Analysis Of Environmental Factors With The Incidence Of Pulmonary Tb In The Working Area Of Sawah Lebar Puskesmas Bengkulu City

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ABSTRACT

Indonesia accounted for 1,060,000 cases in 2022. Bengkulu province recorded 54 cases of BTA+ throughout 2021-2023. Zuraidah's research showed that ventilation area, humidity, lighting, and floor type were related to the incidence of pulmonary TB in Nusa Indah Puskesmas Bengkulu City. This study aims to analyze environmental factors on the incidence of pulmonary TB in the working area of Sawah Lebar Health Center. Using descriptive analytic design with observational analytic approach of case control type. The results of univariate analysis showed the number of respondents 56 people, consisting of 28 cases and 28 controls. A total of 35 respondents had qualified occupancy density, 41 respondents had qualified ventilation, 31 respondents had unqualified lighting, temperature variables showed 37 respondents did not qualify, humidity variables had 47 qualified respondents, and floor type variables 55 qualified respondents. Chi-square test showed density of occupancy value p = 0.001 < 0.05 with OR 9.2; room ventilation p = 1.000 > 0.05 with OR 2.037; lighting p = 0.000 < 0.05 with OR 59.8; room temperature p = 0.023 < 0.05 with OR 4.600; humidity p = 1.000 > 0.05 with OR 1.304; and floor type p = 1.000 > 0.05 with or 2,037. Thus, three variables were related to the incidence of pulmonary tuberculosis, namely occupancy density, lighting, and temperature, while ventilation, humidity, and floor type showed no relationship.

Keywords: *Environmental Factors, Pulmonary Tuberculosis*

INTRODUCTION

Pulmonary tuberculosis is an infectious disease caused by bacteria that attack the lungs. Pulmonary tuberculosis is caused by the bacterium Mycobacterium tuberculosis, which spreads when people who are sick with pulmonary tuberculosis expel the bacteria into the air (for example by coughing), pulmonary tuberculosis is a preventable and usually curable disease (WHO, 2021).

Most of the people who develop pulmonary TB disease each year are in the 30 countries with a high pulmonary TB burden, which accounts for 87% of the global total by 2023. Five countries accounted for 56% of the world total: India (26%), Indonesia (10%), China (6.8%), the Philippines (6.8%), and Pakistan (6.3%). In 2023, 55% of patients with pulmonary tuberculosis will be men, 33% women and 12% children and adolescents (WHO, 2024).

Pulmonary TB disease is still a health problem in Indonesia. Therefore, the government's commitment with the community is very strong to achieve the elimination of tuberculosis by 2030. The global commitment to end tuberculosis is outlined in the

End TB Strategy which targets a reduction in deaths from tuberculosis by 90% by 2030 compared to 2015, a reduction in the incidence of tuberculosis by 80% by 2035

Based on data from the Ministry of Health, there are 1,060,000 people with pulmonary tuberculosis, 31,000 people with drug resistance, 134,000 deaths from pulmonary tuberculosis and 86% of treatment success. To reduce this number, the importance of joint commitment in the case of pulmonary tuberculosis in Indonesia. The government's commitment related to pulmonary tuberculosis cases has been stipulated in Presidential Regulation Number 67 of 2021 concerning the Prevention of pulmonary tuberculosis (Kemenkes, 2024).

Bengkulu Provincial Health Office Data in 2020 amounted to 11,035

cases, in 2021 there were 7,188 cases and the death rate of pulmonary TB during treatment was 100 cases and in 2022 there were 12,339 cases. Bengkulu city is a contributor to the number of pulmonary TB cases in Bengkulu province with 475 cases of tuberculosis found . This case increased when compared to 2022 as many as 343 cases, 2021 as many as 352 cases, in 2020 as many as 339 cases, and in 2019 as many as 977 cases. Pulmonary TB cases in Bengkulu city in 2023 are most often found or netted at Padang Serai Health Center as the first order with 59 cases of pulmonary TB, Suka Merindu Health Center with 47 cases of pulmonary TB, Sidomulyo Health Center with 37 cases of pulmonary TB, Muara Bangkahulu Health Center with 35 cases of pulmonary TB, and Sawah Lebar Health Center with 34 cases of pulmonary TB (bengkulu City Health Office, 2023). Pulmonary TB Data Sawah Lebar Puskesmas Bengkulu city recorded 10 cases of BTA+ in 2021, 18 cases of BTA + in 2022, in 2023 there was an increase in pulmonary tuberculosis cases at Sawah Lebar Puskesmas with a total of 26 cases of BTA +.

