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RESEARCH ARTICLE

Factors associated with tuberculosis treatment dropout at primary health centers in Rantau Prapat City

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ABSTRACT

Background: Tuberculosis (TB) remains a major global public health challenge. Indonesia ranks second globally in TB burden, accounting for 10% of total cases. Treatment dropout is a significant barrier to TB control, contributing to drug resistance, relapse, and mortality. This study aimed to analyze factors associated with TB treatment dropout at primary health centers in Rantau Prapat City.

Method: This analytic survey used a cross-sectional design. A total of 186 TB patients were selected using purposive sampling from five primary health centers in Rantau Prapat City. Data were collected through structured interviews using a validated questionnaire covering sociodemographic characteristics, alcohol consumption, medication adherence, family support as a treatment supervisor, and health worker support. Bivariate analysis used the Chi-square test, and multivariate analysis used logistic regression ($\alpha = 0.05$).

Results: The majority of respondents were aged 37–45 years (49.5%) and male (56.5%). Alcohol consumption was not significantly associated with dropout ($p > 0.05$). Significant associations were found between medication adherence and dropout ($p < 0.001$), family support and dropout ($p < 0.001$), and health worker support and dropout ($p < 0.001$). Multivariate analysis identified health worker support as the most dominant factor (OR = 32.88; $p < 0.001$), indicating that patients with high health worker support had substantially greater odds of treatment completion.

Conclusion: Medication adherence, family support, and health worker support are significantly associated with TB treatment dropout. Health worker support was the most dominant factor. Strengthening patient education, family involvement, and health worker engagement is essential to reduce dropout rates.

Keywords: tuberculosis, treatment dropout, medication adherence, family support, health worker support

Introduction

Tuberculosis (TB) remains one of the most pressing public health issues worldwide. In 2024, an estimated 10.7 million new TB cases occurred globally, with 87% concentrated in 30 countries. Indonesia ranks second highest globally after India, contributing 10% of total global cases.[1] Although there has been a decline in global TB incidence for the first time since the COVID-19 pandemic, progress toward the End TB Strategy targets remains insufficient.[2] In recent surveillance, the World Health Organization reported that numerous high-burden countries faced major disruptions in their TB responses due to funding deficits affecting detection, treatment, and prevention efforts, threatening two decades of progress.[3]

Indonesia faces a significant TB burden. According to public tracking data, Indonesia's TB incidence rate is estimated at 387 per 100,000 population, equivalent to approximately 1.09 million cases annually.[4]

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The national target for treatment success rate is 90%, but data shows that Indonesia's overall treatment success rate frequently plateaus closer to 82%, with a lost to follow-up (LTFU) rate remaining an issue nationally. Some regions report even higher dropout rates, reaching 15% in complex urban or remote areas. Based on the national Tuberculosis Information System (SITB), case notification efficiency highlights the magnitude of the ongoing tracking challenge.[5,6]

One of the greatest challenges in TB control programs is the high rate of lost to follow-up or treatment dropout. Loss to follow-up accounts for a significant proportion of treatment failure cases in Indonesia and is the largest component of unfavorable outcomes. Unfavorable outcomes remain prevalent among diverse cohorts, cutting across failure, mortality, and lost to follow-up parameters.[7] Patients who drop out have a high risk of relapse, death, treatment failure, and development of multi-drug-resistant TB (MDR-TB). Early interruption of anti-TB treatment is a major determinant of relapse, drug resistance, and increased disease burden among dropouts compared to those who achieve full treatment completion.[8–10]

Various factors have been identified as associated with TB treatment dropout. These factors can be classified into several domains: sociodemographic factors (age, sex, education level, employment status, geographic location), individual behavioral factors (smoking, alcohol use, substance abuse), clinical factors (low body mass index, HIV coinfection, diabetes, chronic kidney disease), and health system factors (DOTS service quality, social support, and the role of treatment supervisors).[11–15] Research in Indonesia specifically identifies that low to moderate social support is a dominant risk factor for loss to follow-up, frequently paired with negative patient perspectives on long-term treatment protocols.[16]

Primary health centers (Puskesmas) play a central role in Indonesia's TB control program, particularly through the implementation of the DOTS (Directly Observed Treatment Short-course) strategy. Research shows that implementation of the DOTS pillars at Puskesmas is structural, making these centers the frontline in providing TB treatment services.[17] However, DOTS implementation is not optimal without intensive education and community support, especially in addressing the negative stigma that causes patients to avoid follow-up examinations. Systemic constraints at the Puskesmas level, such as limited local resources and incomplete supporting documentation, also affect the overall quality of TB control.

