

Risk Factors For The Incidence Of Pulmonary Tuberculosis At Elly Uyo Health Center

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ABSTRACT

Tuberculosis is one of the top 10 causes of death in the world and the leading cause of death from a single infectious agent. The purpose of this study was to determine the risk factors for pulmonary tuberculosis in Elly Uyo Health Center in Jayapura City. This type of research is observational analytic with a *case control approach*. The case group was pulmonary tuberculosis patients and the control group was BTA negative patients at Elly Uyo Health Center. The sampling technique in the case group is saturated sampling and the control group is *Purposive sampling*. The number of samples was 60 samples with a ratio of 1: 3 consisting of 15 cases and 45 controls. The measuring instruments used were questionnaires, humidity measurements, lighting and ventilation then the data were analyzed univariately and bivariate. The results of the *chi-square* test showed a significant risk between occupancy densities ($p\text{-value} = 0.000$; $OR=11,000$; $95\% CI=2.830-42.756$), humidity ($p\text{-value}=0.001$; $OR=8.857$; $95\% CI=2.154-36.418$), lighting ($p\text{-value}=0.012$; $OR=5.688$; $95\% CI=1,505-21,495$) with the incidence of pulmonary tuberculosis. While there was an insignificant risk between contact history ($p\text{-value} = 0.153$; $OR=2,714$; $95\% CI=0.709-10.392$), smoking habit ($p\text{-value}=0.274$; $OR=1.938$; $95\% CI=0.587-6.399$), ventilation area ($p\text{-value}=0.527$; $OR=1.476$; $95\% CI=0.440-4.953$) with the incidence of pulmonary tuberculosis at Elly Uyo Health Center in Jayapura City. It can be concluded that occupancy density, humidity and ventilation area are risk factors for pulmonary TB at the Elly Uyo Health Center in Jayapura City.

Keywords : Tuberculosis, Risk Factors, Elly Uyo Health Center

INTRODUCTION

Tuberculosis (TB) is an infectious disease that is a major cause of health problems, one of the top 10 causes of death in the world and the leading cause of death from a single infectious agent. TB is caused by the *Mycobacterium tuberculosis* bacillus, which spreads when a person sick with TB expels the bacteria into the air, for example through coughing. When a person coughs, sneezes or talks in the presence of others, the tuberculosis bacilli are expelled and sucked into the lungs of healthy people. The incubation period is 3-6 months. The risk of infection is related to the length and quality of exposure to the source of infection and is not related to genetic and other host factors. The highest risk of developing the disease is in children under 3 years old, low risk in childhood, and increases again in adolescence, young adulthood, and old age. The bacteria enter the human body through the respiratory tract and can spread to other parts of the body through the bloodstream, lymph vessels, or directly to nearby organs. The disease usually affects the lungs (pulmonary TB) but can also affect other sites (extrapulmonary TB) (1).

Tuberculosis is a major health problem in the world. Based on World Health Organization (WHO) data, 1.5 million people died from tuberculosis and an estimated 10 million people experienced tuberculosis worldwide, including 5.7 million men, 3.2 million women and 1.1 million children. The estimated incidence of tuberculosis in 2016 was 45% in Southeast Asia, including Indonesia. This is a challenge in overcoming tuberculosis (2). TB cases in 2018 were highest in Southeast Asia (44%), Africa (24%) and the Western Pacific (18%), with smaller percentages in the Eastern Mediterranean (8%), Americas (3%) and Europe (3%). Indonesia

is in the list of 30 countries with the highest burden of tuberculosis in the world. The number of BTA-positive pulmonary tuberculosis cases in Indonesia amounted to 168,412 cases, including 101,802 cases in men and 66,610 cases in women (3).