The results of Zuraidah & Ali (2020), research, show that from (65.4%) of the people in the Nusa Indah Puskesmas working area have unqualified lighting. Of the 85 people who have lighting does not meet the requirements, 49 people (76.6%) who suffer from pulmonary TB with a value of p =0.008 this shows Ha accepted which means there is a relationship between lighting and the incidence of pulmonary TB smear positive in the Working Area of Puskesmas Nusa Indah Bengkuu City. In addition, based on an odds ratio of 2.722, a person who lives in a house with unqualified lighting has a 2.722 times greater risk of suffering from tuberculosis than a person who lives in a house with qualified humidity.

Based on the description above, the author is interested in conducting research on the analysis of environmental factors with the incidence of pulmonary tuberculosis in the Working Area of Sawah Lebar Health Center in Bengkulu City. With the formulation of the problem is whether there is a relationship between the density of occupancy, ventilation, lighting, temperature, humidity and type of floor to the incidence of pulmonary TB in the working area of Puskesmas Sawah Lebar Bengkulu City.

This study aims to determine the influence of environmental factors with the incidence of pulmonary tuberculosis in the working area of Puskesmas Sawah Lebar. This

study is important because environmental factors affect the incidence of pulmonary tuberculosis.

The results of the study are expected to provide knowledge about the relationship of environmental factors with the presence of pulmonary tuberculosis in the Working Area of Sawah Lebar Health Center in Bengkulu City.and can serve as a guiding material for further research on the influence of the environment with pulmonary tuberculosis.

METHODS

The research design used in this study is descriptive analytic. This type of research is observational analytic by using Case control Research Design.This study aims to determine the relationship of Home environmental factors with the incidence of pulmonary tuberculosis in the Working Area of Puskesmas Sawah Lebar Bengkulu City.

The population in the study is a subject that has met the quality criteria that have been set by the researcher the population in this study is pulmonary TB patients in 2024 at Sawah Lebar Health Center . The population in this study was 40 people. The sample in this study amounted to 28 respondents for case and 28 respondents for Control. The time of the study begins in March 2025. This study was conducted in the Working Area of Sawah Lebar Health Center in Bengkulu City.

Variables in this study are the incidence of pulmonary TB disease in the Working Area of Sawah Lebar Health Center in Bengkulu City as a dependent variable and occupancy density, ventilation, lighting, temperature, humidity, and floor type as an independent variable

Data retrieval techniques are primary data obtained through an approach to the parties concerned to obtain approval as a respondent. Data obtained directly from respondents through interviews using questionnaires to determine environmental factors that can cause pulmonary tuberculosis in the working area of Sawah Lebar Health Center. Secondary Data obtained from Data Profile Bengkulu City Health Office and data Puskesmas Sawah Lebar to determine the number of cases of pulmonary Tb in the Working Area of Puskesmas Sawah Lebar.

Variable incidence of pulmonary TB was obtained using the register at the health center by looking at patients who have been examined and diagnosed with pulmonary Tb by doctors at the Sawah Lebar Health Center with results 1. He Had Pulmonary Tuberculosis, 2. Not pulmonary tuberculosis,

The variable density of occupancy is measured using a roll meter by calculating the area of the room to see the comparison between the area of the bedroom with the number of residents in one room with the measurement results 1. Not eligible, if occupancy density < 9m2 / person^2.Eligible, if the occupancy density is ≥ 9m^2 /person

Variable ventilation is measured using a roll meter by measuring the area of the window and vent where the entry and exit of air from the outside into the room with the measurement results 1. Not eligible, if ventilation area < 10% of 2nd Floor Area. Qualified, if the ventilation area is ≥ 10% of the floor area

Lighting variables measured using a Lux meter by looking at the value of the lux meter at the time of measurement to see the amount of light intensity coming from sunlight that enters the room and get the measurement results, namely 1. Not qualified, if the illumination level < 60 lux and 2. Qualified, if the illumination level is ≥ 60 lux

Temperature Variable is measured using a Hygrometer by looking at the room temperature measured during the study and the measurement results are 1. Unqualified, if the temperature < 18 °C and >30 °C and 2 are qualified, if it is ≥ 18 °C and ≤ 30 °

Humidity Variable is measured using a Hygrometer by looking at the humidity of the room measured at the time of the study and the measurement results are 1.Unqualified, if the moisture level < 40% and >70% and 2.If it is 40% and 70%%

Variable type of floor measured by looking at the type of room floor respondents with waterproof conditions in the form of ceramics, tiles.The condition of the floor type is not waterproof in the form of soil and the measurement results are 1. Not eligible, if the type of floor in the form of soil, bamboo, wood planks and 2. Qualified, the type of floor in the form of ceramics, tiles (Permenkes Nomor 2, 2023).

