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Risk Factors for Pulmonary Tuberculosis in the Regional Technical Implementation Unit of the Kalibobo Health Center

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A B S T R A C T

The purpose of this study is to identify the relationship between various risk factors and the incidence of Pulmonary Tuberculosis at the Kalibobo Health Center. This study uses an analytical method with a cross-sectional approach. A total of 92 people were sampled using purposive sampling technique. The data was obtained from the secondary data of TIS 2024. Data analyzed by chi-square and prevalence ratio tests. The results showed that the factors of age (0.030), education (0.032), treatment history (0.010), treatment outcome (0.001), and smoking status (0.024) were significant to the incidence of Pulmonary TB. Meanwhile, gender (0.411), distance to health facilities (0.844), HIV status (1,000), and diabetes status (0.976) were not significant to the incidence of Pulmonary Tuberculosis (Pulmonary TB). Factors that have a greater risk of Pulmonary Tuberculosis (Pulmonary TB) are age (RP=1.393), education (RP=1.411), treatment history (RP=1.653), treatment outcomes (RP=1.658) and smoking status (RP=1.412).

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INTRODUCTION

Pulmonary tuberculosis is an infectious disease caused by the bacterium Mycobacterium tuberculosis, generally attacks the lungs, and is still a global health problem (Swarjana & Ekasari, 2021). After three years dominated by COVID-19, tuberculosis is once again the leading cause of death from one infectious agent in the world, with the death rate nearly double that of HIV/AIDS. More than 10 million new cases of TB are recorded each year, and this trend has been steadily increasing since 2021 (WHO, 2023).

Indonesia, which is included in the Southeast Asian region, is one of the 30 countries with the highest burden of tuberculosis in the world, and ranks third with the highest number of cases globally (WHO, 2019a). The World Health Organization (WHO) has set a target to achieve a world free of pulmonary TB by 2035, with the aim of reducing the incidence of TB to below 10/100,000 people (WHO, 2019b).

However, the achievement of the TB control program in Papua Province in 2023 has still not met the national target. As of June 30, 2023, the coverage of TB case detection (Treatment Coverage) in 2022 was recorded at 75% of the target of 90%, and the treatment success rate (Treatment Success Rate) in 2021 was also 75% of the same target. For the first semester of 2023, Treatment Coverage has only reached 34%, one of which is due to the suboptimal reporting of TB cases through the Tuberculosis Information System (TIS) application, as well as TB logistical constraints in TIS because not all health facilities in districts/cities have received socialization regarding this system.

Data until June 2024, there were 9,149 cases of pulmonary TB in Central Papua Province. Mimika Regency is the largest contributor with 2,908 cases. The majority of patients, at 59.3%, were women, and the age group of 25–34 years dominated with a proportion of 37.5%. Efforts to find pulmonary TB cases are still actively being carried out by health workers and cadres in the field (Profile of the Papua Provincial Health Office, 2024)

Risk factors that play a role in the increase in the incidence of tuberculosis include low body mass index, history of TB infection, age, continuous exposure to people with pulmonary TB, male gender with higher vulnerability, low socioeconomic conditions, and inadequate living environment. In addition, decreased immunity and smoking behavior also increase the likelihood of TB infection. Globally, smoking is associated with more than 20% of TB cases (Lele et al., 2024)

Based on an initial survey conducted by researchers at the Kalibobo Health Center, it was found that cases of pulmonary TB were still quite high throughout January to December 2024, namely 208 cases. Of this number, 32.5% of patients were women and 61.7% were aged 25–34 years. These findings prompted researchers to explore further through a study of "Risk Factors for Pulmonary Tuberculosis (Pulmonary TB) in the Kalibobo Health Center Work Area."

THEORETICAL REVIEW

Meta Synthesis (Review of Previous Research)

Factors in the physical environment of the house, including ventilation, temperature, humidity, occupancy density, lighting, floors, and walls, contribute

to the appearance of pulmonary tuberculosis disease. In addition, smoking increases the likelihood of contracting pulmonary TB (Marna et al., 2023) Risk factors associated with the increased prevalence of pulmonary TB include influenza Smokers may be 2.2 times more likely to develop pulmonary TB than non-smokers.

