Factors Related To the Incidence of Pulmonary TB in Rural Communities in South Lampung, Indonesia: A Case-Control Study

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ABSTRACT: Indonesia is ranked second in the world with the highest number of TB cases after India. The trend in the case detection rate of tuberculosis cases for all types per 100,000 population in Lampung Province, Indonesia, during 2016-2020 tends to increase. This research aims to analyze factors related to the incidence of pulmonary TB. This case-control study with a sample of 58 respondents (29 in the case group and 29 in the control group) was conducted in the work area of one of the public health centers in South Lampung Regency, starting September-October 2023, using purposive sampling. The research instrument consists of a questionnaire sheet. Data analysis used Chi-square and logistic regression tests. The results of the study showed that the factors associated with the incidence of pulmonary TB in this study area were age (OR= 3.90; 95% CI = 2.28-6.65), nutritional status (OR= 3.72; 95% CI = 1, 23-11, 16), economic status (OR= 4, 22; 95% CI = 1, 40-12, 65), home hygiene (OR= 6, 89; 95% CI = 2, 17-21.80), smoking habits (OR: 4.71, 95% CI = 1.48-15.03), and the history of pulmonary TB in the immediate family (OR: 3.57, 95% CI = 1.12-11 .37). The dominant factors associated with the incidence of pulmonary TB in this area are economic status (OR= 34.31; 95% CI= 1.56-753.26) and history of pulmonary TB in the immediate family (OR= 37.67; 95% CI = 1.75-809.26). It is necessary to provide education on risk factors for the incidence of tuberculosis, especially about reducing close contact between TB patients and family members, for example, by wearing masks and not throwing away TB patient waste.

KEYWORDS: Case-control study, Disease History, Economic Status, Factors, Tuberculosis, Indonesia.

INTRODUCTION

Based on data from the Global TB Report in 2022, it is known that Indonesia is ranked second after India, with an estimated 969,000 cases or the equivalent of 11 deaths per hour (Global TB Report, 2022). This figure continues to increase by 17% from 2020, namely 824,000 cases, with the number of undiscovered cases of 430,667. This condition significantly increases undiscovered cases (World Health Organization, 2022). TB cases in Indonesia in 2021 are 354 per 100,000 population, meaning that for every 100,000 354 Indonesians are suffering from TB, so the disruption caused by the Covid-19 pandemic since 2020 is predicted to cause a setback in achievements of up to five to eight years (World Health Organization, 2022). Based on data from the 2021 Indonesian Health Profile, the total number of tuberculosis cases in Lampung Province in 2021 was 11,874, or 41.5% (Ministry of Health of Indonesia, 2022). The success rate for pulmonary TB treatment from 2019 to 2022 is 97%, 98%, 94.81%, and 96% of the five-year target of 90% (Lampung Provincial Health Office, 2019).

The Case Detection Rate (CDR) of tuberculosis cases for all types per 100,000 population in Lampung Province during 2016-2020 tended to increase, namely 25% in 2016, 28% in 2017, then rose again to 44.4% in 2018, and highest peak in In 2019 it was 54%, then it fell in 2020 to 36% due to the Covid-19 pandemic, then in 2022 there was an increase to 53% (Lampung Provincial Health Office, 2019). Nutritional status is an expression of the balance of nutrients with the body's needs, which is manifested in the form of certain variables (Hidayati, 2019). If a person is included in the category of malnutrition, the body's immunity will decrease, resulting in an uncomplicated infection with infectious diseases due to decreased immunity. A previous study found a relationship between nutritional status and the incidence of pulmonary TB (Yuniar & Lestari, 2017). Apart from that, economic status is a condition that shows the family's financial capabilities and the material equipment they have (Baswori & Juariyah, 2010). Economic status is essential in families with low or high categories. If the economy is high, it will be easier for families to fulfill their living needs according to health standards. Pulmonary TB is caused by infection with tuberculosis bacteria and supporting factors that cause the body to become infected.

The health of the residential environment is an essential factor in the transmission of TB through the air (airborne transmission). Several studies explain that a bad environment significantly increases the risk of TB transmission. Several environmental factors include humidity and residential density, lighting, and the condition of bedroom windows, which are influenced by bedroom temperature and bedroom window area. Statistically, these risk factors contribute 59% (Arpiah, 2020). According to the Ministry of Health of the Republic of Indonesia in 2002 regarding technical guidelines for assessing healthy homes, the requirements for home environmental sanitation indicators that are assessed are home hygiene or home components consisting of ceilings, walls, floors, bedroom windows, family room and living room windows, ventilation, kitchen and lighting, and behavioral aspects (Ministry of Health of Indonesia, 2002). According to H.L. Blum, health is closely related to genetic factors, the environment, lifestyle, and health services. These four factors positively influence a person's health status (Fitriany *at al.*, 2016).

