

Prevalence and Determinants of Non-Adherence to Anti-Tuberculosis Treatment Among Patients Receiving Tuberculosis Care in Southwestern Uganda

Nakyanzi Grace Juliana

School of Pharmacy, Kampala International University, Box 20000, Ishaka, Uganda

Alrazi Eisa Shogar

alrazieisa@gmail.com

School of Pharmacy, Kampala International University, Box 20000, Ishaka, Uganda

Orwa Siddig

School of Pharmacy, Kampala International University, Box 20000, Ishaka, Uganda

Abdalla A. Elbashir

Department of Chemistry, College of Science, King Faisal University, Al-Ahsa 31982, Saudi Arabia

Ahmed O. Alnajjar

Department of Chemistry, College of Science, King Faisal University, Al-Ahsa 31982, Saudi Arabia

Research Article

Keywords: Tuberculosis, Medication adherence, Anti-tuberculosis treatment, Treatment non-adherence, Risk factors, Southwestern Uganda

Posted Date: August 20th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10416979/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Public Health on September 23rd, 2026. See the published version at <https://doi.org/10.1186/s12889-026-29635-9>.

Abstract

Background

Tuberculosis (TB) remains a major public health challenge in Uganda despite the availability of effective treatment. Non-adherence to anti-TB medication continues to undermine national TB control efforts, contributing to treatment failure, drug resistance, prolonged infectiousness, and increased morbidity and mortality.

Objective

This study assessed patient-related, therapy-related, and health-system factors associated with non-adherence among tuberculosis patients attending Ishaka Adventist Hospital in Bushenyi District, Uganda.

Methods

A cross-sectional study design was employed, involving 152 adult TB patients who had been on treatment for at least three months. Data were collected using structured interviewer-administered questionnaires and extracted from TB treatment registers. Quantitative data were analyzed using IBM SPSS version 27.

Results

The prevalence of non-adherence was 34.2%, with forgetfulness (73.8%), distance to the facility (35.0%), side effects (31.1%), busy schedules (31.1%), and financial constraints (21.4%) being the most frequently reported causes of missed doses. HIV co-infection was the most common comorbidity, affecting 83.7% of participants and 88.5% of those who missed doses. No socio-demographic factors showed statistically significant associations with adherence. A perfect negative correlation was observed between doses missed and percentage adherence, reflecting the mathematical relationship between these variables.

Conclusion

TB non-adherence at Ishaka Adventist Hospital is primarily driven by behavioural, structural, and clinical factors. Addressing these barriers through patient-centered interventions and strengthened health-system support is essential to improving treatment outcomes and reducing TB burden.

INTRODUCTION

1.1 Background of the Study

Tuberculosis (TB) is caused by organisms of the *Mycobacterium tuberculosis* complex, of which *M. tuberculosis* itself accounts for the majority of human disease (1) The infection spreads through airborne droplets during coughing or close contact, and manifests as pulmonary disease in roughly four out of five cases, with the remainder involving extrapulmonary sites such as lymph nodes, bone, the urogenital tract, the meninges, and the peritoneum. Presentation typically includes a persistent cough (of more than two weeks' duration, or of any duration in people living with HIV), chest pain, fatigue, weight loss, fever, and night sweats. Risk is heightened by diabetes, immunosuppression, harmful alcohol use, malnutrition, and tobacco use, and untreated disease can progress to haemoptysis, pleural or pericardial involvement, meningitis, skeletal deformity, respiratory failure, and death within roughly two years (2). Meningitis, skeletal deformity, respiratory failure, and death within roughly two years. Diagnosis relies on culture, microscopy, and nucleic acid amplification testing of sputum or tissue, supported by imaging, and cases are further characterised by bacteriological or clinical confirmation, anatomical site, treatment history, and drug-susceptibility profile, including rifampicin-resistant, multidrug-resistant, and extensively drug-resistant disease (3). TB remains among the leading infectious causes of death worldwide, responsible for close to three million deaths annually and a substantial share of preventable mortality in low- and middle-income countries. History of treatment New: no previous TB treatment (or treatment less < 1 month), Relapse: patient who completed a previous course of treatment, was declared cured or treatment completed, and is now diagnosed with a recurrent episode of TB, treatment after failure: those who have previously been treated for TB and whose treatment failed at the end of their most recent course of treatment, treatment after loss to follow-up: Patient has been previously treated for TB and were declared lost to follow-up at the end of their most recent course of treatment Drug susceptibility status (based on drug susceptibility Tests)(4) Drug Sensitive TB (DS-TB): These are sensitive to 1st line anti-TB drugs Drug resistant TB (DR-TB):

Resistant to any anti-TB drug. Can be classified as follows. Rifampicin resistant: any case of rifampicin resistance (isolated or in combination with other resistance) (RR-TB) Mono-resistant: resistant to only one first line anti-TB drug Poly drug resistant: resistant to more than one first line anti TB other than both rifampicin and Isoniazid Multi drug resistant: resistant to rifampicin and isoniazid (MDR – TB) Extensive drug resistance (XDRTB): resistant to rifampicin, isoniazid (MDR TB) and any fluoroquinolone and at least one of either bedaquiline or Linezolid). Statistically, TB kills nearly 3 million persons per year worldwide and is still one of the leading causes of death worldwide, accounting for 2.5% of the global burden of disease and 25% of all avoidable deaths in developing countries(5-7). TB has been recognized as one of the most frequent opportunistic infections in persons with HIV infection. The co-existence of HIV infection and TB has been hailed as one of the most serious threats to human health, and HIV/TB co-infected individuals are more likely to die or to be lost to follow-up within 12 months of ART clinic entry(8). The 2021 Global TB Report estimates 9.9 million people were infected with TB in 2020, which is equivalent to 127 cases per 100,000 people(9). Close to half of those cases (43%) occurred in the South East Asia region, followed by the African region (25%) and 18% in the Western Pacific region(9, 10). Uganda is among the WHO's 30 high TB/HIV burden countries, which contribute about 60% of the total TB/HIV burden globally, where TB is a major public health problem with an estimated incidence of 453 cases per 100,000 population in 2020(11). Although many individuals are infected with *Mycobacterium*

tuberculosis, only 10% manifest as active disease, while the remaining persist in a latent phase, resulting in a large reservoir of individuals with Latent TB Infection (LTBI)(12).

Management of TB and its other co-morbidities has been evolving greatly with various treatment options. The country has adopted patient-centered care. It is recommended that all TB medicines be taken under direct observation by a treatment supporter (DOT), and Digital Adherence Technologies (DAT) have been introduced to support treatment adherence(13, 14). Anti-TB drugs are given in fixed-dose combination (FDC) regimens according to the patient's TB classification. Treatment is divided into two phases: an initial (intensive) phase of 2 months and a continuation phase of 4 months (longer in severe forms of TB particularly TB meningitis and osteoarticular TB) TB treatment regimens are expressed in a standard format, e.g. 2RHZE/4RH where: - Letters represent abbreviated drug names - Numbers show the duration in months - shows the division between treatment phases(15).

