger participants had a poor experience of healthcare and those older, better educated and employed rated facility experience and access to services in a more favorable way. The effect size (η^2) varied from moderate (0.06 to 0.13 age and education) to large (more than 0.14 occupation), which indicated that demographic variables have a significant impact on patient-perceived quality of TB care.

Table 4. Welch's ANOVA and Games-Howell Post Hoc Comparisons by Independent Variables

Domain / Factor	Independent variables	Welch's F (df1, df2)	Welch's p-value	Post-Hoc Comparison and Interpretation
Factor 1- Professional Conduct	Age Group	F (5,131.139) = 22.901	<0.001	18-24 years old (youngest group) reported significantly lower professional conduct than older

				age groups.
	Education Level	F (4,103.73) = 21.46	<0.001	Illiterate participants reported significantly higher professional conduct than all educated groups.
	Occupational Groups	F (9, 140.68) = 21.46	<0.001	Significant variations across occupations, with higher scores reported among security guards and unemployed participants compared with other occupations.
Factor 2- Facility Experience and Service Delivery	Age Group	F (5, 124.92) = 14.19	<0.001	Participants 18-24 years old differed significantly from older age groups (35-44, 55-64, and 65-75 years).
	Education Level	F (4, 100.75) = 21.35	<0.001	Significant difference s were observed between illiterate and intermediate groups, with better experience reported among educated participants.
	Occupational Groups	F (9, 123.45) = 21.35	<0.001	Facility experience differed significantly among occupational groups.
Factor 3- Access and Cost	Age Group	F (5, 123.84) = 39.02	<0.001	Participants aged 35-44 years reported a significantly higher access and cost burden compared with younger groups.
	Education Level	F (4, 101.67) = 15.80	<0.001	Graduates reported significantly higher satisfaction with access and cost compared with lower-educated groups.

	Occupational Groups	F (9, 244.87) = 10.82	<0.001	Access and cost perceptions differed significantly across occupational categories.
Note. Welch's ANOVA was applied due to unequal variances (Levene's Test $p < 0.05$). Games Howell Post-Hoc test identified significant pairwise differences ($p < 0.05$).				

Correlation Analysis of Patient Perception Factors

The factors of patient perception exhibited a modest relationship with each other. The mean of professional conduct was 2.24, and that of facility experience was 2.55. Professional conduct, experience in the facility, and availability of medicine showed a strong correlation. Between 0.38 and 0.62 ($p < 0.001$), there was a positive correlation between enhanced service quality, and access to medication, and satisfaction scores. On the other hand, there was a strong negative correlation between financial burden ($r = -0.31$ to -0.55, $p < 0.01$), implying that the economic burden had a negative influence on PS and treatment perception.

Table 5. Pearson's Correlation Matrix of Patient Perception Variables (N= 330)

Variables	1	2	3	4	5	6	7	8	9
1.Professional Conduct	-								
2. Facility Experience and Service Delivery	0.528**	-							
3. Access and Cost	0.382**	0.424**	-						
4.Health Services and Health Facilities	-0.012	0.073	0.037	-					
5.Public Sector Health Facilities and Services	0.228**	-0.128*	0.114*	0.395**	-				
6.Physician Interaction and Medication	0.026	0.046	-0.023	0.095	0.178**	-			
7.Cost Burden	-0.309**	-0.379**	-0.545**	-0.245**	0.090	0.047	-		
8.Medicine Availability	0.624**	0.508**	0.411**	0.086	0.032	-0.218**	-0.483**	-	
9.Pharmacist Guidance	-0.259**	-0.032	-0.361**	0.228**	0.168**	0.202*	0.195**	-0.211**	-
10.PS	0.362**	0.521**	0.270**	0.097	0.095	-0.092	-0.320**	0.347**	-0.137*

All variables are based on Likert-scale responses; higher values indicate more positive perception.
*Indicates $p < 0.05$, ** $p < 0.01$.

Factors Influencing Patient Satisfaction

36.3% of the variance was shown by regression analysis in PS ($R^2 = 0.363$, $p < 0.001$). Facility experience ($\beta = 0.587$, $p < 0.001$) and public sector facility services ($\beta = 0.290$, $p < 0.001$) were positive predictors of satisfaction. Cost burden ($\beta = -0.215$, $p < 0.001$), physician interaction and medication quality ($\beta = -0.133$, $p = 0.007$), pharmacist guidance ($\beta = -0.161$, $p = 0.003$), and access and costs issues ($\beta = -0.161$, $p = 0.012$) were found to be negative predictors (Table 6).

