

Determinants of Incidence of Loss to Follow-up in Tuberculosis Patients at Bintuni Health Center

Henderyana Arrang Pantan¹, Hasmi^{2*}, Sarce Makaba³, Arius Togodly⁴,
Novita Medyati⁵, Rosmin Mariati Tingginehe⁶

¹Master of Public Health Study Program, Faculty of Public Health, Cenderawasih University of Jayapura

^{2,3,4,5,6}Department of Master of Public Health Program, Faculty of Public Health, Cenderawasih University of Jayapura

Corresponding Author: Hasmi, hasmiuncen@yahoo.co.id

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ABSTRACT

This study aims to analyze factors related to the incidence of Loss To Follow Up (LTFU) in TB patients at the Bintuni Health Center, Teluk Bintuni Regency. The study used an analytical observational design with a cross-sectional design based on secondary data recorded in the TB 03 register. The study population is all TB patients who started treatment in the period from January 2024 to August 2025, with a total of 245 patients sampled. The results showed that the relationship between age ($p=0.260$), sex ($p=0.998$), distance traveled ($p=0.967$), PMO ($p=0.536$), and ethnicity ($p=0.141$) was not significant with the incidence of LTFU. Meanwhile, the variables of education ($p=0.000$), employment ($p=0.000$), and drug side effects ($p=0.000$) were significantly related to the incidence of LTFU. Drug side effect variables are the most dominant factor in the incidence of LTFU

INTRODUCTION

Tuberculosis is an infectious disease that is still one of the leading causes of death in the world. (Putri, 2024). Tuberculosis (TB) is still a health issue worldwide and is included in the priority targets of *the Sustainable Development Goals (SDGs)* in 2035, namely ending the TB epidemic through a 90% reduction in TB incidence (less than 10 TB cases per 100,000 population), a 75% reduction in TB deaths and a 50% TB incidence by 2025 compared to 2015. However, until 2023, the global reduction will only reach 23% for deaths and 8.3% for incidences (Rate et al., 2022).

Globally, the number of deaths due to TB will also decrease in 2024. The total number of 1.23 million decreased by 3% compared to 1.27 million in 2023. The decline from 2015 to 2024 is more impressive, at 29%, but it is still far from the target of the strategy to end TB, which is a 75% reduction in 2025 and a 90% reduction target by 2030. Much better progress in reducing the burden of TB disease has been achieved in several regions and countries. (Stevens et al., 2024).

According to the 2022 Indonesian Health Profile, the target treatment success rate for all TB cases is at least 90%. However, the treatment success rate (% *success rate*) in Indonesia did not reach the target of only 85.9%. The provinces that have succeeded in achieving the target of a treatment success rate of at least 90% of TB cases in 2022 are Lampung (96.2%), South Sumatra (91.0%), Riau (90.8%), and North Sumatra (90.1%). One of the factors that affects the low success rate of TB treatment is the incidence of *Loss To Follow Up (LTFU)*. Based on Permenkes No.67 of 2016, LTFU is a TB patient who does not start treatment or does not continue treatment for ≥2 consecutive months. The LTFU standard set by WHO is <5% of cases in each country (Hidayaturrahmi et al., 2024).

The success of TB control can be determined by several indicators, namely the complete treatment rate (% *complete rate*), the cure rate (% *cure rate*), and the treatment success rate (% *success rate*). Based on treatment results, TB patients can be grouped into complete treatment, cured, failed treatment, *loss to follow-up (LTFU)*, and death (Pardosi et al., 2024).

Nationally, the burden of Tuberculosis (TB) disease in Indonesia has shown a significant increasing trend in the last five years. By 2024, out of a total estimated 1.1 million TB cases in Indonesia, the achievement of case notifications has reached 78%, or equivalent to 856,420 cases. This figure will increase again in 2025 to 866,554 cases. The increase in cases nationally is also in line with the dynamics of case findings at the regional level. (Kemenkes, 2024).

