Public Policy and Administration Research
ISSN 2224-5731(Paper) ISSN 2225-0972(Online)
Vol.14, No.3, 2024

Public Policy Study on Spatial and Modeling of Risk Factors for The Incidence of Pulmonary Tuberculosis in Kupang City

Wilhelmus Olin[1*], Rafael Paun[2], Sabinus Kedang[2], Agustina Djuma[2]
1. S3 Student of Public Administration Study Program, Fisip, Nusa Cendana University, Kupang, Indonesia
2. Health Polytechnic of Health Ministry, Kupang, Indonesia
* E-mail: olinwem@gmail.com

Abstract

Background : The results of the tracking of pulmonary tuberculosis cases by the Perdhaki Foundation in 3 districts / cities in mainland Timor found 165 cases in Kupang City, 90 cases in Kupang Regency and 94 cases in TTS Regency with a total of 349 cases. Risk factors for pulmonary tuberculosis in Kupang City include behavioural factors and the home environment. The purpose of this study was to conduct a policy study that includes spatial pattern analysis and risk factor models for the incidence of pulmonary tuberculosis in Kupang city.

Methods : This research was conducted in Kupang City, in August-October 2019, with the type of research is Quantitative research with case control study design. The sample of this study was a saturated sample of 132 people consisting of 66 cases of pulmonary tuberculosis and 66 controls of neighbouring family members. The independent variables in this study were individual risk factors (behaviour, characteristics, BMI and history of contact with people with pulmonary tuberculosis) and home environmental factors (ventilation, occupancy density, humidity, temperature and room conditions and sunlight) and the dependent variable was the incidence of pulmonary tuberculosis. This study used questionnaires for observation and interviews in the form of the Avenza Maps application on android. Spatial analysis methods Nearest neighbor index and Geoda Application (Local Moran's Test With EB Rate) and analysed Chi-Square and multiple Logistic Regression.

Results : The results showed the Nearest neighbor index value = 0.57. Spatial Pattern of the incidence of pulmonary tuberculosis cases based on residential density there are 4 (four) villages that have a risk, namely Liliba, Oesapa, Oebobo and Manutapen villages. Spatial Pattern of the incidence of pulmonary tuberculosis cases based on humidity there are 3 (three) villages at risk, namely Fatubesi, Nefonaek and Oepura villages. Spatial Pattern of the incidence of pulmonary tuberculosis cases based on lighting there are 3 (three) villages at risk, namely Oesapa, Oetete and Fatubesi villages. Spatial pattern of the incidence of pulmonary tuberculosis cases based on the temperature of the house there are 2 (two) villages at risk, namely Lasiana and Liliba villages. The results of multiple logistic regression analysis showed the effect of BMI on the incidence of pulmonary tuberculosis B = 2.769; p value = 0.030; OR = 15.938 (95% CI = 1.300 - = 195.440). Effect of neighbour contact B = 3.073; p value = 0.000; OR = 21.604 (95% CI = 4.230 - 110.325). Effect of habit of covering mouth when coughing B = -1.808; p value = 0.029; OR = 0.164 (95% CI = 0.032 - 0.832). Effect of ventilation area B = -3.824; p value = 0.000; OR = 0.022 (95% CI = 0.005 - 0.095).

Conclusion : The incidence of pulmonary tuberculosis in Kupang city is influenced by BMI, neighbour contact, habit of covering mouth when coughing and house ventilation.

Keywords: Spatial pattern, Neighbourhood, Body Mass Index, Pulmonary Tuberculosis
DOI: 10.7176/PPAR/14-3-08
Publication date: November 30th 2024

Introduction

Public studies on policy and disease have been conducted by many parties. Everything boils down to policy praxis in overcoming various problems, both physical and social. In practice, the study of a disease associated with various factors aims to minimize the spread of the disease. Tuberculosis is a direct infectious disease caused by the mycobacterium tuberculosis (TB) germ, most TB germs attack the lungs, but can also affect other organs (Ministry of Health, 2012). Transmission occurs when TB patients cough or sneeze, the germs are dispersed into the air in the form of sputum droplets (dropletnuclei). Infection occurs when other people breathe in air containing infectious sputum droplets (Ministry of Health, 2014). According to WHO, 2015, India, Indonesia and China have the highest incidence of TB in the world. Indonesia ranked 2nd as the country with the highest TB cases in 2014 with a population of 240 million. In recent decades, treatment using the DOTS (Directly Observed Treatment Short Course) strategy has significantly improved case detection and treatment success. According to WHO (2015) in Indonesia, in 2013 the incidence rate of pulmonary tuberculosis was 183 per 100,000 population with a TB mortality rate of 25 per 100,000 population. In 2014 the incidence rate increased

to 399 per 100,000 population with a mortality rate that also increased to 41 per 100,000 population. According to Riskesda in 2018 stated that the prevalence rate of Lung TB in NTT Province was 0.4% with the number of people with Lung TB being 8,725 cases. Based on Riskesda data in 2013, the number of people with pulmonary tuberculosis in three districts/cities, namely in Kupang City, Kupang Regency and TTS Regency who were diagnosed with pulmonary tuberculosis and treated by the program were 0.7; 2.4 and 2.1. Meanwhile, the NTT Provincial Health Office reported that the number of pulmonary tuberculosis patients in 3 districts/cities, namely in Kupang City, Kupang Regency and TTS Regency in 2018 were 669 cases, 271 cases and 369 cases. The total number of cases in the 3 districts/cities was 1,309 cases. Meanwhile, according to the Perdaki Foundation, the cases they encountered in the 3 districts/cities were 165 cases in Kupang City, 90 cases in Kupang Regency and 94 cases in TTS Regency with a total of 349 cases. The number of new patients is increasing while patients who are currently undergoing treatment are dropping out. The risk group for contracting TB disease is generally family members living in the same house as the patient and/or the neighboring community around the patient's house. The results of research by Nevita et al (2014) showed that the risk group for contracting TB is generally children. Positive index cases have a risk of 2.72 times being infected and the number of children> 6 people has a risk of 1.85 times contracting TB. The purpose of this research is to conduct a policy study that includes spatial analysis and risk factor models of pulmonary tuberculosis disease incidence in kupang city.

