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The Relationship Between Physical Quality Of The House, Smoking Behavior And Incidence Of Pulmonary Tuberculosis In The Working Area Of The Medan Helvetia Health Center

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Article Info	ABSTRACT
	Pulmonary Tuberculosis in the Medan Helvetia Community Health Center (Puskesmas) area ranks fourth with 106 cases. This study aims to determine the relationship between physical housing quality, smoking behavior, and mosquito coil use with the incidence of pulmonary tuberculosis in the Medan Helvetia Community Health Center area. This quantitative study used a case-control design. The sample size was 106 respondents, consisting of 53 cases and 53 controls. This test was conducted using the Chi-Square statistical test with SPSS 20. The results of this study found a relationship between the variables of Physical Home Quality, which encompass five components: Room Temperature (p-value = 0.000; OR = 9.518), Home Ventilation (p-value = 0.000; OR = 6.644), Occupancy Density (p value = 0.000; OR = 4.689), Lighting (p-value = 0.000; OR = 4.138), and Humidity (p-value = 0.001; OR = 4.013). The variable, Smoking Behavior (p-value = 0.000; OR = 25.941), was associated with the incidence of Pulmonary Tuberculosis in the Medan Helvetia Community Health Center (Puskesmas Medan) work area. Meanwhile, the variable "Mosquito Coil Use" (p-value = 1.000; OR = 0.290) was not associated with the incidence of pulmonary tuberculosis in the Medan Helvetia Community Health Center (Puskesmas) work area.

INTRODUCTION

Tuberculosis (TB) is an infectious infectious disease caused by *Mycobacterium tuberculosis* and is still a global health problem (Aulia & Lukman., 2023) WHO targets a 90% reduction in TB deaths and 80% incidence by 2030 compared to 2014 within the framework of *the Sustainable Development Goals* (SDGs). However, in 2021 there were 10.6 million cases of TB globally, an increase from 10 million cases in 2020. Of these, 6.4 million (60.3%) have been diagnosed and treated, while 4.2 million (39.7%) have not been discovered or reported (WHO, 2025) TB deaths reached 1.6 million people, including 187,000 deaths in TB patients with HIV, showing that TB is still the leading cause of death due to infectious diseases in the world (World Health Organization, 2023)

Indonesia is one of the countries with the highest burden of TB. In 2023, Indonesia is ranked third in the world with an estimated 1,060,000 cases, and will increase in 2024 to 1,092,000 cases, with a death rate of around 134,000 people (WHO, 2024) In North Sumatra Province, the number of TB cases in 2022 was 19,147 cases, an increase compared to 2021 of 17,303 cases (Lauchan et al., 2025), In Medan City, TB cases in 2024 were recorded at 13,141 cases, up from 12,785 cases in 2023. Data from the Medan Helvetia Health Center in 2024 shows that there are 109 cases of TB and ranks 4th in the number of cases in Medan City. This increase shows that TB is still a serious public health problem at the local level (Dinas Kesehatan Kota Medan., 2024)

TB risk factors are not only related to the individual's condition, but are also influenced by factors in the physical environment of the home. A healthy house must meet the requirements in terms of ventilation, lighting, temperature, humidity, occupancy density, and indoor air quality (Alfikri et al., 2021) Humid home environments, lack of lighting, and poor air circulation can be a medium that supports the growth and

transmission of *Mycobacterium tuberculosis*. In addition, the behavior of the residents of the house such as the habit of smoking in the house and the use of burning mosquito repellent can also worsen the air quality and increase the risk of respiratory disorders including TB (Kementerian Kesehatan RI., 1999)

Various previous studies have shown a significant relationship between home environmental conditions and TB incidence, including lighting (p=0.004) (Septidwina et al., 2022) humidity (p=0.045) (Oktatri & Prakosa, 2022)room temperature (p=0.001) (Wildanny et al., 2021) ventilation (p=0.004) (Efendi et al., 2023), and occupancy density (p=0.000). In addition to the physical factors of the house, smoking behavior is also related to the incidence of TB (p=0.003) (Kurnia et al., 2020)as well as the use of mosquito repellent (p=0.004). The results of the study reinforce the suspicion that the quality of the living environment and the behavior of residents have an important contribution to the increased risk of pulmonary TB.

