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Analysis of household environmental quality and health behavior on tuberculosis incidence in Jember Regency

Syahnia wasilatul Jannah[1], Hadi Prayitno[2], Ikhwan Nawarto[3]
[1]Magister of public Health, University of Jember, Jember, Indonesia
[2]Faculty of Social and political science, University of Jember, Jember, Indonesia
[3]Faculty of medical, University of Jember, Jember, Indonesia

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ABSTRACT

Tuberculosis Disease remains a public health problem in Indonesia, with the country facing a triple burden of TB, namely the incidence of TB-HIV, Drug-Resistant TB (DR-TB), and Drug-Sensitive TB (DS-TB) simultaneously (Global Tuberculosis Report, 2019). The purpose of this study is to determine the relationship between Household Environmental Quality and Health Behavior on the Incidence of Tuberculosis in Jember Regency. This research is a quantitative analytical observational study with a cross-sectional design and purposive sampling technique, involving 105 respondents. After conducting the research, it can be concluded that the variable related to the incidence of Pulmonary TB is the practice of Pulmonary TB prevention, while the variables of wall type, floor type, ventilation area, presence of ceiling, and occupancy density are not related. Half of the respondents have poor behavior regarding tuberculosis prevention in Jember Regency.This research emphasizes the importance of improving the quality of the household environment and health behavior to reduce the incidence of tuberculosis in Jember Regency.

Corresponding Author:

Syahnia Wasilatul jannah,
Master of Public Health,
University of Jember,
Ledokombo, Jember, 68196, East Java, Indonesia
Email: syahniawj@gmail.com

INTRODUCTION

Tuberculosis is still a public health problem in Indonesia, and this country is facing three TB burdens, namely TB-HIV, Drug-Resistant TB (DR-TB), and Drug-Sensitive TB (DS-TB) simultaneously(Imtiaz et al., 2017)(Fitri, 2018)(Zulaikhah et al., 2019)(Nuraini et al., 2022). Based on the 2019 Indonesian Health Profile, the number of TB cases in Indonesia reached 543,874 cases, with the three provinces contributing the most cases being West Java, East Java and Central Java which accounted for almost 40% of new TB cases in Indonesia. There are several risk factors that can cause pulmonary TB, including being influenced by agent, host and environmental factors(Budi et al., 2018)(Pangaribuan et al., 2020)(AGUSTIN, 2021).

Environmental risk factors, such as poor physical condition of the home or non-compliance, can be a risk factor for disease transmission(Sari et al., 2019)(Rustam & Mayasari,

2019)(Fristanti, 2020). According to WHO (World Health Organization), a healthy house has criteria such as adequate windows and ventilation, natural lighting, permanent wall conditions, waterproof floors, not crowded, and maintaining temperature and humidity(Kemenkes, 2015). Homes that do not meet the criteria for healthy homes can increase the risk of Mycobacterium tuberculosis breeding. The number of Mycobacterium tuberculosis bacteria can be influenced by the level of air humidity(Rusda et al., 2021). The humidity level in the home environment is influenced by ventilation, lighting levels, the presence of windows, kitchen smoke holes, and temperature. Floor and wall conditions that are not watertight can be a medium for transmitting pulmonary TB disease(Imaduddin et al., 2019).

Research conducted by(Kaligis et al., 2019) shows that there is a relationship between the type of floor and the incidence of pulmonary TB. In addition, the ceiling of the house must not be made of materials that can emit substances harmful to health and must be waterproof. Research by Budi et al. (2018) shows that there is a significant relationship between ceilings and the incidence of pulmonary TB(Basarah et al., 2022). Poor ventilation quality can increase the risk of respiratory problems, including the risk of contracting pulmonary TB(Village & District, 2019)(Bahri et al., 2021). Research by (Oktavia et al., 2016)proves that there is a relationship between ventilation quality and the incidence of pulmonary TB. This is also proven by Fitriani's (2020) research which found differences in the quality of home ventilation between the case group (pulmonary TB patients) and the control group (non-TB patients). Research by (Suryani & Ibad, 2022) shows that houses with inadequate lighting conditions have a 0.462 times greater risk than houses with adequate lighting conditions for the risk of exposure to pulmonary TB.