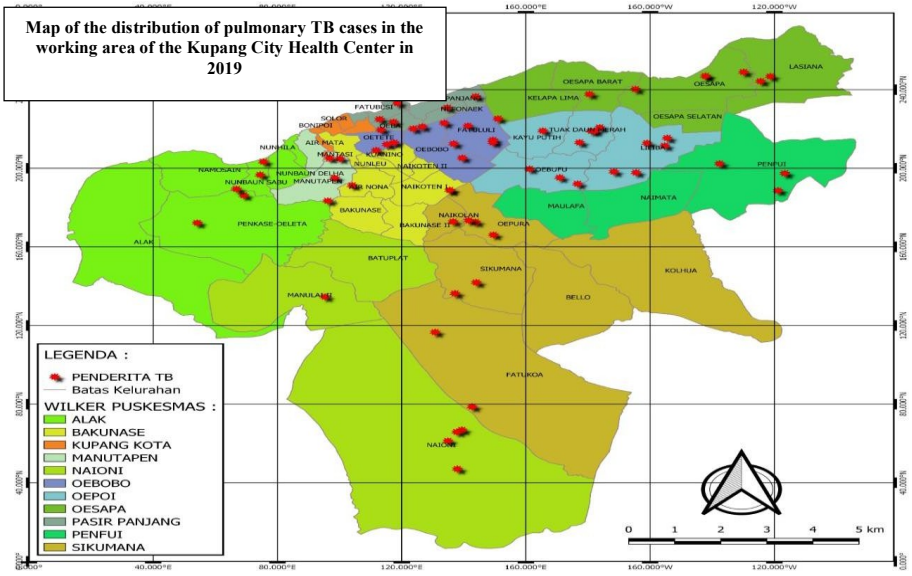
Methods

Type of quantitative research with case control study design. The sample size was 132 people consisting of 66 positive cases (saturated sample) and 66 controls (family members of the closest neighbors) which were carried out through simple random. The variables of this study consisted of independent variables, namely individual risk factors (behavior, characteristics, BMI and history of contact with patients with pulmonary tuberculosis) and home environmental factors (ventilation, occupancy density, humidity, temperature and room conditions and sunlight). While the dependent variable is the incidence of pulmonary tuberculosis. This study used questionnaires for observation and interviews in the form of the Avenza Maps application on android, in which all the variables studied had previously been included. Data were analyzed using the Nearest neighbor index spatial analysis method to delimit a scale relating to patterns of spread (measuring distribution) in a particular space or area with the closest distance determined by the researcher. The application of this nearest neighbor analysis can be used in the transmission and distribution of vector-borne diseases and continued with Spatial pattern analysis with Geoda Application (Local Moran's Test With EB Rate). Bivariate analysis in this study was conducted with Chi-Square analysis and continued with Multiple Logistic Regression analysis.

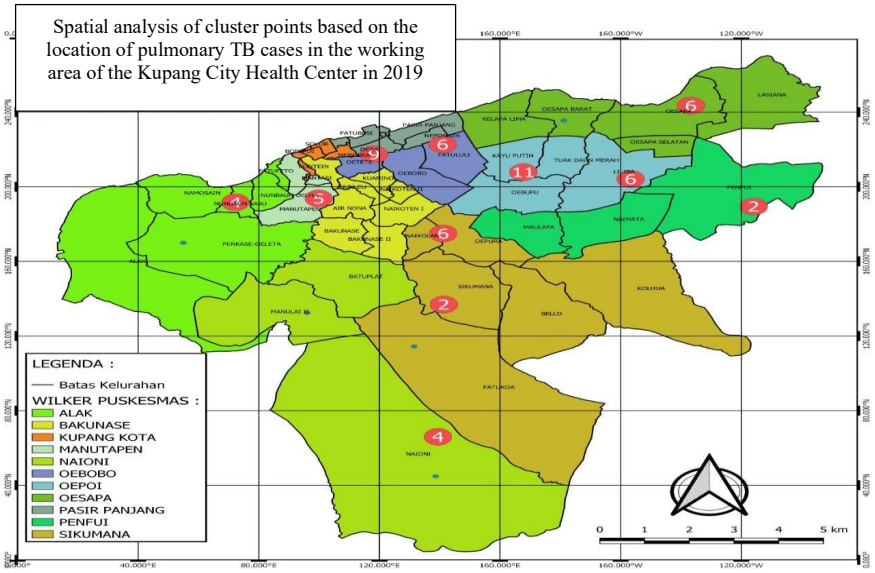
Results

1. Spatial Pattern

The results of the spatial pattern research show that the distribution or distribution of pulmonary tuberculosis cases is mostly in the central area of Kupang city, namely in the Oebobo puskesmas and Oepoi puskesmas areas.

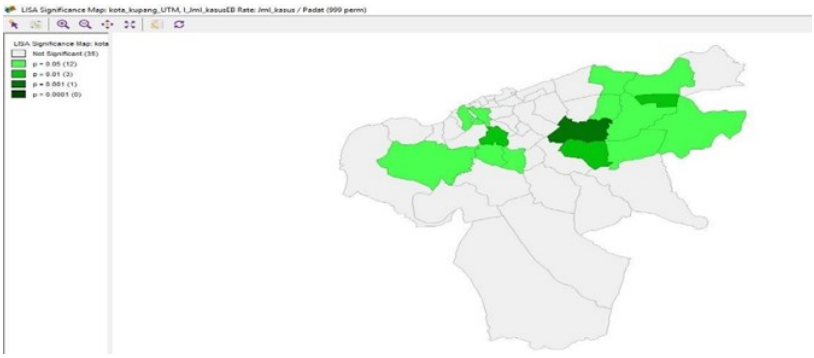


The highest cluster points based on the location of pulmonary TB cases in the Puskesmas area in Kupang city are 1) Puskesmas Oepoi has cluster locations in 11 eucalyptus villages and Liliba has 6 cluster points for pulmonary tuberculosis cases, Oebufu and Tuak Daun Merah. 2) Puskesmas Oebobo cluster point locations are in Oetete village 9 cluster point cases and Oebobo village 6 cluster point cases of pulmonary tuberculosis.



