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ENVIRONMENTAL RISK FACTOR ANALYSIS OF PULMONARY TUBERCULOSIS

Fadillah Ulva[1*], Nailul Hikmi[1]
[1] STIKes Alifah Padang, Indonesia

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CONTACT

Fadillah Ulva
fadillah.ulva21@gmail.com
Public Health, STIKes Alifah Padang, Indonesia

ABSTRACT

Introduction: Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis bacteria and often attacks lung tissue. TB is one of the ten highest causes of death worldwide. The death rate of TB in Indonesia reaches 140,000 people per year. In 2020, the highest TB cases in Padang are in the Andalas Public Health Center, which is 106 cases. The spread of TB is closely related to the environmental conditions such as the physical condition of the house. This study aims to determine the environmental risk of pulmonary tuberculosis.

Methods: This research was observational research with case-control study design. This research was conducted at Andalas Public Health Center (PHC) on Dec 24, 2022 – Feb 16, 2023. The sampling technique used purposive sampling with ratio 1:1, namely 39 houses with pulmonary tuberculosis and 39 houses without pulmonary tuberculosis. Data collection used observation and interview technique. Independent variable in this research is occupancy density, humidity, ventilation to area ratio, and house lighting and pulmonary tuberculosis as dependent variable. Research instrument in the form of questioner, observation sheet, luxmeter, thermo-hygrometer, and roll-meter. Data analysis used univariate, bivariate, and multivariate.

Results: The results showed that occupancy density (OR: 0,267 CI95% 0,051-1,387), humidity (OR:0,661 CI 95% 0,145-3,013), ventilation to area ratio (OR: 0,042 CI 95% 0,007-0,232), and house lighting (OR: 0,183 CI 95% 0,044- 0,759), were related to pulmonary tuberculosis incidence. The multivariate results showed that there was a relationship between house lighting and the incidence of pulmonary tuberculosis after controlling of confounding variables.

Conclusion: Occupancy density, humidity, ventilation to area ratio, and house lighting, have been proven to be related to pulmonary tuberculosis incidence. House lighting was the most influential factor of pulmonary tuberculosis in Andalas Public Health Center Working Area. Healthy house needs to encourage to reduce the spreading and the incidence of pulmonary tuberculosis.

Keywords: *Analysis; Environmental factors; Pulmonary tuberculosis*

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INTRODUCTION

Environmental health is essentially a condition or condition that is optimal so that it has a positive effect on the realization of optimal health status. Environmental health efforts are one way to achieve a healthy environmental quality (Irma, 2020). Environmental conditions are also technical health provisions that must be eligible in order to protect residents and the surrounding community from hazards or health problems. The condition of the home environment that does ineligible health requirements and community behavior that does not pay attention to environmental conditions, health status, individual hygiene tends to contribute positively to an increase in acute infectious diseases, one of which is tuberculosis (Monintja, 2020).

Pulmonary tuberculosis is an infectious disease caused by Mycobakterium tuberculosis. Tuberculosis

bacteria mostly attack the lungs. Risk factors for tuberculosis are people who live in the same house as smear-positive pulmonary tuberculosis sufferers, smoking habits, unhealthy physical home environment, immune system, behavior of pulmonary tuberculosis sufferers, namely the habit of throwing sputum indiscriminately and not covering their mouths when coughing or sneezing, occupancy density. namely the ratio between the area of the house and the number of family members (Kristini et al., 2020).

According to the World Health Organization (WHO), a disease that is still often a concern of the world is tuberculosis. In 2019 tuberculosis cases reached 842 thousand cases and 116 thousand deaths, in 2020 the incidence of pulmonary tuberculosis cases decreased slightly to 12,800 cases. Cases of tuberculosis in Indonesia are in third place after India which reached 2.4 million cases and China 889 thousand cases of all sufferers in the world (World Health Organization, 2018).

In Indonesia, pulmonary tuberculosis is a major public health problem, based on reports from the Indonesian Ministry of Health, all tuberculosis cases in 2019 were 294,731 cases, of which 162,213 were new smear-positive tuberculosis cases, 108,616 were smear-negative tuberculosis cases (Ministry of Health RI, 2019). The results of the data from the Padang City Health Office Profile stated that the number of tuberculosis cases in Padang City reached 11,967 cases. The highest cases of tuberculosis in the city of Padang were in the working area of the Andalas Health Center, namely 106 tuberculosis sufferers, 85 Lubuk Buaya Health Centers, Pagambiran Health Center 65 tuberculosis sufferers (Dinas Kesehatan Kota Padang, 2020).

The spread of tuberculosis is closely related to the environmental conditions in which people live. In addition, the behavior of residents who do not care about environmental conditions can lead to an increase in the incidence of diseases in the community, including mycobacterium tuberculosis. The physical condition of the house has an indirect effect on the incidence of pulmonary tuberculosis, because a home environment that does ineligible health requirements will affect the number of bacteria in the house, including mycobacterium tuberculosis. Unhealthy home environment such as lack of ventilation, occupant density, type of floor and lighting. (Aprianawati, 2018). This study aims to determine the environmental risk of pulmonary tuberculosis in Andalas Public Health Center Work Area.