After that the data in the analysis to see the results of analysis and univariate and bivariate analasisis

RESULTS AND DISCUSSIONS

Results Of Univariate Analysis

Table 1

Frequency Distribution of Respondents Based on Characteristics (Gender, Age, Education, and Occupation) in the Working Area of the Sawah Lebar Community Health Center

NO	Variabel	F	(%)
1	**Gender**		
	Male	33	58,9 %
	Vemale	23	41,1 %
	Total	**56**	**100 %**
2	**Age**		
	1-20	5	8,9 %
	21-40	24	42,9 %
	41-60	14	25 %
	61-80	13	23,2 %
	Total	**56**	**100 %**
3	**Education Level**		
	No school	2	3,6 %
	SD	9	16,1 %
	SMP	8	14,3 %
	SMA	29	51,8 %
	College	8	14,3 %

NO	Variabel	F	(%)
	Total	**56**	**100 %**
4	**Work**		
	Not working	9	16,1 %
	Hou se wife	6	10,7 %
	Day labore r	17	30,4 %
	E ntre pre ne u r	6	10,7 %
	Re tire d	3	5,4 %
	PNS	15	26,8 %
	Total	**56**	**100 %**

Base d on the table of re sponde nt characte ristics in the working are a of the Sawah Le bar Commu nity He alth Ce nte r, the re is a fairly dive rse distribu tion. Of the total 56 re sponde nts, the majority we re male , name ly 33 pe ople (58.9%), while fe male re sponde nts nu mbe re d 23 pe ople (41.1%). This proportion shows that male re sponde nt participation was more dominant in this stu dy. The age distribu tion of re sponde nts shows that the 21–40 age grou p is the large st, with 24 pe ople (42.9%). The 41–60 age grou p had 14 re sponde nts (25%), while the 61–80 age grou p had 13 re sponde nts (23.2%). Me anwhile , the 1–20 age grou p had the fe we st re sponde nts, name ly 5 pe ople (8.9%). This distribu tion illu strate s that the majority of re sponde nts we re of produ ctive age . The e du cational characte ristics of the re sponde nts also showe d variations in e du cational le ve ls. High school gradu ate s we re the large st grou p with 29 re sponde nts (51.8%). Ne xt, the re we re 9 e le me ntary school gradu ate s (16.1%), while ju nior high school and colle ge gradu ate s e ach nu mbe re d 8 re sponde nts (14.3%). The re we re 2 re sponde nts (3.6%) who had ne ve r atte nde d formal e du cation. This finding shows that most re sponde nts had a high school e du cation. Base d on occu pation, the large st grou p was daily labore rs, with 17 re sponde nts (30.4%). Ne xt, the re we re 15 re sponde nts (26.8%) who worke d as civil se rvants (PNS). The re we re 9 re sponde nts (16.1%) who we re u ne mploye d. Me anwhile , the re we re 6 re sponde nts (10.7%) who we re hou se wive s (IRT) and 6 re sponde nts (10.7%) who we re e ntre pre ne u rs.

Table 2
Variable Frequency Distribution

No	Variable	F	%
1	Pu lmonary TB		
	Case	28	50 %
	Comtrol	28	50 %
	Total	**56**	**100 %**

2	Occupancy Density		
	Not Eligible	21	37,5 %
	Qualify	35	62,5 %
	Total	**56**	**100 %**
3	Ventilation		
	Not Eligible	1	1,8 %
	Qualify	55	98,2 %
	Total	**56**	**100 %**
4	Lighting		
	Not Eligible	31	55,4 %
	Qualify	25	44,6 %
	Total	**56**	**100 %**
5	Temperature		
	Not Eligible	37	66,1 %
	Qualify	19	33,9 %
	Total	**56**	**100 %**
6	Humidity		
	Not Eligible	47	83,9 %
	Qualify	9	16,1 %
	Total	**56**	**100 %**
7	Floor Type		
	Not Eligible	1	1,8 %
	Qualify	55	98,2 %
	Total	**56**	**100 %**

Based on the table, the room occupancy density variable shows that 21 respondents (37.5%) were in the non-compliant category, while 35 respondents (62.5%) were compliant with the Ministry of Health regulation of ≥ 9m2 /person. For the room ventilation variable, most respondents' room ventilation met the requirements, with 55 respondents (98.2%) meeting the criteria, and only 1 respondent (1.8%) failing to meet the requirements. Regarding the room lighting variable, it was found that 31 respondents (55.4%) did not meet the requirements, while 41 respondents (73.2%) had room lighting that met the requirements. The room temperature variable of the respondents also showed suboptimal environmental conditions, with 37 respondents (66.1%) in the non-compliant temperature category and only 19 respondents (33.9%) meeting the requirements. In terms of room humidity, most respondents' rooms had unsatisfactory humidity, namely 47 respondents (83.9%), while only 9 respondents (16.1%) had satisfactory humidity. Regarding the room floor type variable, the majority of respondents met the requirements, namely 55 houses (98.2%), while only 1 respondent (1.8%) did not meet the requirements.