Based on the calculation results of the nearest neighbor analysis formula above, the Nearest neighbor index value = 0.5703795997580187. This index value has a 95% probability level distribution between 0 - 2.15. So it can be interpreted that Rn statistics are significant values of the resulting distribution pattern is between clustering (cluster pattern) and the resulting distribution pattern is uneven / regular / scattered (random pattern). The following are the results of Spatial Analysis with Geoda Application (Local Moran's Test With EB Rate), showing:

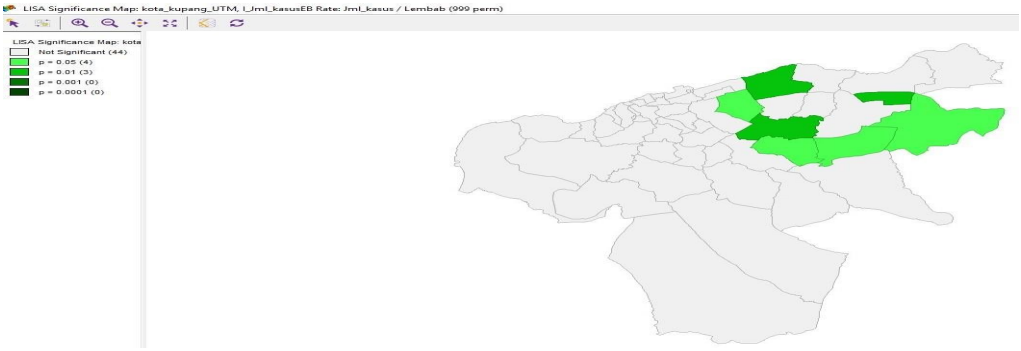
1) Incidence of Pulmonary TB Cases Based on Residential Density



Risk Of Residential Density on the Incidence of Pulmonary TB

The diagram above shows the results of Spatial analysis of the incidence of pulmonary tuberculosis cases based on residential density, there is 1 (one) significant village with a p value of 0.001 in Liliba village and 3 (three) villages with a p value of 0.01, namely Oesapa, Oebobo and Manutapen villages. Thus the risk of residential density on the incidence of pulmonary tuberculosis is found in Liliba, Oesapa, Oebobo and Manutapen villages.

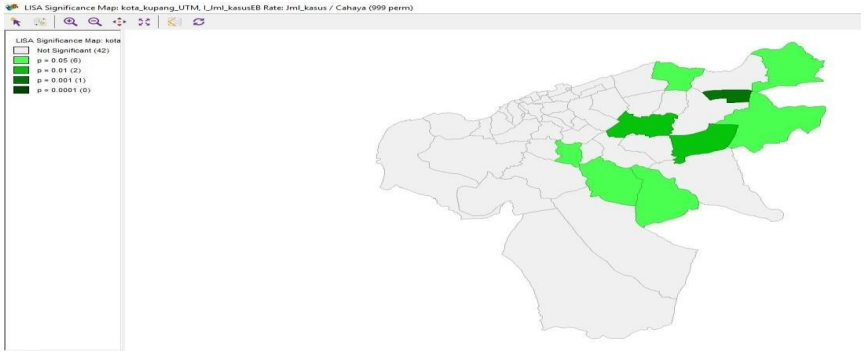
2) Incidence of Pulmonary TB Cases Based on Humidity Level



Risk of Humidity on the Incidence of Pulmonary TB

The diagram above shows the results of Spatial analysis of the incidence of pulmonary tuberculosis cases based on humidity, there are 3 (three) significant villages with a p value of 0.01, namely Fatubesi, Nefonaek and Oepura villages. This the risk of humidity levels on the incidence of pulmonary tuberculosis is found in Fatubesi, Nefonaek and Oepura Villages.

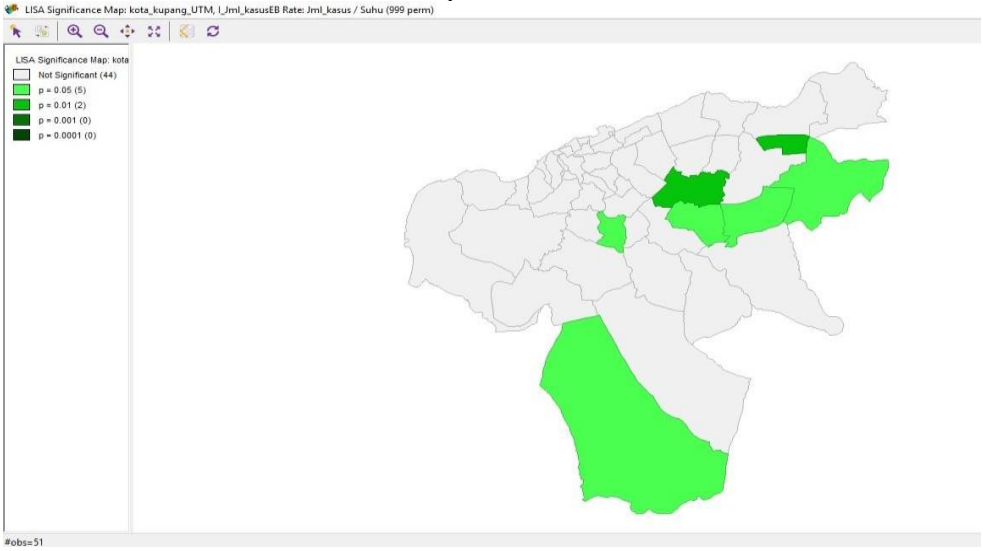
3) Incidence of Pulmonary TB Cases Based on Indoor Lighting



Risk of Lighting on the Incidence of Pulmonary TB

The diagram above shows the results of Spatial analysis of the incidence of pulmonary tuberculosis cases based on lighting in the house, there is 1 (one) significant village with a p value of 0.001, namely Oesapa village and 2 (sub-district) significant with a p value of 0.01, namely Oettete and Fatubesi villages. The risk of house lighting on the incidence of pulmonary tuberculosis is found in Oesapa, Oetete and Fatubesi villages.