METHODS

This study used case-control design. The population of this study were AFB positive pulmonary tuberculosis patients who were treated at Andalas Public Health Center during December 2022 – February 2023. There were 39 positive pulmonary tuberculosis with a comparison between cases control = 1:1, which consisted of 39 respondents in the case group and 39 respondents in the control group, thus the sample in this study was 78 respondents. Cases were respondents who had AFB positive pulmonary TB with a history of clinical symptoms recorded at Andalas Public Health Center. Controls we re people who lived around the cases, usually the closest neighbors who did not have pulmonary tuberculosis.

The location of this study was in Andalas Public Health Center Work Area in Padang. The study conducted in February 2023. The instruments used in this study were questionnaires, observation sheets, hygrometers used to measure humidity, luxmeters used to measure house lighting, and roll-meter used to measure ventilation to area ratio. Data analysis was conducted with statistical tests used logistic regression.

RESULTS

The number of respondents was 78 respondents, consisting of 36 case respondents and 36 control respondents. The characteristics of respondents are presented in Table 1 below:

Tabel 1. Characteristics of cases and controls of respondents of pulmonary tuberculosis in Andalas Public Health Work Area, 2023

Characteristics	Number of cases (%)	Number of Controls (%)
Gender		
Male	20 (25,6%)	36 (46,2%)
Female	19 (24,4%)	3 (3,8%)
Age (year)		
17-25	8 (10,3%)	2 (2,6%)
26-35	9 (11,5%)	14 (17,9%)
36-45	15 (19,2%)	14 (17,9%)
>45	7 (9,0%)	9 (11,5%)

Table 1 showed that 48,7% of respondents infected by pulmonary tuberculosis were female and mostly were in the group of 36-45 years. The study results on the physical condition of the house related to incidence of pulmonary tuberculosis in Andalas Public Health Center Work Area are presented in Table 2 below:

Table 2. Results of bivariate analysis of physical condition of the house and the incidence of pulmonary tuberculosis in Andalas Public Health Work Area, 2023

Variables	Cases (%)	Control (%)	Pvalue	OR (95% CI)
Occupancy density				
Ineligible	35 (63,6 %)	20 (36,4 %)	0,001	1,61 (0,05 1-1,387)
Eligible	4 (17,4 %)	19 (82,6 %)		

Humidity				
Ineligible	26 (89,7 %)	3 (10,3 %)	0,000	2,24 (0,145-3,031)
Eligible	13 (26,5 %)	36 (73,5 %)		
House Lighting				
Ineligible	25 (65,8 %)	13 (34,2 %)	0,013	1,01 (0,044-0,232)
Eligible	14 (35,0 %)	26 (65,0 %)		
Ventilation to are ratio				
Ineligible	19 (79,2 %)	5 (20,8 %)	0,001	1,12 (0,007-0,479)
Eligible	20 (37,0 %)	34 (63,0 %		

Table 2 showed that the physical condition of the house: population density, humidity, house lighting and ventilation to are ratio were related to the incidence of pulmonary tuberculosis in in Andalas Public Health Work Area (p value <0,05).

Tabel 3. Results of multivariate analysis of environmental factors of pulmonary tuberculosis in Andalas Public Health Work Area, 2023

Variables	P Value	OR	95% CI
Humidity	0,024	1,92	1,08-2,94
Light house	0,032	1,02	0,98-2,76
Constant	0,010	0.00	

The multivariate analysis showed that the most related factor of pulmonary tuberculosis in Andalas Public Health Work Area was humidity (pvalues: 0,024)

DISCUSSION

The study showed that the physical environment consisted of occupancy density, lighting, humidity, and ventilation-to-area ratio. It can be seen that the conditions of occupancy density were ineligible in the case group (63.6%) and the control group (36.4%). House lighting was ineligible in the case group (65.8%) and the control group (34.2%). The humidity was ineligible in case group 89.7% and control group 10.3%. The environment is everything that is around something, including the external factors that affect how well or poorly a disease can spread among people or animals. Environmental factors can include biological, social, cultural, and physical aspects of the environment. The environment or the physical quality of the house that does ineligible the health requirements is a risk factor for the source of transmission of several types of diseases, such as diarrhea, acute respiratory infections, malaria, pulmonary tuberculosis, dengue fever, plague, and others. Environmental risk factors in residential buildings that can affect the incidence of disease include ventilation, lighting, occupancy density, floor type, and humidity (Astuti, 2017).

Based on the study, it was discovered that respondents with an occupancy density that was ineligible (63.6%) had a larger percentage of pulmonary tuberculosis than respondents with an eligible occupancy density (17.4%). According to the chi-squared analysis's findings, the p value is 0.001 (p 0.05). Aditama's research (2019), which demonstrates a strong association between occupancy density and the incidence of pulmonary tuberculosis with a p-value of 0.000, lends confirmation to the findings of this study.