Previous studies have shown that the 15–35 year old age group has a higher proportion of tuberculosis cases based on population characteristics, male, classification of pulmonary tuberculosis, complete treatment results, marital status, and type of farmer/fisherman occupation. According to the variable of 6 months of treatment, as well as according to the variable where more tuberculosis cases occur in Siwalima sub-district (Bellytra et al., 2021)

There are several studies that discuss the incidence of TB, including those conducted by (Widyastuti et al., 2019) stating that based on gender, the incidence of TB is more common in men. Meanwhile, based on age, Ages 50 to 59 years are the age range with the most incidence of TB. TB sufferers are more in those who do not work and have a lower body mass index. Then, research (Amina, Handoko Dwi, 2019) stated that TB sufferers are more common in men, age group less than 60 years.

Frame of Mind

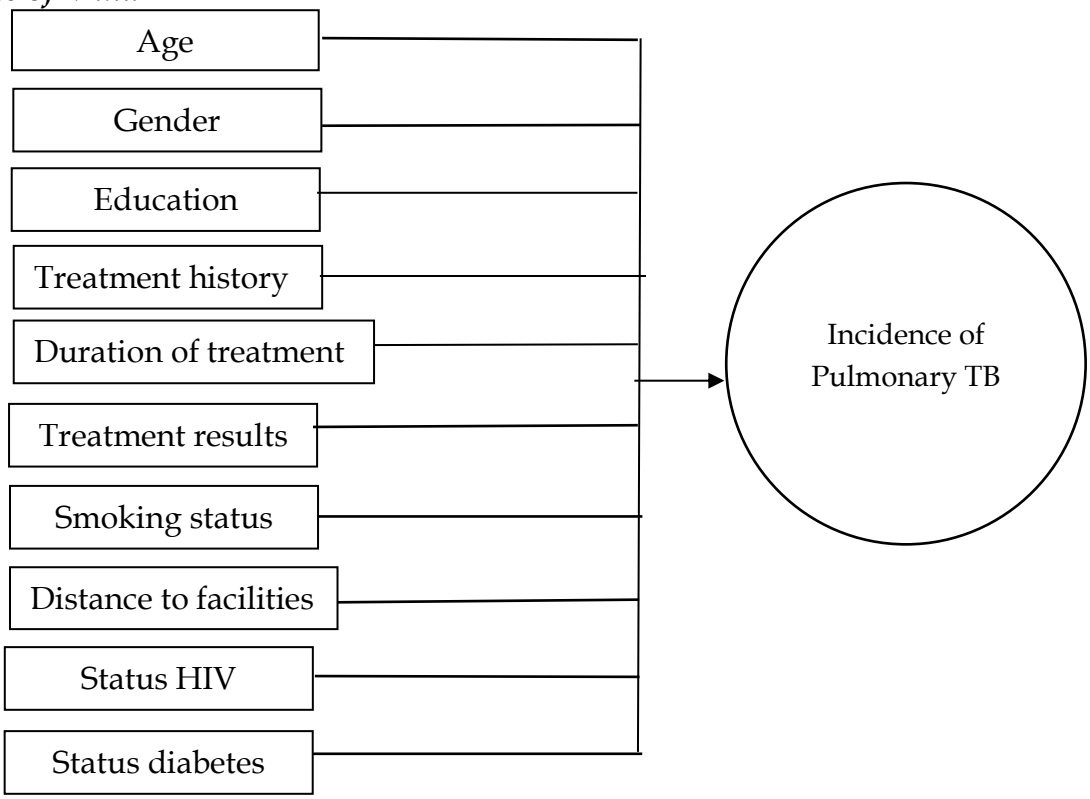

Figure 1. Conceptual Framework

METHODOLOGY

This study uses an analytical method with a cross-cutting approach. Sampling was carried out purposively. Data analysis was carried out statistically

through cross-tabulation followed by chi-square test and prevalence ratio calculation

RESEARCH RESULTS

Univariate Analysis

Table 1. Independent variable distribution

No.	Variable	Frequency (n)	Presentation (%)
1.	Age		
	≤15 years old	102	53,1
	>15 years old	90	46,9
2.	Sex		
	Man	117	60,9
	Woman	75	39,1
3.	Education		
	Low (≤High School)	114	59,4
	High (>High School)	78	40,6
4.	Treatment history		
	Previously treated (≥ 1 month)	143	74,5
	Never (< 1 month)	49	25,5
5.	Treatment results		
	Incomplete	8	4,2
	Complete	139	72,3
6.	Smoking status		
	Smoke	63	32,8
	No smoking	129	67,2
7.	Distance to healthcare facilities		
	Far (>5 km)	14	7,3
8.	Nearby (≤5 km)	178	92,7
	Status HIV		
	HIV	26	13,5
9.	No HIV	166	86,5
	Status Diabetes		
	Yes	2	1,0
10.	No	190	99,0
	Incidence of Pulmonary TB		
	Positive	98	51,0
	Negative	94	49,0
Total		192	100