Tuberculosis is still a health problem in Papua. In 2017 the number of tuberculosis cases in Papua reached 7,354 cases with the number of BTA positive TB cases totaling 2,611 cases and in 2018 the number of tuberculosis cases in Papua reached 10,813 cases with the number of BTA positive cases totaling 3,932 cases (4). In 2019, TB cases in Papua reached 11,813 or 49.39% with CDR of 80.5% and CNR of 349.57/100,000 population. Based on TB report data from 14 Puskesmas in Jayapura city, Papua, the highest suspected cases were at Kotaraja Health Center 806 cases with 124 cases, second place was Elly Uyo Health Center 625 with 83 cases, third place was Twano Health Center 613 with 89 cases, while Abepura Health Center ranks sixth with 471 suspected cases and 135 cases, CNR at Abepura Health Center 249/100,000 population and CDR 26.57% (5).

The epidemiologic triangle is a basic concept of epidemiology that describes the relationship between the three main factors that influence the occurrence of a disease or health problem: host, agent, and environment. The emergence of disease occurs due to an imbalance in the mutual interaction between these three factors. The host consists of all the elements present in humans that can affect how a disease occurs in an individual. The process of developing a disease involves complex human elements and depends on the personal characteristics of each individual (6). Many factors contribute to the occurrence of Tuberculosis cases. According to age group, the most frequent cases are found in the productive age group. According to gender, BTA+ cases in men are higher than in women, which is almost 1.5 times higher than BTA+ cases in women. In addition, the home environment is one of the factors in the spread of tuberculosis, including humidity, house temperature and occupancy density. Occupancy density is the quotient between the area of the room and the number of occupants in one house (7).

The most dominant variable or indicator to predict the incidence of pulmonary TB is the history of contact with TB patients. This is indeed often encountered because the main factor a person can be infected is after inhaling air containing droplets containing germs transmitted by people with BTA positive pulmonary TB. Contact history is one of the factors causing pulmonary tuberculosis. The contact history in question is someone who has lived or is living in the same house and has been in contact with people with pulmonary TB. The results of hypothesis testing of risk factors for pulmonary tuberculosis incidence in the working area of Perumnas Health Center in Kendari City showed that there was a large risk of contact history with the incidence of pulmonary tuberculosis with a risk of 8.3 greater than that of people who did not have a history of contact with pulmonary tuberculosis patients (8).

Smoking habits are also one of the factors that influence the incidence of pulmonary TB, active smokers are at greater risk of suffering from pulmonary TB compared to those who do not smoke. In theory, smoking is an important factor that can reduce the body's resistance, making it susceptible to disease. Smoking is known to be associated with an increased risk of lung cancer, coronary heart disease, chronic bronchitis and bladder cancer. Smoking behavior has a risk of developing Pulmonary TB disease 2.2 times greater than non-smokers. This is evidenced by research conducted by Rahmaniati (2018) which obtained a p value of $0.009 \leq 0.005$ with OR = 3.244; 95% CI (1.345-7.826) which means that respondents who have a history of smoking have a 3.244 times higher risk of developing Lung TB disease when compared to respondents who do not have a history of smoking (9).

Environmental factors are external factors (outside the agent and the host) that affect the agent and the opportunity for exposure that allows disease transmission. Environmental factors play an important role in transmission, especially the unqualified home environment. The home environment is one of the factors that have a major influence on the health status of its residents. Home environmental conditions such as occupancy density, humidity, lighting and ventilation area are risk factors for pulmonary TB disease because the density of the house

with a large number of occupants facilitates the process of disease transmission. The floor area of a healthy house must be sufficient for the occupants in it, meaning that the floor area of the house must be adjusted to the number of occupants so as not to cause overload. This is unhealthy, because in addition to causing a lack of oxygen consumption, if one family member has an infectious disease, especially tuberculosis, it will be easily transmitted to other family members where an average patient can transmit to 2-3 people in his house. House density is one of the criteria for a healthy home. An unhealthy house has an OR of 5.22 times to experience the incidence of pulmonary tuberculosis compared to respondents with unhealthy house occupancy levels (10).