4) Incidence of TB Cases Based on Room Temperature



Risk of Room Temperature on the Incidence of Pulmonary TB

The diagram above shows the results of Spatial analysis of the incidence of pulmonary tuberculosis cases based on house temperature, there are 2 (two) significant villages with a p value of 0.01, namely Lasiana Village and Liliba Village. This the risk of room temperature on the incidence of pulmonary tuberculosis is found in Lasiana and Liliba Villages.

2. Influence of Characteristics on the Incidence of Pulmonary TB

a. Effect of Gender Risk on the Incidence of Pulmonary TB Table 4.8 Effect of Gender on the Incidence of Lung TB

Gender	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Male	41 (62,1%)	31 (47,0%)	72 (54,5%)				
Female	25 (37,9%)	35 (53,0%)	60 (45,5%)	0,080	1,852	0,925	3,705

Table 4.8 above shows the effect of gender on the incidence of pulmonary tuberculosis in men 62.1% and women 37.9% in cases of pulmonary tuberculosis disease. The statistical test results show a p value of 0.080> p alpha 0.05, so there is no effect of gender on the incidence of pulmonary tuberculosis. The OR value = 1.852, so it is likely that men have a risk of developing pulmonary tuberculosis 1.852 times compared to women.

b. Risk Factors of Marital Status on the Incidence of Pulmonary TB Table 4.9 Effect of Marital Status on the Incidence of Lung TB

Marital Status	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Mating	40 (60,6%)	50 (55,6%)	90 (68,2%)				
Not Married	26 (3,4%)	16 (24,2%)	42 (31,8%)	0,062	0,492	0,233	1,041
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.9 above shows that most marital status (60.6%) is married with pulmonary tuberculosis cases and not married (3.4%) with pulmonary tuberculosis cases. The statistical test results showed p value =0.062 > alpha 0.05, so there was no effect of marital status on the incidence of pulmonary tuberculosis. The OR value = 0.492 indicates the possibility of people with marital status being protective against the incidence of pulmonary tuberculosis compared to people who are not married.

a. The Effect of Educational Risk on the Incidence of Pulmonary TB

Table 4.10 below shows the most cases (47.0%) of respondents with high school education level and the least cases of respondents with D3 education level 1.5% and S1 6.1%. The results of the *Fisher's Exact* statistical test showed a p value of 0.329> alphaf 0.05, thus there was no effect of education level on the incidence of TB.

b. The Effect of Education on the Incidence of Pulmonary TB

Education	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Not in School	5 (7,6%)	4(6,1%)	9 (6,6%)				
Elementary school	14 (21,2%)	14 (21,2%)	28 (21,2%)				
graduate	11 (16,0%)	2 (6,1%)	15 (11,4%)	0,329	1,000	0,000	1,000
Junior high school	31 (47,0%)	33 (30,0%)	64 (48,5%)				
graduate	1 (1,5%)	2 (3,0%)	3 (2,3%)				
High school	4 (6,1%)	9 (13,6%)	13 (9,8%)				
graduate							
D3 graduate							
Bachelor's Degree							
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

OR = 1.000, it can be concluded that education level is not a risk factor for pulmonary tuberculosis in Kupang City.

c. Influence of Respondents' Occupational Risks on Lung TB Occurrence Table 4.11 Effect of Occupation on the Incidence of Pulmonary TB

Jobs	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Civil	2(3,0%)	5(7,6%)	7 (5,3%)				
Servant/Police/TNI	8(12,1%)	5(7,6%)	13(9,8%)				
Retirement	2(3,0%)	4(6,1%)	6(4,5%)				
Private Employee	1(1,5%)	3(4,5%)	4(3,0%)	0,249	1,000	0,000	1,000
Farmers	1(1,5%)	4(6,1%)	5(3,8%)				
Fisherman	2(3,0%)	1(1,5%)	3(2,3%)				
Merchant	11(16,7%)	4(6,1%)	15(11,4%)				
Self-employed	39(59,1%)	40(60,6%)	79(59,8%)				
Miscellaneous							
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.11 above shows the most cases (59.1%) of respondents with other jobs (odd jobs) pensioners 12.1% and self-employed 16.7%) and the least in farmers and fishermen each 1.5%. *Fisher's Exact* statistical test results showed p value = 0.256 > alpha 0.05 so there was no effect of all occupations on the incidence of pulmonary tuberculosis. The OR value of 1.000 indicates the possibility that occupation is not at risk of pulmonary tuberculosis.

d. The Effect of Family Income Risk on the Incidence of Pulmonary TB Table 4.12 Effect of Family Income on the Incidence of Lung TB

Family Income	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
<Rp 1,000.00	31(47,0%)	34(51,5%)	65(49,2%)				
IDR 1,000,000- 2,000,000	25(37,9%)	21(31,8%)	46(34,8%)	0,766			1,000
>Rp 2,000,000	10(15,2%)	11(16,7%)	21(15,(%)		1,000	0,000	
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

The table above shows the most cases (47.0%) of families with income <Rp 1000,000, income Rp 1000,000-Rp 2,000,000 = 37.9% and family income > Rp 2,000,000 = 15.2%. The statistical test results showed p value = > alpha 0.05, so there was no effect of income on the incidence of pulmonary tuberculosis. The OR value = 1.000 indicates that all levels of family income are not at risk for the incidence of pulmonary tuberculosis.

e. The Effect of Distance to Health Facilities on the Occurrence of Pulmonary TB

Table 4.13 Effect of Health Facility Distance on the Incidence of Pulmonary TB

Distance	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
< 1 KM	12 (18,2%)	8 (12,1%)	20 (15,2%)				
1KM	20 (30,3%)	27(40,9%)	47(35,6%)				
2KM	24 (36,4%)	23((34,8%)	47(35,6%)	0,689	1,000	0,000	1,000
3KM	1(1,5%)	2(3,0%)	3(2,3%)				
4KM	3(4,5%)	3(4,5%)	6(4,5%)				
5KM	6(9,1%)	3(4,5%)	9(6,8)				
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.13 above shows that the distance between the house and health facilities is highest in cases (36.4%) with a distance of 2 KM and the lowest (1.5%) with a distance of 3 KM. *Fisher's Exact* statistical test results show p value = 0.689 > alpha 0.05, so there is no effect of distance from home to health facilities on the incidence of pulmonary tuberculosis. The OR value of distance < 1 KM = 1.000, so it is likely that the distance of the house is not at risk of TB incidence.