Requirements for occupancy density: In accordance with Indonesian Minister of Health No. 1077/MENKES/PER/V/2011, regarding Housing Health Requirements, the occupancy density of a bedroom that qualifies for the requirements is a minimum bedroom area of 8 meters, and it is not advised to use more than 2 people sleeping in one bedroom, except for children under 5 years old. A home's occupants suffer when it has a high density of non-qualifying housing. The humidity rises as the number of people in a given space increases. Human sweat and exhaling water vapor both contribute to this. Due to the function that moisture plays in the development of germs, such as the bacterium Mycobacterium tuberculosis, a high human population density also indirectly contributes to pulmonary tuberculosis. Additionally, more frequent interactions between family members of people with pulmonary tuberculosis in highly populated areas facilitate the disease's spread. (Kenedyanti & Sulistyorini, 2017).

Based on the results of the study, it was found that the percentage of pulmonary tuberculosis incidents was higher in respondents with humidity that did ineligible the requirements (89.7%) when compared with respondents with humidity that eligible the requirements (26.5%). Based on the results of the chi-squared analysis, the p value is 0.000 (p 0.05). This research is in line with the research of Romadhan (2019), which shows that there is a significant relationship between humidity and the incidence of pulmonary tuberculosis in the Babana Health Center Work Area (p value 0.022).

Air humidity in the house, according to the requirements in Indonesian Minister of Health No. 1077/MENKES/PER/V/2011, is 40–60%. Houses with humidity that does ineligible the requirements are affected by ventilation and lighting. High humidity can increase the growth of microorganisms and the release of building materials. An environment with humidity that does ineligible the requirements is a good medium for the growth of Mycobacterium tuberculosis. This bacterium can live in an environment with high humidity to ensure its survival. This is a risk factor for the transmission of

pulmonary tuberculosis, which will very easily occur with the support of unhealthy environmental factors. So that it can infect the occupants of the house.

The percentage of pulmonary TB incidents was higher in respondents with lighting that did ineligible the requirements (65.8%) when compared to lighting that eligible the requirements (35.0%). Based on the results of the chi-squared analysis, the p value is 0.013 (p 0.05). The results of the study are in line with research conducted by Monintja (2019), which shows that the results of the Chi-square test obtained a value of p = 0.000 (p 0.05), which means that there is a relationship between the physical condition of the house and the incidence of pulmonary tuberculosis in the Bailang Health Center area, with an OR value of 4.808 and a 95% CI of 0.832–27.798, which means that respondents who have lighting less than 60 lux have a 4.8 times greater risk of suffering from pulmonary tuberculosis.

The study found that houses with poor lighting conditions were at greater risk of being exposed to pulmonary TB when compared to houses with sufficient sunlight. Adequate lighting is a significant risk factor. This lighting can be obtained by using artificial light from lamps and natural light from sunlight. Natural lighting is obtained from sun rays that enter through ventilation or windows. The presence of sufficient sunlight is an important factor in human health because sunlight has ultraviolet (UV) rays that can kill bacteria. The lack of sunlight tends to cause the air to become humid and the room to be dark so that the pulmonary tuberculosis bacteria can survive for a long time in the house; this allows the transmission of pulmonary tuberculosis to household members. (Rojali, 2020)

According to Indonesian Minister of Health Regulations (2011), the physical condition of the house influences the incidence of pulmonary tuberculosis because the home environment does ineligible health requirements, and the external conditions of humans or animals that cause disease transmission also affect the number of bacteria in the house, including the bacteria Mycobacterium tuberculosis. This mycobacterium bacteria can die if exposed to direct sunlight for 2 hours.

Based on the results of the study, it was found that the percentage of pulmonary tuberculosis incidents was higher in respondents with ventilation areas that did ineligible the requirements (79.2%) when compared with ventilation areas that eligible the requirements (37.0%). Based on the results of the chi-squared analysis, the p value is 0.001 (p 0.05). This research is in line with Monintja's (2020) finding that there is a significant relationship between ventilation area and the incidence of pulmonary tuberculosis in the working area of the Bailaing Health Center (p value 0.001).

Ventilation plays an important role in allowing sunlight to enter the patient's house because sunlight entering the patient's house can kill Mycobacterium tuberculosis in two hours. If there is no ventilation, the Mycobacterium tuberculosis bacteria can live long in the patient's house and can infect the occupants of the house. At the same time, with the environmental conditions of sufferers living in boarding houses and many residents of the same house, there will be a greater risk of people contracting pulmonary tuberculosis, so that when sufferers cough or sneeze, they can be carried under the air and inhaled by other sufferers so that they are inhaled and enter the body through breathing. Ventilation that eligibles the requirements, even if it is not opened and does not let sunlight in, can be a place of transmission of pulmonary tuberculosis. Ventilation must also not be blocked by other buildings so that sunlight enters the sufferer's house.(Muchsin, 2020)

CONCLUSION

According to this study, there were correlations between occupancy density, humidity, house lighting, ventilation to area ratio with the incidence of pulmonary tuberculosis in Andalas Public Health Work Area, Padang.

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