In research by(Apriliani & Rahayu, n.d.), statistical tests showed that there was a significant relationship between lighting conditions and the incidence of pulmonary TB. One of the risk factors for TB disease from host factors is behavior and lifestyle. The unhealthy behavior of household members is closely related to the incidence of pulmonary TB (Ministry of Health of the Republic of Indonesia, 2013)(Cochran et al., 2014). Behaviors such as opening the windows of the house every day, expelling phlegm in special containers, and maintaining a healthy home can prevent transmission of pulmonary TB to other people(Sandalayuk et al., 2023). If a family member has pulmonary TB, there is the potential for transmission to other family members due to direct contact, so preventive behavior is needed to reduce the risk of transmission(Diniarti et al., 2019).

Based on data from the Jember District Health Service in 2021, only 41.93% of houses met the criteria for healthy homes, still not meeting the target for healthy homes(Farida et al., 2021)(Shehmolo et al., 2021)(Roslan et al., 2022). Based on the problems and background explanation that have been described, researchers are interested in conducting research with the title "Analysis of Home Environmental Quality and Health Behavior on Tuberculosis Incidence in Jember Regency"(Chatterjee et al., 2023). This study aims to understand how physical environmental factors at home and health behavior influence the incidence of pulmonary TB in the area(Indonesia, 2013). By identifying the relationship between environmental conditions and health behavior, it is hoped that this research can provide deeper insight and effective solutions in efforts to prevent and control pulmonary TB in Jember Regency.

RESEARCH METHOD

This study is a quantitative analytical observational study with a cross-sectional design. The choice of a cross-sectional design was made because it is relatively easier and cheaper to conduct. This research was carried out in Jember Regency in May 2024 at health centers with the highest TB cases, namely Ledokombo Health Center, Kalisat Health Center, and Sumberjambe Health Center. The study population includes all objects or respondents with certain predetermined characteristics, divided into case and control populations. The sampling procedure used in this study is non-probability with a purposive sampling technique. The sample size was determined

using the Slovin formula to calculate the minimum sample size. The sample size in this study was determined using the formula used to calculate the minimum sample size with the Slovin formula as follows:

$$n = \frac{N}{1 + N\ (d^2)} = \frac{147}{1 + 147\ \ (0{,}05^2)} = \frac{147}{1{,}3675} = 105$$

N = Population
n = Sample size
d = 0,05

From the above calculation, the number of respondents in this study is 105. The research instruments used include a questionnaire sheet modified from previous studies, as well as measurement tools such as a roll meter for ventilation area, a hygrometer for humidity, a lux meter for lighting, and Compact Dry TC to measure the number of airborne germs. Primary data were collected through questionnaires filled out by respondents, with measurements using a Likert scale. After data collection, analysis was conducted using descriptive and multivariate analysis. Descriptive analysis presents data in tabular form to describe the characteristics of respondents and research variables, while bivariate and multivariate analysis were used to determine the relationship between independent and dependent variables, using chi-square statistical tests and logistic regression.

RESULTS AND DISCUSSIONS

Table 1. Distribution of TB patients respondents based on age, gender, education, occupation, marital status, family history, and source of information.