3. The Effect of Body Mass Index Risk on the Incidence of Pulmonary Tuberculosis

Table 4.14 Effect of BMI on the incidence of pulmonary tuberculosis

IMT	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Underweigth	36(54,5%)	11(16,7%)	47(35,6%)				
Ideal	27(40,9%)	39(59,1%)	66(50,0%)				
Overweigth	3(4,5%)	9(13,6%)	12(9,1%)	0,000	1,000	0,000	1,000
Obesity	0(0,0%)	7(10,6%)	7(5,3%)				
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.13 above shows the most cases of pulmonary tuberculosis (54.5%) of respondents with IMT Underweight, ideal 40.9%, Overweight 4.5% and Obesity (0.0%). *Fisher's Exact* statistical test results show p value = 0.000 <0.05, so there is a significant influence of IMT on the incidence of pulmonary tuberculosis. The OR value = 1.000 indicates that BMI may not be at risk for the incidence of pulmonary tuberculosis.

4. Behavioral Influence on the Incidence of Pulmonary TB

a. Influence of Risk of Contact History of Family Members on the Incidence of Pulmonary TB

Table 4.15 Effect of Contact History of Family Members on the Incidence of Pulmonary TB

Contact History	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Yes	50(75,8%	62(93,9%)	112(84,8%)				
No	16(24,2%)	4(6,1%)	20(15,2%)	0,006	4,960	1,559	15.779
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.14 above shows that pulmonary tuberculosis cases with no contact history were 24.2% and there was a history of contact with family members 75.8%. *Fisher's Exact* statistical test results showed p value = 0.006 < alpha 0.05, so there is a significant effect of contact history on the incidence of pulmonary tuberculosis. The OR value = 4.960 indicates a history of contact with family members has a risk of 4.960 times the incidence of pulmonary tuberculosis compared to no contact history.

b. Effect of Risk of Neighbor Contact History on the Incidence of Pulmonary TB

Table 4.15 Effect of Neighbor Contact History on the Incidence of Pulmonary TB

Neighbor Contact History	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Yes	47(71,2%	16(24,2%)	63(47,7%)				
No	19(28,8%)	50(75,8%)	69(52,3%)	0,000	0,129	0,060	0,281
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.15 above shows TB cases in people with no history of contact with neighbors 28.8% and there is a history of contact with TB neighbors 71.2%. The statistical test results show p value = 0.000 < alpha 0.05, so

there is a significant effect of contact history with neighbors of pulmonary tuberculosis on the incidence of pulmonary tuberculosis. The OR value = 0.129 indicates that there may be a history of contact with protective neighbors on the incidence of pulmonary tuberculosis.

c. The Effect of Risk of Smoking History on the Incidence of Pulmonary TB

Table 4.16 Effect of Current Smoking History on the Incidence of Pulmonary TB

Smoking Habit	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Yes	62(93,9%)	43(65,2%)	105(79,5%)				
No	4(6,1%)	23(34,8%)	27(20,5%)	0,000	0,121	0,039	0,374
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.16 above shows TB cases of respondents who have a history of not smoking 6.1% and have a history of smoking 93.9%. The results of the statistical test showed p value = 0.000 < alpha 0.05, so there is a significant influence of smoking on the incidence of pulmonary tuberculosis. The OR value = 0.121 indicates the smoking factor is protective against the incidence of pulmonary tuberculosis.

d. Risk Factors of Sputum Collection Habits on the Incidence of Pulmonary TB

Table 4.17 Effect of Sputum Collection Habits on the Incidence of Pulmonary TB

Habitual phlegm collection	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
No	35(53,0%)	55 (83,3%)	90(68,2%)				
Yes	31(47,0%)	11(16,7%)	42(31,8%)	0,000	4,429	1,974	9,934
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.17 above shows that pulmonary tuberculosis cases in the habit of collecting sputum were 47.0% and those who did not collect sputum were 53.0%. The statistical test results show p value = 0.000 < alpha 005, so there is a significant effect of sputum collection habits on the incidence of pulmonary tuberculosis. The OR value = 4.006 indicates the possibility that the habit of not collecting sputum will risk the incidence of pulmonary tuberculosis 4.006 times.

e. Risk Effect of Habitual Mouth Covering when Coughing on the Incidence of Tuberculosis

Table 4.18 below shows cases of pulmonary tuberculosis in the habit of not closing the mouth when coughing as much as 34.8% and those who closed their mouths 65.2%. The statistical test results show p value = 0.000 < alpha 005, so there is a significant effect of the habit of closing the mouth on the incidence of pulmonary tuberculosis.

Table 4.18 Effect of Mouth Closing Habits on the Incidence of Lung TB

Closing Your Mouth When Coughing	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
No	43(65,2%)	21(31,8%)	64(48,5%)				
Yes	23(34,8%)	45(68,2%)	68(51,5%)	0,000	4,006	1,942	8,266

The table above shows OR = 4.006, thus the possibility of the habit of not covering the mouth when coughing risks the incidence of pulmonary tuberculosis 4.006 times.