Bivariate Analysis

No.	Variable	Incidence of Pulmonary TB				n	%	*p-value*	RP CI 95%
1.	Age	TB Pulmonary		No Pulmonary TB					
		n	%	n	%				
	≤15 years	60	58,8	42	41,2	102	100	0,030*	1,393
	>15 years	38	12,5	52	12,5	90	100		(1,041-1,864)
2.	Sex								
	Man	63	53,8	54	46,2	117	100	0,411	1,154
	Female	35	46,7	40	53,3	75	100		(0,860-1,549)
3.	Education								
	Low	66	57,9	48	42,1	14	100	0,032*	1,411
	High	32	41,0	46	59,0	46	100		(1,036-1,922)
4.	History Treatmen								
	Ever	18	78,3	5	21,7	29	100	0,010*	1,653
	Never	80	47,3	89	52,7	163	100		(1,265-2,161)
5.	Treatment results								
	Incomplete	33	73,3	12	26,7	45	100	0,001*	1,658
	Complete	65	44,2	82	55,8	147	100		(1,288-2,136)
6.	Smoking Status								
	Smoke	40	63,5	23	36,5	63	100	0,024*	1,412
	No Smoking	58	45,0	71	55,0	129	100		(1,081-1,845)
7.	Distance to Health Facilities								
	Far	8	57,1	6	42,9	14	100	0,844	1,130
	Near	90	50,6	88	49,4	178	100		(0,702-1,820)
8.	Status HIV								
	HIV	13	50,0	13	50,0	26	100	1,000	0,976
	non HIV	85	51,2	81	48,8	166	100		(0,647-1,474)
9.	Status Diabetes								
	Diabetes	1	50,0	1	50,0	2	100	0,976	0,979
	non Diabetes	97	51,1	93	48,9	190	100		(0,243-3,943)

According to the findings from the Chi-square test and the Prevalence Ratio at a significance level of 95% (α=0.05) shows that:

1. Individuals aged ≤15 years were found to have a 1.393 times higher risk of developing pulmonary TB compared to those older than 15 years (RP = 1.393; 95% CI: 1.041–1.864; p = 0.030). This result is statistically significant
2. Gender Male respondents were 1.154 times more likely to develop pulmonary TB compared to females; however, this finding was not statistically significant (RP = 1.154; 95% CI: 0.860–1.549; p = 0.411)
3. Education Respondents with low education (≤ high school) had a 1.411 times greater risk of developing pulmonary TB than those with higher education (>high school) and these results were statistically significant (RP = 1.411; 95% CI: 1.036-1.922; *p = 0.032*).
4. Treatment History Respondents who had been treated (≥ 1 month) had a 1.653 times greater risk of developing pulmonary TB than those who had never been treated, and these results were statistically significant (RP = 1.653; 95% CI 1.265 - 2.161; *p = 0.010*).

5. Treatment Results Respondents with incomplete treatment outcomes had a 1.658 times higher risk of developing pulmonary TB compared to those with complete treatment outcomes. This result was statistically significant (RP = 1.658; 95% CI: 1.288–2.136; p = 0.001)
6. Individuals who smoked were found to be 1.412 times more at risk for pulmonary TB than those who did not smoke, with the results showing statistical significance (RP = 1.412; 95% CI: 1.081–1.845; p = 0.024)
7. Proximity to Health Facilities — Individuals residing more than 5 km from health facilities had a 1.130 times higher risk of developing pulmonary TB compared to those living within 5 km. However, this finding was not statistically significant (p-value not provided)
8. Status HIV
   Participants with HIV had a 0.976 times likelihood of developing pulmonary TB compared to those without HIV. Nevertheless, this result was not statistically significant (RP = 0.976; 95% CI: 0.647–1.474; p = 1.000).
9. Status Diabetes
   Respondents with a history of diabetes had a 0.979 times likelihood of developing pulmonary TB compared to those without diabetes. However, this result was not statistically significant (RP = 0.979; 95% CI: 0.243–3.943; p = 0.976)

DISCUSSION

Association Between Age and the Occurrence of Pulmonary Tuberculosis at the Kalibobo TIU Health Center