West Papua Province in 2025 ranks third nationally out of 38 provinces with an achievement of Tuberculosis (TB) case notification of 89.1% out of an estimated 3,254 cases. Based on a report by the West Papua Provincial Health Office, the high number of cases was accompanied by the challenge of the constant level of *Lost to Follow Up (LTFU)* in the previous four years. In 2024, 2,957 cases were recorded (97.2% of the estimated 3,260 cases) with an LTFU rate of 18.12%. The trend of LTFU percentage in previous consecutive years was recorded at 20.42% of the 2,584 cases treated in 2023; 20.12% of 2,043 cases in 2022; and 20.41% of the 1,503 cases found in 2021 (Dinkes Papua Barat, 2025).

Based on a report by the Bintuni Bay Regency Health Office, the number of Tuberculosis (TB) cases in the region shows an increasing trend every year. At the district level, TB case notifications were recorded consecutively at 322 cases in 2022, increasing to 452 cases in 2023, 555 cases in 2024, to reach 655 cases in 2025. Meanwhile, more specifically in the work area of the Bintuni Health Center, the discovery of pulmonary TB cases shows a fluctuating trend. The number of case notifications started from 60 cases in 2022, rose to 82 cases in 2023, and peaked at 149 cases in 2024, before finally dropping back to 111 cases in 2025 (Health Office of Teluk Bintuni Regency, 2026).

Loss to follow-up is one of the factors that affects the low success rate of TB treatment. The achievement of *the Treatment Success Rate* in 2022 of 85% still has not reached the target of 90%. One of them is that there are still many cases of *loss to follow-up* (discontinuation of treatment) that are not evaluated. Non-compliance with treatment is a serious problem because it has a wide impact on the spread of the virus in the community (Munarwi et al., 2025).

The high incidence of *loss to follow-up* (LTFU) is still the main challenge for the tuberculosis control program in Teluk Bintuni Regency. The cohort report of the local Health Office (2026) shows that the dynamics of LTFU cases at the district level in 2022 to 2025 are 95 cases (30%), 158 cases (35%), 138 cases, and 148 cases (23%) (Health Office of Teluk Bintuni Regency, 2026).

More specifically, at the research locus, the Bintuni Health Center showed a very worrying proportion of LTFU. In 2023, almost half of the patients who started treatment at this health center failed to complete their therapy, namely 39 cases (48%). Although this proportion shows a downward trend to 28% (42 cases) in 2024 and 20% (23 cases) until August 2025, this figure still consistently shows the need for an in-depth evaluation of the factors that cause treatment failure at the health center (DinKes Kab. Teluk Bintuni, 2026)

The incidence of LTFU mostly occurs in TB patients who are of adult or productive age. The Ministry of Health said that the productive age has an age range of 15-64 years. The productive age has more daily activities because at this age, it is the age of school children and the age of productive workers. This results in them not caring about the disease they suffer from. As a result, this age group increases the risk of LTFU in TB patients (Mohd Ghazali et al., 2025).

Factors related to the incidence of LTFU from a study conducted by Maya et al. (2023) are gender and distance to health facilities. Gender and employment status affect the incidence of LTFU. Most of them occur in male patients compared to women because men are the backbone of the family, so they still have to work even when they are sick. Research by Soedarsono et al. (2021) found that high levels of LTFU were found in patients who did not work permanently. As a result, they often disappear from treatment and feel that they do not need to take medication, so they do not continue treatment until it is finished. Even though this is very risky for transmission to others. Patients who are employees still have a lower LTFU level because they already have a permanent job and do not have to worry about dividing their time between work and treatment.