Results Of Univariate Analysis

Table 3
Relationship of House occupancy density with pulmonary TB incidence in Sawah Lebar Health Center working area

Occupancy Density	Pulmonary Tb				Total	P-Value	Or
	Case	%	Control	%	F		
Not Eligible	17	30,4	4	7,1	21	0,001	9,273
Qualify	11	19,6	24	42,9	35		
Total	**28**	**50**	**28**	**50**	**56**		

Based on the research results table, it shows that out of 28 (50%) respondents in the case group (pulmonary tuberculosis), there were 17 (30.4%) respondents with a housing density of less than 9m^2 and 11 (19.6%) respondents with a housing density of more than 9m^2. Meanwhile, out of 28 (50%) respondents in the control group (non-tuberculosis), there were 4 (7.1%) respondents with a housing density of less than 9m^2 and 24 (42.9%) respondents with a housing density of more than 9m^2.

The Chi-square test yielded a p-value of 0.001 < 0.05. Therefore, Ho was rejected and Ha was accepted. This indicates that there is a significant relationship between housing density and the incidence of pulmonary TB in the working area of the Sawah Lebar Community Health Center, with an OR value of 9.2, which means that respondents with a housing density of less than 9m^2 are 9.2 times more likely to suffer from pulmonary TB than respondents with a housing density of more than 9m^2.

Table 4
Relationship of Ventilation with pulmonary TB incidence in Sawah Lebar Health Center working area

Ventilation	Pulmonary Tb				Total	P-Value	Or
	Case	%	Control	%	F		
Not Eligible	1	1,8	0	0	1	1,000	2,037
Qualify	27	48,2	28	50	55		
Total	**28**	**50**	**28**	**50**	**56**		

The table shows that the results of this study from 28 respondents in the case group (pulmonary tuberculosis) found 1 respondent with ventilation less than 10% of the floor area and 27 respondents with ventilation more than 10%. Meanwhile, from 28 respondents in the control group (no pulmonary tuberculosis), all respondents had ventilation more than 10% of the floor area.

The results of the Chi-square test yielded a P value of 1.000 > 0.05, so Ha was rejected and Ho was accepted. This indicates that there is no significant relationship between home ventilation and the incidence of pulmonary tuberculosis in the working area of the Sawah Lebar Community Health Center, with an OR value of 2.037.

Table 5
Relationship of Lighting with pulmonary TB incidence in Sawah Lebar Health Center working area

Lighting	Pulmonary Tb				Total	P-Value	Or
	Case	%	Control	%	F		
Not Eligible	26	46,4	5	8,9	31	0,000	59,800
Qualify	2	3,6	23	41,1	25		
Total	**28**	**50**	**28**	**50**	**56**		

The results of the study show that of the 28 respondents in the case group (pulmonary tuberculosis), 26 respondents had lighting less than 60 lux and 5 respondents had lighting more than 60 lux. Meanwhile, out of 28 respondents in the control group (non-tuberculosis), there were 2 respondents with lighting less than 60 lux and 23 respondents with lighting more than 60 lux.

The Chi-square test resulted in a p-value of 0.000 < 0.05. Therefore, Ho was rejected and Ha was accepted. This indicates that there is a significant relationship between lighting and the incidence of pulmonary TB in the working area of the Sawah Lebar Community Health Center, with an OR value of 59.8, meaning that respondents with lighting less than 60 lux are 59.8 times more likely to suffer from pulmonary TB than respondents with lighting more than 60 lux.

Table 6 Relationship of Temperature with pulmonary TB incidence in Sawah Lebar Health Center working area

Temperature	Pulmonary Tb				Total	P-Value	Or
	Case	%	Control	%	F		
Not Eligible	23	41,1	14	25,0	37	0,023	4,600
Qualify	5	8,9	14	25,0	19		
Total	**28**	**50**	**28**	**50**	**56**		

The results showed that of the 28 (50%) respondents in the case group (pulmonary tuberculosis), 23 (41.1%) had temperatures <18^0 C and > 30^0 C, and 5 (8.9%) had temperatures that met the criteria of ≥ 18 °C and ≤ 30 °C. Meanwhile, of the 28 (50%) respondents in the control group (non-tuberculosis), 14 (25.0%) had temperatures <18^0

C and > 30^0 C, and 14 (25.0%) had temperatures that met the criteria of ≥ 18 °C and ≤ 30 °C.