No	Respondents	Cases	
		N	%
1	Age		
	1. 15-25 old years	19	15
	2. 26-35 old years	28	25
	3. 36-50 old years	33	35
	4. 51-65 old years	15	15
	5. 66-75 old years	10	10
2	Education		
	1. Primary school (SD/MI)	32	35
	2. Junior high school (SMP/Equivalent)	19	20
	3. Senior high school (SMA/Equivalent)	46	40
	4. Bachelor's degree (Sarjana)	8	5
3	Occupation		30
	1. Farmer	36	15
	2. Entrepreneur	9	25
	3. Housewife	24	0
	4. Civil servant	0	30
	5. Unemployed	36	
4	Marital Status		
	1. Married	65	75
	2. Unmarried	24	15
	3. Widower/Widow	16	10
5	Gender		
	1. Male	79	80
	2. Female	26	20
6	Duration of Suffering from TB		
	1. 1-3 months	38	25
		60	60
	2. > 3-6 months	0	0
		7	15

No	Respondents	Cases	
		N	%
	3. > 6-9 months		
	4. > 9 months		
	Family History		
7	1. None	59	62
	2. Present	46	38

Table 1 shows that nearly half of the respondents are aged 36-50 years, with a total of 33 respondents (35%). Almost half of the respondents have a high school education or equivalent, totaling 46 respondents (40%). Nearly half of the respondents are farmers, with 36 respondents (30%), and 36 respondents (30%) are unemployed. The majority of respondents are married, totaling 65 respondents (75%). There are 59 respondents (62%) with no family history of pulmonary TB, and 46 respondents (38%) with a family history of pulmonary TB.

In this study, occupation is one of the factors influencing an individual's behavior. Respondents who are employed and have a stable job exhibit better behavior than those who are unemployed or do not have a stable job. This is closely related to information exposure, as interactions between individuals occur in the workplace. This exposure to information influences an individual's behavior. During the study, the researcher found feelings of inferiority and uselessness expressed by unemployed respondents. They felt unable to support their family's economic life, especially with their current illness. When an individual becomes unemployed, they often lose social contact. This is shown in a study(Pohlan, 2019) that unemployment is associated with very low social activities and less social support from relatives or colleagues compared to employed individuals. Furthermore,(Goldstein & Schweikhart, 2002) also explained that prolonged psychological stress leads to negative attitudes. Negative attitudes tend to result in negative behaviors.

A family history of pulmonary TB is also a factor influencing individual behavior. A family history of pulmonary TB is closely related to experience. Someone with a family history of pulmonary TB or who has had a family member with pulmonary TB certainly has knowledge about pulmonary TB and good prevention methods, leading to good preventive behaviors. Conversely, someone without a family history of pulmonary TB does not have experience caring for TB patients, so they lack knowledge about pulmonary TB and its prevention methods, resulting in poor preventive behaviors. Respondents also stated that the lack of experience in caring for family members with pulmonary TB led to their lack of knowledge on how to prevent TB transmission, resulting in poor preventive behaviors.

Education is one of the factors influencing an individual's behavior regarding lifestyle and motivation in forming attitudes. The learning process involves not only the transfer of information but also interactions between individuals and various unavoidable problems. This indirectly shapes an individual's personality. Generally, the higher the education level, the easier it is to accept information. A small portion of respondents have a high school or diploma/bachelor's education. This affects respondents' ability to receive and understand information or knowledge, including TB prevention.

During the study, respondents aged 25-34 asked more questions about their illness, indicating high curiosity and awareness about pulmonary TB, its transmission, and preventive measures. Onge, Jarron M. Saint, and Krueger, Patrick M. in their 2017 study stated that individuals aged 25-34 have the most positive attitudes towards a healthy lifestyle. Preventing infectious diseases, such as pulmonary TB, is a reflection of a healthy lifestyle.