Humidity is one of the factors that has a very strong relationship with the incidence of pulmonary TB, high humidity (> 60%) easily becomes a place for bacteria to live and supports the presence of bacteria in a room, thus facilitating transmission. The results of data analysis of the Determinants of the Physical Environment of the House on the Incidence of Pulmonary TB in the Kabila Health Center Working Area using the chi square test showed that there was a significant relationship between pulmonary TB disease and house humidity with a p-value of 0.045 (<0.05)(11).

Lighting that does not meet the requirements has a relationship with the incidence of pulmonary tuberculosis. In a humid and dark room, germs can survive for days or even months. The germs will die when exposed to sunlight, Mycobacterium tuberculosis germs will die within 2 hours by sunlight. Houses that do not receive sunlight have a risk of suffering from tuberculosis 3.7 times compared to houses that receive sunlight. Because many types of bacteria can be killed if the bacteria get direct sunlight, so can the mycobacterium tuberculosis bacteria die due to ultraviolet light from sunlight entering the room. The statistical test results of the risk factors for the incidence of tuberculosis at the Malinau health center obtained the results of p value: $0.005 < \alpha: 0.05$ and $OR = 3.451 > 1$ so that H_0 is rejected, namely lighting is a risk factor for the incidence of Pulmonary Tuberculosis in the Malinau Health Center work area.

Ventilation has many functions. The first function is to keep the air flow in the house fresh. This means that the balance of oxygen needed by the occupants of the house is maintained. Lack of ventilation will cause a lack of oxygen in the house, in addition to the lack of ventilation will cause the humidity in the room to rise due to the process of evaporation of fluids from the skin and absorption. This humidity will be a good medium for the growth of pathogenic bacteria, such as TB germs. The second function of ventilation is to free the room air from bacteria, especially pathogenic bacteria, because there is always a continuous flow of air. Bacteria carried by the air will always flow. Another function is to keep the bedroom always remains in the optimum humidity (humidity). The results of hypothesis testing showed that ventilation was a risk factor for the incidence of pulmonary tuberculosis, with an Odd Ratio (OR) = 3.071, which means that a person who does not have ventilation that meets health criteria is 3.1 times more likely to suffer from pulmonary tuberculosis than someone who has a ventilation area that meets the requirements (12).

The results of preliminary data collection in the Elly Uyo Health Center register book for TB cases in the last 3 years, namely in 2020 Pulmonary TB cases reached 39 cases, then increased in 2021 Pulmonary TB cases reached 70 cases and in 2022 the achievement was 64 cases. Elly Uyo Health Center was second with 525 suspected cases, but there were only 64 cases in 2022. Based on the results of interviews with the person in charge of pulmonary TB at the Elly Uyo Health Center, the condition of the house where people with pulmonary TB live is quite adequate but on average those who live in one house are not only nuclear families but consist of several heads of households so that researchers are interested in examining the risk factors for the incidence of pulmonary TB at the Elly Uyo Health Center. Previous research discusses individual characteristics, but in this study, in addition to discussing individual characteristics, it also discusses environmental factors of TB patients' homes at the Elly Uyo Health Center in Jayapura City.

The general objective of this study was to determine the risk factors for the incidence of pulmonary tuberculosis at the Elly Uyo Health Center in Jayapura City. The specific objectives are to determine the risk of individual characteristics (age, sex, contact history and smoking habits) with the incidence of pulmonary TB in the working area of the Elly Uyo Health Center in Jayapura City. Knowing the risk of environmental conditions (occupancy density, humidity, lighting and ventilation area) with the incidence of pulmonary TB in the working area of the Elly Uyo Health Center in Jayapura City.

