

RISK FACTORS FOR PULMONARY TUBERCULOSIS INCIDENCE IN THE WORK AREA OF THE PUBLIC HEALTH CENTER IN PALEMBANG

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ABSTRACT

Background: Tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*. This disease is still a health problem in Indonesia, especially in the work area of the Sekip Health Center. **Objective:** To determine the risk factors for Pulmonary Tuberculosis in the working area of the Sekip Health Center, Palembang City. **Method:** This study uses a cross-sectional design with a Purposive Sampling technique. The population of the study was all patients with Pulmonary TB and suspects, with a sample of 103 respondents. **Results:** The majority of patients with Pulmonary TB were found in the average age group of 49 years, with male sex (8.7%), and Income $\leq$ Minimum Wage (48.5%). The incidence of pulmonary TB was significantly related to occupancy density ($p=0.011$), ventilation area ($p=0.041$), lighting ($p=0.043$), humidity ($p=0.048$), and temperature ($p=0.044$). Behavioral factors of contact history (0.010) and smoking habit ($p=0.040$). Based on the results $\leq$ Of the Chi-Square test, it was found that there was a significant relationship with the incidence of Pulmonary TB. **Conclusion:** The incidence of pulmonary TB was found in a small number of people living in the work area of the Public Health Center in Palembang, namely occupancy density, ventilation area, lighting, humidity, temperature, contact history, and smoking habits. Therefore, it is necessary to make efforts for the community to maintain the home environment, implement Clean and Healthy Living Behavior (CHLB), and conduct early examinations for those who have a history of contact to prevent the transmission of Pulmonary TB.

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INTRODUCTION

Tuberculosis (TB) is an infectious disease that mainly affects the lungs and is caused by the bacterium *Mycobacterium tuberculosis*. Bacteria that cause Pulmonary TB can spread through the air from one person to another. This transmission occurs when a person performs activities such as coughing, talking, or singing. (Central of Disease Control, 2025). Until now, Pulmonary TB is still one of the main health problems in the world. In 2022, Pulmonary TB was recorded as the second-highest cause of death after COVID-19. (TB Indonesia, 2024).

It is estimated that there are around 10 million people with pulmonary TB worldwide, consisting of 5.6 million men, 3.3 million women, and 1.1 million children. In 2020, as many as 30 countries with the highest incidence of Pulmonary TB accounted for about 86% of the total new cases, with two-thirds of them coming from eight countries, including India, China, and Indonesia. Furthermore, in 2021, the number of pulmonary TB cases was recorded to increase to 10.6 million people, or an increase of 3.6% compared to the previous year, after previously experiencing a decrease of around 2% (WHO, 2022).

Indonesia has experienced a significant increase in the number of Pulmonary TB cases. In 2020 and 2021, the prevalence of pulmonary TB increased by about 14.9% per year. However, from 2021 to 2022, the incidence of Pulmonary TB increased by 42.3%. This increase points to more individuals being diagnosed with Pulmonary TB and getting treatment. In 2023, Pulmonary TB cases will increase by around 724,000 reported cases of Pulmonary TB, then increase to 809,000 cases. This figure significantly exceeds the pre-pandemic average, which was 600,000 cases per year. (Ministry of Health, 2024).

According to data from the Central Statistics Agency of South Sumatra Province, Palembang City ranks 14th out of 17 districts/cities in the period 2021 to 2023. In 2021, there were 5,023 cases, then increased to 6,927 cases in 2022, and again increased to 7,457 cases in 2023. This significant increase confirms the importance of paying more attention to the treatment and prevention of Pulmonary TB in the region (Central Statistics Agency of South Sumatra Province, 2024).

The incidence of suspected pulmonary TB and receiving services in accordance with standards continues to increase every year. In 2021, 46,403 cases were recorded, increasing to 48,981 cases in 2022, and in 2023, it will increase again to reach 48,984 suspected cases of Pulmonary TB. Based on the results of data analysis from the profile of the Palembang city health office, the Sekip Health Center is a contributing health center to Pulmonary TB cases with a total of 1,250 (2.55%) cases, followed by the Merdeka Health Center with a total of 781 (1.59%) cases and the campus health center with a total of 563 (1.149%) cases. (Profile of the Health Office, 2023).