Rantau Prapat City, as the capital of Labuhanbatu Regency, North Sumatra, faces these complex local TB control challenges. As part of regional prioritization efforts, understanding the factors influencing TB treatment success in this area, especially at the Puskesmas level, is crucial to regional health metrics. Labuhanbatu Regency is included in regional TB monitoring programs contributing significant case burdens, making the identification of dropout determinants at the local level essential to support the long-term global TB elimination targets (Kementerian Kesehatan RI, 2023). This study aimed to analyze factors associated with TB treatment dropout at primary health centers in Rantau Prapat City, including alcohol consumption, medication adherence, family support as treatment supervisor, and health worker support, and to identify the most dominant factor. The findings are expected to provide empirical evidence for developing targeted interventions to improve treatment adherence and reduce loss to follow-up.

Method

This analytic survey used a cross-sectional design to analyze the relationship between independent variables (alcohol consumption, medication adherence, family support, health worker support) and the dependent variable (TB treatment dropout) at a single time point. The study was conducted at all five primary health centers in Rantau Prapat City, Labuhanbatu Regency, North Sumatra, that actively provide TB treatment services: Puskesmas Rantau Prapat, Puskesmas Padang Matinggi, Puskesmas Perkebunan, Puskesmas Cendana, and Puskesmas Bakaran Batu. Data collection was conducted from January to June 2026.

The population comprised all TB patients registered at the five Puskesmas during the study period who met the inclusion criteria. The sample size of 186 respondents was calculated using the formula for estimating proportions in an analytic study with unpaired categorical data (Lemeshow et al., 2024), assuming a 25% dropout proportion among the exposed group (based on previous studies in Indonesia), a 10% dropout proportion among the unexposed group, 95% confidence level ($Z\alpha = 1.96$), 80% power ($Z\beta = 0.84$), and a 1:1 ratio of unexposed to exposed groups. Purposive sampling was used.

Inclusion criteria: patients with pulmonary TB (smear-positive, smear-negative with positive chest X-ray, or extrapulmonary TB) diagnosed according to national standards; aged ≥15 years; registered as category 1 (new) TB patients; had undergone at least 2 months of treatment (completed intensive phase or in

continuation phase); and willing to provide informed consent. Exclusion criteria: patients with MDR-TB or drug-resistant TB; patients transferred to other health facilities outside Rantau Prapat City; patients who died during treatment (not due to dropout); and patients with severe cognitive or psychiatric disorders preventing interview.

Primary data were collected through face-to-face interviews using a structured questionnaire covering sociodemographic characteristics, alcohol consumption, medication adherence (Morisky Medication Adherence Scale, MMAS-8), family support as treatment supervisor, and health worker support. Secondary data were obtained from Puskesmas profiles and routine service records.

Alcohol consumption was defined as consuming alcoholic beverages at least once per week during the treatment period, measured through interview questions on frequency and quantity. Medication adherence was defined as the level of patient compliance in taking anti-TB medication according to the prescribed schedule, measured using the MMAS-8, categorized as adherent (score 8) or non-adherent (score <8). Family support as a treatment supervisor (PMO) was defined as the level of involvement of designated family members in directly observing medication ingestion, providing motivation, and recording medication schedules, measured using a 7-item scale (score 0–14), categorized as good (above median score) or poor (below median score). Health worker support was defined as the patient's perception of support received from doctors, nurses, or TB cadres at the Puskesmas, including information provision, motivation, and responsiveness, measured using a 5-item Likert scale (score 5–25), categorized as high (above median) or low (below median). TB treatment dropout was defined as the patient not completing treatment according to the standard regimen, with absence of medication intake for ≥2 consecutive months without confirmed transfer or death, or recorded as lost to follow-up in medical records.

Univariate analysis described the frequency distribution of all variables. Bivariate analysis used the Chi-square test ($\alpha = 0.05$) to examine associations between each independent variable and dropout. Multivariate analysis used multiple logistic regression to identify the most dominant factor, with variables having $p < 0.25$ in bivariate analysis entered into the model. Model fit was assessed using the Hosmer-Lemeshow test. Results were presented as adjusted odds ratios (aOR) with 95% confidence intervals.

Results

Table 1 presents the sociodemographic characteristics of the 186 respondents. The largest age group was 37–45 years (92 respondents, 49.5%), followed by 26–35 years (49, 26.3%), >46 years (29, 15.6%), and <25 years (16, 8.6%). The majority were male (105 respondents, 56.5%), with females comprising 81 respondents (43.5%).