5. The Effect of Home Environmental Factors on the Incidence of Pulmonary Tuberculosis

a. Effect of Residential Density Risk on the Incidence of Pulmonary TB Table 4.19 Effect of Residential Density on the Incidence of Pulmonary TB

Residential Density	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Not Eligible Eligible	32(48,5%)	26(39,4%)	58(43,9%)	0,293	1,448	0,726	2,888
	34(51,5%)	40(60,6%)	74(56,1%)				
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.19 above shows that pulmonary tuberculosis cases in residential densities that do not meet the requirements are 48.5%% and those that meet the requirements are 51.5%. The statistical test results show p value = 0.293 > alpha 005, so there is no effect of residential density on the incidence of pulmonary tuberculosis. The OR value = 1.448 indicates that residential density that does not meet the requirements is likely to cause pulmonary tuberculosis1.448 times.

b. Risk Effect of Ventilation Presence on the Incidence of Pulmonary Tuberculosis Table 4.20 Effect of Risk of Ventilation on the Incidence of Pulmonary TB

Presence of Ventilation	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
None	4(6,1%)	5(7,6%)	9(6,8%)				
There is	62(93,9%)	61(92,4%)	74(56,1%)	0,730	0,787	0,202	3,071
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.20 above shows that the presence of pulmonary tuberculosis cases without ventilation is 6.1% and those with ventilation is 93.3%%. The statistical test results showed p value = 0.730 > alpha 005, so there was no effect of the presence of ventilation on the incidence of pulmonary tuberculosis. The OR value = 0.787 indicates the presence of ventilation is likely protective against the incidence of tuberculosis.

c. Effect of Ventilation Area Risk on the Incidence of Pulmonary TB

Table 4.21 Effect of Ventilation Area Risk on the Incidence of Pulmonary TB

Ventilation Area	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Not Eligible Qualified	58 (87,9%)	5(7,6%)	63(47,7%)	0,000	88,450	27,349	266,055
	8(12,1%)	61(92,4%)	69(52,3%)				
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.21 above shows the cases of pulmonary tuberculosis in home ventilation areas that do not meet the requirements are 87.9% and those that meet the requirements are 12.1%. The statistical test results show p value = 0.0,000 < alpha 005, so there is an influence of the ventilation area of the house on the incidence of pulmonary tuberculosis. The OR value = 88.450 indicates that the ventilation area does not meet the requirements for the possibility of pulmonary tuberculosis 88.450 times.

d. Effect of Humidity Risk on the Incidence of Pulmonary TB

Table 4.22 Effect of Humidity Risk on the Incidence of Pulmonary TB

Humidity	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Not Eligible Qualified	2 (3,0%)	2(3,0%)	4(3,0%)	1,000	1,000	0,137	7,318
	64(97,0%)	64(97,0%)	128(97,0%)				
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.22 above shows cases of pulmonary tuberculosis in unqualified house moisture as much as 3.0% and those that meet the requirements 97.0%. The statistical test results show p value = 1.000> alpha 005, so there is no house moisture on the incidence of pulmonary tuberculosis. The OR value = 1.000 indicates that house moisture may not be associated with the incidence of pulmonary tuberculosis.

e. Effect of Lighting on the Incidence of Pulmonary TB

Table 4.23 Effect of Lighting on the Incidence of Pulmonary TB

Lighting	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
Not Eligible Qualified	15(22,7%)	21(31,8%)	36(27,3%)	0,241	0,630	0,291	1,367
	51(77,3%)	45(68,2%)	6(72,7%)				
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.23 above shows that cases of pulmonary tuberculosis in unqualified house lighting were 22.7% and those that met the requirements were 77.3%%. The statistical test results showed p value = 0.241 > alpha 005, so there was no effect of house lighting on the incidence of pulmonary tuberculosis. The OR value = 0.630 indicates the presence of protective house lighting against the incidence of tuberculosis.

f. The Effect of Room Temperature on the Incidence of Pulmonary TB

Table 4.24 Effect of Room Temperature on the Incidence of Pulmonary TB

Room Temperature	Lung TB Disease Status		Total	P Value	OR
	Case	Control			
Not Eligible Qualified	0(0,0%)	0(0,0%)	0(0,0%)	1,000	1,000
	66(100,0%)	66(100,0%)	132(100,0%)		
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)		

Table 4.24 above shows that the room temperature of the respondent's house 100% meets the requirements, thus there is no effect of home room temperature on lung TB awareness.

g. The Effect of Sunlight on the Incidence of Pulmonary TB

Table 4.25 Effect of Sunlight on the Incidence of Pulmonary TB

Sunlight	Lung TB Disease Status		Total	P Value	OR	95% CI	
	Case	Control				Low	Upper
None	15(22,7%)	18(27,3%)	33(25,0%)				
There is	51(77,3%)	48(72,7%)	99(75,0%)	0,546	1,275	0,578	2,811
Total	66 (100,0%)	66 (100,0%)	132 (100,0%)				

Table 4.25 above shows that morning sunlight entering the sleeping room is absent in cases of pulmonary tuberculosis as much as 22.7% and there is sunlight entering 80.3%. The statistical test results show p value = 0.546> alpha 0.05, so there is no effect of sunlight on the incidence of pulmonary tuberculosis. The OR value = 1.275 indicates the possibility of no sunlight entering the sleeping room the risk of TB incidence is 1.275 times.

6. Risk Model for Pulmonary TB Incidence

Table 4.26. Risk Model for Lung TB Incidence

Variables	B	P Value	OR	95% CI	
				Lower	Upper
IMT	2,769	0,030	15,938	1,300	195,440
Neighbor Contact	3,073	0,000	21,604	4,230	110,325
Cover your mouth when coughing	-1,808	0,029	0,164	0,032	0,832
Ventilation Area	-3,824	0,000	0,022	0,005	0,095

Table 4.26 above shows the results of the Multiple Logistic Regression statistical test of the effect of Body Mass Index (IMT) on the incidence of pulmonary tuberculosis p value =0.030 < α 0.05, thus there is an effect of Body Mass Index (IMT) on the incidence of pulmonary tuberculosis. OR value = 15.938 then the possibility of Body Mass Index (BMI) underweight has a risk of incidence of pulmonary tuberculosis 15.938 times.

The risk of influence of contact with neighbors on the incidence of pulmonary tuberculosis p value = 0.000 < α 0.05, thus there is a significant influence of the risk of contact with neighbors on the incidence of pulmonary tuberculosis. OR value = 21.604, so the possibility of the influence of contact with neighbors has a risk of incidence of pulmonary tuberculosis 21.604 times compared with no contact with neighbors.