Based on an initial survey conducted by researchers in the working area of the Medan Helvetia Health Center, it was still found that many houses did not meet health requirements, such as the absence of adequate ventilation, lack of sunlight lighting entering the house, and the presence of family members who smoked in the house. This condition is suspected to have contributed to the increase in TB cases in the region. Therefore, this study is important to analyze the relationship between the physical quality of the house, smoking behavior, and the use of burning mosquito repellent with the incidence of TB in the working area of the Medan Helvetia Health Center in 2024, so that the results can be the basis for more effective and efficient TB intervention planning and control efforts.

METHODS

This study uses an **analytical study design with *a case control approach***, which is to trace risk factors based on the incidence of diseases that have occurred. Researchers first assigned the case group (people with pulmonary TB) and the control group (not people with TB), then identified related risk factors, such as the physical quality of the home, smoking behavior, and the use of mosquito repellent. The research was carried out in the working area of the Medan Helvetia Health Center in February-June 2025.

The study population consisted of 109 people with TB as the case group and people who did not have TB as the control group. The number of samples was determined using the Lemeshow formula based on the proportion of exposure from previous research. From this calculation, a minimum sample of 53 respondents was obtained for each group (ratio of 1:1), so that the total sample was 106 respondents. The sampling technique was carried out by simple random sampling.

The dependent variables in this study were the incidence of pulmonary TB, while the independent variables included the physical condition of the house (temperature, ventilation, occupancy density, lighting, and humidity), smoking behavior, and the use of mosquito repellent. Data measurement was carried out using a Guttman scale questionnaire (answer yes = 1, no = 0), as well as direct observation and measurement using tools such as thermohygrometers for temperature and humidity, lux meters for lighting, and roll meters for ventilation and room area.

The data used consisted of primary data (interviews, observations, and direct measurements at the respondents' homes) as well as secondary data obtained from the Medan City Health Office and the Medan Helvetia Health Center. Data analysis was carried out univariate to see the frequency distribution of each variable, and bivariate analysis used *the Chi-Square test* with a significance level of 0.05 to determine the relationship between risk factors and the incidence of pulmonary TB.

RESULTS
Overview of General Research Locations

This research was carried out in the working area of the Medan Helvetia Health Center located on Jalan Kemuning Perumnas Helvetia, Helvetia Village, Medan Helvetia District, Medan City. Medan Helvetia District consists of seven sub-districts, namely Cinta Damai, Sei Sikambing C II, Dwikora, East Helvetia, Central Helvetia, Helvetia, and Tanjung Gusta. Geographically, this area is bordered by Deli Serdang Regency to the north, Medan Sunggal District to the south and west, and West Medan and Medan Petisah Districts to the east. Medan Helvetia District is one of 21 sub-districts in Medan City with an area of 13.16 km² and a population of 15,450 people in 2023, consisting of 7,553 males and 7,897 females.

Characteristics of Research Respondents

Table 1. Respondent Characteristics

Characteristics	Frequency (n)	Percentage (%)
Gender		
Men – men	57	53,8
Women	49	46,2
Age Group		
Teens 9 – 18 years old	8	7,5
Adults 19 – 59 years old	73	68,9

Seniors 60+	25	23,6
Jobs		
Labor	31	29,2
Private	34	31,1
PNS	7	6,6
IRT	25	23,6
Students	9	8,5
Total	**106**	**100,0**

Based on Table 1, it shows that the majority of respondents are men as many as 57 (53.8%) while women are only 49 (46.2%). There are 3 age categories in the category, Adolescents aged 9-18 years amounting to 8 (7.5%) respondents, Adults aged 19-59 years amounting to 73 (68.9%) respondents and Elderly aged 60 years and above amounting to 25 (23.6%). The majority of respondents worked as self-employed as 34 (32.1%), respondents who worked as laborers as many as 31 (29.2%), respondents who were not working or housewives as many as 25 (23.6%), respondents who were still students as many as 9 (8.5%) and respondents who worked as civil servants as many as 7 (6.6%).