METHOD

The type of research used is quantitative research with a non-experimental approach using case control where factors are studied starting from the effect then traced retrospectively. The case control approach is often called a retrospective study because risk factors are measured by past events to determine the presence or absence of risk factors experienced. The population in this study were all patients with pulmonary TB at the Elly Uyo Health Center in January-March, totaling 15 patients with pulmonary TB. The number of samples is equal to the total population which is divided into two categories, namely the case group taken from all pulmonary TB patients and the control group taken from BTA negative patients, by matching age and gender to minimize the occurrence of bias by controlling when selecting samples between the case group and the control group. The matching technique in this study is the selection of the same number of samples on the age and gender variables with a ratio of 1: 3, this is due to the number of case groups less than 30 so that a ratio of 1: 3 is made with the control group. The sample size in this study was 60 respondents, where the number of case groups was 15 respondents and the number of control groups was 45 respondents. The variables in this study were contact history, smoking habits, residential density, humidity, lighting, ventilation area.

The measuring instrument used was a questionnaire to obtain information related to the characteristics of respondents, such as name, age, gender, education of respondents. Roll meter measures the density of occupancy by comparing the floor area of the house with the number of family members who occupy the house, thermohygrometer to measure humidity and lux meter to measure the intensity of natural lighting by determining the measurement point, then taking measurements with a distance and tool 80 cm from the floor. the measuring scale is nominal and the measurement results are at risk and not at risk.

The case sampling technique is saturated sampling. Saturated sampling is a sampling technique when all members of the population are sampled, this is done when the number is relatively small, less than 30, or research wants to make generalizations with very small errors. While the control sample is purposive sampling by taking BTA negative patients, having the same age and gender as the case and the condition of the home environment in the last 3 months there is no improvement. This study was conducted in June 2023 at the Elly Uyo Health Center, Jayapura City. The analysis used was univariate and bivariate analysis which aims to see the odds between 2 research variables, namely the dependent variable and the independent variable. The calculation of the OR value was carried out using the SPSS application using the Chi-square test sampling using certain considerations in accordance with the desired criteria to be able to determine the number of samples to be studied.

RESULT AND DISCUSSION

The results of the frequency distribution analysis of the characteristics of respondents at the Elly Uyo Health Center, Jayapura City can be seen in the table 1.

Table 1. Frequency Distribution of Respondents' Characteristics at Elly Uyo Health Center

Kategori	Case		Control		Total	
	n=15	%	n=45	%	n=60	%
Gender						
Male	7	46,7	18	40,0	25	41,6
Female	8	53,3	27	60,0	35	58,4
Education						
Elementary	2	13,3	4	8,8	6	10,0
Junior High	1	6,7	7	15,6	8	13,3
High School	10	66,7	32	71,2	42	70,0
Higher Education	2	13,3	2	4,4	4	6,7

Source: Primary Data, 2023

Table 1 shows that the frequency distribution of respondents according to gender was highest in the female group as many as 35 respondents (58.4) while in the male group there were 25 respondents (41.6), elementary education as many as 6 respondents (10.0%), junior high school as many as 8 respondents (13.3%), high school as many as 42 respondents (70.0%), and college as many as 4 respondents (6.7%). The results of the analysis of risk factors for the incidence of pulmonary tuberculosis at the Elly Uyo Health Center in Jayapura City can be seen in the table below.

Table 2. Risk Factors for Pulmonary Tuberculosis Incidence at Elly Uyo Health Center

Variabel	Case		Control		Total		p-value	OR 95% CI
	n=15	%	n=45	%	n=60	%		
Conctact History								
Risk	5	33,3	7	15,6	12	20,0	0,153	2,714 (0,709-10,392)
Not Risk	10	66,7	38	84,4	48	80,0		
Smoking Habit								
Risk	7	46,7	14	31,1	21	35,0	0,274	1,938 (0,587-6,399)
Not Risk	8	53,3	31	68,9	39	65,0		
Residental Density								
Risk	11	73,3	9	20,0	20	33,3	0,000	11,000 (2,830-42,756)
Not Risk	4	26,7	36	80,0	40	66,7		
Humidity								
Risk	12	80,0	14	31,1	26	43,3	0,001	8,857 (2,154-36,418)
Not Risk	3	20,0	31	68,9	34	56,7		
Lighting								
Risk	7	46,7	6	13,3	13	21,6	0,012	5,688 (1,505-21,495)
Not Risk	8	53,3	39	86,7	47	78,4		
Ventilation Area								
Risk	6	40,0	14	31,1	20	33,3	0,527	1,476 (0,440-4,953)
Not Risk	9	60,0	31	68,9	40	66,7		