The Chi-square test yielded a p-value of 0.023 < 0.05, so Ho was rejected and Ha was accepted. This indicates that there is a significant relationship between home temperature and the incidence of pulmonary TB in the working area of the Sawah Lebar Community Health Center, with an OR value of 4.600, which means that respondents whose home temperature did not meet the requirements of <18^0 C and > 30^0 C were 4.600 times more likely to suffer from pulmonary TB than respondents whose home temperature met the requirements of ≥ 18 °C and ≤ 30 °C

Table 7
Relationship of humidity with pulmonary TB incidence in Sawah Lebar Health Center working area

Humidity	Pulmonary Tb				Total	P-Value	Or
	Case	%	Control	%	F		
Not Eligible	24	42,9	23	41,1	47	1,000	1,304
Qualify	4	7,1	5	8,9	9		
Total	**28**	**50**	**28**	**50**	**56**		

The results of the study show that of the 28 (50%) respondents in the case group (pulmonary tuberculosis), 24 (42.9%) respondents had humidity levels < 40% and > 60%, and 5 (7.1%) respondents had humidity levels that met the requirements of ≥ 40% and ≤ 60%. Meanwhile, of the 28 (50%) respondents in the control group (non-tuberculosis), there were 23 (41.1%) respondents with humidity < 40% and > 60 and 5 (8.9%) respondents with humidity meeting the requirements ≥ 40% and ≤ 60%.

The Chi-square test yielded a p-value of 1.000 > 0.05, so Ha was rejected and Ho was accepted. This indicates that there is no significant association between home humidity and the incidence of pulmonary TB in the Sawah Lebar Community Health Center working area, with an OR value of 1.304, meaning that respondents with home humidity below the required range of < 40% and > 60% are 1.304 times more likely to suffer from pulmonary TB than respondents with room humidity ≥ 40% and ≤ 60%.

Table 8
Relationship of floor type with pulmonary TB incidence in Sawah Lebar Health Center working area

Floor type	Pulmonary Tb				Total	P-Value	Or
	Case	%	Control	%	F		
Not Eligible	1	1,8	0	0	1	1,000	2,037
Qualify	27	48,2	28	50	55		
Total	**28**	**50**	**28**	**50**	**56**		

The results showed that of the 28 (50%) respondents in the case group (pulmonary tuberculosis), 1 (1.8%) respondent had a dirt floor and 27 (48.2%) respondents had tile floors. Meanwhile, of the 28 (50%) respondents in the control group (non-tuberculosis), all respondents had tile flooring.

The Chi-square test yielded a p-value of 1.000 > 0.05, so Ha was rejected and Ho was accepted. This indicates that there is no significant relationship between the type of flooring in the home and the incidence of pulmonary TB in the working area of the Sawah Lebar Community Health Center, with an OR value of 2.037.

DISCUSSIONS

Relationship of House occupancy density with pulmonary TB incidence in Sawah Lebar Health Center working area

Chi-square test results obtained the value of p = 0.001 < 0.05. Ho was rejected and Ha was accepted. This shows that there is a significant relationship between the density of home occupancy with the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with an OR value of 9.2 which means that respondents who have a housing density of less than 9m^2 are at risk of 9.2 times greater suffering from pulmonary TB than respondents who have a residential density of more than (9m)^2.

Basic human activities determine how much space each individual needs. especially 9 m2, and a maximum of two people are allowed in one room, based on the regulation of the Minister of health of the Republic of Indonesia Number 2 of 2023 concerning the implementation of Government Regulation Number 66 of 2014 concerning Environmental Health. The ratio of the number of family members in a bedroom to its floor area is known as occupancy density. Inadequate occupancy density can result in overcrowding. The air in the room will be polluted faster if the density is higher. The growth and reproduction of bacteria can increase due to increased CO2 levels in the atmosphere. In addition, the density of occupancy increases the likelihood of more frequent interactions between family members and people with pulmonary tuberculosis, which accelerates the spread of the disease (Kemenkes, 2024)

The findings of this study are consistent with the study (Konde et al., 2020) the results of bivariate analysis using statistical tests showed that occupancy density was a risk

factor for pulmonary TB, with an Odds Ratio (RO) value of 4,500 and the hypothesis was rejected because the p value was below 0.05. This suggests a correlation between the incidence of pulmonary tuberculosis and occupancy density. (Gulo, 2021) also conducted the same study. P value of 0.008 < 0.05 obtained through statistical tests Chi Square. This shows that the prevalence of pulmonary TB in the Working Area of the Padang Bulan Health Center in Medan City correlates with the density of occupancy.