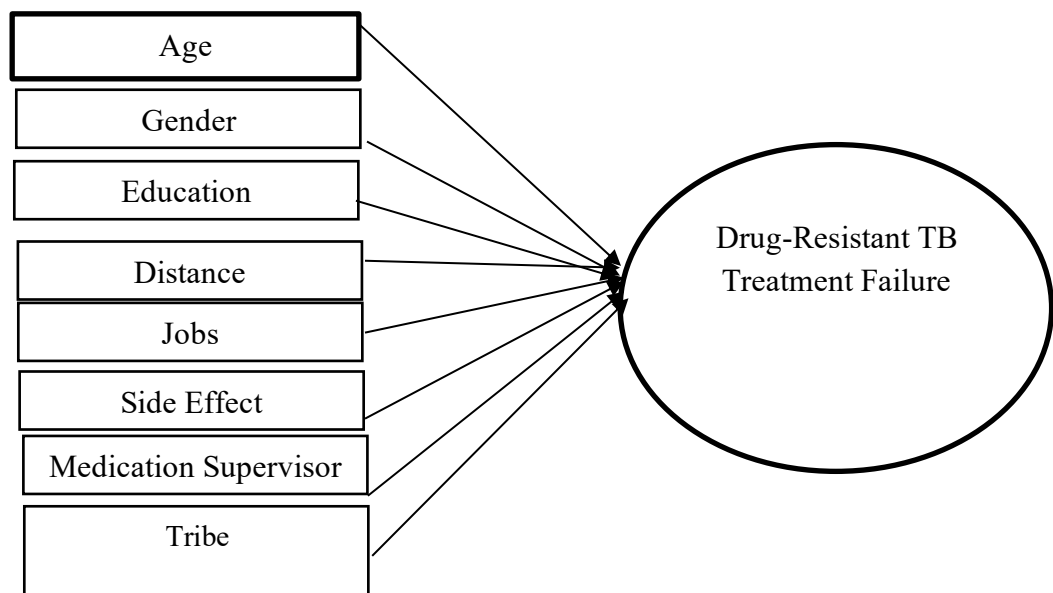
Salam's (2020) research shows that there is a meaningful relationship between the distance of lung TB patients and the occurrence of LTFU. The

distance of the home of pulmonary TB patients who live >5 km from health facilities has a risk of 3.26 times for LTFU compared to pulmonary TB patients whose home distance is <5 km. Research by Birhane et al. (2023) found that pulmonary TB patients who lived more than 10 km from a health facility were five times more likely to be LTFU compared to those who lived within 10 km.

The type of diagnosis is also one of the factors that cause the occurrence of LTFU. Research conducted by Sri Retna (2023) explains that LTFU patients occur more in patients with clinical diagnoses than bacteriological diagnoses. In addition to the type of diagnosis, treatment history also affects the incidence of LTFU. Nur's research (2023) found that patients who previously relapsed/had received TB treatment had a greater likelihood of discontinuation of treatment (LTFU), which could result in failure in the treatment process.

Puskesmas have a role in providing TB services ranging from case discovery to complete treatment, and even track LTFU cases domiciled in their work area to find out the factors that cause patients to undergo LTFU treatment (Pratiwi & Syafina, 2025).

Frame of Mind



Picture 1. Conceptual Framework

THEORETICAL REVIEW

The literature indicates that loss to follow-up (LTFU) among tuberculosis (TB) patients remains a significant global challenge, closely associated with individual, social, and health system factors. Several previous studies have identified that treatment adherence in TB patients is strongly influenced by sociodemographic characteristics such as education level, employment status, and social support. A systematic review by Mahartati and Syarif (2024) highlights that low educational attainment is associated with limited patient understanding of the importance of long-term treatment, thereby increasing the risk of premature treatment discontinuation. Furthermore, research by Hasmi and

Makaba (2024) emphasizes that medication adherence in TB patients is also affected by access to health information and the quality of interaction with healthcare providers, which ultimately influences treatment continuity.

METHODOLOGY

This study is an analytical observational study with a *cross-sectional* design. In this design, measurements of independent variables and dependent variables are carried out simultaneously at the same time (Hasmi, 2016). The population in this study is all Tuberculosis patients (January 2024 to August 2025) and was recorded at the Bintuni Health Center, as many as 245, all of which were used as samples or saturated sampling. The data were analyzed by rate and proportion, chi-square test, and binary logistic test.