Table 2. Frequency distribution of home environment quality

No	Risk Factor	Kasus		Kontrol	
		N	%	N	%

No	Risk Factor	Kasus		Kontrol	
		N	%	N	%
	Type of Walls				
1	1. Non-permanent	25	26,2	1	2.7
	2. Permanent	80	73,7	104	97,3
	Floor Condition				
2	1. Meets requirements	7	2,7	0	0
	2. Does not meet requirements	98	97,3	105	100
	Ventilation Area				
3	1. <10 %	29	30,4	10	27
	2. > 10%	76	69,6	95	73
	Presence of Ceiling				
4	1. None	21	22,5	29	30,4
	2. Present	84	77,5	76	69,6
	Temperature				
5	1. 18-30°C	76	79,8	99	93,7
	2. >30°C	29	20,2	6	6,3
	Lighting Level				
6	1. < 60 lux	82	86,1	92	86,4
	2. >60 lux	23	13,9	13	13,6
	Humidity Level				
7	1. < 40% dan > 70 %	90	94,5	90	84,3
	2. 40% -70%	15	5,5	15	15,7
	Occupancy Density				
8	1. < 8 m^2 /org	87	91,3	102	96,9
	2. > 8 m^2 /org	18	8,7	3	3,1
	Hygiene Practices				
9	1. Poor	101	92,8	81	74,8
	2. Good	4	4,2	24	25,2

Table 2 shows that in the case group, the number of houses with permanent walls was 80 (73.3%), while in the control group it was 104 (97.3%). The number of houses with floors that meet the requirements in the case group was 7 (2.7%). The presence of ceilings in the case group was 84 (77.5%) and in the control group was 76 (69.6%). The temperature around the house between 18-30 degrees in the case group was 76 (79.8%) and in the control group was 99 (93.7%). The lighting level <60 Lux in the case group was 82 houses (86.1%) and in the control group was 92 houses (86.4%). The humidity level less than 40% and more than 40% was 90 houses (94.5%) in both the case and control groups. The occupancy density less than 8 m^2/person was 87 houses (91.3%) in the case group and 102 houses (96.9%) in the control group. Hygiene practices that were rarely performed by the residents were reported by 101 respondents (92.8%) in the case group and 81 respondents (74.8%) in the control group.

The study results indicate that the proportion of houses with non-permanent walls (not meeting the standards) was higher in the case group (26.2%) compared to the control group (2.7%). The type of wall in a house affects humidity and can be a chain of transmission for pulmonary tuberculosis. Individuals living in houses with non-permanent/semi-permanent walls made of non-waterproof boards and partially unplastered walls have a higher risk of contracting pulmonary tuberculosis compared to those living in houses with permanent or standard-compliant walls. House walls serve various functions such as separating rooms, blocking noise, wind, rain, and radiation from sunlight.

The study results indicate that the proportion of houses with floors that do not meet the standards was 2.7% in the case group. Floors made of soil or not meeting the standards can cause humid air, which supports the growth of tuberculosis bacteria. Floors can also act as a medium for TB transmission. Non-standard floors (soil floors) cannot prevent water seepage, increasing indoor humidity. In contrast, standard-compliant floors (ceramic, plaster) are more resistant to water seepage, helping to control indoor humidity.

The study results indicate that the proportion of houses with ventilation areas <10% was higher in the case group (30.4%) compared to the control group (22.5%). Besides ensuring continuous air flow, ventilation also helps to free indoor air from bacteria, especially pathogenic bacteria harmful to residents. Open windows during the day are a requirement for determining indoor air quality from microorganism contamination, including Mycobacterium tuberculosis. Closed windows during the day increase the risk of pulmonary tuberculosis but also provide protection against Mycobacterium tuberculosis entering the house through the air.

The study results indicate that the proportion of houses with non-standard ceilings was higher in the case group (22.5%) compared to the control group (30.4%). Good house ceilings should be easy to clean, able to block dust and dirt from the roof, prevent rainwater from seeping through roof gaps, not prone to accidents, not made of materials that release harmful substances, and not conducive to the growth of pathogenic microorganisms, including tuberculosis bacteria. Respondents without house ceilings might be due to low socioeconomic status, which can be related to poor nutritional status. Poor nutritional status, combined with the absence of house ceilings, increases the risk of inhaling harmful substances from the roof (asbestos), raising the likelihood of contracting pulmonary TB.