The results of Chi Square analysis showed that the value of p is 0.001 (p < 0.05) which means Ha is accepted and H0 is rejected. These results prove the existence of a significant relationship between the density of occupancy with the incidence of tuberculosis in the community in the village Sorimanaon, District Angkola Muaratais, South Tapanuli (Siregar et al., 2022)

According to the study findings, pulmonary tuberculosis respondents were more common among those living in dwellings with a density of less than 9 meters (below the recommended threshold) compared to those living in dwellings with a density of 9 meters. The density of the inhabitants of the House will have an impact on the residents. It is quite risky to have a house that is too large for the number of people living there because it can cause overcrowding. and the lack of oxygen consumption in the room. In addition, if one family member has an infectious condition, the disease can quickly pass to other family members.

The relationship of home ventilation with the incidence of pulmonary tuberculosis in the Working Area of Sawah Lebar Health Center

Chi-square test results obtained the value of P = 1.000 > 0.05 then ha rejected Ho accepted. This shows that there is no significant relationship between home ventilation with the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with an OR value of 2.0377 which means that respondents who have ventilated homes less than 10% of floor area are at risk of 2,037 times greater suffering from pulmonary TB than respondents who have ventilation area more than 10% of floor area.

When people with pulmonary tuberculosis cough, sneeze, or talk, microscopic droplets or droplet nuclei (less than 5 microns) will be released into the air, which is often a way of transmitting tuberculosis from person to person. Aerosol-producing operations, including sputum induction, bronchoscopy, and laboratory tissue processing or manipulation of lesions, can also produce droplets. Resistant Bias in angina for up to four hours and is highly contagious (KemenkesRI, 2020)

The findings Langkai et al (2020) chisquare test results obtained p = 0.089 (> 0.005). From these results, it can be interpreted that there is no relationship between ventilation and the incidence of pulmonary tuberculosis. The relationship of ventilation with the incidence of pulmonary tuberculosis. From the results of statistical tests obtained the value of p = 0.089 (> 0.005). With these results, it can be concluded that there is no relationship between ventilation and the incidence of pulmonary tuberculosis. Although

in this study there is no relationship between ventilation and the incidence of pulmonary TB, everyone should pay attention to the ventilation area of existing homes, especially homes that have pulmonary TB patients so that the transmission process can be prevented. For homes that do not have pulmonary TB patients, the ventilation area must be considered because it also affects everyone. Good ventilation can provide natural lighting, facilitate the entry of UV rays (Ultra Violet) into the house so as to kill bacteria pategon both TB bacteria and other bacteria and can help the process of changing the air in the house, so that the air is not good in the house can be replaced with good air

This finding is in contrast to Monintja et al (2020), the results of The Chi-square test obtained a value of p= 0.001(p < 0.05) which means that there is a relationship between ventilation area and pulmonary TB in the working area of bailaing health center, with an OR value of 3.354 times, which means that respondents who have ventilation area less than 10% of floor area are at risk of 3.354 times greater suffering from pulmonary TB than respondents who have ventilation area more than 10% of floor area.

Based on the results of observations by taking measurements, it was concluded that perspons has an airway according to its requirements so that it can reduce the growth of Mycobacterium tuberculosis. Even if the respondent's place of residence is adequately ventilated, this can still be affected. there is a relationship to the incidence of pulmonary TB but respondents do not always open the house ventilation every day. When interviewing respondents, most did not have the habit of opening windows. The room becomes gloomy as a result of this circumstance due to the fact that the air dilution procedure was not carried out correctly. is a bacterial growth medium.

Health problems can arise as a result of the proliferation of germs due to inadequate air exchange. Lack of ventilation (according to health criteria, insufficient number and size of vents). Controlling air exchange can help health initiatives. For example, the House should be ventilated, at least 10% of the floor area should be used for ventilation, and windows should be opened often, at least once in the morning, for air exchange.

The relationship of Home Lighting with the incidence of pulmonary tuberculosis in the Working Area of Sawah Lebar Health Center

Chi-square test results obtained the value of p = 0.000 < 0.05. Ho was rejected and Ha was accepted. This shows that there is a significant relationship between lighting with the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with an OR value of 59.8, meaning that respondents who have lighting less than 60 lux are 59.8 times more likely to suffer from pulmonary TB than respondents who have lighting more than 60 lux.

Pulmonary TB usually spreads in dimly lit spaces with little ventilation, allowing microscopic droplets to float in the atmosphere. Longer duration. Tuberculosis bacilli can quickly die in direct sunlight, but will live longer in dark places KemenkesRI (2020), Meanwhile, lighting can help kill Mycobacterium pulmonary TB because this bacterium grows best in environments with lighting less than 60 lux. Because it can eradicate harmful

microorganisms such as pulmonary TB Bacillus at home, solar lighting is very important. Because Mycobacterium tuberculosis can be killed by UV light in the light of the world that is deposited in the room of the house direct natural lighting can help prevent the spread of pulmonary tuberculosis. Bacteria can be killed by sunlight of at least 60 lux, as long as it is not too bright.

