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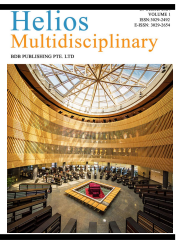

Overview of Ventilation and Lighting of Tuberculosis Patients' Homes in Sumenep, Indonesia

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ABSTRACT

Tuberculosis is an infectious disease caused by the mycobacterium tuberculosis germ by causing respiratory disorders and is known as MOTT (Mycobacterium Other Than Tubercoluss). In Indonesia, tuberculosis is one of the public health problems that still has a high incidence rate. Tuberculosis can be affected by unqualified lighting, ventilation of the house. The purpose of this study is to find out the Overview of Ventilation and Lighting of Houses of Tuberculosis Patients in the Working Area of the Arjasa Health Center, Sumenep Regency. This study is an analytical research, with a cross sectional approach. The population of Tuberculosis patients in the Working Area of the Arjasa Health Center, Sumenep Regency is 65 people, with a sample of 56 people. The sampling technique uses Simple Random Sampling. Data collection will be carried out from May to June 2024. Data were collected by observation and interviews. The results of the study showed that the condition of the houses of Tuberculosis patients in the Working Area of the Arjasa Health Center, Sumenep Regency who did not meet the requirements was mostly influenced by house lighting (62.5%) and ventilation (67.9%). To reduce the transmission of Tuberculosis, it is sought to open windows when residents are in the house so that sunlight can kill tuberculosis germs, in addition to modifying the design of the house so that the air circulation system in the house remains fresh and comparing the floor area of the house with the number of residents in accordance with health requirements so as to minimize the transmission of Tuberculosis.

1. Introduction

Tuberculosis transmission is one of the problems that must be considered because the spread of this disease is very related to the physical environmental conditions of the homes where people live (Wang et al., 2024). Tuberculosis is an infectious disease caused by the bacterium Mycobacterium tuberculosis which can cause disorders in the respiratory tract known as MOTT (Mycobacterium Other Than Tuberculosis) which can sometimes interfere with the diagnosis and

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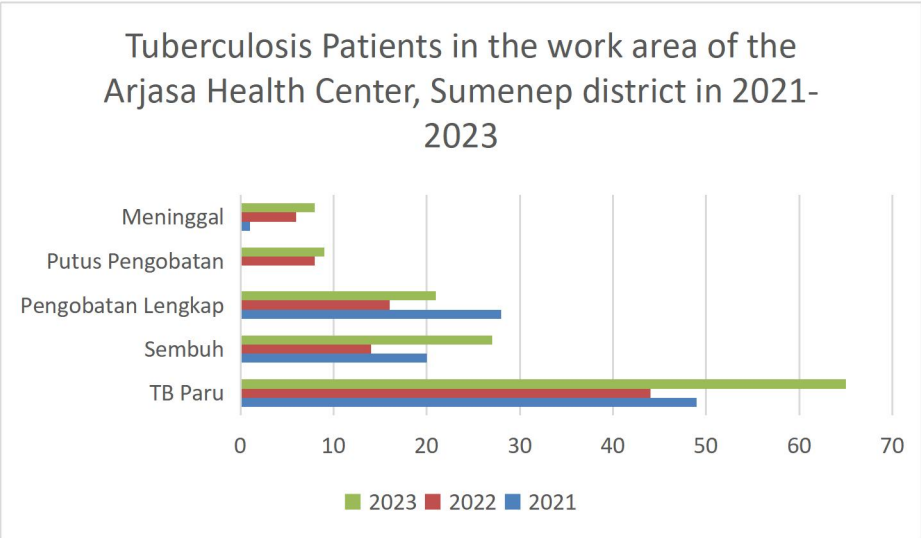
treatment of tuberculosis (Kemenkes RI, 2020). Tuberculosis is an infectious disease caused by the bacterium Mycobacterium tuberculosis usually attacks the lungs (Forster et al., 2024). The disease spreads when people with Tuberculosis release bacteria into the air in the form of sputum droplet nuclei (Marshall et al., 2024).

Based on the report of the Indonesian Ministry of Health in 2023, it is explained that the number of Tuberculosis patients that have been recorded in 2021 is 202,301 people and the prevalence is 138/100,000 population in Indonesia. In 2022, the number of Tuberculosis patients has increased from 351,893 to 360,770 cases in 2023 (Kemenkes RI, 2023).

Approximately 168,412 new positive cases of BTA were found with the highest number of known cases, namely in Central Java province there were 18,248 cases (10.8%), East Java 22,585 cases (13.4%), and West Java 31,598 cases (18.8%) 168,412 new positive cases of BTA were found with the highest number of known cases, namely in Central Java province there were 18,248 cases (10.8%), East Java 22,585 cases (13.4%), and West Java 31,598 cases (18.8%) (Kemenkes RI, 2023).