However, different studies conducted in different parts of Uganda showed that adherence among TB patients in Uganda was estimated at around 67–85.4%. Contributing factors to poor uptake of anti-TB medications in Uganda included: poor patient adherence, knowledge by health workers, lack of confidence in symptom-based screening alone, and fear of Isoniazid resistance(13, 16).

Adherence — taking medication as prescribed — is central to TB control, since cure typically requires adherence above 90%; falling short raises the risk of drug resistance, onward transmission, and poorer outcomes. Non-adherence is common across chronic conditions generally, averaging around 60%. (1, 17). Patients with TB are expected to have adherence levels greater than 90% to facilitate a cure; failure of which increases the risk of development of drug-resistant strains, spread of TB in the community, and, in turn, increases morbidity and mortality(17). Non-adherence is a problem in TB management because the treatment is long and involves taking several medications, side effects, and the patient usually feels better long before treatment has been completed. Treatment is associated with non-adherence among patients.

Non-adherence is further classified as: Intentional where the patient decides not to follow the treatment recommendations based on their beliefs and preferences. Unintentional – where the patient wants to follow the treatment recommendations but faces practical barriers, e.g., poor recall or forgetting to take medication regularly. Reasons for behaviors, which drive low rates of medication adherence, are complex and multifaceted. To have a significant impact on medication adherence rates, patients need to be informed, motivated, and skilled/supported to take their medications optimally. TB treatment is prolonged, multi-drug, and often associated with early symptomatic improvement well before completion, no single intervention is likely to resolve non-adherence on its own; guidance from bodies such as the UK's National Institute for Health and Care Excellence instead recommends individually tailored combinations of support (13, 18).

Despite this body of evidence, most Ugandan studies on TB treatment adherence have focused on national referral or urban public facilities, leaving adherence patterns at smaller, private not-for-profit facilities in southwestern Uganda comparatively unexamined — settings where the mix of patient-,

therapy-, and system-level barriers may differ. This study addresses that gap by assessing the patient-related, therapy-related, and health-system factors associated with non-adherence among TB patients attending Ishaka Adventist Hospital. Characterising these factors is intended to inform interventions that reduce treatment failure, drug resistance, relapse, and mortality, and to strengthen the design of adherence-support programmes more broadly.

Patient factors associated with non-adherence among TB patients

Several patient factors have been identified as potential determinants of non-adherence to TB treatment uptake among TB contacts. Studies have found that cultural/religious beliefs and practices, substance use, comorbidities, mental status, socio-economic factors like poverty, lack of adequate education, unemployment, education level, and social support, among others, have been identified as barriers to adherence to TB treatment(19, 20).

Poverty is a significant barrier to adherence to TB treatment among TB contacts. Studies have consistently shown that individuals from households with lower income are less likely to effectively take TB medications than those from higher- income households. Poverty impacts the ability of patients to access, understand, and adhere to treatment regimens(21). Although many TB treatments are available at no cost in most healthcare systems, indirect costs pose a barrier whereby some medications that are not covered need to be catered for by the patient, and transportation costs to the health facility make patients skip appointments or avoid accessing healthcare. Some patients living in poverty prioritize basic needs like food and shelter over healthcare, leading to missed doses or discontinuation of medication. Such findings suggest that poverty limits access to healthcare services and medications among TB contacts.

Comorbidities or the presence of multiple health conditions can significantly impact TB medication adherence in the following ways: Patients with comorbidities often require multiple medications for different conditions. This can lead to confusion, forgetfulness, increased chances of drug interactions, multiple side effects, and adverse effects, which lead to discomfort and discouragement towards medication adherence(21).

Patient-related factors promoting non-adherence to TB medication, e.g., cultural/religious beliefs and practices, forgetfulness, comorbidities, mental status, socio-economic factors, e.g., poverty, education level, employment status, and social status, play a significant role in adherence to TB medications among TB contacts.

Healthcare facility factors associated with non-adherence among TB patients

A systematic review and meta-analysis of 38 studies across different countries found that healthcare providers' knowledge and attitudes towards adherence to TB medications significantly influence adherence to medications by patients. In Uganda, a study conducted among healthcare workers in six districts found that their knowledge about TB treatment and adherence was very low, with only 34.1% of respondents aware of the recommended duration of TB treatment (22).

The availability and accessibility of TB medications at healthcare facilities promotes adherence to TB medication. However, inability and shortages of TB medications lead to non-adherence since patients are unable to obtain the required medications. The long distance to the healthcare facilities from the patients' homes makes the patients unable to access medication regularly. In some settings, TB medications may be difficult to obtain due to complex supply chains or inadequate infrastructure. Some patients may not be aware of the availability of TB medications or where to access them, which hinders their ability to obtain treatment(23).

Therapy-related factors contributing to non-adherence among TB patients

Non-adherence to TB treatment is a significant challenge globally, impacting treatment success and contributing to the spread of the disease. These factors often stem from the nature of the disease and the treatment itself, creating challenges that can lead to patients discontinuing or modifying their treatment regimens(24). Understanding these therapy-related factors is crucial for developing strategies to improve adherence and ensure successful treatment outcomes for TB patients. The following are therapy-related factors contributing to non-adherence among TB contacts: the complexity of TB treatment regimens is a crucial factor. The regimens often involve multiple medications taken at specific times over a lengthy duration, making it a challenge for patients to maintain consistent adherence. TB treatment typically involves taking multiple medications, each with its own specific dosage and frequency. This can be confusing to remember, especially for patients with limited literacy or cognitive abilities (25). The extended duration of TB treatment is a significant factor contributing to non-adherence among TB contacts. The long treatment regimens lasting for several months or even years pose challenges for patients to maintain consistent adherence, leading to potential treatment failure and the spread of drug-resistant TB(26). Maintaining motivation and commitment to a lengthy treatment regimen can be challenging for patients. The initial enthusiasm and determination may wane over time, especially if patients experience side effects, feel well enough to believe they no longer need treatment, or face difficulties with access to medication or support. The long duration of treatment can significantly impact patients' mental health. Anxiety, depression, and feelings of hopelessness can contribute to non-adherence, especially if patients feel overwhelmed by challenges of treatment and the potential consequences of non-adherence.

MATERIALS AND METHODS

3.1 Study Designs

An analytical cross-sectional study was conducted to assess the prevalence of non-adherence and its associated factors among tuberculosis patients attending Ishaka Adventist Hospital.

3.2 Description of Study Area

The study was conducted at Ishaka Adventist Hospital, a private not-for-profit facility located in Bushenyi District in Western Uganda. The hospital provides comprehensive TB diagnostic and treatment services

and serves both urban and rural populations.

3.3 Study Population

The study population consisted of adult tuberculosis patients receiving anti-TB treatment from the TB clinic at Ishaka Adventist Hospital.

3.3.1 Inclusion Criteria

Adult TB patients aged 18 years and above.

Patients who had been on anti-TB treatment for at least three months.

Patients who consented to participate.