RESEARCH RESULTS

Univariate Analysis

Table 1. Independent variable distribution

No	Variable	Frequency (n)	Presentase (%)
1	Age		
	Child	26	10.6
	Adult	219	89.4
2	Gender		
	Male	130	53.1
	Female	115	46.9
3	Education		
	Low	131	53,5
	High	114	46.5
4	Distance		
	Near	171	69.8
	Far away	74	30.2
5	Jobs		
	Not working	159	64.9
	Work	105	35.1
6	Side Effects of OAT		
	None	156	63.7
	Yes	89	36.3
7	Medication Supervisor		
	None	10	4.1
	Available	235	95.9
8	Tribe		
	Papua	149	60.8
	Non Papua	96	39.2
9	Insiden LTFU		
	LTFU	65	26.5
	Non LTFU	180	73.5
	Total	245	100,0

The distribution of respondents by gender was predominantly male, 130 people (53.1%). According to education, the dominant primary education is 131 people (53.5%). The variable of distance traveled, the dominant close to health care facilities, was 171 people (69.8%). The distribution of respondents according to occupation, respondents who are not employed, is 159 people (64.9%). The distribution of respondents according to drug side effects, as many as 156 people (63.7%) stated that there were no drug side effects. According to the drug supervisor, almost all respondents have PMO, which is as many as 235 people (95.9%). The distribution of respondents by tribe, the OAP group amounted to 149 people (60.8%). The distribution of respondents according to age, the adult group was 219 people (89.4%).

Bivariate Analysis

Table 2. Chi-Square Analysis and Prevalence Ratio

No	Variable	<i>Treatment failure</i>				n	<i>p-value</i>	<i>RP</i>
		Fail		Successful				Lower-Upper
		n	%	n	%			
1	Age							
	Child	4	6.5	22	12	26	0.26	
	Adult	61	93.5	158	88	219		(0,21-1.39)
2	Gender							
	Male	35	54	95	53	130	0.99	
	Female	30	46	85	47	115		(0.6-1.5)
3	Education							
	Low	50	38.4	80	61.6	130	0.00	
	High	15	13	100	87	115		(1.7-4.9)
4	Distance							
	Near	46	71	125	69	171	0.96	
	Far away	19	29	55	31	74		(0.6-1.6)
5	Jobs							
	Not Working	56	86	104	58	159	0.00	
	Working	9	14	76	42	85		(1.7-6.3)
6	Side Effect							
	None	25	38	131	73	156	0.00	
	Yes	40	62	49	27	89		(0.2-0.54)
7	Medication Supervisor							
	None	4	6	6	3	10	0.53	
	Yes	61	94	174	97	235		(0.7-3.3)
8	Tribe							
	Papua	45	69	104	58	149	0.14	
	Non-Papua	20	31	76	42	96		(0.9-2.2)

The results showed that the relationship between age ($p=0.260$), sex ($p=0.998$), distance traveled ($p=0.967$), PMO ($p=0.536$), and ethnicity ($p=0.141$) was not significant with the incidence of LTFU. Meanwhile, the variables of education ($p=0.000$), employment ($p=0.000$), and drug side effects ($p=0.000$) were significantly related to the incidence of LTFU.

Multivariate Analysis

Table 3. Multiple Logistic Regression Variable Analysis

No	Variabel	p-value	RP	95% CI	
				Lower	Upper
1	Education	0,000	2.94	1.7	4.9
2	Jobs	0.000	3.3	1.7	6.3
3	Side Effect	0,000	0.35	0,2	0.54
4	Tribe	0,141	1.45	0.9	2.2

Based on Table 3 above, it shows that there are variables that meet the criteria for multivariate analysis, namely education, occupation, drug side effects, and ethnicity.