The study results indicate that the proportion of houses with occupancy density <8 m^2/person (not meeting the standards) was higher in the control group (96.8%) compared to the case group (91.8%). Thus, it can be stated that individuals living in houses with floor area <8 m^2/person are more likely to contract pulmonary tuberculosis compared to those living in houses with floor area >8 m^2/person. Anggi Fathrida (2015) stated that houses with non-standard ceilings have a six times higher risk of tuberculosis compared to those with standard-compliant ceilings. The study results indicate that the proportion of houses with occupancy density <8 m^2/person (not meeting the standards) was higher in the control group (96.8%) compared to the case group (91.8%). High occupancy density in a house affects its residents. The denser the occupancy, the faster the indoor air becomes polluted. High occupancy density reduces oxygen consumption and increases carbon dioxide levels, leading to more bacteria being inhaled through the respiratory tract.

Table 3. Distribution of TB patients in relation to health behavior in tuberculosis incidence in Jember Regency

No	Behavior	Cases		Control	
		N	%	N	%
1	Poor	73	76,6	13	13,6
2	Good	32	23,4	92	86,4
	Amount	105	100	105	100

Table 3 shows that based on the health behavior of 105 respondents in Jember Regency, those with fair behavior consisted of 32 respondents (23.4%) suffering from pulmonary TB and 92 respondents (86.4%) not suffering from pulmonary TB. Meanwhile, respondents with poor knowledge consisted of 73 respondents (76.6%) suffering from pulmonary TB and 13 respondents (13.6%) not suffering from pulmonary TB.

Based on the most frequent variable, the fair behavior category, 86.0% did not suffer from pulmonary TB, indicating that respondents with fair behavior tend not to suffer from pulmonary TB. The 23.4% of respondents suffering from pulmonary TB may be due to other factors besides their behavior status, such as poor immune system, lack of information, and insufficient health education due to irregular implementation by health workers.

Respondents with poor behavior, 76.6% suffered from pulmonary TB, indicating that poor behavior tends to lead to pulmonary TB. The 14.0% who did not suffer from pulmonary TB may be due to other factors besides behavior, such as a good immune system. According to the theory, health promotion plays a significant role and influences a person's behavior, as promotional

activities spread messages and instill beliefs, making the community not only aware, knowledgeable, and understanding but also able to implement health-related recommendations(Agustina & Wahjuni, 2017).

Other factors, such as a lack of awareness in preventing pulmonary TB, even if the knowledge is sufficient, can lead to TB infection. For example, the community does not immediately report to local health workers if they find or suspect someone with tuberculosis, they spit and dispose of phlegm carelessly, do not always cover their nose or mouth with tissue or a handkerchief when coughing, and do not immediately dispose of the tissue in the trash or dispose of it carelessly.

Behavior is closely related to the incidence of pulmonary TB because poor health behavior in preventing pulmonary TB makes individuals more susceptible to tuberculosis if not accompanied by awareness in preventive behavior, such as early detection of tuberculosis(Herdianti et al., 2020). Preventive behavior against pulmonary tuberculosis transmission is key to reducing the incidence of pulmonary tuberculosis. Unhealthy behavior in patients with pulmonary tuberculosis can be due to a lack of information about TB in the community, making them less responsible for tuberculosis transmission. To assess habits in preventing pulmonary tuberculosis transmission, behavioral changes in the community are necessary.

CONCLUSION

After conducting a study on the analysis of home environmental quality and health behavior with the incidence of TB in Jember Regency, it can be concluded that the variable related to the incidence of pulmonary TB is the practice of pulmonary TB prevention, while the variables of wall type, floor type, ventilation area, ceiling (plafond) presence, and occupancy density are not significantly related. Half of the respondents have poor behavior regarding tuberculosis prevention in Jember Regency. For patients with Pulmonary TB in Jember Regency, it is expected to improve the condition of the home environment, especially the area of ventilation, humidity, lighting, and occupant density, because this environmental factor has been proven to have an effect on the incidence of Pulmonary TB. In addition, it is necessary to improve Hygiene Practices, healthy lifestyles, and health behaviors. Because this factor is still in the lack category

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