3.3.2 Exclusion Criteria

Seriously ill patients unable to respond to the questionnaire.

Patients who did not consent to participate.

3.4 Sample Size and Sampling Technique

All eligible patients attending the TB clinic during the study period were approached consecutively until data collection closed, yielding a total sample of 152 patients. As this reflected the full population of eligible attendees over the study window rather than a pre-calculated minimum, no formal sample size formula was applied; the resulting sample nonetheless represents a substantial proportion of the clinic's active TB caseload during that period.

3.5 Data Collection Procedure

Data were collected through interviewer-administered questionnaires, supplemented by information extracted from TB treatment registers. The questionnaire was developed by the investigators based on an extensive review of the literature and relevant tuberculosis treatment guidelines. The English version of the questionnaire is provided as Supplementary File 1. Before use, it underwent expert review and pilot testing to check clarity, relevance, and flow, and minor revisions were made accordingly. The final instrument was printed in English but administered orally in Runyankore, the language most familiar to participants, to ensure accurate comprehension. Data collection was carried out by the principal investigator with support from trained research assistants, and covered four domains: socio-demographic characteristics; comorbidities and other disease-related factors; patient-related factors contributing to non-adherence; and medication- and therapy-related factors contributing to non-adherence. Socio-demographic and comorbidity items were open-ended, while items on patient- and therapy-related factors combined open and closed formats to capture both structured responses and free-text detail.

3.6 Study Variables

Dependent variable:

- Non-adherence to anti-TB medication.

Independent variables:

- Socio-demographic factors (age, sex, education, occupation, religion, marital status).
- Clinical factors (comorbidities, previous TB treatment).
- Therapy-related factors (side effects, pill burden).
- Psychosocial factors (stigma, forgetfulness).

3.7 Data Analysis

Data were entered into IBM SPSS Statistics version 27 for analysis. Participant characteristics were summarized using descriptive statistics (means, standard deviations, frequencies, and percentages). Bivariate logistic regression was used to screen for variables associated with non-adherence, and those meeting a threshold of $p < 0.20$ were entered into a multivariable logistic regression model to identify independent determinants. Adjusted odds ratios with 95% confidence intervals are reported, with statistical significance set at $p < 0.05$.

3.8 Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was granted by the Kampala International University School of Pharmacy Research Ethics Committee (reference KIU-SOPRC/085/25). All participants received a full explanation of the study's purpose and procedures and gave written informed consent before enrolment, in English, with interviews subsequently conducted in Runyankore; participants were also informed of their right to withdraw at any stage without consequence. Interviews were conducted in private settings to protect participants' comfort and confidentiality, and no identifying information was recorded – all data were anonymized so that individual participants cannot be identified in this or any related publication.

RESULTS

This section presents the descriptive and inferential statistics of adherence to TB treatment among participants, stratified by demographic and clinical characteristics.

4.1 Descriptive statistics

Table 4.1
Socio-demographic factors

		count	column n %
Gender	Female	73	48%
	Male	79	52%
Religion	Faith of Unity	7	5%
	Muslim	14	9%
	Seventh Day Adventist	6	4%
	Catholic	42	28%
	Anglican	43	28%
	Born again	40	26%
Age group	20–29	27	18%
	30–39	34	22%
	40–49	32	21%
	50–59	27	18%
	60–69	17	11%
	70–79	7	5%
	80–89	8	5%
Marital status	Widowed	24	16%
	Single	14	9%
	Married	112	74%
	Divorced	2	1%
Education level	No formal education	27	18%
	Primary school	47	31%
	Secondary school	57	38%
	Tertiary	21	14%
Occupation	Retired	7	5%
	Peasant	51	34%
	Student	11	7%
	Self employed	64	42%

Employed	19	13%
----------	----	-----

As shown in Table 4.1, a total of 152 participants were included in the study. The majority were male (52%) and married (74%). Most participants had secondary education (38%) and were self-employed (42%). Regarding religion, Anglican and Catholic participants were the most represented (28% each). The age distribution was fairly even, with the 30–39-year age group being the largest (22%)

Table 4.2
Multi-response general trends

Multiple-Response Category	Response Option	N	% of Responses	% of Cases
Other Medicines Used	CPT	51	27.1%	54.3%
	Amlodipine	18	9.6%	19.1%
	Losartan	16	8.5%	17.0%
	Metformin	25	13.3%	26.6%
	TDF/3TC/DTG	62	33.0%	66.0%
	TDF/3TC/EFV	16	8.5%	17.0%
Comorbidities	HIV	82	64.6%	83.7%
	Diabetes Mellitus	25	19.7%	25.5%
	Hypertension	20	15.7%	20.4%
Reasons for Missing a Dose	Forgot	76	29.3%	73.8%
	Busy schedule	32	12.4%	31.1%
	Side effects	32	12.4%	31.1%
	Pill burden	21	8.1%	20.4%
	Got and felt better	31	12.0%	30.1%
	Financial burden	22	8.5%	21.4%
	Distance	36	13.9%	35.0%
	Religious beliefs	9	3.5%	8.7%
Access-Related Barriers	Distance	43	26.5%	51.2%
	Side effects	45	27.8%	53.6%
	Financial constraints	39	24.1%	46.4%
	Pill burden	35	21.6%	41.7%
Current Medicines	RHZE	99	33.2%	65.1%
	RH	47	15.8%	30.9%
	Pyridoxine	152	51.0%	100.0%
Reasons for Not Completing Previous Regimen	Felt and got better	3	42.9%	75.0%

Multiple-Response Category	Response Option	N	% of Responses	% of Cases
	Side effects	3	42.9%	75.0%
	Forgot	1	14.3%	25.0%

Other medicines taken

As shown in Table 4.2, the multiple-response data showed that most participants were on TDF/3TC/DTG (66.0% of cases), followed by CPT (54.3%). Metformin (26.6%), Amlodipine (19.1%), Losartan (17.0%), and TDF/3TC/EFV (17.0%) were less frequently reported (Table 4.2).

Co-morbidities

Participants also reported multiple comorbidities (Table 4.2), yielding a total of 127 comorbidity responses. HIV infection was the most prevalent comorbidity, representing 64.6% of all responses and affecting 83.7% of cases. Diabetes mellitus (DM) accounted for 19.7% of responses and was present in 25.5% of participants, while hypertension (HTN) contributed 15.7% of responses and affected 20.4% of cases. These findings indicate that HIV was the dominant comorbidity in this sample, with a smaller proportion of participants experiencing metabolic and cardiovascular conditions such as diabetes and hypertension.

Missing a dose

Several reasons for missed doses were reported (Table 4.2). The most common reason was forgetfulness, contributing 29.3% of all responses and affecting 73.8% of cases. Distance to the facility (13.9%; 35.0% of cases), busy schedules (12.4%; 31.1% of cases), side effects (12.4%; 31.1% of cases), and feeling better after some improvement in symptoms (12.0%; 30.1% of cases) also featured prominently. Less frequently reported reasons included financial burden (8.5%; 21.4% of cases), pill burden (8.1%; 20.4% of cases), and religious beliefs (3.5%; 8.7% of cases). In total, 259 reasons were cited, demonstrating multiple overlapping barriers to optimal adherence (Table 4.2).