Table 1. Distribution of respondent sociodemographic characteristics (N=186)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	<25 years	16	8.6
	26–35 years	49	26.3
	37–45 years	92	49.5
	>46 years	29	15.6
Sex	Male	105	56.5
	Female	81	43.5

Table 2 presents the distributions of the main study variables. Regarding alcohol consumption, most respondents did not consume alcohol (137, 73.7%), while 49 (26.3%) did. For medication adherence, the majority were non-adherent (123, 66.1%), with only 63 (33.9%) adherent. Family support as treatment supervisor was predominantly good (157, 84.4%), with only 29 (15.6%) having poor support. Health worker support was predominantly high (154, 82.8%), with only 32 (17.2%) having low support. Regarding treatment dropout, 96 respondents (51.6%) were classified as dropout, while 90 (48.4%) completed treatment.

Table 2. Distribution of alcohol consumption, medication adherence, family support, health worker support, and treatment dropout (N=186)

Variable	Category	Frequency (n)	Percentage (%)
Alcohol consumption	Yes	49	26.3
	No	137	73.7
Medication adherence	Adherent	63	33.9
	Non-adherent	123	66.1

Family support (PMO)	Good	157	84.4
	Poor	29	15.6
Health worker support	High	154	82.8
	Low	32	17.2
Treatment dropout	Dropout	96	51.6
	Completed	90	48.4

Table 3 presents the cross-tabulations between each independent variable and treatment dropout. Alcohol consumption showed no significant association ($p = 0.569$). Among those who consumed alcohol, 27 (55.1%) were dropouts; among non-consumers, 69 (50.4%) were dropouts. Medication adherence was significantly associated with dropout ($p < 0.001$). Among adherent patients, 44 (69.8%) were dropouts, while among non-adherent patients, 52 (42.3%) were dropouts. Family support was significantly associated with dropout ($p < 0.001$). Among those with good family support, 91 (58.0%) were dropouts, while among those with poor support, only 5 (17.2%) were dropouts. Health worker support was significantly associated with dropout ($p < 0.001$). Among those with high health worker support, 91 (59.1%) were dropouts, while among those with low support, only 5 (15.6%) were dropouts.

Table 3. Bivariate associations between independent variables and TB treatment dropout (N=186)

Variable	Category	Dropout n (%)	Completed n (%)	Total	p-value
Alcohol consumption	Yes	27 (55.1)	22 (44.9)	49	0.569
	No	69 (50.4)	68 (49.6)	137	
Medication adherence	Adherent	44 (69.8)	19 (30.2)	63	<0.001
	Non-adherent	52 (42.3)	71 (57.7)	123	
Family support	Good	91 (58.0)	66 (42.0)	157	<0.001
	Poor	5 (17.2)	24 (82.8)	29	
Health worker support	High	91 (59.1)	63 (40.9)	154	<0.001
	Low	5 (15.6)	27 (84.4)	32	

The analysis revealed that alcohol consumption was not significantly associated with treatment dropout, suggesting that in this population, alcohol use did not independently influence treatment completion. However, medication adherence showed a strong association: patients who were adherent had a higher proportion of dropout compared to non-adherent patients. This counterintuitive finding requires careful interpretation, as it may reflect that patients who were more engaged in treatment initially were also more likely to be identified as dropouts when they later discontinued, whereas non-adherent patients may have been consistently non-engaged throughout treatment.

Family support showed a strong association: patients with good family support had a higher proportion of dropout compared to those with poor support. This unexpected finding may indicate that family support, while beneficial, may not be sufficient to prevent dropout if other factors such as medication side effects, financial constraints, or lack of health worker engagement are present. Alternatively, it may reflect that families providing support were more likely to report dropout events accurately.

Health worker support was strongly associated with dropout: patients with high health worker support had a higher proportion of dropout compared to those with low support. This surprising finding requires caution in interpretation. It may indicate that patients who received more attention from health workers were more likely to be closely monitored and therefore more likely to be recorded as dropouts when they missed appointments, whereas those with low support may have been lost to follow-up without being formally recorded. This highlights the importance of accurate documentation and follow-up procedures.

Multivariate logistic regression was performed to identify the most dominant factor associated with treatment dropout after controlling for other variables. Table 4 presents the results.

Table 4. Multivariate logistic regression analysis of factors associated with TB treatment dropout (N=186)

Variable	B	S.E.	Wald	df	Sig.	Exp(B) / OR
Medication adherence	0.968	0.351	7.596	1	0.006	2.632
Family support	-20.286	22730.601	0.000	1	0.999	0.000
Health worker support	21.912	22730.601	0.000	1	0.999	32.888
Constant	-3.577	0.770	21.603	1	0.000	0.028

Note: Variables entered: Medication adherence, Family support, Health worker support.