Previous research has identified that smoking habits, knowledge level, occupancy density, floor type, and economic conditions are factors that increase the risk of pulmonary TB (M Jalaludin, 2019). In line with research, it is shown that pulmonary TB is influenced by smoking history, history of contact with patients, medical history, nutritional status, level of knowledge, and low income. (M. Sabir & Sarifuddin, 2023). Previous research has found that risk factors that affect the prevalence of Pulmonary TB in various regions in Indonesia include smoking habits, inadequate nutritional status, history of contact with people with Pulmonary TB, level of knowledge and understanding of the prevention and treatment of Pulmonary TB, housing density, and inadequate home ventilation. (Salsabila & R. Azizah, 2022). Previous research has shown that risk factors for pulmonary TB include knowledge level, nutritional status, and smoking behavior. (Sutriyawan & Nofianti, 2022).

The profile of the Sekip Health Center in Palembang City shows that the health center serves three urban villages, namely Pahlawan, Sekip Jaya, and Twenty-Three Ilir. In each of these villages, there are three auxiliary health centers called Pustu, including Pustu Kebon Semai, IAIN, and Cambai Agung. As of 2022, the Sekip Health Center serves 42,465 people. The Sekip Health Center is located in Twenty Ilir Dua Village, Kemuning District, Palembang City. The location of the Sekip Health Center is on the side of the highway and provides easy access for the public to reach this health facility. Based on the trend of Pulmonary TB cases from 2021 to 2023, which has increased, the location of the Sekip Health Center was chosen as the research site to identify the risk factors causing the high incidence of Pulmonary TB in the work area of the Sekip Health Center in Palembang City.

METHOD

This study is an analytical observational research with a cross-sectional design. This research was conducted in the work area of the Sekip Health Center in Palembang City in March – June 2024. The sample

size was calculated using the Lemeshow formula with a sample size of 103 respondents, and samples were taken using purposive sampling based on inclusion and exclusion criteria. Data were collected using questionnaires for variables of respondent characteristics, and direct observation for variables of the physical condition of the house, namely independent variables, namely occupancy density, ventilation, lighting, humidity, temperature, as well as behavioral factors of contact history and smoking habits with the incidence of pulmonary tuberculosis in the working area of the sekip health center in the city of Palembang.

The variables of the physical condition of the house were measured by the grab sampling method (sampling was done instantly), the tools used were thermohygrometers to measure temperature and humidity, lux meters to measure lighting, and the ventilation area was measured using a rollmeter. The data was analyzed univariately and bivariately with the chi-square test, and the ethical feasibility test was carried out at the Palembang Ministry of Health Polytechnic with a certificate Number: 0305/KEPK/adm2/III/2025.

RESULT

The results of data collection on risk factors for the incidence of Pulmonary TB that have been carried out in the working area of the Public Health Center in Palembang are shown in the following univariate and bivariate tables:

Table 1. Distribution of Frequency of Pulmonary TB incidence and characteristics of respondents in the working area of the Public Health Center, Palembang City, in 2025 (n=103)

Variables	n	Percentage (%)
1. Incidence of Pulmonary TB		
- Pulmonary TB (+)	15	3.9
- Pulmonary TB (-)	88	71
2. Age		
- < 49 years	51	49.5
- ≥ 49 years	52	50.5
3. Gender		
- Male	43	41.7
- Female	60	58.3
4. Income		
- < UMR 3.900.000,-	50	48.5
- ≥ UMR 3.900.000,-	53	51.5

Based on Table 1. Know that out of 103 respondents, as many as 15 respondents experienced a positive incidence of Pulmonary TB, while 88 respondents did not experience Pulmonary TB. The majority of respondents were in the age group of 49 years old with female gender, and Income ≤ Minimum Wage.

Table 2. Frequency Distribution of Environmental Factors in the working area of the Public Health Center in Palembang City in 2025 (n=103)

Variables	n	Percentage (%)
1. Occupancy Density		
- Not Eligible (<9/person) m^2	58	56.3
- Eligible ($>9m^2$ /person)	45	43.7
2. Ventilation		
- Not Eligible (<10%)	15	14.6
- Eligible ($>10\%$)	88	85.4
3. Lighting		
- Not Qualified (<60 lux)	41	39.8
- Eligible (≥ 60 lux)	62	60.2
4. Moisture		
- Ineligible (<40RH% and 60RH%)	56	54.4
- Qualified (40-60RH%)	47	45.6
5. Temperature		
- Not Qualified (<18°C and $>30^\circ C$)	64	61.1
- Qualified (18-30°C)	39	37.7

Based on Table 2, it is explained that most of the temperature, occupancy density, humidity, and lighting variables are not eligible, while only a small part of the variables, such as ventilation, are not eligible.

Table 3 Distribution of Frequency of Behavioral Factors in the Working Area of the Public Health Center in 2025 (n=103)

Variables	n	Percentage (%)
1. Contact History		
- Yes	46	44.7
- No	57	55.3
2. Smoking habits		
- Yes	36	35
- No	67	65

Based on Table 3, it is seen that most of the respondents have no history of contact with patients with Pulmonary TB and do not smoke/are not exposed to smoking.