Table 4. Multiple Logistic Regression Variable Analysis

No	Variable	B	p-value	RP	95% CI for Exp(B)	
					Lower	Upper
1	Education	-1.004	0.009	0,339	0,172	0,778
	Jobs	-1.083	0.017	0.366	0.140	0.821
	Side Effect	1.525	0.000	4.595	2.422	8.721

Source: Secondary Data, processed 2026

Based on the results of multivariate analysis from Table 4, it was shown that the most dominant variable related to the incidence of *loss to follow up* was drug side effects with a P value of 0.000 and a Prevalence Ratio of 4,595 CI 95% (2.42-8.72). This value shows that drug side effects are statistically significantly related to risk factors and have a 4.5 times chance of LTFU occurring compared to other variables at the Bintuni Health Center.

DISCUSSION

Based on the results of this study, it can be seen that most of the TB patients who stopped seeking treatment were adults aged ≥ 15 years, which was 61 people (93.5%), while patients who did not stop seeking treatment in the age group of ≥ 15 years were 158 people (88%). According to the results of the study, a p-value = 0.260 (>0.05) was obtained. This means that there is no significant relationship between age and the incidence of discontinuation of treatment in TB patients. Prevalence Ratio value RP = 0.552; 95% CI = 0.219-1.395 (RP < 1) which indicates that children tend to have a lower risk/prevalence of LTFU compared to adults.

This study is in line with research conducted (Kam & Cahyady, 2023) that age is not related to the incidence of OAT withdrawal, even though the incidence of OAT withdrawal is found at the age of more than 45 years (p=0.474). In addition, a study (Soedarsono et al., 2021) of DR-TB patients in Indonesia also reported that age was not significantly related to the group that completed treatment and LTFU, with a p-value = 0.367. In the study, the factors that were

actually meaningful were gender, employment status, income, and body mass index.

A study on MDR/RR TB cases in DKI Jakarta found that age was significantly related to the incidence of discontinuation, with $p = 0.01$ and $RR = 1.37$ (95% CI 1.06–1.76) in patients aged >40 years compared to ≤ 40 years of age. This means that in the context of drug-resistant TB, older age can be a risk factor, possibly due to a longer duration of therapy, a heavier burden of side effects, and a higher need for social support (Suryani Nasution & Yunis Miko Wahyono, 2020).

Pulmonary TB disease tends to be higher in males than in females, because males' exposure traits and susceptibility levels are higher than those of females. Male genders have high mobility, such as farmers, drivers, rickshaw drivers, and motorcycle taxi drivers, who require strong labor compared to women who stay at home, such as housewives, so men have a greater likelihood of being exposed to TB germs (Octaviani & Kusuma, 2020).

The results of the study found that there was no significant relationship between sex and the incidence of discontinuation of treatment in TB patients. This is in line with research (Kam & Cahyady, 2023). The bivariate analysis in this study did not find a relationship between sex and the incidence of OAT breakup. Men have a greater incidence of OAT withdrawal compared to women.

Based on the reality on the ground, a higher incidence of loss to follow-up was found in male patients compared to women, suggesting that men were less compliant with their treatment. In addition, men are the backbone of the family, so even though they are sick, they must continue to work to meet their needs, so they often lack treatment or feel healthy, so they do not continue treatment even though they are very likely to spread it to others (Soedarsono et al., 2021a).

The results of this study show that education is significantly related to the incidence of Lost to Follow-up (LTFU) TB at the Bintuni Health Center, which shows that of the 65 respondents with low education, there are 50 people (77%) and 15 people (23%) who are LTFU.

These findings show that education is one of the important determinants in the sustainability of TB treatment. In theory, education level is closely related to an individual's ability to receive, understand, and interpret health information. Patients with lower levels of education tend to have limitations in understanding the explanation of TB disease, the length of treatment, the risk of stopping treatment prematurely, and the clinical consequences if treatment is not completed. These conditions can make it easier for patients to stop treatment when symptoms begin to improve, side effects of medication arise, or they face social and economic barriers during the therapy period.

The same study conducted by Kam and Cahyadi showed that 12 respondents (66.7%) had OAT withdrawal with non-school/elementary school education (Kam & Cahyadi, 2023).