The risk of the influence of the habit of closing the mouth when coughing p value =0.029 < α 0.05, thus there is an influence of the habit of closing the mouth when coughing on the incidence of pulmonary tuberculosis. OR value = 0.164, so the possibility of the risk of the habit of not closing the mouth when coughing will be prostective to the incidence of pulmonary tuberculosis. Conversely, if you cover your mouth when coughing, the possibility of not being at risk of pulmonary tuberculosis is 6.09 times (1/0.029).

The effect of house ventilation area showed p value = 0.000 < α 0.05, thus there is a significant effect of ventilation area on the incidence of pulmonary tuberculosis. OR value =0.022 then the possibility of ventilation area that is less qualified will be protective against the incidence of pulmonary tuberculosis. Conversely, if the ventilation area meets the requirements, the possibility of not being at risk of pulmonary tuberculosis is 45.45 times (1/0.022).

Discussion

The distribution of pulmonary tuberculosis cases is highest in the central area of Kupang, namely in the Oebobo and Oepoi puskesmas areas. The risk group for contracting TB disease is generally family members living in the same house as the patient and/or neighboring communities around the patient's house. The results of the study are somewhat different from Wulandari's research, where the distribution of pulmonary tuberculosis cases in Kendal Regency is almost evenly distributed in all sub-districts / puskesmas areas (Wulandari, et al 2015). The results of research by Nevita et al (2014) showed that the risk group for contracting

the disease is generally children. Positive index cases have a risk of 2.72 times being infected and the number of children > 6 people has a risk of 1.85 times contracting TB.

1. The Effect of Body Mass Index on the Incidence of Pulmonary Tuberculosis

Body Mass Index (BMI) is a simple tool for monitoring the nutritional status of adults, especially with regard to underweight and overweight. IMT applies to adults over the age of eighteen (Supariasa, et al, 2002). The results showed the most cases of pulmonary tuberculosis (54.5%) with BMI underweight, ideal 40.9%, overweight 4.5% and obesity (0.0%). The statistical test results showed p value = 0.000, so there was a significant effect of IMT on the incidence of pulmonary tuberculosis. The OR value = 4.085 indicates that underweight IMT has a risk of pulmonary tuberculosis 4.085 times. The effect of body mass index can occur in relation to high underweigh in patients with pulmonary tuberculosis. Low nutritional status affects the decrease in body power, so that TB pathogens easily invade the human body.

2. Behavioral Influences on TB Incidence

The results showed that pulmonary tuberculosis cases with a contact history were 24.2% and no contact history with family members 75.8%. The statistical test results showed p value = 0.006 < alpha 0.05, so there is a significant effect of contact history on the incidence of pulmonary tuberculosis. The OR value = 4.960 indicates a history of contact with family members has a risk of 4.960 times the incidence of pulmonary tuberculosis compared to no contact history. The results also showed TB cases in people with contact with neighbors 28.8% and no history of contact with neighbors of TB 71.2%. The statistical test results showed p value = 0.000 <alpha 0.05, so there is a significant effect of contact history with neighbors of pulmonary tuberculosis on the incidence of pulmonary tuberculosis. The OR value = 0.129 indicates that there may be a history of contact with protective neighbors on the incidence of pulmonary tuberculosis. History of contact with patients with pulmonary tuberculosis both with household members and neighbors and the concentration of bacteria. The longer a person is exposed to pulmonary TB germs and the higher the concentration of germs present, the higher the likelihood of being infected with pulmonary TB.

The results showed that pulmonary tuberculosis cases in the habit of not collecting sputum were 34.8% and those who collected sputum were 65.2%. The statistical test results showed p value = 0.000 < alpha 005, so there was a significant influence of the habit of collecting sputum on the incidence of pulmonary tuberculosis. The OR value = 0.250 indicates the possibility that the habit of not collecting sputum will be protective against the incidence of pulmonary tuberculosis. This study is not different from the results of research by Wulandari et al, showing that the habit of collecting sputum has a risk of occurrence and contracting pulmonary tuberculosis disease with p value = 0.016 and OR = 4.402. The results also showed that cases of pulmonary tuberculosis in the habit of not covering the mouth when coughing were 34.8% and those who closed their mouths were 65.2%. The statistical test results show p value = 0.000 < alpha 005, so there is a significant effect of the habit of closing the mouth on the incidence of pulmonary tuberculosis. The OR value = 0.250 indicates the possibility that the habit of not covering the mouth will be protective against the incidence of pulmonary tuberculosis. The study is not different from the results of research by Wulandari et al, where the habit of covering the mouth when coughing is at risk of contracting or incidence of pulmonary tuberculosis with p value = 0.001 and OR = 9.137 (Wulandari et al, 2015).

Behavioral factors include pulmonary tuberculosis patients who have the habit of disposing of sputum carelessly, not covering their mouths when coughing, sneezing, and talking will increase the risk of pulmonary tuberculosis. Individual characteristics, including: low immunity, HIV/AIDS infection and malnutrition, DM, taking immune-suppressant drugs, TB is found in low socioeconomic groups, and BCG immunization. History of contact with TB patients and bacteria concentration. The longer a person is exposed to TB germs and the higher the concentration of germs present, the higher the chance of becoming infected with TB. The results of the study also showed that cases of pulmonary tuberculosis in the habit of not checking themselves at the VCT clinic were 90.9% and checking themselves at the VCT clinic 9.1%, by not conducting examinations at the VCT clinic, the risk of HIV / AIDS to the incidence of pulmonary tuberculosis cannot be known. In addition, smoking factors also have a risk of TB incidence, this is in accordance with the results of the study showing TB cases of respondents who have a smoking habit of 6.1% and do not have a smoking habit of 93.9%. The results of the statistical test showed p value = 0.000 < alpha 0.05, so there is a significant influence of smoking on the incidence of pulmonary tuberculosis. The OR value = 0.121 indicates the smoking factor is protective against the incidence of pulmonary tuberculosis. This study is no different from the research of Wulandari et al, where in the case of people the habit of smoking was 36.9% and not smoking 63.1% (Wulandari et al 2015).