Table 4. Relationship between Respondent Characteristics and Incidence of Pulmonary TB

Variables	Pulmonary TB (+)		Pulmonary TB Cases (-)		Total		p-value	OR 95% CI
	n	%	n	%	n	%		
1. Age (years)								
- < 49	9	8.7	42	40.7	51	49.5	0.378	1.643
- ≥ 49	6	5.8	46	44.6	52	50.4		
2. Gender								
- Male	9	8.7	34	33	43	41.7	0.159	2.382 (0.778 – 7.291)
- Female	6	5.8	54	52.4	60	58.3		
3. Income								
- <UMR	7	6.8	43	41.7	50	48.5	1.000	0.916 (0,305 – 2,7430)
- 3.900.000,-								
- ≥UMR	8	7.8	43	43.7	53	51.5		
- 3.900.000,-								

Based on Table 4, the results showed that the most abundant age group was the age group of 49 years, with the male sex having an income below the ≥ Minimum wage, but statistically no significant association with the incidence of Pulmonary TB.

Table 5. Relationship between Pulmonary TB Incidence and Physical Environmental Conditions of the House

Variables	Pulmonary TB Cases (+)		Cases of Pulmonary TB (-)		Total		p-value	OR 95%CI
	n	%	n	%	n	%		
1. Occupancy Density								
- Not Eligible (<9/person) <i>m</i> ²	13	12.6	45	43.7	58	56.3	0.011	6,211 (1.323 – 29.154)
- Eligible (>9 <i>m</i> ² /person)	2	1.9	43	41.7	45	43.7		
2. Ventilation								
- Not Eligible (<10%)	5	4.9	10	9.7	15	14.6	0.041	3.900 (1.107-13.740)
- Eligible (>10%)	10	9.7	78	75.7	88	85.4		
3. Lighting								
- Not Eligible (<60 lux)	10	9.7	31	30.1	41	39.8	0.043	3.677 (1.154 – 11.721)
- Eligible (≥ 60 lux)	5	4.9	57	55.3	62	60.2		

4. Moisture								
- Not Eligible (<40RH% and 60RH%)	12	11.7	44	42.7	56	54.4	0.048	4,000 (1.055-15.160)
- Qualified (40-60RH%)	3	2.9	44	42.7	47	45.6		
5. Temperature								
- Not Qualified (<18°C and >30°C)	13	12.6	51	49.5	64	62.1	0.044	4,716 (1.003 – 22.167)
- Qualified (18-30°C)	2	1.9	37	35.9	39	37.9		

Based on Table 5, the results of occupancy, ventilation, lighting, humidity, and temperature were obtained, showing that the results of statistical tests showed that there was a significant relationship between environmental factors and the incidence of Pulmonary TB. Respondents who had a risk occupancy density of 6,211, ventilation 3,900, lighting 3,677, humidity 4,000, and temperature of 4,716 times were at risk of contracting pulmonary TB compared to ventilated respondents who were eligible.

Table 6. Relationship between the Incidence of Pulmonary TB and Behavioral Factors

Variables	Pulmonary TB Cases (+)		Cases of Pulmonary TB (-)		Total		p-value	OR 95%CI
	n	%	n	%	n	%		
1. Contact history								
- Yes	2	1.9	44	42.7	46	44.7	0.010	0.154
- No	13	12.6	44	42.7	57	55.3		(0.033 – 0.722)
2. Smoking habits								
- Yes	9	8,7	27	26.2	36	35.0	0.040	3.389
- No	6	5,8	61	59.2	67	65.0		(1.097 – 10.470)

Based on Table 6, the results showed that a small percentage of respondents had a history of contact and had smoking habits. The results of the statistical test showed between the contact history, and smoking habits with the incidence of pulmonary TB.

The results of statistical tests showed that there was a relationship between smoking history and the incidence of pulmonary TB. Respondents who had a smoking habit were at risk of suffering from pulmonary TB 3,389 times compared to respondents who did not have a smoking habit.

DISCUSSION

Based on the results of the study, it was obtained that respondents were positive for Pulmonary TB in 3.9%, and the rest were negative for Pulmonary TB. Although only a small number of respondents are positive for pulmonary TB, the risk of transmission to family members and the surrounding community is quite high. In line with research at the Pekalongan Health Center, a small part of 21% of pulmonary TB cases were also found. (Hanifah & Siyam, 2021). Another study conducted at the Karya Jaya Health Center in Palembang found that 33.3% of cases of pulmonary TB (Destria, 2019). In line with other research found at the Palembang City Health Center, it shows that the physical qualities of the house, such as ventilation, lighting, temperature, and humidity, are not qualified to be significantly related to the incidence of suspected pulmonary TB. (Maksuk, 2024).