The results of this study are in line with a recent study in Selangor, Malaysia, which found that low education is one of the factors significantly related to the incidence of LTFU in pulmonary TB patients. In the study, patients with low education had a p -value = 0.001 and $OR = 6.13$ to experience LTFU. The

researcher explained that low education often goes hand in hand with limited understanding of diseases, low awareness of the importance of treatment to completion, and the existence of other social barriers that aggravate adherence to treatment (Mohd Ghazali et al., 2025).

From a program perspective, the results of this study have an important impact on the implementation of TB services at the Bintuni Health Center. Patients with low education categories, as high-risk groups who experience LTFU, require more intensive interventions. It is not enough to educate patients only in general, but needs to be adjusted to the ability to receive information. Counseling materials should use simple, concrete, and easy-to-understand language; be delivered repeatedly, and supported by visual media or short educational sheets. In addition, health workers need to identify patients with low education early from the beginning of treatment and then be given more rigorous monitoring, for example, through individual counseling, reminders of control schedules, home visits, or active follow-up when patients start not coming to take medication.

The results of this study showed that distance traveled was not significantly related to the incidence of *Lost to Follow-up* (LTFU) TB at the Bintuni Health Center. The results of this study are also in line with several studies that show that distance is not always directly related to the incidence of LTFU. A cohort study in Kampala, Uganda, found that distance to health facilities was not associated with the final outcome of TB treatment, and that even in certain analyses, patients who received further treatment had a lower risk of LTFU. Researchers wrote that patients who chose facilities further away may have a stronger motivation to continue treatment or deliberately seek facilities that are considered better (Robsky et al., 2020).

Research conducted by found that there was no relationship between home distance and health services) On the incidence of discontinuation of treatment for pulmonary tuberculosis (TB) patients at Balkemas in the Semarang region, where the p-value was 0.32 (<0.05). This research contradicts the research of Fauziyah (2010), where there is a relationship between home distance and the incidence of dropout of pulmonary tuberculosis (TB). From the results of the study, 90% of patients who stopped seeking treatment lived far (30-60 minutes by car) from health services, while only 45% of patients who did not stop seeking treatment were far from health services.

The results of this study show that there is a relationship between work and the incidence of LTFU in the work area of the Bintuni Health Center. These results show that employment status is not just a socio-demographic characteristic, but also reflects economic conditions, social stability, the ability to meet daily needs, and the capacity to sustain long-term treatment. In TB patients, the status of not working is often related to limited transportation costs, lack of nutritional intake, dependence on family, and decreased motivation to continue treatment until it is complete. WHO emphasizes that TB treatment adherence is influenced by the social and economic costs that patients have to bear during treatment, so the support approach must be patient-centred and consider the financial and social needs of the patient.

A study on drug-resistant TB patients in Indonesia by Soedarsono et al. found that employment status had a meaningful relationship between the treatment success group and LTFU, with $p = 0.010$; in the LTFU group, more patients with irregular jobs were found. This study makes economic and psychosocial factors important components in the occurrence of LTFU (Soedarsono et al., 2021). A study in Indonesia, summarized in Trisakti's review article, reported that work was significantly related to TB drug adherence with $p = 0.001$. Another study in North Sumatra in 2025 also reported that employment status was associated with TB treatment adherence, with $p = 0.03$ (Meiyanti et al., 2024).

Lost to Follow-up in the non-working group seems to illustrate that economic vulnerability is a more prominent mechanism than the constraint of working time. Patients who are not working may face difficulties with transportation costs, inability to meet basic needs, as well as socio-economic stress that decreases motivation to continue treatment. This can make it easier for patients to postpone visits, stop medication when they feel better, or shift focus to daily life needs compared to completing therapy. This explanation is also in line with the Indonesian DR-TB study, which emphasizes the importance of economic and social aspects in the occurrence of LTFU (Soedarsono et al., 2021).