Smoking can interfere with the effectiveness of some respiratory or breathing defense mechanisms. Cigarette smoke can reduce the movement of cilia and stimulate mucus formation, resulting in the accumulation of mucosa and an increased risk of bacterial growth, including Mycobacterium tuberculosis. This germ causes pulmonary TB, which can cause infection. Research in India reports that people who smoke have a 2.48 times greater risk of being infected with pulmonary TB compared to people who do not smoke (Kolappan, 2002) Meanwhile, in Indonesia, it is reported that having a smoking habit carries a 2.56 times greater risk of contracting pulmonary TB when compared with those who have never smoked (Rustono, 2008). Data from the Central Statistics Agency shows that South Lampung Regency has been designated as a location for extreme poverty in 2022 (Badan Pusat Statistik Lampung, 2023). This study aimed to analyze factors related to the incidence of pulmonary TB in rural communities in South Lampung, Indonesia.

METHODS

This case-control research was conducted in the Puskesmas work area in South Lampung Regency with a sample of 58 respondents (29 in the case group and 29 in the control group) starting September-October 2023 using purposive sampling. The research instrument consisted of a questionnaire sheet belonging to the Indonesian Ministry of Health in 2002 concerning Technical Guidelines for Healthy Home Assessment (Ministry of Health of Indonesia, 2002). Data analysis used Chi-square and binary logistic regression tests. The independent variables in this study are age, gender, nutritional status, economic status, home hygiene, smoking habits, and history of TB in the immediate family, and the dependent variable in this study is the incidence of pulmonary TB. Before conducting the research, the researcher explained the research objectives first and asked the public for consent to become respondents.

Respondents included in this study were respondents who met the inclusion criteria, namely for the group of cases of TB sufferers recorded in medical records; the respondent was at least fifteen years old and was willing to be a respondent. Meanwhile, the inclusion criteria in the control group were not being a TB sufferer, not living in the same house as a TB sufferer, and neighbors of respondents in the case group. Meanwhile, the exclusion criteria for the case group and control group were having comorbidities such as hypertension, diabetes, stroke, and cancer. This research received ethical approval from the Tanjung Karang Polytechnic Health Research Ethics Committee (Number: 472/KEPK-TJ/IX/2023) on September 29, 2023.

RESULTS

1. **Descriptive analysis**

Table 1. Respondent characteristics and variables of study (n=58)

Variable	Category	Frequency (n)	Percentage (%)
Age	<35 years	19	32,8
	≥35 years	39	67,2
Gender	Male	42	72,4
	Female	39	27,6
Education	Elementary school	4	6,9
	Junior high school	10	17,2
	Senior high school	38	65,5
Ocupation	Government officials	5	8,6

	Seller	5	8,6
	Private sector employee	9	15,5
	Self-employed	2	3,4
	Farmer	25	43,1
	Housewife	12	20,7
Economic status	≥Regional minimum wage	28	48,3
	<Regional minimum wage	30	51,7
Nutritional status	Normal	33	56,9
	Abnormal	25	43,1
Home Hygiene	Healthy	29	50
	Unhealthy	29	50
Smoking habit	No risk	36	62,1
	Risky	22	37,9
History of TB in the immediate family	No	38	65,5
	Yes	20	34,5

Based on table 1, it is known that the respondents were predominantly aged ≥35 years (67.2%), male (72.4%), high school education (65.5%), farmer occupation (43.1%), economic status <regional minimum wage (51.7%), normal nutritional status (56.9%), hygiene in the healthy category and unhealthy category (50%), smoking habits are not at risk (62.1%), history of pulmonary TB disease in the immediate family is not there is a history (65.5%).

2. **Bivariate analysis**

Table 2. Relationship between independent variables and the incidence of pulmonary TB (n=58)

Variable	Incidence of TB				p-value	OR (95%CI)
	Yes		No			
	n	%	n	%		
Age						
<35 years	0	0	19	65,5	<0,001	3,90 (2,28-6,66)
≥35 years	29	100	10	34,5		
Nutrional Status						
Normal	12	41,1	21	72,4	0,017	3,72 (1,23-11,16)
Abnormal	17	58,6	8	27,6		
Economic status					0,009	4,22 (1,41-12,65)
≥Regional minimum wage	10	34,5	20	69		
<Regional minimum wage	19	65,5	9	31		
Home Hygiene						
Healthy	8	27,6	21	72,4		
Unhealthy	21	72,4	8	27,6	0,001	6,90 (2,18-21,80)
Smoking habit						
No risk	13	44,8	23	79,3	0,007	4,72 (1,48-15,03)
Risky	16	55,2	6	20,7		
History of TB in the immediate family						
No	15	51,7	23	79,3	0,027	3,57 (1,12-11,37)
Yes	14	48,3	6	20,7		