Source: Primary Data, 2023

Based on table 2, the results of the analysis of contact history with the incidence of pulmonary tuberculosis showed that respondents in the case group who had a history of risky contact were 5 respondents (33.3%) and 10 respondents (66.7%) who did not have a history of risky contact, while in the control group there were 7 respondents (15.6%) and 38 respondents (84.4%) who were not at risk. Contact with TB patients in this study is living

together in the same house with family members who are or have had TB. This allows the presence of TB bacterial droplets that come out through sneezing or coughing patients that can be inhaled with oxygen in the air in the house by other family members, thus facilitating the transmission process. The results of statistical analysis obtained a p-value of $0.153 > 0.05$, $OR = 2.714$ ($OR = >1$), 95% CI (0.709-10.392) means that there is an insignificant risk between contact history and the incidence of pulmonary tuberculosis at the Elly Uyo Health Center in Jayapura City. The case group who had a history of contact was 2.714 times more likely to have pulmonary TB than the control group. This was due to the lower number of respondents who had a history of household contact (20%) compared to respondents who did not have a history of household contact with patients with pulmonary TB (80%), however most respondents had a history of contact with patients such as being neighbors with patients.

This is in line with research conducted by Yusran Yunus (2018) in Tallo District, Makassar City that the results of statistical tests showed an OR value = 15.892 at the interval $LL - UL = 3.515 - 71.843$ with a confidence level of 95%. The value obtained shows that the presence of a history of home contact with people with pulmonary TB has a 15.892 times greater risk of the incidence of pulmonary TB disease compared to people who do not have a history of home contact with people with pulmonary TB and is statistically significant. This is due to respondents who have a history of close contact with patients more than respondents who do not have contact with TB patients (13). The study is in line with research conducted by Hartina (2019) in the Girian Weru Health Center Work area of Bitung City that respondents who had a history of contact with patients with pulmonary TB were 23 respondents (60.5%) and 20 respondents (52.6%) who did not have pulmonary TB had a history of contact with patients with pulmonary TB. The results found in the bivariate analysis $p > \alpha$ (0.05) which is = 0.488 and OR value = 1.380 with 95% CI value = 0.555 3.429 which means that there is no relationship and is not a risk factor between the patient's contact history and the incidence of Lung TB in the working area of Puskesmas Girian Weru Bitung City (14).

The results showed that smoking habits with the incidence of pulmonary TB obtained a p-value of $0.274 > 0.05$, $OR = 1.938$ ($OR \Rightarrow 1$), 95% CI (0.587-6.399) means that there is an insignificant risk between smoking habits and the incidence of pulmonary tuberculosis at the Elly Uyo Health Center, Jayapura City. This occurred because case group respondents had a history of smoking before developing pulmonary TB but had stopped at the time of developing pulmonary TB and did not smoke again. Meanwhile, the control group was more exposed to cigarette smoke caused by family members who smoked in the house.

This study is in line with research conducted by Nurjana (2015) in Donggala Regency that at productive age, active smokers, especially former smokers ($OR = 2.7$; $CI = 2.40-3.05$), meaning that smoking behavior is a risk factor for pulmonary TB. This shows that former smokers have a risk of developing TB 2.7 times compared to those who have never smoked at all (15). In contrast to research conducted by Hartina (2019) in the Girian Weru Health Center Work area of Bitung City that the risk factor for smoking habits with patients with pulmonary TB shows that most respondents who smoke who suffer from pulmonary TB are 30 respondents (78.9%) and do not suffer from pulmonary TB are 22 respondents (57.9%) who smoke. The results of bivariate analysis with a p-value of 0.047 means $p < \alpha$ (0.05) and with an Odds Ratio (OR) value = 2.727 ($CI = 0.992- 7.499$) statistically means that there is a relationship and is a risk factor for smoking habits with the incidence of pulmonary TB in the work area of the Girian Weru Health Center, Bitung City. Where respondents who smoke are at risk of 2.727 times developing Pulmonary TB compared to those who do not smoke (14).