Table 6: Multiple Linear Regression Analysis Predicting PS

Variables	B	*SE*	β Coefficients	95% CI	*p*	VIF

				for B		
(constant)	2.330	0.418		1.507, 3.153	<0.001	
Factor 1: Professional Conduct	-0.044	0.081	-0.038	-0.204, 0.117	0.592	2.469
Factor 2: Facility Experience	**0.689**	0.075	**0.587**	**0.541, 0.838**	**< 0.001**	2.068
Factor 3: Access and Costs	**-0.146**	0.058	-0.161	-0.259, -0.033	0.012	2.010
Health Services & Facilities	-0.109	0.109	-0.056	-0.323, 0.105	0.316	1.536
Public Sector Facility Services	**0.452**	0.095	**0.290**	**0.264, 0.639**	**<0.001**	1.882
Physician Interaction & Medication	-0.248	0.091	-0.133	-0.427, -0.070	0.007	1.191
Cost Burden	**-0.360**	0.105	**-0.215**	**-0.566, -0.155**	**0.001**	1.947
Medicine Availability	-0.045	0.089	-0.034	-0.221, 0.130	0.614	2.237
Pharmacist Guidance	-0.386	0.130	-0.161	-0.642, -0.130	0.003	1.477
$R^2 = 0.363$						
$F(9,320) = 6.25$, $p < 0.001$						
Note. The dependent variable is PS. Statistically significant predictors are in bold.						

Discussion

Health inequities still strike vulnerable groups in LMICs despite advances [14]. Access to quality care, treatment compliance, and PS depend on medication availability, facility capacity, and patient-provider communication [15]. Poverty, limited education, high out-of-pocket costs, and long distances often delay care. Poor transport and unavailability of medicinal supply decreases adherence and worsen outcomes [16][17]. Core programmatic functions of WHO End TB Strategy calls for action by targeted outreach to underserved people [18]. TB puts psychological, social, financial, emotional, and physical burdens on patients and their families. The healthcare service quality should be enhanced to address the impact [19].

This study points to sociodemographic differences in the patient's perceptions. Females expressed higher satisfaction in the domains of professional conduct, facility experience, and access to care, a trend consistent with previous evidence implying that they tend to perceive healthcare interactions more positively [2,21]. Similarly, married and those from joint families reported greater satisfaction and perceived support, deliberating broader household resources, internal peer encouragement, and greater collective health-seeking behaviors [22]. In contrast, younger, less-educated, and unemployed patients reported lower satisfaction along with greater challenges regarding access and financial burden, reflecting the impact of socioeconomic disadvantage on perceived care [29]. The predominance of male participants in this study is in line with global TB epidemiology, where higher exposure and health-seeking patterns contribute to greater TB burden among men [20]. No statistically significant differences were observed based on area of residence; however,

participants from rural areas expressed slightly greater concerns about cost and access ($p = 0.059$). This differs from findings from several LMIC studies that reported poorer healthcare experiences among rural populations [30], and may reflect the urban-dominant sample (79.1% urban) or selective access among rural participants [23].

Our finding that females rated access and cost significantly higher ($p < 0.001$) may diverge from some studies showing males perceiving fewer access challenges; this suggests that in our context, women perceive/ access benefits differently- possibly due to targeted outreach, community programmes, or spousal/ family-mediated care facilitation in joint households [24].

Socioeconomic disadvantage was common in our sample: 70.3% reported lower household income, and 71.2% had low education (32.7% were illiterate; 38.5% were below matriculation). This pattern is consistent with longstanding findings that TB risk and care inequities are significantly influenced by poverty, inadequate education, overcrowding, and low income that limit access to care and delay diagnosis [25].

The increased use of public healthcare centers observed in this study align with evidence that most patients first seek care in public sector settings, due to accessibility and reliance on government-sponsored TB services [26].

A minority of patients aged 65 years illustrate change in global trends of TB burden to geriatrics, as reported in China for which understanding of the local demographics in health-seeking context is needed [27]. The lower representation of older adults may reflect regional demographics, early mortality, or disparities in access to healthcare services.

Medicine availability was rated lowest, whereas access and cost concerns were rated highest, indicating functional shortcomings in pharmaceutical supply and accessibility. Infrastructure and service efficiency were associated with patient perception of care because $r = 0.521$, $p < 0.01$ shows that facility experience correlated positively with service delivery and PS [31]. However, evidence suggest that professionalism and communication of healthcare providers supersede structural aspects in satisfaction [32].

Negative correlation was observed between financial burden and PS $r = -0.320$, $p < 0.01$, indicating the adverse effect of out-of-pocket expenditure on TB care [33]. Although, some studies report no correlation between healthcare expenditure and satisfaction, suggesting experience over expense [34][35].

Public sector services and physician interaction had weak correlations with satisfaction ($r = -0.092$ and $r = 0.095$, respectively). Some Pakistani studies reported lower satisfaction to paternalistic provider-patient relationships and poor communication [2,36]. Though most international evidence has found communication skills as an important determinant of satisfaction [37,38].