Access-related barriers

Several barriers affected participants' access to medicines (Table 4.2). Side effects were the most commonly reported challenge, accounting for 27.8% of responses (53.6% of cases). This was followed by long distances to health facilities (26.5% of responses). Financial constraints constituted 24.1% of responses and affected nearly half of the participants (46.4% of cases). Pill burden contributed 21.6% of responses. These findings suggest that adverse effects, geographical barriers, and financial limitations are key obstacles to accessing medication among the study population.

Current medicines

As shown in Table 4.2, Pyridoxine was the most frequently reported current medication, representing 51.0% of all responses and used by all participants in the dataset (100.0%). The RHZE regimen accounted for 33.2% of responses and was reported in 65.1% of cases, while the RH regimen contributed 15.8% of responses and was used by 30.9% of participants. This pattern reflects standard TB treatment phases, with pyridoxine co-administration being universal and RHZE more commonly used during the intensive phase.

Not completing regimen

Among participants who did not complete a previous treatment regimen (Table 4.2), the main reasons cited were side effects and feeling better, each contributing 42.9% of responses and reported by 75.0% of cases. Forgetfulness was less commonly reported (14.3%; 25.0%) (Table 4.3). Although the number of responses was small (n = 7), the findings highlight side effects and perceived improvement as key factors affecting treatment completion.

Table 4.3
Comorbidities against missed doses Cross tabulation

Comorbidities against missed doses Cross tabulation				
			MISSED DOSES	Total
			YES	
Co-morbidities	HIV	Count	46	46
		% within MISSEDDOSES	88.5%	
	DM	Count	13	13
		% within MISSEDDOSES	25.0%	
	HTN	Count	11	11
		% within MISSEDDOSES	21.2%	
Total		Count	52	52

As shown in Table 4.3, among the 52 participants who reported missing doses, the most common comorbidity was HIV (88.5%), followed by diabetes mellitus (25.0%) and hypertension (21.2%).

Table 4.4
Access to medicines against missed doses Cross tabulation

Access to medicines against missed doses Cross tabulation				
			MISSED DOSES	Total
			YES	
Access to medicines	DISTANCE	Count	27	27
		% within MISSEDDOSES	56.3%	
	SIDE EFFECTS	Count	21	21
		% within MISSEDDOSES	43.8%	
	FINANCIAL CONSTRAINTS	Count	21	21
		% within MISSEDDOSES	43.8%	
	PILL BURDEN	Count	18	18
		% within MISSEDDOSES	37.5%	
Total		Count	48	48

As presented in Table 4.4, among participants who reported missing doses (n = 48), several barriers to accessing medicines were identified. The most commonly reported barrier was distance to the health facility, affecting 56.3% of participants, followed by side effects (43.8%), financial constraints (43.8%), and pill burden (37.5%).

Table 4.5
Reasons for missing a dose and Stigma Cross tabulation

Reasons for missing a dose and Stigma Cross tabulation					
			STIGMA		Total
			NO	YES	
Reasons for missing a dose	FORGOT	Count	26	50	76
		% within Stigma	70.3%	75.8%	
	BUSY SCHEDULE	Count	12	20	32
		% within Stigma	32.4%	30.3%	
	SIDE EFFECTS	Count	11	21	32
		% within Stigma	29.7%	31.8%	
	PILL BURDEN	Count	7	14	21
		% within Stigma	18.9%	21.2%	
	GOT AND FELT BETTER	Count	11	20	31
		% within Stigma	29.7%	30.3%	
	FINANCIAL BURDEN	Count	11	11	22
		% within STIGMA	29.7%	16.7%	
	DISTANCE	Count	17	19	36
		% within Stigma	45.9%	28.8%	
	RELIGIOUS BELIEFS	Count	3	6	9
		% within Stigma	8.1%	9.1%	
Total		Count	37	66	103

As Shown in Table 4.5. Among the 103 participants who reported missing doses, multiple reasons were identified, stratified by experience of stigma. Forgetting to take the medication was the most commonly reported reason, affecting 70.3% of participants without stigma and 75.8% of those who experienced stigma. Other frequently reported reasons included being busy (32.4% vs. 30.3%), side effects (29.7% vs. 31.8%), pill burden (18.9% vs. 21.2%), and feeling better after taking previous doses (29.7% vs. 30.3%). Distance to the health facility was reported by 45.9% of participants without stigma and 28.8% of those with stigma, while financial burden was cited by 29.7% of participants without stigma compared to 16.7% with stigma. Religious beliefs were the least frequently reported reason (8.1% vs. 9.1%). Overall, forgetting doses and busy schedules were the leading contributors to non-adherence regardless of stigma experience, while logistical and financial barriers showed some variation between groups.

Table 4.6
Correlations between percent adherence and number of doses missed

Correlations			
		Percent Adherence	Number of doses missed
PERCENT_ADHERENCE	Pearson Correlation	1	-1.000**
	Sig. (2-tailed)		.000
	Sum of Squares and Cross-products	19068.587	-11441.152
	Covariance	238.357	-143.014
	N	81	81
NUMBER OF DOSES MISSED	Pearson Correlation	-1.000**	1
	Sig. (2-tailed)	.000	
	Sum of Squares and Cross-products	-11441.152	6864.691
	Covariance	-143.014	85.809
	N	81	81
**. Correlation is significant at the 0.01 level (2-tailed).			

As presented in Table 4.6, There was a perfect negative correlation between the number of doses missed and percent adherence ($r = -1.00$, $p < 0.001$), indicating that as the number of doses missed increased, percent adherence decreased.

Table 4.7

Correlation between percentage adherence and socio-demographic factors /behavioral factors

Correlations		Percent Adherence	Age Group	Education Level	Occupation	HIV	Forgot
Percent Adherence	Pearson Correlation	1	-.087	-.090	-.196	-.090	-.124
	Sig. (2-Tailed)		.440	.427	.079	.426	.269
Age Group	Pearson Correlation	-.087	1	-.144	-.326**	-.024	.158
	Sig. (2-Tailed)	.440		.077	.000	.770	.052
Education Level	Pearson Correlation	-.090	-.144	1	.343**	-.110	-.098
	Sig. (2-Tailed)	.427	.077		.000	.176	.229
Occupation	Pearson Correlation	-.196	-.326**	.343**	1	.023	-.140
	Sig. (2-Tailed)	.079	.000	.000		.779	.086
HIV	Pearson Correlation	-.090	-.024	-.110	.023	1	.000
	Sig. (2-Tailed)	.426	.770	.176	.779		1.000
Forgot	Pearson Correlation	-.124	.158	-.098	-.140	.000	1
	Sig. (2-Tailed)	.269	.052	.229	.086	1.000	
**. Correlation Is Significant At The 0.01 Level (2-Tailed).							