The results showed that the residential density factor with the incidence of pulmonary TB obtained a p-value of $0.000 < 0.05$, $OR = 11.000$ ($OR \Rightarrow 1$), 95% CI (2.830-42.756) means that there is a significant risk between residential density and the incidence of pulmonary tuberculosis at Puskesmas Elly Uyo Jayapura City. The case group that had a residential density of $<8 \text{ m}^2$ and more than 2 people had a 11,000 times greater risk of developing pulmonary tuberculosis compared to the control group. Based on the results of observations

in the respondents' homes, it was concluded that residential density is a risk factor for the incidence of pulmonary tuberculosis, this is because most of the case respondents (73%) had a number of occupants that was not proportional to the floor area of the house, resulting in overload. This is unhealthy, because in addition to causing a lack of oxygen consumption, if one family member has an infectious disease, it will easily spread to other family members.

This study is in line with research conducted by Muh Yusran Yunus (2018) in Tallo District, Makassar City that the results of statistical tests show an OR = 2.199 value at the interval LL - UL = 1.036-4.666. This shows that respondents who have unqualified residential density (< 10 m² / person) have a 2.199 times greater risk of developing pulmonary TB disease compared to respondents who have qualified residential density and are statistically significant. Residential density is one of the risks of people exposed to pulmonary TB germs becoming infected with pulmonary TB, to prevent transmission of pulmonary TB is to reduce and eliminate social conditions that increase the risk of infection such as residential density. The denser the house, the easier and faster the transfer of disease, especially airborne infectious diseases, if there are family members suffering from TB with BTA positive who accidentally cough (13). However, this study is not in line with research conducted by Zuriya (2016) in the Pamulang Health Center work area, it is known that of the 14 respondents who had residential density that did not meet the requirements, 6 respondents (42.8%) of them had pulmonary TB. Meanwhile, of the 47 respondents who had a residential density that met the requirements, 22 respondents (46.8%) of them suffered from pulmonary TB. The statistical test results showed a p-value of 1.000, meaning that at the 5% level of significance there was no significant relationship between occupancy density and the incidence of pulmonary TB. The statistical test also showed an OR value of 0.852, meaning that patients who have a qualified residential density have a 0.852 times chance of developing pulmonary TB (16).

The results showed that the humidity factor with the incidence of pulmonary TB obtained a p-value of 0.001 < 0.05, OR = 8.857 (OR => 1), 95% CI (2.154-36.418) means that there is a significant risk between humidity and the incidence of pulmonary tuberculosis at the Elly Uyo Health Center in Jayapura City. The case group who lived in a humid place was 8.857 times more likely to experience pulmonary TB than the control group. Humidity in the house is a suitable medium for the growth of bacteria with TB so that the process of transmission will be very easy. The results of the observations made showed that most of the case respondents (80%) did not open the windows during the day and even closed the ventilation holes permanently so that sunlight could not enter directly which resulted in the room in the house being dark and humid, besides the lack of ventilation and the influence of hot weather is likely to be a factor in causing the air humidity in the house does not meet health requirements. The geographical conditions of the population are in the highlands with many mountains and hills and trees that cause a lack of direct sunlight, so that environmental conditions become humid.