In line with the findings by Rahmawati et al (2021), a p-value of 0.000 (<0.05) indicates a relationship between lighting and the incidence of pulmonary tuberculosis in the working area of the Pekalongan Health Center, based on a bivariate analysis using the Chi-square test to ascertain the relationship between lighting factors and the incidence of the disease. Similar studies have been conducted by (Septidwina et al., 2022) lighting and incidence of pulmonary TB in Betung Health Center, East OKU Regency, have a relationship in 2022, based on statistical tests with a P value of 0.004.

Findings in the field it is known that inadequate lighting in the bedroom in the working area of Sawah Lebar Health Center was caused by several things. It is impossible for sunlight to penetrate as a natural light source. because residents rarely open curtains or window coverings. As a result, the room becomes dark and damp. In addition, the improper layout of the bedroom also affects the level of lighting. The less strategic position of the rooms makes the sun's rays blocked, coupled with the condition of the houses in the region that are close to each other. Buildings around the rooms often block the entry of daylight. To overcome this problem and reduce the risk of transmission of tuberculosis, there are some good habits that should be implemented by residents of the House routinely drying mattresses and pillows every day. Sunlight effectively kills tuberculosis germs that may stick to mattresses and pillows. Make it a habit to always open the windows during the day. This allows maximum sunlight to enter and at the same time helps air circulation in the room.

The relationship of Home temperature with the incidence of pulmonary tuberculosis in the Working Area of Sawah Lebar Health Center

Chi-square test results obtained the value of p = 0.023 < 0.05, then Ho rejected ha accepted. This shows that there is a significant relationship between home temperature and the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with an OR value of 4.60, which means that respondents who have a home temperature that does not meet the requirements <18^0 C and > 30^0 C are at risk of 4.60 times greater suffering from pulmonary TB than respondents who have a home temperature of respondents with a temperature that meets the requirements of ≥ 18 °C and ≤ 30 °C.

The key factor in the development of Mycobacterium TB bacteria is temperature. In a house that does not allow Mycobacterium tuberculosis bacteria to grow, room temperature. pathogens will use temperature as a growth medium if it meets the necessary requirements, which allows them to live for a long period of time in the Home Air. This condition allows family members to inhale germs, which can lead to the spread of tuberculosis. In addition to being important for blood pressure, oxygen consumption and

metabolism, temperature also affects the growth and development of TB bacteria. When the home temperature is below what is considered healthy, the body loses more heat and tries to adjust through evaporation to the outside temperature. The body will become less vital and more susceptible to disease, especially respiratory infections, due to this loss of body heat (Salsa Sabila et al., 2024).

The findings of this study are the same as Maulinda et a (2021), the results of a study of 114 respondents showed that most of the respondent's houses met the room temperature requirements (18 ± 300C), namely 78 respondents (68.4%) consisting of 31 (27.2%) case Group respondents and 47 respondents (41.2%) from the control group. Chisquare test shows the value of p-value = 0.001 which means.

Bivariate test results obtained a p value of 0.032, meaning that home temperature has a relationship with the occurrence of pulmonary tuberculosis in farmers. The OR value is 3.889, which means that unqualified home temperature conditions increase the chances of experiencing pulmonary tuberculosis 3.889 times compared to qualified home temperatures (Adha & Kinanthi, 2024).

Based on the findings in the field, it is known that many homes with tuberculosis patients have room temperatures that tend to be high. This condition is one of them caused by the roof structure of the house that is made too low, thus inhibiting the process of releasing hot air to the outside. In addition, the habit of residents who rarely or do not apply the habit of opening windows also causes the air in the house to become trapped and no air exchange with outside air. This accumulation of hot air and the lack of natural ventilation create a stuffy, humid and less healthy environment. A home environment with these conditions not only decreases the comfort of living, but also has the potential to worsen the health condition of TB sufferers and increase the risk of transmitting the disease to other family members.

The relationship of household humidity with the incidence of pulmonary TB in the Working Area of Sawah Lebar Health Center

Chi-square test results obtained the value of p = 1.000 > 0.05, then ha rejected Ho accepted. This shows that there is no significant relationship between the humidity of the house with the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with an OR value of 1,304 which means that respondents who have home humidity does not meet the requirements < 40% and > 60% are at risk of 1,304 times greater suffering from pulmonary TB than respondents who have a house humidity of 40% and 60 %.