The study found that the majority of respondents were aged ≤15 years, totaling 102 individuals (53.1%). The Chi-square test at a 95% confidence level (α = 0.05) revealed a p-value of 0.030 for the age variable, indicating statistical significance. The prevalence ratio (RP) of 1.393 with a 95% confidence interval (CI: 1.041–1.864) suggests that age is a risk factor, as the RP value exceeds 1

Therefore, individuals aged ≤15 years had a 1.393 times higher likelihood of developing pulmonary TB compared to those older than 15 years. According to (Notoadmodjo, 2022) age is the length of time a person has lived since birth. As age increases, an individual's ability to deal with problems also increases. Older individuals are generally more mature in adjusting their behavior to the environment.

Age is an internal factor that significantly contributes to the development of pulmonary TB. However, the findings of this study differ from those reported by Nur et al. (2022) which states that at the age of over 50 years, the function of the immune system begins to decline compared to younger ages, one of which is influenced by the biological aging process and shrinking of the thymus gland, which has an impact on changes in cellular and humoral immune responses. According to (Sunarmi & Kurniawaty, 2022), productive age requires a lot of physical activity and needs to expend more energy so that the body's immunity is easily reduced. However, according to research (Samuel Marganda Halomoan Manalu et al., 2022) shows that TB can attack all age groups, depending on the nutritional status, level of physical activity, and immunity of each individual.

The Relationship Between Sex and the Incidence of Pulmonary Tuberculosis (Pulmonary TB) at TIU Kalibobo Health Center

Based on the results of the study, most of the respondents were male, namely 117 respondents (60.9%). The results of the statistical test on the sex variable showed a p-value of 0.411, which means that it is not statistically significant.

This study is in line with the study (Nur et al., 2022) stating that male patients are 1,546 times at risk of developing tuberculosis compared to female patients. Differences in sick behavior patterns can affect a person's level of wellness, especially in men and women, women are more likely to pay attention to health and a good lifestyle compared to men (Windiyaningsih et al., 2019).

Gender is not a risk factor for the incidence of pulmonary TB because the role of women at this time has many activities outside the home such as work, social activities, worship activities, social gatherings so that contact with pulmonary TB patients has also increased. In addition, men who suffer from pulmonary TB, women around them (family) have the possibility of getting an infection also because of the transmission of pulmonary TB through breathing when the patient coughs, sneezes or talks to release germs in the form of droplets (sputum splashes). The more germs that enter the lung tissue, the higher the likelihood of suffering from pulmonary TB (Samsugito & Hambyah, 2018).

Based on the results of observations of male respondents who came to the TIU Kalibobo Health Center, it was found that most of them had a smoking habit. This habit has the potential to increase the risk of developing pulmonary tuberculosis because it can interfere with the function of mucosal secretion which is the body's main defense against infection. In addition, men tend to do more activities outside the home than women, so they have a greater chance of being exposed to tuberculosis-causing bacteria.

Association Between Educational Level and the Incidence of Pulmonary Tuberculosis at TIU Kalibobo Health Center

The study revealed that the majority of respondents had a low educational background (high school level or below), totaling 114 individuals (59.4%). The statistical analysis for the education variable produced a p-value of 0.032, indicating statistical significance. A prevalence ratio (RP) of 1.411 with a 95% confidence interval of 1.036–1.922 suggests that education is a risk factor for pulmonary TB incidence, as the RP value is greater than 1. Thus, respondents who were poorly educated had a 1,411 times greater chance of developing pulmonary TB compared to those who were highly educated (>Upper Intermediate School).

This study is not in line with (Nur et al., 2022), which shows that there is no significant relationship between education and tuberculosis incidence. This study also determined a PR (Prevalence Ratio) of 1.426 with a 95% CI: 1.040 – 1.956 However, it is known that patients who have low education are 1.426 times more at risk of developing tuberculosis compared to patients who have higher education.

There is a relationship between educational factors, a person who has low education can affect a person to get a disease but the absence of awareness in a person can affect behavior where a person who has the behavior of not wearing a mask when coughing, spitting carelessly, not taking medication regularly can affect or make a person to be easily infected or infected with tuberculosis germs.

The Relationship Between Treatment History and the Incidence of Pulmonary Tuberculosis (Pulmonary TB) at TIU Kalibobo Health Center

Based on the results of the study, most of the respondents had a medical history with the category of having been treated (≥ 1 month), which was as many as 143 people (74.5%). The results of the statistical test showed a p-value of 0.010, which means that there is a significant relationship between treatment history and the incidence of pulmonary TB. The prevalence ratio (RP) value of 1.653 with a Confidence Interval (CI) of 95%: 1.265-2.161 indicates that treatment history is a risk factor, due to the RP>1 value.