Based on table 2, the age (OR= 3.90; 95% CI=2.28-6.66), nutritional status (OR= 3.72; 95% CI=1.23-11.16), economic status (OR=4.22; 95% CI=1.41-12.65), home hygiene (OR: 6.90; 95% CI=2.18-21.80), smoking habit (OR=4.72; 95% CI=1.48-

15.03), has the history of TB in the closest family variable (OR= 3.57; 95% CI=1.12-11.37) was associated with incidence of pulmonary TB.

3. Multivariate analysis

Table 3. Multivariate analysis (n=58)

Variable	Odds Ratio (95%*CI)*	p-value
Age		
<35 years	5818 (0,000-)	0,998
≥35 years	1	
Nutrional Status		
Normal	3,06 (0,32-28,97)	0,328
Abnormal	1	
Economic Status		
≥ Regional minimum wage	34,31 (1,56-753,26)	0,025
< Regional minimum wage	1	
Home Hygiene		
Healthy	7,50 (0,57-97,72)	0,124
Unhealthy	1	
Smoking habit		
No risk	22,90 (0,88-596,10)	0, 006
Risky	1	
History of TB in the immediate family		
No	37,67 (1,75-809,26)	0,020
Yes	1	

Multivariate test results show that economic status (OR=34.31; 95% CI= 1.56-753.26) and family history of TB (OR= 37.67; 95% CI=1.75 - 809.27) are the most dominant factor for the incidence of pulmonary TB in this study area.

DISCUSSION

This study aims to analyze the relationship between the incidence of pulmonary TB and factors such as age, nutritional status, economic status, home hygiene, smoking habits, and family history of pulmonary TB. In the multivariate test, it was found that economic status and family history of TB were the most dominant factors for the incidence of pulmonary TB in this study area. Based on the results of the logistic regression test, the variable history of pulmonary TB disease in the dominant family has the largest OR value = 37.67, meaning that a history of pulmonary TB disease in the immediate family is 37.67 times more susceptible to contracting pulmonary TB, compared to families who do not have a history of pulmonary TB. Previous research shows that the risk of developing pulmonary TB is 36.5 if the contact source's sputum contains BTA+, compared to contact with a source that does not contain BTA+ (Rusnoto, 2016). The study results show a relationship between family history of TB, household contact, length of contact, and density of residents in contact with the incidence of pulmonary TB When coughing or sneezing, pulmonary TB sufferers spread germs by droplets or splashes of phlegm-containing germs, which can survive in the air for several hours at room temperature. Suppose droplets are inhaled into the respiratory tract and enter other body parts through the circulatory, lymphatic, or respiratory systems or spread directly to other body parts. In that case, the Mycobacterium Tuberculosis germ will infect the person. A person's infectious power is determined by the number of germs released by their lungs or the concentration of droplets in the air, so low body resistance is a factor in someone being susceptible to pulmonary TB, including poor nutrition or HIV/AIDS (Sangadji, 2020). Apart from that, economic status also influences the incidence of pulmonary TB; the results of previous research conducted by Sejati and Sofiana in 2015 showed that families with income below the regional minimum wage had a 1.123 times higher risk of being infected with TB

compared to families whose income above the minimum wage (Adhitya and Liena, 2015). This finding is likely due to the inability of households to provide adequate nutritional intake and a clean environment to prevent infection with TB.

Based on 2018 Indonesian Basic Health Research data, the age group of new cases found was mainly in the 65-74 year age group, amounting to 1% or 40,180 cases (Riskesdas, 2019). The study results showed that the incidence of pulmonary TB in the age category <35 years old in the non-pulmonary TB sufferer group was 65.5%, whereas in the pulmonary TB sufferer group, it was not found or 0%. The age category ≥35 years in the non-pulmonary TB sufferer group was 35.5% or 10 people, while in the TB sufferer group, it was 100% or 29 people. The present study results obtained OR: 3.90; 95% CI=2.28-6.66, meaning a significant relationship exists between age and the incidence of pulmonary TB. The OR value=3.90 means that those aged ≥35 years are 3.90 times more likely to contract pulmonary TB compared to those aged <35 years. The results of this research are in line with research conducted by Sikumbang that there is a relationship between the age of the respondent and the incidence of pulmonary TB in the working area of the Tegal Sari Community Health Center, Medan Denai District (Sikumbang, et, al. 2022).