Pearson correlation analysis was conducted to examine the relationships between percent adherence and demographic/behavioral variables. Percent adherence showed no statistically significant correlations with age group ($r = -0.087$, $p = 0.440$), education level ($r = -0.090$, $p = 0.427$), occupation ($r = -0.196$, $p = 0.079$), HIV status ($r = -0.090$, $p = 0.426$), or forgetfulness ($r = -0.124$, $p = 0.269$) As Show in Table 4.7. While occupation and forgetfulness showed weak negative trends with adherence, these did not reach statistical significance. Significant correlations were observed between some predictors: age group and occupation ($r = -0.326$, $p < 0.01$), and education level and occupation ($r = 0.343$, $p < 0.01$), indicating moderate associations among demographic variables.

4.2 Bivariate Analysis

Table 4.8
Bivariate Analysis of Factors Associated with TB Treatment Non-Adherence

Variable	Category	Adherent n (%)	Non- adherent n (%)	Test statistic	p- value	Odds Ratio (95% CI)	Significance
Gender	Male	20 (50%)	20 (50X%)	$\chi^2(1) = 0.012$	.913	1.05 (0.44–2.51)	Not significant
	Female	20(48.8%)	21 (58.5%)				
Age group	20–40	19(47.5%)	14(34.2%)	Wald = 1.919	.166	2.21 (0.72–6.75)	Not significant
	41–60	13(32.5%)	14(34.2%)	Wald = 0.483	.487	1.51 (0.47–4.81)	Not significant
	Reference: 45+	8 (20%)	13(31.7%)	—	—	1.00	—
Marital Status	Married	30 (75%)	30(73.2%)	Wald = 0.000	1.000	1.00 (0.35–2.87)	Not significant
	Single	1 (2.5%)	2 (4.9%)	Wald = 0.307	.580	0.50 (0.04–5.81)	Not significant
	Reference: Divorced	9 (22.5%)	9 (21.9%)	—	—	1.00	—
Occupation	Retired	4 (10%)	1 (2.4%)	Wald = 3.280	.070	10.67 (0.82–138.22)	Not significant
	Peasant	17 (42.5%)	17 (41.5%)	Wald = 1.670	.196	2.67 (0.60–11.80)	Not significant
	Student	1 (2.5%)	0 (0%)	Wald = 0.000	1.000	4.31×10 ⁹	Not significant
	Self employed	15 (37.5%)	15 (36.6%)	Wald = 1.626	.202	2.67 (0.59–12.04)	Not significant
	Reference: Employed	3 (7.5%)	8 (19.5%)	—	—	1.00	—
Education Level	No formal education	10 (25%)	8 (19.5%)	Wald = 0.040	.841	1.17 (0.26–5.25)	Not significant

Variable	Category	Adherent n (%)	Non- adherent n (%)	Test statistic	p- value	Odds Ratio (95% CI)	Significance
Religion	Primary school	12 (30%)	13 (31.7%)	Wald = 0.295	.587	1.56 (0.31–7.82)	Not significant
	Secondary school	14 (35%)	15 (36.6%)	Wald = 0.034	.855	1.15 (0.25–5.34)	Not significant
	Reference: Tertiary	4 (10%)	5 (12.2%)	—	—	1.00	—
	Faith of Unity	2 (5%)	2 (2%)	Wald = 0.370	.543	2.00 (0.21–18.69)	Not significant
Religion	Muslim	6 (15%)	2 (4.9%)	Wald = 3.321	.068	6.00 (0.87–41.21)	Not significant
	Seventh Day Adventist	2 (5%)	0 (0%)	Wald = 0.000	.999	3.23×10 ⁹	Not significant
	Catholic	11 (27.5%)	16 (39.0%)	Wald = 0.224	.636	1.38 (0.37–5.15)	Not significant
	Anglican	14 (35%)	11(26.8%)	Wald = 1.888	.169	2.55 (0.67–9.65)	Not significant
	Reference: Born Again	5 (12.5%)	10 (24.4%)	—	—	1.00	—

As shown in Table 4.8, Bivariate Analysis of Factors Associated with TB Treatment Non-Adherence, A bivariate analysis was conducted to examine the association between socio-demographic factors and TB treatment non-adherence among the study participants (n = 81). Gender, age group, marital status, occupation, education level, and religion were included in the analysis.

Overall, no statistically significant associations were observed between the selected socio-demographic factors and TB non-adherence (all $p > 0.05$). For gender, males and females showed similar adherence patterns ($\chi^2 (1) = 0.012$, $p = .913$; OR = 1.05, 95% CI: 0.44–2.51). Among age groups, participants aged 20–40 years and 41–60 years demonstrated slightly higher odds of non-adherence compared to those aged 61 years and above, though these differences were not statistically significant (Wald = 1.919, $p = .166$, OR = 2.21, 95% CI: 0.72–6.75; Wald = 0.483, $p = .487$, OR = 1.51, 95% CI: 0.47–4.81).

Marital status showed minimal variation, with married participants exhibiting similar adherence to single or other categories (Wald = 0.000–0.307, $p = 1.000$ –0.580; OR = 0.50–1.00). Regarding occupation,

although retired participants appeared to have higher odds of non-adherence (OR = 10.67, 95% CI: 0.82–138.22), this did not reach statistical significance (Wald = 3.280, $p = .070$), and some categories had very small sample sizes, leading to unstable estimates.

Education level trends indicated that participants with no formal education, primary, or secondary school had slightly higher odds of non-adherence compared to those with tertiary education. Still, none of these associations were statistically significant (Wald = 0.034–0.295, $p = .587$ –.855).

Religion showed similar trends, with Muslim participants having higher odds of non-adherence compared to the reference group (Born Again, OR = 6.00, 95% CI: 0.87–41.21), while other religious groups showed smaller variations (Wald = 0.000–3.321, $p = .068$ –.999). Again, none of the associations reached statistical significance.

Overall, while no socio-demographic variable was significantly associated with TB treatment non-adherence, the data suggest certain trends, such as higher non-adherence among younger participants, some occupational categories, and Muslim participants.

Correlations

Figure 4.1 presents the mean percent adherence stratified by HIV status. Participants without HIV had a slightly higher mean adherence (79.77%) compared with participants living with HIV (77.00%). The observed difference between the two groups was small.

DISCUSSION

5.1 Introduction

Adherence to tuberculosis (TB) therapy remains a cornerstone of global TB control. Although Uganda has implemented multifaceted strategies including DOT, community adherence support, and nutritional assistance, non-adherence continues to challenge programmatic success. The goal of this study was not only to quantify adherence patterns but to illuminate the broader contextual forces shaping patient behavior in a real-world Ugandan clinical setting. This discussion interprets the study's findings within the context of regional and global literature, critically comparing and appraising evidence from Uganda, East Africa, and beyond. In doing so, the chapter underscores how patient, social, and health-care dimensions interact to influence treatment completion, and highlights how this study's findings contribute novel and locally relevant insights into the persistent problem of non-adherence.