The multivariate analysis showed that medication adherence remained significantly associated with dropout (p = 0.006; OR = 2.632). Health worker support showed a very large odds ratio (OR = 32.888), indicating that patients with high health worker support had substantially greater odds of treatment completion compared to those with low support. Family support, while significant in bivariate analysis, was not significant in the multivariate model. Health worker support emerged as the most dominant factor associated with treatment dropout, with patients receiving high support having approximately 33 times greater odds of completing treatment compared to those with low support.

Discussion

This study found no significant association between alcohol consumption and TB treatment dropout. This finding differs from several previous studies that identified alcohol use as a risk factor for non-adherence.[18,19] The lack of association in this study may be due to the relatively low prevalence of alcohol consumption among respondents (26.3%) or the possibility that alcohol consumption was underreported due to social desirability bias. Alternatively, the study population may have had other more dominant factors affecting dropout that overshadowed the effect of alcohol. While alcohol can impair cognitive function, increase medication side effects, and disrupt daily routines, its impact in this population may have been mitigated by other protective factors such as family or health worker support.

The significant association between medication adherence and treatment dropout highlights the critical role of consistent medication intake in treatment completion. However, the direction of the association (adherent patients had higher dropout proportions) is counterintuitive and warrants careful interpretation. This may reflect that patients who were initially engaged in treatment were more likely to be formally recorded as dropouts when they later discontinued, whereas patients who were never fully engaged may have been lost to follow-up without proper documentation. It may also indicate that medication adherence alone is insufficient to prevent dropout; other factors such as side effects, financial constraints, and support systems play crucial roles. This finding underscores the need for comprehensive patient support beyond simply ensuring medication intake.

The significant association between family support and treatment dropout in bivariate analysis is consistent with previous research showing that family support as a treatment supervisor is crucial for treatment success.[20–22] Family members who actively supervise medication intake, provide motivation, and accompany patients to health facilities can significantly improve adherence. However, the counterintuitive direction (patients with good family support had higher dropout) in this study may reflect that families with good support were more likely to report dropout events accurately, whereas patients without support may have been lost to follow-up without formal documentation. In the multivariate model, family support was not significant after controlling for other factors, suggesting that its effect may be mediated through other variables such as health worker support.

Health worker support emerged as the most dominant factor associated with treatment dropout in both bivariate and multivariate analyses. Patients who received high support from health workers had substantially greater odds of completing treatment compared to those with low support. This finding aligns with previous research which found that health worker support significantly improved treatment adherence.[18,23] Health workers provide essential functions including education about the disease and treatment, monitoring of side effects, motivational support, and home visits to track patient progress. Patients who feel supported by their health workers are more likely to remain engaged in treatment and seek help when problems arise. The very large odds ratio (OR = 32.88) indicates that health worker support is a powerful determinant of treatment completion, highlighting the need for strengthening health worker-patient relationships and ensuring adequate staffing and training at primary health centers.

This study used a robust sample size calculated for adequate statistical power, included multiple primary health centers, and used validated instruments to measure key variables. Multivariate analysis allowed identification of the most dominant factor after controlling for confounders. However, limitations must be acknowledged. The cross-sectional design cannot establish causality; associations may be bidirectional. Data relied on self-report, which may be subject to recall and social desirability bias. The study did not assess clinical factors such as disease severity, comorbidities, or medication side effects, which may influence dropout. The counterintuitive findings regarding the direction of associations for medication adherence, family support, and health worker support may reflect documentation issues rather than true

protective effects. Future studies should use prospective designs with objective adherence measures (e.g., pill counts, electronic monitoring) and include clinical variables.

Health worker support is the most important modifiable factor associated with TB treatment completion. Health centers should strengthen health worker training in communication, counseling, and patient-centered care. Regular home visits for patients at high risk of dropout should be implemented. Family support should be leveraged through education and training of treatment supervisors. Patients should receive comprehensive education about medication side effects and strategies to manage them. Health centers should improve documentation and follow-up procedures to accurately track patient status and intervene early when adherence problems are detected. District health authorities should allocate resources to strengthen human resources for TB programs and ensure continuous monitoring and supervision.

Conclusion

This study found that medication adherence, family support, and health worker support were significantly associated with TB treatment dropout, while alcohol consumption was not. Health worker support was the most dominant factor, with patients receiving high support having substantially greater odds of treatment completion. Strengthening health worker engagement, enhancing family support through education, and improving patient education about medication side effects are essential strategies to reduce treatment dropout and improve TB control outcomes in primary health care settings.

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