The research showed that the incidence of pulmonary TB in the nutritional status variable was expected in the group not suffering from pulmonary TB (72.4%). In comparison, in the group suffering from pulmonary TB, it was 41.1%. Abnormal nutritional status in the group not suffering from pulmonary TB was 27.6%, while in the group suffering from TB, it was 58.6%. The results of the chi-square statistical test from the research results obtained a value of OR= 3.72; 95% CI=1.23-11.16, meaning that abnormal nutritional status is 3.72 times more likely to contract pulmonary TB compared to normal nutritional status. This finding is in line with research conducted by Yusuf and Nuleli at the Lung Disease Treatment Center (BP4) Lubuk Alung, West Sumatra, that there is a relationship between nutritional status and the incidence of pulmonary TB at BP4 Lubuk Alung, West Sumatra (Yusuf dan Nuleli, 2018). The chi-square statistical test results from the research results obtained an OR value of 4.22; 95% CI=1.41-12.65, meaning that an economic status <REGIONAL MINIMUM WAGE> is 4.22 times more susceptible to contracting pulmonary TB than an economic status ≥REGIONAL MINIMUM WAGE. The results of this research align with research conducted by Saputra and Herlina, which found a significant relationship between socio-economics and the incidence of pulmonary TB (Saputra dan Herlina, 2021). Economically, the cause of the development of tuberculosis germs in Indonesia is mainly the low income per head. Socioeconomic level includes income, education, and employment, which indirectly cause health problems (Nurjannah, et. al., 2022).

The results of the bivariate analysis showed that there was a significant relationship between home hygiene and the incidence of pulmonary TB in the bivariate analysis with a value of OR=6.90, meaning that unhealthy home hygiene was 6.90 times more susceptible to contracting pulmonary TB, compared to healthy home hygiene. In line with research conducted by Butarbutar, there is a significant relationship between environmental sanitation and pulmonary TB patients in the Amplas Medan Health Center working area. The environment is everything that surrounds humans, as well as external influences that can influence human development and life (Butarbutar, 2018). Home hygiene plays a significant role in the transmission of disease, especially in a home environment that does not meet the requirements, because the home environment is one of the factors that significantly influence the health of its residents (Tandang, et al , 2018). Several factors that influence health are grouped into four forces according to Hendrik L. Blum, 1981, namely (1) environment: social, economic, political, and cultural; (2) heredity/genetics; (3) lifestyle behavior; and (4) health services: types of coverage and quality (Purnama, 2017).

The results of research using bivariate tests showed that there was a significant relationship between smoking habits and the incidence of pulmonary TB, with an OR value = 4.72, meaning that active smokers were 4.72 times more susceptible to contracting pulmonary TB compared to passive smokers or non-smokers. This research is in line with previous research that found there was a relationship between smoking habits (p-value=0.000) and the incidence of pulmonary TB. Smoking can interfere with the effectiveness of some respiratory defense mechanisms (Sutriyawan et, al. 2022). Cigarette smoke can reduce the movement of cilia and stimulate mucus formation, resulting in the accumulation of mucosa and an increased risk of bacterial growth, including mycobacterium tuberculosis. This germ causes pulmonary TB, which can cause infection (Tandang, dkk, 2018). One of the dangerous substances contained in cigarettes is nicotine, which can accumulate in the liver, kidneys, fat, and lungs. Nicotine is poisonous or toxic to nerve tissue, which can increase systolic and diastolic blood pressure and tachycardia. The more individuals smoke, the more nicotine is consumed, and the higher the risk of developing risky diseases due to smoking, such as pulmonary TB (Mishra, et al, 2015). Tuberculosis bacteria in tiny microscopic form (5 μm) are inhaled and can enter the alveoli. The results of the bivariate test showed that there was a significant relationship between a history of TB in the immediate family and the incidence of pulmonary TB, with an OR value = 3.57, meaning that families with a history of pulmonary TB were 3.57 times more susceptible to contracting

pulmonary TB, compared with families who have no history of pulmonary TB This is in line with research conducted by Budi which found a strong relationship between a family member's history of TB and the incidence of pulmonary TB (Budi, I.S.et al, 2018)

CONCLUSION

The history of pulmonary TB disease in the immediate family and economic status are the most dominant risk factors related to the incidence of pulmonary TB in our study area. Public health center officials need to strengthen education regarding reducing close contact between TB patients and family members, for example, by wearing masks and not throwing away TB patient waste. In addition, Puskesmas management through Community Health Effort (UKM) in the field of infectious diseases, especially those holding the Pulmonary TB Program, are expected to carry out updates or retraining on factors related to the incidence of pulmonary TB, especially for families of patients diagnosed with pulmonary TB.

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