The study revealed that although many patients pioneered TB treatment, a substantial proportion reported missing doses, with forgetfulness, treatment fatigue, side effects, distance to health facilities, and financial barriers emerging as major drivers. HIV co-infection was highly prevalent (over 83%), and most individuals who missed doses were also living with HIV—suggesting clinical vulnerability amplifies adherence challenges. Importantly, none of the socio-demographic variables (age, gender, occupation,

education, religion) demonstrated statistically significant associations with adherence. Percent adherence showed no significant correlation with age, education level, occupation, HIV status, or self-reported forgetfulness. These findings resonate with some Ugandan studies but diverge from others, pointing to a complex, context-dependent interplay of clinical, psychological, and structural factors.

5.2 Comparison with and critical appraisal of existing literature

5.2.1 Socio-demographic Predictors of Adherence

The study observed a nearly balanced gender distribution (52% male, 48% female) and a high proportion of married participants (74%). While previous studies have suggested that gender may influence TB treatment adherence, with males often being at higher risk of non-adherence due to occupational demands and mobility(26, 27), the present study found no significant association between gender and non-adherence ($\chi^2(1) = 0.012$, $p = .913$; OR = 1.05). This finding is consistent with the work in Ethiopia(28), which reported negligible gender differences in adherence among adult TB patients, suggesting that in contexts where health systems provide structured support and reminders, gender disparities may be minimized.

Age distribution revealed that younger participants (20–39 years) had a non-significant trend towards higher odds of non-adherence (OR = 2.21 for 20–40 years; OR = 1.51 for 41–60 years), compared to older adults. This aligns with literature from Kenya and Uganda, where younger patients often demonstrate lower adherence due to work commitments, social stigma, and mobility. The lack of statistical significance may reflect either the sample size or the balancing effect of supportive care interventions in the study facilities(27).

Marital status, education level, and occupation were not significantly associated with adherence, though certain trends were observed. Self-employed participants and those with lower educational attainment showed slightly higher odds of non-adherence. Similar patterns have been reported by(24), indicating that socioeconomic pressures, including inconsistent income and low health literacy, may influence the ability to maintain strict TB treatment schedules. Religion also did not show a statistically significant association, though Muslim participants had higher estimated odds of non-adherence compared to the reference group. This trend could reflect cultural or community-specific barriers, such as religious obligations affecting treatment timing.

The lack of statistically significant socio-demographic predictors in the study aligns with findings from (13). On MDR-TB patients at Mulago National Referral Hospital. Their analysis of 227 individuals showed that most socio-demographic variables did not independently predict non-adherence, with the strongest factor being a clinical history of previous DR-TB treatment. Despite methodological rigor, Batte et al. relied on programmatic adherence definitions (missing $\geq 10\%$ of DOT sessions), which could under-detect subtler non-adherence behaviours compared to self-report. This difference positions this study's findings

as complementary: while Batte et al. highlight structural programmatic predictors in a referral hospital, this study captures the subtler, patient-reported challenges typical in peripheral facilities.

Similarly, in Ethiopia found that socio-demographic variables had only weak or inconsistent associations with adherence in multivariable models. Their large study benefited from robust sampling but had limitations due to reliance on self-report and lack of electronic adherence monitoring. This study's findings therefore reinforce a growing consensus that demographic characteristics alone seldom explain adherence variation unless modulated by stronger structural factors.

In contrast,(13). In South Korea found that age, comorbidity profiles, and treatment regimen complexities were associated with non-adherence. However, their study population was urban, insured, and managed through a technologically advanced health system, conditions that differ substantially from the Ugandan context. Such inconsistency underscores the importance of localized evidence, and these findings contribute to this contextual understanding.

5.2.2 Structural and Health-System Barriers

Distance to the health facility and financial constraints emerged as major barriers in this study's sample; these findings echoed strongly across Ugandan qualitative literature. For instance, documented that transportation costs, long waiting times, and health-system inefficiencies were central barriers to treatment initiation and continuation. Their qualitative design allowed deep exploration of context but was limited by small sample sizes and potential participant selection bias. Nevertheless, their findings corroborate with this study's, reinforcing that structural inequities remain major obstacles to TB control in Uganda.

5.2.3 Clinical Predictors and Comorbidities

Comorbidities were prevalent among participants, with HIV being the most common (83.7% of cases), followed by diabetes mellitus (25.5%) and hypertension (20.4%). This finding underscores the high burden of co-infections among TB patients, consistent with global trends reported by the World Health Organization (WHO, 2022) and studies conducted in Uganda (27, 29). Among participants reporting missed doses, 88.5% had HIV, indicating a strong intersection between HIV comorbidity and treatment interruptions. Similar observations have been documented in Mulago National Referral Hospital, where TB-HIV co-infected patients exhibited higher rates of missed doses due to pill burden, frequent clinic visits, and side effects from combination therapies(13).

The high prevalence of HIV co-infection among those with missed doses underscores the clinical fragility of these patients. (29)demonstrate that comorbidities including HIV and diabetes amplify pill burden, treatment fatigue, and risk for side effects. Their methodological strength lies in their prospective design, but since much of their data derives from tertiary care, the structural challenges seen in peripheral Ugandan settings are somewhat underrepresented.

Similarly found that clinical history, not demographics, predicted non-adherence. However, their focus on MDR-TB means higher pill burden, severe side effects, and prolonged treatment durations, factors

distinct from the drug-susceptible population in this study.

5.2.4 Psychosocial Barriers: Stigma, Forgetfulness, and Motivation

This study's finding that forgetfulness was the leading cause of missed doses (over 70%) aligns with multiple African studies. For instance(27). Highlighted that TB-related stigma undermines consistent video DOT engagement and pushes patients into concealment behaviors that lead to missed doses. His study's strength lies in unveiling the psychosocial dimensions of adherence in Uganda; however, reliance on a digital tool limits generalizability to rural settings.

The Kenyan Baringo County study reported similar findings, identifying stigma, lack of family support, and poor health literacy as significant barriers. Their mixed-methods design strengthens credibility, but sampling from a single county limits national representativeness.

These findings align strongly with these regional patterns, highlighting that forgetfulness is rarely a simple cognitive issue; it is often a symptom of deeper psychosocial burdens, including treatment fatigue, stigma, and poor social support.

Participants experiencing stigma reported similar adherence challenges as those without stigma, with forgetfulness and busy schedules dominating. However, distance and financial burden were slightly more prevalent among participants without reported stigma. This suggests that while stigma may influence psychosocial barriers, structural challenges such as distance and finances remain critical obstacles for all patients. These findings corroborate earlier qualitative research in Uganda highlighting stigma as a hidden but persistent barrier to treatment adherence(24, 27).

5.2.5 Side Effects and Treatment Fatigue

More than half of the participants who missed doses cited side effects. This aligns with the study (24) that identified side effects as major adherence barriers. These studies had rigorous quantitative methods but relied on self-report, risking recall bias. Nevertheless, the consistency across multiple settings underscores that managing side effects must remain a priority in TB programming.