The availability of medicine has a positive correlation with satisfaction $r = 0.347$, $p = 0.01$, emphasizing reliable access to medications and appropriate pharmacy guidance. In TB treatment, continuous access to medicines is paramount for satisfaction and for preventing drug resistance along with prolonged toxic regimens [39].

Several significant predictors were identified through a multiple linear regression model, which explained 36.3% of the variance in PS ($R^2 = 0.363$, $F(9, 320) = 6.25$, $p < 0.001$). The strongest predictor was facility experience ($\beta = 0.587$, $p < 0.001$), which echoes with prior evidence showing that structured care settings improve PS [40]. Additionally, public sector facility services showed a significant positive association ($\beta = 0.290$, $p < 0.001$) which is an encouraging finding supporting evidence that responsive and effective public facilities can earn patient trust even in resource-limited settings. Congruently, cost burden and access and costs were significant negative predictors, stressing the influence of financial accessibility on perceived care [41].

Interestingly, significant negative association of Physician interaction and medication quality with PS was observed ($\beta = -0.133$, $p < 0.007$), which might indicate a lack of satisfaction because of unmet expectations or poor communication even with service provision [42]. Furthermore, pharmacist guidance was a predicted of higher PS corroborating with previous studies about the role of pharmacists in adherence and patient education [43][44].

Professional behavior, medical facilities, and medicine availability were not significant predictors, which might be because these were already at an acceptable baseline. However, in other healthcare systems, these characteristics may become critical predictors of PS [45].

The results provide several practical options with the demonstrated improvements in facility-level experience with better cleanliness, comfortable waiting areas, and efficient patient flow contributing to PS. These are achievable improvements that pay real dividends. The impact of FB on PS is evident. Implementing measures to reduce these burdens by providing subsidies for travel,

nutritional support, and expanding social protection schemes into policy will help mitigate these burdens. Such efforts would be better aligned the WHO's End TB Strategy which would strengthen both patient experience and pragmatic outcomes.

PS can be improved by providing structured training programs on patient-centered communication, empathy, and counselling techniques. Extending the time of patient-provider interactions may also improve perceived care quality. Pharmacists should be included in TB management as their active involvement in medication counselling, adherence, and early detection of side effects could improve PS and treatment outcomes. Training involving pharmacist in multidisciplinary TB care teams would amplify their contribution. Incessant medication availability should be a priority. Supply chain management, accurate forecasting of medicine requirements, and vigilant monitoring would ensure that there are no stock-outs and uninterrupted treatment.

Strengths and limitations of the study

This study gives a practical assessment of PS with TB care across both public and private facilities in Lahore. With a sample of (n = 330) patients and a validated questionnaire, it elucidates the main factors defining PS such as facility environment, public sector, and FB while considering accessibility and overall service quality. It provides evidence for clinicians and policymakers probing to strengthen patient-centered TB care in resource-limited settings. It also has some limitations that should be considered. It relies on self-reported data, which carries risks of recall and social desirability bias. Although the sample was adequate, it may not fully reflect regional variations in TB care experiences across Pakistan.

Conclusion

This multicenter study provides an understanding of patient-perceived treatment effectiveness and healthcare service quality among individuals receiving TB care in public and private facilities. Overall PS was moderate to high, yet varied meaningfully across sociodemographic groups. Higher satisfaction levels were reported by females, married, and joint-family participants, emphasizing the role of social and familial support. Facility experience and the quality of public sector services stood out as the strongest predictors of PS. Conversely, treatment costs, limited medicine availability, and suboptimal provider-patient communication negatively affected perceived care quality. Strengthening communication, ensuring an incessant medicine supply, and implementing financial support mechanisms are essential to enhance PS and treatment adherence. Integrating these improvements within Pakistan's DOTS framework could reinforce trust in the healthcare system and contribute to the WHO End TB strategy. Sustained investment in facility infrastructure, staff training, and equitable access to affordable TB care remains vital for improving patient experience and long-term outcomes. Future research should explore longitudinal and intervention-based approaches to further evaluate strategies for improving PS and treatment outcomes.

Acknowledgement

We gratefully acknowledge the support and cooperation extended by the administrators and staff of healthcare facilities **(**Sir Ganga Ram Hospital, Social Security Hospital, Mayo Hospital, and Services Hospital, Lahore District Tuberculosis (T.B) Association, 33-F, Gulberg II, Lahore, Lahore District Tuberculosis (T.B) Association, 28 Nisbat Road, Lahore, Lahore District Tuberculosis (T.B) Association, Kaura Pind Walton, Lahore, and the University of Lahore Teaching Hospital). We also extend our heartfelt gratitude to the patients for sharing their valuable time and experiences.

Funding

Not applicable

Conflict of interest

All authors have declared no conflict of interest in this study

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