Univariate Analysis

Table 2. Univariate Analysis

Variabel	Frequency (n)	Percentage (%)
Tuberkulosis Paru		
Case	53	50,0
Control	53	50,0
Temperature		
Not Eligible	55	51,9
Eligible	51	48,1
Ventilation		
Not Eligible	59	55,7
Eligible	47	44,4
Occupancy Density		
Not Eligible	61	57,5
Eligible	45	42,5
Lighting		
Not Eligible	56	52,8
Eligible	50	47,2
Humidity		
Not Eligible	63	59,4
Eligible	43	40,6
Smoking Behavior		
Smoking	66	62,3
No Smoking	40	37,7
Use of Burning Mosquito Repellents		
Using	12	11,3
Not Using	94	88,7
Total	**106**	**100,0**

Based on the table above, it shows that the majority of respondents' room temperature does not meet the requirements as much as 55 (51.9%) and the room temperature that meets the requirements is 51 (48.1%). The ventilation of respondents' houses that did not meet the requirements was 59 (55.7%) and that the qualified ones were 47 (44.3%). The occupancy density of respondents who did not meet the requirements was 61 (57.5) and the occupancy density of respondents who met the requirements was 45 (42.5). Lighting of respondents' homes that did not meet the requirements was 56 (52.8%) and that of home lighting that met the requirements was 50 (47.2%). The humidity of the house that did not meet the requirements was 63 (59.4) and the humidity of the respondents' house that met the requirements was 43 (40.6%).

The majority of respondents who smoked were 66 (62.3) and respondents who did not smoke were 40 (37.7). The majority of respondents who used mosquito repellent were 12 (11.3%) and respondents who did not use mosquito repellent were 94 (88.7%).

Bivariate Analysis

Table 3. Bivariate Analysis

Variabel	Incidence of Pulmonary Tuberculosis				Total		P-Value	OR (95%CI)
	Case		Control					
	n	%	n	%	N	%		
Temperature								
Not Fulfilling the Conditions	41	38,7	14	13,2	55	51,9	0,000	9,518 (3,920 – 23,107)
Eligible	12	11,3	39	36,8	51	48,1		
Ventilation								
Not Fulfilling the Conditions	35	33,0	12	11,3	47	44,3	0,000	6,644 (2,816 – 15,676)
Eligible	18	17,0	41	38,7	59	55,7		
Occupancy Density								
Not Fulfilling the Conditions	34	65,6	21	19,8	61	57,5	0,000	4,689 (2,038 – 10,789)
Eligible	19	28,9	32	30,2	45	42,5		
Lighting								
Not Fulfilling the Conditions	34	32,1	16	15,1	50	47,2	0,000	4,138 (1,838 – 9,319)
Eligible	19	17,9	37	34,9	56	52,8		
Humidity								
Not Fulfilling the Conditions	40	37,7	23	21,7	63	59,4	0,001	4,013 (1,752 – 9,191)
Eligible	13	12,3	30	28,3	43	40,6		
Smoking Behavior								
Smoking	49	46,2	17	16,0	66	62,3	0,000	25,941 (8,043 – 83,673)
No Smoking	4	3,8	36	34,0	40	37,7		
Use of Burning Mosquito Repellents								
Using	6	55,7	6	5,7	12	11,3	1,000	0,290 (0,301 – 3,326)
Not Using	47	44,3	47	44,3	94	88,7		
Total	53	50,0	53	50,0	106	100,0		

Based on the table above, a significant value (P-value) of the room temperature variable is 0.000 < 0.05 which means that the room temperature variable is related to the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. Having an Odds Ratio of 9.518 (3.920 – 23.107) means that respondents with unqualified room temperature are 9.518 times greater at risk of suffering from Pulmonary Tuberculosis compared to qualified room temperature.

The significant value (P-value) of the house ventilation variable is 0.000 < 0.05 which means that the house ventilation variable is related to the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. Having an Odds Ratio of 6.644 (2.816 – 15.676) means that respondents with unqualified home ventilation are 6.644 times more likely to suffer from Pulmonary Tuberculosis compared to qualified home ventilation.