This study is in line with research conducted by Farah Fahdienie (2020) in the Pidie Health Center work area of Pidie Regency that humidity is the most risky factor for tuberculosis disease (OR = 4.26; 95% CI = 1.19 - 15.29), which means that unqualified house humidity is 4.26 times greater than houses with qualified humidity levels. Observations showed that ventilation and windows were not well maximized for the air circulation process, so the humidity level in the house did not meet the requirements. A humid house is a good medium for the growth of microorganisms, these microorganisms can enter the body through the air. In addition, high humidity can cause the nasal mucous membrane to become dry, making it less effective in blocking microorganisms. Mycobacterium tuberculosis bacteria, like other bacteria, will thrive in an environment with high humidity. The water arena makes up more than 80% of the volume of bacterial cells and is essential for the growth and survival of bacterial cells. In addition, increased air humidity is a good medium for pathogenic bacteria including tuberculosis bacteria (17). In contrast to research conducted by Najiyah (2022) in the Mandiranca Community Health Center working area, the humidity variable in this study was grouped into two categories, namely unqualified and qualified. The physical condition of the

respondent's house, namely humidity in the unqualified category, experienced an incidence of pulmonary tuberculosis of 59.5%. The results of bivariate analysis using the chi-square test also showed that the p value was 0.288, meaning that at α 5% there was no significant relationship between humidity and the incidence of pulmonary tuberculosis in the Mandirancan Health Center working area in 2022 (18).

The results showed that the lighting factor with the incidence of pulmonary TB obtained a p-value of $0.012 < 0.05$, OR = 5.688 (OR $\Rightarrow$ 1), 95% CI (1.505-21.495) means that there is a significant risk between lighting and the incidence of pulmonary tuberculosis at the Elly Uyo Health Center in Jayapura City. The case group who lived in a place with poor lighting was 5.688 times more likely to experience pulmonary tuberculosis than the control group. From the measurement of the lighting level of the respondents' houses, it was found that many 13 respondents' houses had minimum or unqualified lighting. The measured lighting is natural light that comes from sunlight that enters directly through vents, doors, windows. The results of observations in the respondent's house concluded that the level of lighting in the respondent's house was a risk factor for the incidence of pulmonary tuberculosis. This occurred because most of the case respondents (46.7%) permanently closed the ventilation holes in several parts of the room and did not have the habit of opening windows or curtains in the morning until noon so that the lack of air exchange and lighting could make *Mycobacterium tuberculosis* survive in the room. The geographical conditions of the population are in the highlands with many mountains and hills and trees that cause minimal exposure to direct sunlight.

The results showed that the lighting factor with the incidence of pulmonary TB obtained a p-value of $0.012 < 0.05$, OR = 5.688 (OR $\Rightarrow$ 1), 95% CI (1.505-21.495) means that there is a significant risk between lighting and the incidence of pulmonary tuberculosis at the Elly Uyo Health Center in Jayapura City. The case group who lived in a place with poor lighting was 5.688 times more likely to experience pulmonary tuberculosis than the control group. From the measurement of the lighting level of the respondents' houses, it was found that many 13 respondents' houses had minimum or unqualified lighting. The measured lighting is natural light that comes from sunlight that enters directly through vents, doors, windows. The results of observations in the respondent's house concluded that the level of lighting in the respondent's house was a risk factor for the incidence of pulmonary tuberculosis. This occurred because most of the case respondents (46.7%) permanently closed the ventilation holes in several parts of the room and did not have the habit of opening windows or curtains in the morning until noon so that the lack of air exchange and lighting could make *Mycobacterium tuberculosis* survive in the room. The geographical conditions of the population are in the highlands with many mountains and hills and trees that cause minimal exposure to direct sunlight.

The results showed that the ventilation area factor with the incidence of pulmonary TB obtained a p-value of $0.527 > 0.05$, OR = 1.476 (OR $\Rightarrow$ 1), 95% CI (0.440-4.953) means that there is an insignificant risk between ventilation area and the incidence of pulmonary tuberculosis at the Elly Uyo Health Center, Jayapura City. The case group with ventilation area $< 10\%$, 5.688 times more likely to experience pulmonary TB compared to the control group. The results of observations by taking measurements concluded that most respondents had a ventilation area that was not at risk (66.3%) or met the requirements even though the ventilation of the house was not always opened every day. When interviews were conducted with respondents that most did not have the habit of opening windows in the morning, even in some respondents' homes ventilation holes such as windows were permanently closed so that this situation resulted in the air dilution process not happening properly and the room conditions became dark resulting in a medium for bacterial growth, where transmission occurs in a room when droplets of infected people are in the air for a long time.