This study adds a critical insight: side effects appear especially impactful among HIV-positive individuals, who already endure high pill burden and ART-related toxicities. This suggests synergistic negative effects of TB medication toxicities layered atop ART side effects—which require integrated clinical management approaches.

5.2.6 Treatment Regimens and Adherence

Current TB medications followed standard guidelines, with RHZE prescribed to 65.1% of participants, RH to 30.9%, and pyridoxine co-administered universally. The universal use of pyridoxine is consistent with international recommendations to prevent neuropathy during isoniazid therapy(30). Multiple-response data also revealed extensive use of ART regimens and other comedications, which may increase the risk

of polypharmacy-related non-adherence due to complex schedules and side effects. This is particularly relevant for HIV co-infected patients, who constituted the majority of the study population. Among participants who did not complete prior TB regimens, side effects and perceived recovery were the leading reasons (42.9% each), underscoring the dual importance of clinical symptom management and patient education to reinforce the need to complete therapy, even when symptoms abate.

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Non-adherence to anti-tuberculosis treatment remains common among patients receiving TB care in Southwestern Uganda. Behavioral, clinical, and structural factors, particularly forgetfulness, side effects, financial constraints, and long travel distances, were the main barriers to adherence. Interventions targeting these modifiable factors may improve treatment outcomes.

6.2 Recommendation

Interventions that combine behavioural reminders, clinical support, and structural facilitation are essential for improving adherence and achieving optimal TB control outcomes in Uganda and similar low-resource settings.

Abbreviations

ART

Anti-retroviral Therapy

DATS

Digital Adherence Technologies

DOTS

Directly Observed Therapy

HIV

Human Immunodeficiency Virus

KIU

Kampala International University

LTBI

Latent Tuberculosis Infection

MOH

Ministry of Health

MDR-TB

Multidrug-Resistant Tuberculosis

PLHIV

People Living With Human Immunodeficiency Virus

TB

Tuberculosis
TPT
Tuberculosis Preventive Therapy
WHO
World Health Organization.

Declarations

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was granted by the Kampala International University School of Pharmacy Research Ethics Committee (reference KIU-SOPRC/085/25). All participants received a full explanation of the study's purpose and procedures and gave written informed consent before enrolment, in English, with interviews subsequently conducted in Runyankore; participants were also informed of their right to withdraw at any stage without consequence. Interviews were conducted in private settings to protect participants' comfort and confidentiality, and no identifying information was recorded – all data were anonymized so that individual participants cannot be identified in this or any related publication.

Consent for publication: N/A

Data availability:

The data set and data collection tools used in this study are available upon reasonable request from the corresponding author.

Funding

This research was funded by King Fahd University, reference Number KF263743.

Competing interests

The authors declare no competing interests.

Authors' contributions

All the authors named in this manuscript have contributed considerably to this work and meet the criteria for authorship. N.G.J., A.E.S, and O.S. participated in research conceptualization, data collection, data interpretation, and manuscript revision. N.G.J., A.E.S, O.S., A.A.E., and A.O.N. contributed to the data analysis, data interpretation, and manuscript writing/revision. All the authors read and approved the final manuscript.

Clinical trial number

Not applicable.

Consent to Participate

All Patients involved in the study provided informed consent at the time of data collection. The objectives, methods, possible risks, and benefits of the study were all presented to the participants transparently. They decided to participate and were also informed that they could choose to withdraw from the study at any time without penalty. Informed oral and written consent was obtained as per institutional ethics and principles of the World Medical Association Declaration of Helsinki.

Acknowledgements

We would like to thank everyone who helped make this study successful. Above all, we are deeply grateful to the Tuberculosis Patients, who participated in this survey. This research was only possible through their cooperation, time, and willingness to share their considerable expertise.

References

1. Awofeso N. Anti-tuberculosis medication side-effects constitute major factor for poor adherence to tuberculosis treatment. *Bull World Health Organ*. 2008;86:B–D.
2. Lohiniva AL, Mokhtar A, Azer A, Elmoghazy E, Kamal E, Benkirane M, et al. Qualitative interviews with non-national tuberculosis patients in Cairo, Egypt: understanding the financial and social cost of treatment adherence. *Health Soc Care Commun*. 2016;24(6):e164–72.
3. Organization WH. October. Report of the WHO consultation on asymptomatic tuberculosis, Geneva, Switzerland, 14–15 2024. 2025.
4. Lukoye D. Anti-tuberculosis drug resistance in Sub-Saharan Africa: The case of Uganda. Universiteit van Amsterdam [Host]; 2015.
5. Dye C. Global epidemiology of tuberculosis. *Lancet*. 2006;367(9514):938–40.
6. Meditter J. *Hematol Infect Dis* 2014, 6 (1): e2014035. DOI: 2014.
7. Glaziou P, Floyd K, Raviglione MC, editors. Global epidemiology of tuberculosis. *Seminars in respiratory and critical care medicine*. Thieme Medical; 2018.
8. Babirye S, Turyabagye B, Tigist M, Namugeere HM, Owarwo N, Ddungu A, et al. Performance Evaluation of a Clinical Decision Support System (MAMAOPE AI) for Tuberculosis and Pneumonia Diagnosis. *VeriXiv*. 2026;3(147):147.
9. Bruchfeld J, Correia-Neves M, Källenius G. Tuberculosis and HIV coinfection. *Cold Spring Harbor Perspect Med*. 2015;5(7):a017871.
10. Mostafavi E, Ebrahimi B, Doosti-Irani A, Mirzazadeh A. Prevalence of hepatitis B, hepatitis C, and tuberculosis among people living with HIV in Iran: a systematic review and meta-analysis. *BMC Infect Dis*. 2024;24(1):777.