Thus, respondents who had undergone treatment had a 1.653 times greater chance of developing pulmonary TB compared to respondents who had never undergone treatment.

The results of this study are not in line with the research carried out (Wiratmo et al., 2021) showing that there is no relationship between previous treatment history and Tuberculosis treatment adherence. The factors of previous treatment history, both old patients and new patients, are not a determining factor for non-compliance with the Tuberculosis treatment they are undergoing. Statistically, new patients (who have never been treated for Tuberculosis) tend to be more compliant with treatment than old patients (who have never been treated for Tuberculosis).

Effective treatment of pulmonary TB requires proper monitoring and action to prevent drug resistance and ensure patient recovery. Improper or incomplete treatment can lead to drug resistance, so it is important to know the patient's medical history. Treatment history can help determine a more effective treatment strategy for patients who are at risk of drug resistance or treatment failure.

The relationship between treatment outcomes and the incidence of Pulmonary Tuberculosis (Pulmonary TB) at TIU Kalibobo Health Center

Based on the results of the study, most of the respondents had complete treatment results, namely 139 people (72.3%). The results of the statistical test showed a p-value of 0.001 which means that there is a significant relationship between treatment results and the incidence of pulmonary TB. The prevalence ratio (RP) value of 1.658 with a Confidence Interval (CI) of 95%: 1.288 – 2.136 indicates that treatment outcomes are risk factors, because the RP>1 value.

Thus, respondents with incomplete treatment results had a 1.658 times greater chance of developing pulmonary TB compared to respondents who completed complete treatment.

This study is not in line with the study (Janah et al., 2023), from the results of cross-tabulation between the treatment status variable and treatment success the results were obtained using Chi Square analysis known to be p-value = 0.000,

this shows that treatment status has a relationship with the success of productive age TB treatment in Palembang City. It is known that of the 2,982 people who have succeeded in carrying out TB treatment in Palembang City are patients who have received treatment according to standards. 863 people who succeeded in treating TB in Palembang City were patients who did treatment that was not up to standard. Then the result was PR= 0.957 which means that the treatment status is a protective factor.

The success of the TB program is influenced by the commitment to providing services, making policy decisions, allocating funds for operations, and providing materials, equipment, and facilities is also influenced by treatment standards in TB management referring to national guidelines and International Standards for Tuberculosis Care. This includes case identification and diagnosis, use of predetermined drug regimens, monitoring of treatment processes, standard-compliant recording and reporting, and the role of cross-sectors in TB control efforts.

The Relationship Between Smoking Status and the Incidence of Pulmonary Tuberculosis (Pulmonary TB) at TIU Kalibobo Health Center

Based on the results of the study, most of the respondents had a non-smoking status, which was 129 people (67.2%). The results of the statistical test showed a p-value of 0.024, which means that there is a significant relationship between smoking status and the incidence of pulmonary TB. The prevalence ratio (RP) value of 1.412 with a Confidence Interval (CI) of 95%: 1.081-1.845 indicates that smoking status is a risk factor, because the RP>1 value.

Thus, respondents who smoked had a 1.412 times greater chance of developing Pulmonary TB compared to respondents who did not smoke.

This study is not in line with the research (Ernawati et al., 2018) found that there is no relationship between smoking habits and the incidence of pulmonary TB. In contrast to the results of Indah WH.'s research, et al (2014) (Harahap et al., 2017) found that there was a relationship between the variable degree of smoking and the incidence of tuberculosis after controlling for the variables of age, gender, education level, income level, body mass index and type of house walls.

The increasing number of smokers in the community will increase the incidence of tuberculosis. Not only tuberculosis, cigarettes are also a major risk factor for several diseases, especially chronic diseases (World Health Organization (WHO, 2019a). Cigarettes can cause structural changes in Mycobacterium exposure. The function of lung fluid production will also increase for both normal people and those affected by Pulmonary TB. Cigarettes also cause changes in natural and acquired cell immunity that can affect macrophages and leukocytes.