The significant value (P-value) of the residential density variable is 0.000 < 0.05 which means that the occupancy variable is related to the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. By having an Odds Ratio value of 4,689 (2,038 – 10,789) which indicates that the density of unqualified dwellings is 4.689 times greater to suffer from Pulmonary Tuberculosis compared to the density of qualified dwellings.

The significant value (P-value) of the room lighting variable is 0.000 < 0.05 which means that the room lighting variable is related to the incidence of Pulmonary Tuberculosis in the Medan Helvetia Health Center Work Area. By having an Odds Ratio value of 4,138 (1,838 – 9,319) which indicates that unqualified room lighting is 4.138 times greater than qualified room lighting compared to qualified room lighting.

The significant value (P-value) of the room humidity variable is 0.001 < 0.05 which means that the room humidity variable is related to the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. By having an Odds Ratio value of 4.013 (1.752 – 9.191) which indicates that the unqualified room humidity is 4.013 times greater to suffer from Pulmonary Tuberculosis compared to the qualified room humidity.

The significant value (P value) of the smoking behavior variable was 0.000 < 0.05 which means that the smoking behavior variable is related to the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. By having an Odds Ratio value of 25,941 (8,043 – 83,673) which shows that respondents who smoke are 25,941 times more likely to suffer from Pulmonary Tuberculosis compared to respondents who do not smoke.

The significant value (P value) of the use of burnt mosquito repellent was 0.000 < 0.05, which means that the variable of the use of burnt mosquito repellent was not related to the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. By having an Odds Ratio value of 0.290 (0.301 – 3,326) which shows that the variable of the use of mosquito repellent is not a risk factor for the incidence of Pulmonary Tuberculosis.

DISCUSSION
The Relationship between Home Physical Quality and the Incidence of Pulmonary Tuberculosis
Temperature

Based on the results of the statistical test carried out, the room temperature variable obtained a significant value (P-value) of 0.000. This value is certainly lower than 0.05 so that the Room Temperature variable has a relationship with the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. Where the number of respondents in the control group with qualified room temperature was more with 39 (36.8%), than the number of unqualified room temperatures as much as 14 (13.2%). However, in the case group, the number of unqualified room temperatures was more by 41 (38.7%), than the number of qualified room temperatures of 12 (11.3%).

These results are in line with research conducted by Mahawati et al., 2023. In his study, room temperature had a significant value (P-value) of 0.004 < 0.05 so that room temperature had a relationship with the incidence of Pulmonary Tuberculosis. The study wrote that inappropriate temperatures will have the potential for conducive bacterial growth and cause health problems such as dehydration (Eni et al., 2023).

Based on the results of observations and findings in the field, the room temperature respondents did not meet the requirements because the ventilation in the respondent's house was small. The respondents' habit also rarely opens the windows of their houses or rooms because most of the majority of respondents work outside the house, so if they open the windows, they can make dust enter the house. The instrument used in this measurement is the thermohygrometer.

Ventilation

Based on the results of the statistical test carried out, the variable of house ventilation was obtained a significant value (P-value) of 0.000. This value is certainly lower than 0.05 so that the variable of home ventilation has a relationship with the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. Where the number of respondents in the control group with qualified home ventilation was more with 41 (38.7%), than 12 (11.3%) unqualified house ventilation. However, in the case group, the number of unqualified home ventilation was more by 35 (33%), than the number of qualified home ventilation as much as 18 (17%).

This result is in line with the research conducted by Nasution et al., 2025, in their research home ventilation has a P-value = 0.001 smaller than 0.05 so that home ventilation has a significant relationship with the incidence of Pulmonary Tuberculosis. In the study, it was explained that unqualified air circulation will cause a large number of microorganism growth. (41)

Based on the results of observations in the field, it shows that the average ventilation in the respondent's house has a small size. The existence of ventilation greatly affects a person to get infections, including Pulmonary Tuberculosis. Ventilation has many functions, one of which is to maintain airflow in the house. Ventilation is as a way of entering sunlight, If the sunlight enters the house is small, the humidity in the house increases.