3. The Effect of Home Environment on the Incidence of Pulmonary TB

Home ventilation serves to maintain air flow in and out of the room so that the temperature and humidity of the room remain optimum and also free the room from germs. The density of occupants has a direct impact on the

incidence of disease, the denser the occupancy of the house, the easier and faster the transfer of germs will be because of the possibility of direct contact with sufferers and the transmission of TB germs will be greater. Room conditions (temperature, humidity, sunlight), M. tuberculosis germs will die within 5 minutes when exposed to the sun and will survive for a long time in dark and humid conditions. The ideal temperature for the room is 18-30^0 C, and this will inhibit the growth of TB germs because the optimum temperature for TB germ growth is 37^0 C. TB germs can survive in humidity >70%, so the optimum humidity of a room should be 40-70%.

The results of the statistical test of residential density showed p value = 0.293 > alpha 005, so there was no effect of residential density on the incidence of pulmonary tuberculosis. The OR value = 1.448 indicates that residential density that does not meet the requirements is likely to cause pulmonary tuberculosis 1.448 times. Spatial analysis of the incidence of pulmonary tuberculosis cases based on residential density found 1 (one) significant village with a p value of 0.001 in Liliba village and 3 (three) villages with a p value of 0.01, namely Oesapa, Oebobo and Manutapen villages. Thus the risk of residential density on the incidence of pulmonary tuberculosis is found in Liliba, Oesapa, Oebobo and Manutapen villages. This study is different from the research of Wulandari et al, where the risk of residential density has a positive effect with p value = 0.0002 and OR = 7.841 (Wulandari, et al 2015). This may be due to the fact that most of the residential density of the respondents' houses mostly met the requirements. Although it does not have a significant effect, not meeting the house occupancy requirements is a risk factor for the incidence of pulmonary tuberculosis.

The results showed 93.3% of pulmonary tuberculosis cases occurred in homes that had ventilation. The statistical test results showed p value = 1.000 > alpha 005, so there was no effect of the presence of ventilation on the incidence of pulmonary tuberculosis. The OR value = 0.787 indicates the presence of ventilation may be protective against the incidence of TB. Although most houses have ventilation, the existing ventilation does not meet the requirements of the community. This is in accordance with the results of the study which showed cases of pulmonary tuberculosis in the area of home ventilation that did not meet the requirements as much as 22.7% and which met the requirements of 77.3%. The statistical test results show p value = 0.0.004 < alpha 005, so there is an influence of the ventilation area of the house on the incidence of pulmonary tuberculosis. The OR value = 6.176 indicates that the ventilation area does not meet the requirements for the possibility of pulmonary tuberculosis incidence 6.176 times. Unqualified ventilation area tends to risk the incidence of pulmonary tuberculosis. Lack of ventilation area results in poor air circulation in the house, so that family members who suffer from pulmonary tuberculosis are easily transmitted to other family members.

The results of this study also show that the level of humidity, lighting systems in the house, room temperature and sunlight lighting meet the requirements, so it tends not to be at risk and does not affect the incidence of pulmonary tuberculosis. The results of Spatial analysis of the incidence of pulmonary tuberculosis cases based on humidity, there are 3 (three) significant villages with a p value of 0.01, namely Fatubesi Village, Nefonaek Village and Oepura Village. This the risk of humidity levels on the incidence of pulmonary tuberculosis is found in Fatubesi, Nefonaek and Oepura villages. Spatial analysis of the incidence of pulmonary tuberculosis cases based on lighting in the house, there is 1 (one) significant village with a p value of 0.001, namely the Oesapa village and 2 (sub-districts) that are significant with a p value of 0.01, namely the Oetete and Fatubesi villages. This the risk of house lighting on the incidence of pulmonary tuberculosis is found in Oesapa, Oetete and Fatubesi villages. The results of Spatial analysis of the incidence of pulmonary tuberculosis cases based on the room temperature of the house there are 2 (two) significant villages with a p value of 0.01, namely Lasiana Village and Liliba Village. This the risk of room temperature on the incidence of pulmonary tuberculosis is found in Lasiana and Liliba villages. The results of the study differed from the research of Wulandari et al, the risk of room humidity was at risk of pulmonary tuberculosis with p value = 0.018 and OR = 4.705. Room temperature has a positive effect on the incidence of pulmonary tuberculosis transmission with P value = 0.001 and OR = 8.048 (Wulandari et al, 2015).

Conclusion

The results of the public policy review in this study show that

a. The spatial pattern of pulmonary tuberculosis disease distribution in Kupang city is highest in the sub-district or working area of the Oebobo puskesmas, lowest in the Bakunase puskesmas and no cases in the working area of the Kupang Kota puskesmas.
b. There is an effect of Body Mass Index on the incidence of pulmonary tuberculosis in Kupang city, but not the risk of pulmonary tuberculosis.
c. There is a behavioral influence on the incidence of TB in Kupang City, especially, the habit of collecting sputum, the habit of coughing without covering the mouth, the history of contact with family members in the same house and neighbors, the history of smoking.
d. The influence of the home environment on the incidence of pulmonary tuberculosis, including occupancy density, does not have a significant effect but has a risk of pulmonary tuberculosis. There is an effect of

house ventilation area on the incidence of pulmonary tuberculosis and has a risk of pulmonary tuberculosis. There is no effect of humidity, lighting, room temperature and sunlight on the incidence of pulmonary tuberculosis. The level of humidity, the lighting system in the house, the room temperature in the house and the sunlight that meets the requirements.

e. The risk model for the incidence of pulmonary tuberculosis in Kupang City is influenced by Body Mass Index, history of contact with neighbors, habit of covering the mouth when coughing and ventilation area simultaneously.

Suggestions

a. For puskesmas in Kupang city, it is necessary to conduct regular health promotion to help people at risk of pulmonary tuberculosis, reduce the habit of making sputum collected, the habit of covering the mouth when coughing and avoid smoking.
b. There is a need to assist pulmonary TB patients in making efforts to prevent transmission to other family members and neighbors.
c. The community needs to organize the home environment, especially making ventilation that meets the requirements.
d. Further research is needed to reduce risk factors, prevent transmission and treat pulmonary tuberculosis.

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