Results Siagian et al (2021), the incidence of pulmonary tuberculosis was also not related to house humidity (p=0.150). With an odds ratio of 3.25, it can be said that respondents who have moisture does not meet the requirements 3 times more at risk to experience the incidence of tuberculosis compared with respondents who have moisture that meets the requirements. The absence of moisture relationship with the incidence of pulmonary TB is due to the high rate of humidity experienced by the control group,

namely 12 houses out of 29 houses that do not meet the requirements. From the results of the study also obtained the fact that respondents do not understand that the humidity of a room can support the development of microorganisms or tubercu losis bacteria so that respondents do not care about the humidity of the room. Therefore, it is necessary to increase public awareness in order to maintain the physical condition of the House remains in good condition.

The results of the study Zuraidah & Ali (2020), showed that of the (70.0%) people in the Working Area of the Nusa Indah Health Center in Bengkulu City had unqualified home humidity, of the 91 people who had unqualified home humidity, 58 people (90.6%) who suffered from pulmonary TB with a P value =0.000 this shows that Ha is accepted which means that there is a relationship between home humidity and the incidence of pulmonary TB in the Working Area of the Nusa Indah Health Center in Bengkulu City. In addition, based on an odds ratio of 9.667, a person who lives in a house with unqualified humidity has a 9.667 times greater risk of developing tubercu losis than a person who lives in a house with qualified humidity.

Based on the findings in the field, it is known that the average humidity level at the research site reached 70%. This high humidity is influenced by the characteristics of a tropical climate that is identical to high rainfall and relatively warm air temperatures throughout the year. In addition, the geographical location of Bengkulu city which is in the coastal area also strengthens the condition, because this area gets a direct influence from the sea breeze that carries water vapor. The combination of tropical climate and coastal winds causes the air in the settlement environment to become humid, thus creating conditions that potentially support the development of microorganisms, including bacteria that cause tubercu losis.

Relationship of House floor type with incidence of pulmonary TB in Sawah Lebar Puskesmas working area

Chi-square test results obtained the value of p = 1.000 > 0.05, then ha rejected Ho accepted. This shows that there is no significant relationship between the type of House floor with the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with an OR value of 2,037.

Based on statistical analysis Gultom et al (2024) obtained a p-value of 0.601, which indicates that there is no significant relationship between the type of House floor and the incidence of pulmonary tubercu losis. The majority of respondents have a waterproof type of floor, such as ceramic tile.

A good floor is one that is made of a waterproof material. If the floor is moist, it will be a good breeding ground for TB bacteria. The type of floor referred to in this study is the dominant floor construction of the house is made of materials that are waterproof and easy to clean .Although the results had no relationship, the type of floor that did not qualify was a good place to live for germs such as TB bacteria. Therefore, you should pay attention to the condition of the floor and if it is easily damp, you can keep the floor clean

every day and use better air ventilation to reduce humidity in the House (Langkai et al., 2020).

Studies from Susilawaty et al (2024) found that having an unsuitable floor type was identified as a risk factor for pulmonary TB, with an odds (OR) ratio of 1.14 and a 95 percent confidence interval of 0.41-3.16. This means that the likelihood of developing pulmonary tuberculosis is 1.14 times higher for individuals with an unsuitable floor type compared to with those who have the appropriate type of flooring.

Based on the results of measurements in the field, it is known that the average type of House floor in the working area of Sawah Lebar Health Center is dominated by ceramic, cement, or tile floors, which are as many as 55 houses. Meanwhile, only one house still uses earthen floors. Floors of houses that do not meet health requirements, such as dirt floors or floors that are not waterproof, have the potential to become a place to live and breed germs and disease vectors. Improper floor conditions can also cause indoor air humidity to increase, thus creating a less healthy environment and favoring the growth of microorganisms. In addition, in summer, such floors tend to become very dry and Dusty, which can affect indoor air quality and have an impact on the health of residents.

CONCLUSIONS

1. There is a significant relationship between the density of residential homes with the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with Chi-square test results obtained p value = 0.001 < 0.05 or value of 9.2.
2. There was no significant relationship between home ventilation with the incidence of pulmonary tuberculosis in the working area of Sawah Lebar Health Center, with Chi-square test results obtained p value = 1.000 > 0.05 or value of 2.037.
3. There is a significant relationship between lighting and the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with Chi-square test results obtained p value = 0.000 < 0.05 or value of 59.8.
4. There is a significant relationship between temperature and the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with Chi-square test results obtained p value = 0.023 < 0.05 or value of 4.60.
5. There is no significant relationship between humidity with the incidence of pulmonary tuberculosis in the working area of Sawah Lebar Health Center, with Chi-square test results obtained P = 1,000 > 0.05 or value of 1.304.
6. There was no significant relationship between the type of floor with the incidence of pulmonary TB in the working area of Sawah Lebar Health Center, with Chi-square test results obtained p value = 1,000 > 0.05 or value of 2.037.

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