Occupancy Density

Based on the results of the statistical test carried out, the Occupancy Density variable obtained a significant value (P-value) of 0.000. This value is certainly lower than 0.05 so that the Occupancy Density variable has a relationship with the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. Where the number of respondents in the control group with qualified occupancy was more with 32 (30.2%), than the room temperature that did not meet the requirements as much as 21 (19.8%). However, in the case group, the number of unqualified occupancy was more by 40 (65.6%), than the density of qualified occupancy as much as 13 (28.9%).

This is in line with the research conducted by Sabila et al., 2024, in their research the residential density has a P-value = 0.021 smaller than 0.05 so that the housing density has a relationship with the incidence of Pulmonary Tuberculosis in the UPTD Work Area of the Cigeureung Health Center, Lake Malaya City. The study showed that the density of unqualified dwellings was 2.976 times higher to develop Pulmonary

Tuberculosis compared to the density of eligible dwellings. Unqualified occupancy density will also increase the humidity in the house caused by human sweat and moisture when humans breathe (Az et al., 2025).

Based on the results of field observations, the majority of respondents' houses are quite small in size and are occupied by families with one family of 3-5 people. Occupancy density was obtained based on the measurement of room density measured through direct observation and interviews related to the number of people who slept in the same room with respondents. The tool used in this measurement is a *rollmeter*.

Room Lighting

Based on the results of the statistical test carried out, the variable of Room Lighting obtained a significant value (P-value) of 0.000. This value is certainly lower than 0.05 so that the variable of Room Lighting has a relationship with the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. Where the number of respondents in the control group with qualified room lighting was more with 37 (34.9%), than with unqualified room lighting as much as 16 (15.1%). However, in the case group, the number of unqualified room lighting was more by 34 (32.1%), than the number of qualified room lighting as much as 19 (17.9%).

This study is in line with research conducted by Putra et al., 2023, in their research room lighting has a P value = 0.000 which indicates that the room temperature shows that there is a significant correlation with the incidence of Pulmonary Tuberculosis in the work area of the Kedungkandang Health Center, Malang City (Najiyah, 2022).

The study explained that lighting conditions that are not in accordance with the requirements of a healthy home are due to the lack of exposure to sunlight that enters the house, causing the room in the residence to become dark and humid. Based on the results of field observations, it was shown that respondents with unqualified exposure in the case group were 34 respondents and the control group was 16 respondents. This measurement is carried out from 10.00 a.m. until it is finished. The respondent's house with lighting was not eligible because the ventilation in the respondent's house was small and there were windows that were rarely opened. The tool used in this study is *the Lux Meter*.

Humidity

Based on the results of the statistical test carried out, the variable humidity obtained a significant value (P-value) of 0.001. This value is certainly lower than 0.05 so that the humidity variable has a relationship with the incidence of Pulmonary Tuberculosis in the Medan Helvetia Health Center Working Area. Where the number of respondents in the control group with qualified humidity was more by 30 (28.3%), than by room temperature that was not qualified by 23 (21.7%). However, in the case group, the number of respondents with unqualified humidity was more by 40 (37.7%), than the number of qualified humidity was 13 (12.3%).

This research is in line with research conducted by Revinovita., 2021, in his research a P-value = 0.000 was obtained which shows that there is a relationship between humidity and the incidence of Pulmonary Tuberculosis in the Pamenang Health Center Working Area in 2021. The study explains that humidity is related to pulmonary tuberculosis infection because humidity is the nest where Mycrobacterium Tuberculosis bacteria breed the fastest (Revinovita, 2021).

Based on the results of field findings, the unqualified humidity is caused by the lack of wind vents or ventilation. Unqualified humidity conditions can cause susceptible germs or bacteria to live better indoors with high humidity levels. The instrument used in this measurement is the *thermohygrometer*.

The Relationship of Smoking Behavior with the Incidence of Pulmonary Tuberculosis

Based on the results of the statistical test carried out, the smoking behavior variable obtained a significant value (P-value) of 0.000. This value is lower than 0.05 so that the smoking behavior variable has a relationship with the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. Where the number of respondents in the control group who did not smoke was more with 36 (34%), than respondents who smoked as many as 17 (16%). However, in the case group, the number of respondents who smoked was more with 49 (46.2%), than respondents who did not smoke as much as 4 (3.8%).