The Relationship Between Health Facility Distance and the Incidence of Pulmonary Tuberculosis (Pulmonary TB) at TIU Kalibobo Health Center

Based on the results of the study, most of the respondents had a close living distance to health facilities (≤ 5 km), which was 178 people (92.7%). The results of the statistical test showed a p-value of 0.844, which means that there is

no significant relationship between distance to health facilities and the incidence of pulmonary TB.

This study is not in line with the study (Salam & Wahyono, 2020), it can be concluded that there is a significant relationship between the distance between the house and the hospital and the occurrence of default, OR=2.262 p=0.0321 while the other covariate variables do not show a meaningful relationship with the occurrence of defaults due to p>0.05.

The main requirement for good health services is that it is easy to achieve by the community. The meaning of intended achievement is mainly from the location angle. Thus, to be able to realize good health services, the regulation of the distribution of health facilities is very important. Health services that are too concentrated in urban areas only, and while they are not found in rural areas, are not good health services.

Pulmonary TB patients choose the first treatment place which only takes 30 minutes from their home. The distance factor between the home and this health facility is indeed an important factor. The detection of tuberculosis cases will decrease in line with the increasing distance between homes and nearby health facilities.

The Relationship Between HIV Status and the Incidence of Pulmonary Tuberculosis (Pulmonary TB) at TIU Kalibobo Health Center

Based on the results of the study, most of the respondents had HIV negative status, namely 166 people (86.5%). The results of the statistical test showed a p-value of 1,000, which means there was no significant association between HIV status and the incidence of pulmonary TB.

This study is not in line with Sanna's (2023) research, it is known that the results of the examination of 218 samples, it is known that as many as 6 people (2.75%) are HIV-positive tuberculosis patients. Meanwhile, the remaining 212 people (97.25%) were known to be HIV negative. This shows a small percentage because it does not exceed 50%. Of the 6 samples that were positive, 3 were women and 3 were men.

This germ usually attacks the lungs (pulmonary TB), but can attack other organs of the body (extrapulmonary TB). The germs enter the body through respiratory air that enters the lungs, then the germs spread from the lungs to other parts of the body through the circulatory system, lymphatic duct system, through the airways, or spread directly to other bodies. People with HIV who are also infected with latent TB are more likely to develop active TB disease, and active TB can accelerate the progression of HIV and increase the risk of death

The Relationship Between Diabetes Status and the Incidence of Pulmonary Tuberculosis (Pulmonary TB) at TIU Kalibobo Health Center

Based on the results of the study, most of the respondents had non-diabetic status, which was as many as 190 people (99%). The results of the statistical test showed a p-value of 0.976, which means that there is no significant relationship between diabetes status and the incidence of pulmonary TB.

This study is not in line with (Utomo et al., 2016), A significant association was found between type 2 diabetes mellitus and extensive tuberculosis lesions.

Diabetes mellitus is one of the risk factors for tuberculosis. This condition can reduce the body's resistance, including in the lungs. People with diabetes are more susceptible to faster spread of TB. Pulmonary infection in diabetic patients occurs due to a weakening of the body's defense system, characterized by disruption of the function of the respiratory tract epithelium and cilia movement. In addition, damage to the pulmonary vascular capillary endothelium, red blood cell stiffness, and changes in the oxygen dissociation curve due to chronic hyperglycemia contribute to the failure of the body's defense mechanism against infection.

CONCLUSION

1. A significant association was found between age and the incidence of pulmonary tuberculosis (p-value = 0.030).
2. No statistically significant correlation was observed between sex and the occurrence of pulmonary TB (p-value = 0.411).
3. Educational level was significantly related to the incidence of pulmonary TB (p-value = 0.032).
4. A significant link existed between treatment history and the occurrence of pulmonary TB (p-value = 0.010).
5. Treatment outcomes were significantly associated with the incidence of pulmonary TB (p-value = 0.001).
6. Smoking status showed a significant correlation with the incidence of pulmonary TB (p-value = 0.024).
7. There was no significant link between distance to health facilities and pulmonary TB incidence (p-value = 0.844).
8. HIV status was not significantly associated with pulmonary TB incidence (p-value = 1.000).
9. No significant relationship was found between diabetes status and pulmonary TB incidence (p-value = 0.976).

RECOMMENDATION

So that the health center is able to improve public health services. One of the efforts that can be made is to increase counseling activities regarding the risk and prevention of Pulmonary Tubeculosis in the work area of the health center.

FURTHER STUDY

It is recommended that further research use *a cohort* or *case-control* study design to obtain more comprehensive results, so that we can determine the cause-and-effect relationship of atar variables.

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