11. Kyagulanyi E, Mirembe J, Nantaayi B, Nalukenge S, Mukasa D, Tamale J, et al. The prevalence of concurrent pulmonary and extrapulmonary tuberculosis in Uganda: a retrospective study. *Therapeutic Adv Infect Disease*. 2022;9:20499361221107304.
12. Ayanyinka A, Oyelayo I, Okediji A, Opaleye O, Ojurongbe O, Olowe O, Hepatitis B. Virus (HBV), Human Immunodeficiency Virus (HIV) and Tuberculosis (TB) infection: Challenges and global health strategies. *Hosts Viruses*. 2025;12:70–82.
13. Batte C, Namusobya MS, Kirabo R, Mukisa J, Adakun S, Katamba A. Prevalence and factors associated with non-adherence to multi-drug resistant tuberculosis (MDR-TB) treatment at Mulago National Referral Hospital, Kampala, Uganda. *Afr Health Sci*. 2021;21(1):238.
14. Arinaitwe J, Muleme J, Ochanda PN, Nuwematsiko R, Omongot S, Bakamutumaho B, et al. Pre-treatment loss to follow-up and associated factors among drug-resistant tuberculosis patients diagnosed in Wakiso district, central Uganda. *BMC Infect Dis*. 2025;25(1):967.
15. Yulam R, Oroma M, Abonga C, Auld M, Wright A. Bringing 'Yotkom'to northern Uganda: translating 'health'for those who need it most through a synthesis of clinical practice guidelines. *Evid Policy*. 2024;20(3):409–19.
16. Nabaziwa J, Kigongo E, Kabunga A, Acup W, Puleh SS. Adherence to Tuberculosis Treatment and Its Associated Factors among Drug-susceptible Tuberculosis Patients in Lira District, Northern Uganda. *IJARBS*. 2023;13:307–17.
17. Kalema N, Semeere A, Banturaki G, Kyamugabwa A, Ssozi S, Ggita J, et al. Gaps in TB preventive therapy for persons initiating antiretroviral therapy in Uganda: an explanatory sequential cascade analysis. *Int J Tuberculosis Lung Disease: Official J Int Union Against Tuberculosis Lung Disease*. 2021;25(5):388–94.
18. Peltzer K, Pengpid S. Predictors of non-adherence to anti-tuberculosis medication in tuberculosis patients in Thailand. 2015.
19. Adane AA, Alene KA, Koye DN, Zeleke BM. Non-adherence to anti-tuberculosis treatment and determinant factors among patients with tuberculosis in northwest Ethiopia. *PLoS ONE*. 2013;8(11):e78791.
20. Tola HH, Azar T, Shojaeizadeh D, Garmaroudi G. Tuberculosis treatment non-adherence and lost to follow-up among TB patients with or without HIV in developing countries: a systematic review. *Iran J public health*. 2015;44(1):1.
21. Mekonnen HS, Azagew AW. Non-adherence to anti-tuberculosis treatment, reasons and associated factors among TB patients attending Gondar town health centers, Northwest Ethiopia. *BMC Res Notes*. 2018;11(1):691.
22. Buregyeya E, Nuwaha F, Wanyenze RK, Mitchell EM, Criel B, Verver S et al. Utilization of HIV and tuberculosis services by health care workers in Uganda: implications for occupational health policies and implementation. 2012.
23. Zawedde-Muyanja S, Manabe YC, Cattamanchi A, Castelnovo B, Katamba A. Patient and health system level barriers to and facilitators for tuberculosis treatment initiation in Uganda: a qualitative

- study. BMC Health Serv Res. 2022;22(1):831.
24. Lemma Tirore L, Ersido T, Beyene Handiso T, Shiferaw Areba A. Non-adherence to anti-tuberculosis treatment and associated factors among TB patients in public health facilities of Hossana town. South Ethiopia 2022 Front Med. 2024;11:1360351.
 25. Kaona FA, Tuba M, Siziya S, Sikaona L. An assessment of factors contributing to treatment adherence and knowledge of TB transmission among patients on TB treatment. BMC Public Health. 2004;4(1):68.
 26. Sheikhrobat MV, Alizadeh S, Shahamiri K, Shahriari S, Tahmasebi-Ghorrabi A. A Comparative Policy Review of Tuberculosis Infection Control Policies Across Six Countries: Insights on Screening, Prevention, and Treatment Strategies. Health Sci Rep. 2026;9(7):e72728.
 27. Bwambale K, Nakkonde D, Nassanga G, Buregyeya E, Zalwango S, Sekandi JN. TB-Related Stigma: A Hidden Obstacle to Adherence Monitoring with Video Directly Observed Treatment Among Patients with Tuberculosis in Uganda. Research Square. 2025:rs. 3. rs-7447805.
 28. Woimo TT, Yimer WK, Bati T, Gesesew HA. The prevalence and factors associated with anti-tuberculosis treatment non-adherence among pulmonary tuberculosis patients in public health care facilities in South Ethiopia: a cross-sectional study. BMC Public Health. 2017;17(1):269.
 29. Ochieng M, Nyaberi J, Mambo S, Wafula C. Healthcare worker-related factors contributing to tuberculosis treatment non-adherence among patients in Kisumu East Sub-County. J tuberculosis Res. 2024;12(1):13.
 30. Organization WH. Tuberculosis surveillance and monitoring in Europe 2023: 2021 data. 2023.

Figures

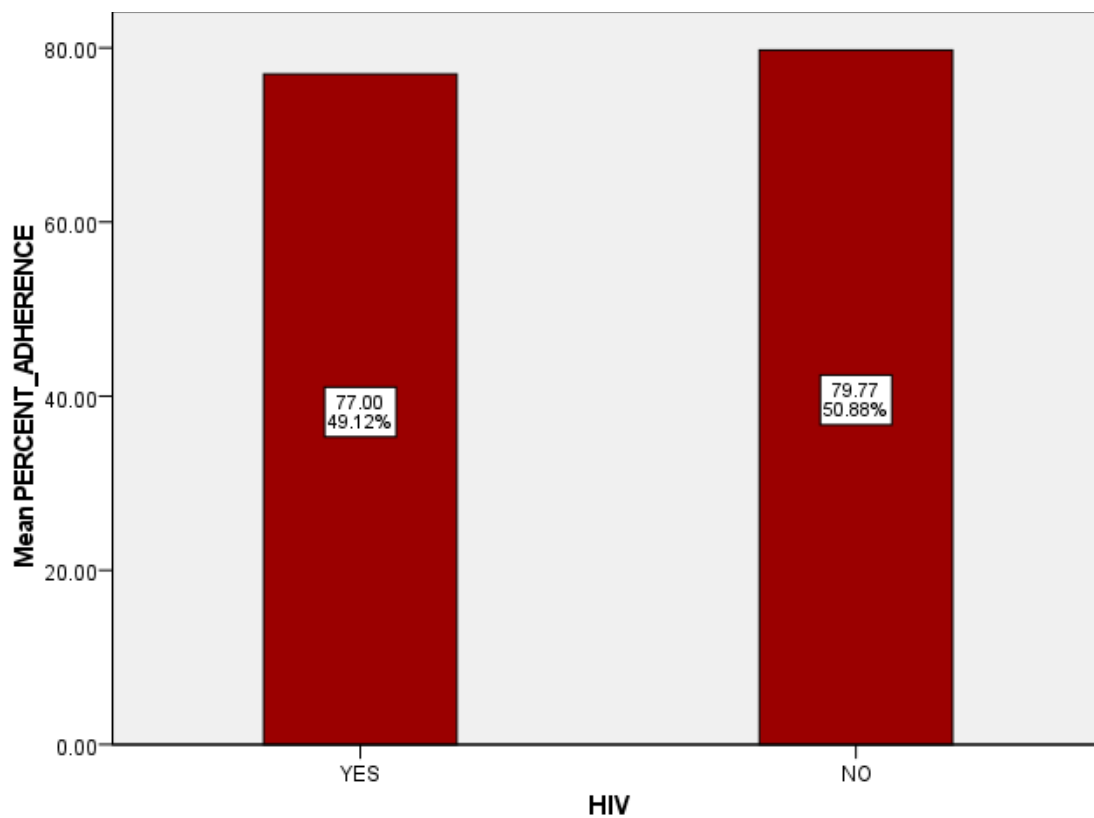


Figure 1

Figure 4.1: Mean of percent adherence by HIV

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryFile1.docx](#)