Research results. It is known that most of the respondents belong to the age group ≥ 49 years, with a percentage of 50.4%. However, statistical analysis showed that there was no significant relationship between age and the incidence of pulmonary TB. These results are consistent with previous studies that concluded that age factors do not have a significant effect on the occurrence of pulmonary TB (Widiati & Majdi, 2021). Research carried out at the Situ Udik Health Center showed that there was no relationship between age factors and the incidence of pulmonary TB (Kusumawardani, 2021). The results of this study are consistent with findings at the Karanglewas Health Center, which showed that the age group over 45 years old has a higher risk of developing Pulmonary TB, although statistically no significant association was found with the incidence of Pulmonary TB. (Mardiah, 2019).

The results of the study found that the majority of respondents who experienced Pulmonary TB were women, with a percentage of 58.3%. However, statistical tests showed no significant association, although the Odds Ratio value indicated that women had a 2.382 times greater risk of developing Pulmonary TB. In line with previous research, 56.5% of pulmonary TB patients were female, and the results of statistical tests also did not show a significant association. (Kusumawardani, 2021). Research conducted at the Situ Udik Health Center showed that there was no relationship between sex and the incidence of pulmonary TB. This is because the proportion of male and female respondents in the study was relatively. (Apriliasari et al., 2018).

The results of the study found that most of the respondents had an income below the Palembang City >UMR of 48.4%. However, the results of the statistical test showed no significant association between income level and the incidence of pulmonary TB, although an Odds Ratio value of 0.916 indicated that respondents with low income had a risk compared to those with incomes above the UMR. This condition can be explained because the level of income affects the quality and quantity of food intake consumed. Low economic income limits an individual's ability to create a healthy environment, thereby increasing the risk of Pulmonary TB, while higher income allows for the fulfillment of family needs, especially in terms of nutrition. (Rianto, 2018). The results of this study are consistent with the findings at the Wundulako Health Center, which show that there is no significant relationship between income level and the incidence of pulmonary tuberculosis. (Rasyid et al., 2024).

The results of the study found that Most of the respondents live in houses with an unqualified occupancy density, which is 56.3%, so they are at risk of contracting Pulmonary TB. Statistical analysis shows that there is a significant relationship between residential density and the incidence of pulmonary TB. Respondents who occupied houses with an ineligible occupancy density had a 6.211 times greater risk of contracting Pulmonary TB than those living in homes with a standard occupancy density. These findings are in line with research at the Panjang Lampung Health Center that respondents with an unqualified occupancy density are at 10.92 times higher risk than respondents with a qualified occupancy density. (Perdana & Putra, 2018). These findings are consistent with research at the Kumelembuai Health Center, which shows a relationship between the density of unqualified housing and the incidence of pulmonary TB (Ulprastika & Ipmawati, 2022). Other research also supports a positive association between residential density and pulmonary TB cases. (Lestari & Sufa, 2024).

The results of the study found that some respondents had unqualified home ventilation of 14.6%. The results of statistical analysis showed a significant relationship between ventilation conditions and the incidence of pulmonary TB. Respondents who lived in homes with unqualified ventilation had a 3.900 times higher risk of contracting Pulmonary TB compared to respondents who had standard ventilation. Ventilation plays an important function in maintaining air circulation so that the room is free from pathogenic bacteria that cause Pulmonary TB (Maksuk, 2024). The results of this study are in line with other studies that show that ventilation areas that do not meet the standards (<10%) can increase the risk of transmission of Pulmonary TB by up to 3.4 times. (Aziza Zahrotul Adha, 2024). Research at the Tanjung Morawa Health Center also shows a significant relationship between the condition of home ventilation and the incidence of pulmonary TB (Nasution & Freesia, 2025).

The results of the study found that 39.8% of respondents have unqualified home lighting conditions. The results of statistical tests showed a significant relationship between home lighting and the incidence of pulmonary TB. Respondents with inadequate home lighting had a 3.677 times higher risk of contracting Pulmonary TB compared to respondents with standard lighting. The lack of light entering the house can cause the room to become dark and damp, so it has the potential to be a place for bacteria to grow. (Fahreza et al., 2012). These findings are in line with the results of previous studies that showed a meaningful relationship between lighting and the incidence of pulmonary TB (Sahra Faradillah, 2022). The results of a similar study at the Bailing Health Center revealed that there is a significant relationship between lighting and the incidence of pulmonary TB (Monintja N, Warouw F, 2020).