The results of the study showed that drug side effects were significantly related to the incidence of *loss to follow-up* (LTFU) in TB patients at the Bintuni Health Center. From the results of the multivariate analysis, the drug side effect variable was the most dominant factor related to the incidence of LTFU. In the logistic regression table, the ESO variable had $p < 0.001$, $\text{Exp}(B) = 4.595$, with 95% $\text{CI} = 2.422\text{--}8.721$.

The results of previous research are in line with this research conducted by The results of the analysis showed that severe (p -value 0.01) and mild (p -value 0.04) side effects of OAT, and that there was a relationship between OAT side effects and the incidence of discontinuation of treatment in patients with pulmonary TB. From the results of a survey conducted by researchers, it is known that one of the reason people with pulmonary TB decide to stop treatment, one of which is the side effects received after taking OAT. The number of sufferers who experience side effects, both mild and severe, often makes patients decide to stop treatment because they are afraid that if it is continued, it will get worse and cannot be endured if it is constantly experienced.

The results of a study conducted in Jakarta by Setiawan found that the reaction of first-line anti-TB drugs was significantly related to the default treatment, with $\text{OR} = 9.33$; 95% $\text{CI} = 4.20\text{--}20.72$; $p < 0.001$. Even in multivariate analysis, the effect of drug side effects remained strong with $\text{OR} = 10.91$; 95% $\text{CI} = 4.62\text{--}25.75$; $p < 0.001$. These results reinforce that drug side effects are an important determinant of discontinuation of treatment in TB patients in Indonesia.

Patients who received an effective PMO had a chance of recovery about 9.3 times greater than patients with an ineffective PMO. These results show that it is not only the existence of the PMO that is important, but the effectiveness of the role of the PMO itself (Rahmi, 2017).

The results of the study on the relationship between Medication Supervisors and the Incidence of Lost to Follow-up (LTFU) TB at the Bintuni Health Center showed that the results of the chi-square analysis were not significant.

This research is in line with previous research conducted by. This study, with bivariate analysis, did not find a relationship between the role of PMO and the incidence of OAT discontinuation ($p=0.732$). This study also found no association between the role of PMO and the incidence of OAT drinking disorders. This is because the patient explained that the appointed PMO was in accordance with the actual role and duties. This task is like bringing TB patients to health workers, reminding them, and giving medication to take every day. Another hypothesis is that people who stop taking OAT because a number of families who are tasked with reminding them to take the medication do not believe that their family members have TB. This makes the PMO family not remind them to take medicine.

Research conducted by Merzistya showed that the role of PMO was not related to the incidence of discontinuation of treatment in TB patients ($p\text{-value} > 0.22$). (Merzistya & Rahayu, 2019).

Stigma and family support also play a role in influencing the patient's decision to stop treatment. The results of this study show that there is no relationship between tribes and the incidence of LTFU in the working area of the Bintuni Health Center.

The results of this study have similarities with a study in Jayapura, Papua, by Ruru, which examined factors of non-compliance during TB treatment. Theoretically, the results of the study at the Bintuni Health Center indicate that the tribe variable is not a direct causative factor that directly affects the incidence of lost to follow-up, but rather reflects background factors that have the potential to influence the event through its interaction with other factors that are closer to the patient's treatment behavior.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. The relationship between age ($p=0.260$) with the incidence LTFU was not significant
2. The relationship between Sex ($p=0.998$) with the incidence LTFU was not significant
3. The relationship between Distance traveled ($p=0.967$) with the incidence LTFU was not significant
4. The relationship between PMO ($p=0.536$) with the incidence LTFU was not significant
5. The relationship between Ethnicity ($p=0.141$) with the incidence LTFU was not significant
6. The relationship between Education ($p=0.000$) with the incidence LTFU was significant
7. The relationship between employment ($p=0.000$) with the incidence LTFU was significant

8. The relationship between drug side effects ($p=0.000$) with the incidence LTFU was significant
9. Drug side effect variables are the most dominant factor in the incidence of LTFU.

Recommendation

The TB control program is expected to increase collaboration with several health care facilities.

ADVANCED RESEARCH

It is necessary to conduct more in-depth research with the addition of other variables.

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