This study is in line with research conducted by Nisgunawan Sidiq (2013) in the working area of the Somba Opu Health Center that the results of statistical analysis obtained an OR

value = 1.220 (OR => 1), 95% CI (0.353-4.217), meaning that the ventilation area is a risk factor for the incidence of pulmonary tuberculosis. This is because at the time of direct observation, almost all respondents had the windows of their houses mostly covered by curtains and so on (20). In theory, ventilation affects the air dilution process or can help dilute the concentration of mycobacterium tuberculosis, so increasing natural ventilation can prevent or minimize the risk of pulmonary tuberculosis. So in this case, an eligible ventilation area will reduce the growth of mycobacterium tuberculosis bacteria. Unqualified ventilation areas should be aware of the risk of pulmonary tuberculosis transmission, where transmission occurs in a room when droplets of infected people are in the air for a long time. With ventilation, air exchange can flow to reduce the number of droplets and sunlight entering the room through ventilation can kill Mycobacterium tuberculosis. A qualified home environment, such as sunlight entering the house and proper ventilation, will reduce the risk of pulmonary tuberculosis disease development and transmission. From the explanation above, it was found that the incidence of pulmonary tuberculosis is influenced by the behavior of opening windows in the house.

Several limitations found in this study contributed to the completeness/accuracy of the information obtained. The obstacle in question is a limitation in this study, namely the researcher did not examine the behavior of the community in opening the windows of the house. That the variable associated with the incidence of pulmonary tuberculosis is lighting. This is due to the behavior of people who do not open windows regularly from morning to noon, so there is no lighting entering the house. difficulty communicating with some respondents directly due to language and age factors, so respondents must be accompanied by family members, some respondents are not at home, so respondents must be represented by the closest family member and delays in data collection due to having to adjust the work schedule of PJ TB Puskesmas Elly Uyo and the person in charge of the Sanitarian Kit.

As for the weaknesses of this research, the number of samples is relatively small, limited in understanding the context and in-depth understanding of the phenomenon under study. Numerical data also cannot explain complex situations well. The advantage of this study is that it combines variables of individual characteristics and environmental factors so that this research becomes broad not only looking at the history of TB patients but also in terms of the home environment of TB patients. This study also collected data that can be measured directly through research instruments such as questionnaires, measurements, and structured observations.

CONCLUSION

Based on the results of the study, it was concluded that the variables of occupancy density, humidity and lighting were significant risk factors for the incidence of pulmonary tuberculosis at the Elly Uyo Community Health Center in Jayapura City. The variables of contact history, smoking habit and ventilation area are insignificant risk factors for the incidence of pulmonary tuberculosis at the Elly Uyo Community Health Center in Jayapura City.

From the results of this study, it is expected that the community can maintain personal and family hygiene such as washing hands after doing activities outside the home and not smoking in the house to avoid the growth and breeding of TB germs, thereby reducing the level of transmission of pulmonary tuberculosis disease and can meet the criteria of a healthy home such as the availability of windows and ventilation for each room so that air and sunlight can enter to avoid humid room conditions and lack of lighting. For pulmonary TB officers at the Elly Uyo Health Center to maintain service performance and conduct promotion and education related to increasing correct and comprehensive knowledge about prevention of transmission, treatment, clean and healthy lifestyles (PHBS), so that there are changes in the attitudes and behavior of the targets of the pulmonary TB program related to this and eliminate the stigma and discrimination of the community and health workers against pulmonary TB patients. The strategies used for health promotion in pulmonary TB control are: community empowerment,

advocacy and partnerships. For future researchers to be able to examine the incidence of pulmonary TB disease and expand the research variables that have not been studied in this study.

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