The results of this study are in line with the results of research conducted by Kurniawan., 2020, in his research a P-value = 0.001 < 0.05 was obtained, which means that there is a relationship between smoking behavior and the incidence of Pulmonary Tuberculosis at the Plaosan Health Center, Plaosan District, Magetan Regency. This study also explained that smoking behavior has a risk of 19.68 times compared to people who do not smoke. Smoking behavior is difficult to control because the behavior has become a habit or routine (Kurniawan IR, 2023).

The results of field observations showed that respondents with smoking habits in the case group were 49 people and respondents with smoking habits in the control group were 17 people. The results of statistical tests found that smoking habits are a factor in the incidence of Pulmonary Tuberculosis. This could be because in the respondents' homes surveyed there are still people smoking indoors. But cigarettes are not the direct cause of the occurrence of Pulmonary Tuberculosis because smoking can damage the lungs and weaken the

immune system, thus making it easier for TB bacteria to infect the body.

The Relationship between the Use of Burning Mosquito Repellents and the Incidence of Pulmonary Tuberculosis

Based on the results of the statistical test carried out, the variable of the Use of Mosquito Repellent was obtained a significant value (P-value) of 1,000. This value is higher than 0.05 so that the variable of the Use of Burning Mosquito Repellent has no relationship with the incidence of Pulmonary Tuberculosis in the Working Area of the Medan Helvetia Health Center. From the results of table 4.10, it is known that the majority of respondents who do not use burning mosquito repellent are more with 47 (44.3%), compared to respondents who still use burning mosquito repellent as many as 6 (5.7%).

This study is not in line with the research of Lubis et al., 2019 in their research it was obtained that the P-value = 0.044 < 0.005 so that the use of mosquito repellent has a relationship with the incidence of Pulmonary Tuberculosis. The study explained that the majority of respondents still use burnt mosquito repellent because the respondents' houses are around the sea. This causes there are still many mosquitoes in the area (Lubis & Annisa, 2019).

The results of field observations found that the majority of respondents in the work area of the Medan Helvetia Health Center no longer use burning mosquito repellent. According to respondents, burning mosquito repellent is no longer effective because it can interfere with breathing and can also harm the environment, such as mosquitoes. From the interviews conducted, the average respondents only used mosquito repellent spray and mosquito repellent lotion. This is done karenan lebih praktis, lebih efektif dan lebih aman digunakan dalam jangka Panjang.

CONCLUSION

Based on the results of a study on the relationship between the physical quality of the home, smoking behavior, and the use of burnt mosquito repellent with the incidence of Pulmonary Tuberculosis (TB) in the working area of the Medan Helvetia Health Center in 2025, which uses a case control design with case groups (positive TB) and control groups (non-TB), it is concluded that there is a significant relationship between the physical quality of the home and the incidence of Pulmonary TB. The physical quality of the house studied includes five variables, namely room temperature, ventilation, occupancy density, lighting, and humidity. Room temperature was significantly related to the incidence of pulmonary TB (p-value = 0.000; OR = 9,518; CI 95%: 3.920–23.107), which suggests that an unqualified home temperature increases the risk of TB by about 9.5 times. Home ventilation was also significantly related (p-value = 0.000; OR = 6,644; CI 95%: 2.816–15.676), followed by occupancy density (p-value = 0.000; OR = 4,689; 95% CI: 2.038–10.789), lighting (p-value = 0.000; OR = 4.138; 95% CI: 1.838–9.319), and humidity (p-value = 0.001; OR = 4.013; CI 95%: 1,752–9,191). In addition, smoking behavior also showed a very significant association with the incidence of pulmonary TB (p-value = 0.000; OR = 25,941; CI 95%: 8,043–83,673), which means smokers have almost 26 times greater risk of developing TB than non-smokers. However, the variable of mosquito repellent use did not show a significant association with the incidence of pulmonary TB (p-value = 1,000; OR = 0.290; CI 95%: 0.301–3.326). Thus, the factors of physical quality of the home and smoking behavior were shown to play a role in increasing the risk of pulmonary TB, while the use of burnt mosquito repellent was not shown to be related in this study.

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