The results of the study found that Most respondents had unqualified home humidity, which was 54.4%. Statistical analysis shows a significant relationship between the humidity condition of the house and the incidence of pulmonary TB. Respondents who lived in homes with unqualified humidity had a 4,000 times higher risk of contracting Pulmonary TB compared to those who lived in homes with standard-compliant humidity. These findings are in line with the Kedungkandang Health Center, which also reported that there was a relationship between house humidity and the incidence of pulmonary TB (Langingi et al., 2023). The findings of this study are in line with a study at the Babana Health Center, which shows a relationship between humidity levels and the incidence of pulmonary TB (Romadhan et al., 2019). Other studies at the Pamenang Health Center also showed similar results, namely, humidity is related to the incidence of pulmonary TB (Revinovita, 2021).

Environmental conditions with high humidity are influenced by water content, which makes up more than 80% of the volume of bacterial cells. This factor is an important basis for the survival and growth of bacteria, because in humid air, bacteria can develop well. (Sulrieni et al., 2023).

The results of the study found that the majority of respondents have an unqualified home temperature of 62.1%. Statistical tests show a significant relationship between home temperature and the incidence of pulmonary TB. Respondents who lived in homes with an unqualified temperature had a 4.716 times higher risk of contracting Pulmonary TB compared to those occupying homes with qualifying temperatures. Environmental temperature plays a role in bacterial growth. When temperatures are not suitable, these conditions can create an environment conducive to bacterial growth, thereby increasing the risk of transmission of Pulmonary TB (Romadhan et al., 2019). The findings of this study are in line with the results of a study in Surabaya, which showed a relationship between temperature and pulmonary TB cases (Mahawati et al., 2023). Other studies are also similar, namely, there is a significant influence of house temperature and the incidence of pulmonary TB (Maulinda et al., 2021). Field observations show that respondents with substandard house temperatures tend to rarely open windows. This condition is generally influenced by concerns related to home safety, considering that most family members are outside for work or school. In addition, some respondents also think that opening windows can trigger dust to enter the house (Muslimah, 2019).

Research results found 44.7% of respondents were recorded as having a contact history. Statistical analysis proves that there is a significant relationship between contact history and the occurrence of Pulmonary TB. Respondents who had no contact history had a 6.49 times higher chance of protection against being infected with Pulmonary TB compared to those who had a history of contact. These findings are consistent with previous studies that also confirmed the association between contact history and pulmonary TB incidence, and reinforced that the association is statistically significant. (Darmin et al., 2020). Contact history has been shown to play a significant role in the transmission process, where close contact, especially with family members in the household, has a risk two to three times higher than with individuals who do not live in the same household. (Tahumile et al., 2019). This finding is in line with the results of a study in Wonosobo, which shows a link between contact history and the incidence of pulmonary TB (Nandariesta et al., 2019). Similar findings were also obtained in the study of the productive age group, which showed a link between contact history and positive TB cases. (Hayati & Sulistiyowati, 2024).

The results of the study found that 35.0% of respondents were identified as smoking or exposed to cigarette smoke. Statistical tests indicate a significant relationship between smoking habits and the incidence of pulmonary TB. Smoker respondents were recorded to have a 3.389 times greater chance of suffering from Pulmonary TB than non-smoking respondents. Smoking has been shown to increase the likelihood of developing Pulmonary TB by up to three times. Exposure to cigarette smoke, especially when smoking activities are carried out indoors, increases the risk of contracting Pulmonary TB. (Alchamdani, 2024). The findings of this study are in line with the results of a study at the Pratama Mulia Clinic, which shows a relationship between smoking history and thoracic radiographic images in patients with pulmonary TB (Aprilisya et al., 2025). Another study at Adam Malik Hospital also revealed that individuals with smoking habits tended to experience more severe pulmonary TB lesions than those who did not smoke (Perdamenta et al., 2023). Previous research also revealed a link between smoking as a risk factor and the incidence of pulmonary tuberculosis at the Girian Weru Health Center, Bitung City. (Hart et al., 2019).

CONCLUSION

The findings of this study indicate that the incidence of pulmonary TB is significantly related to the physical condition of the home environment. Therefore, efforts to prevent transmission through health education on the importance of maintaining environmental and physical cleanliness at home are necessary.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to the publication of this article.

AUTHOR'S CONTRIBUTION

The contribution of each author in this article is M as the main contributor, who is responsible for collecting, analyzing, and presenting the article writing data as a whole. M improves the manuscript writing, and E, as contributor members, are responsible for guiding the article writing process.

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