Based on a preliminary study conducted on February 15-16, 2024 to 12 respondents using interview and observation methods in the work area of the Arjasa Health Center, Sumenep Regency, 12 out of 20 respondents whose ventilation and lighting at home still do not meet the requirements for a healthy house due to the humid state of the house and the lack of sunlight lighting entering the room. In the working area of the Arjasa Health Center, Sumenep Regency, people with Tuberculosis can be seen in the following Figure 1. (Figure 1)

Figure 1. Tuberculosis patients in the work area of the Arjasa Health Center, Sumenep district in 2021-2023 (BPS, 2023)



Some of the factors that affect the increase in Tuberculosis patients in the Arjasa Health Center area include house ventilation that is rarely opened, lack of sunlight lighting indoors. The discovery of these factors and poor patient behavior factors will greatly affect Tuberculosis patients, if left unchecked, it is feared that there is a high risk of transmission to other people so that the population of Tuberculosis patients in the working area of the Arjasa Health Center in Sumenep Regency will increase.

A healthy home needs enough light, which is natural light such as sunlight. Sunlight is at least 60 lux provided that it does not create glare (Sulidah et al., 2024). Lighting of houses that do not meet the requirements are 2.5 times more likely to develop tuberculosis than residents who meet the requirements in East Jakarta (Listiyani, 2021). In addition, the house must also have sufficient ventilation. Ventilation is an effort to meet atmospheric conditions that are healthy for humans (Hassen et al., 2020). Ventilation is beneficial for air circulation in the house and also reduces humidity. The more people in a room, the higher the humidity because of water vapor from both breathing and sweat (Humphrey et al., 2019).

Houses that do not meet environmental health requirements are a risk factor for the transmission of Tuberculosis disease (Didkowska et al., 2024). The opinion of a study that has been conducted in Clampea is that the risk of developing tuberculosis is 5.2 times in residents of poorly ventilated houses compared to residents whose houses are ventilated enough to meet health requirements (Tanjung & N Sagala, 2022). Lighting that is not eligible for home is 2.5 times more likely to develop tuberculosis than that of eligible (Yan et al., 2024).

2. Method

Research design

In this study, a descriptive research design is used, a research method is carried out with the main purpose of making an overview or description of a phenomenon based on empirical facts in the field (Nursalam, 2020). According to field research because it is in the field, while according to the time it uses a cross sectional approach, which is a type of research that emphasizes the time to measure/observe independent and dependent variable data only once at a time (Nursalam, 2020). The variables studied were taken with one observation in a certain period of time.

Population

Population, namely subjects who have met the criteria and have been determined (Nursalam, 2020). In this study, the population is 65 people with Tuberculosis who go to the health center in the working area of the Arjasa Health Center, Sumenep Regency.

Inclusion and Exclusion Criteria

The inclusion criteria in this study are Tuberculosis patients who are treated at the health center visit. Meanwhile, the exclusion criteria in this study are respondents who experience communication disorders and respondents who experience illness and respondents who resign.

Sample

The sampling technique in this study uses Simple Random Sampling, random sampling without paying attention to the strata in the population. The sample in this study was 56 respondents.

Research instruments

The research instruments used in this study are in the form of Wawan method and observation sheet.

Data analysis techniques

This study uses the Univariate Analysis technique, this analysis is used to analyze descriptively, namely calculating the frequency and percentage of each variable.

Results

Respondents by gender, age, education level, and occupation

Table 1 shows that most of the respondents with Tuberculosis are male, which is 29 people (51.8%). And the age of respondents with Tuberculosis is mostly 27-60 years old, which is as many as 34 people (60.7%). Meanwhile, respondents based on education showed that almost half of the education of respondents with Tuberculosis was elementary education, which was 16 people (28.6%). Meanwhile, almost half of the respondents with Tuberculosis were self-employed, namely 16 people (33.9%), and 16 people (33.9%) were not working.(Table 1)

Gender	Total	Percentage (%)
Man	**29**	**51.8**
Woman	**27**	**48.2**
Total	**56**	**100**
Age		
22-26 year	**4**	**7.2**
27-60 year	**34**	**60.7**
61-70 year	**18**	**32.1**
Total	**56**	**100**
Education level		
SD	**16**	**28.6**
SMP	**13**	**23.2**
SMA	**15**	**26.8**
Sarjana(S1)	**12**	**21.4**
Total	**56**	**100**
Work		
Not Working	**16**	**28.6**
Student	**2**	**3.6**
farmer	**10**	**17.9**
Entrepreneurial	**16**	**28.6**
PNS	**12**	**21.4**
Total	**56**	**100**

Table 1. Distribution of respondent frequency based on gender, age, education, occupation of Tuberculosis patients in the Working Area of Arjasa Health Center, Sumenep RegencyRespondent's house based on home lighting

Table 2 shows that most of the home lighting of respondents with Tuberculosis is not eligible, namely 35 houses (62.5%). This states that home lighting can affect the incidence of Tuberculosis in the working area of the Arjasa Health Center, Sumenep Regency.(Table 2)

Category	Total	Percentage (%)
Not Eligible	**35**	**62.5**
Qualify	**21**	**37.5**
Total	**56**	**100**

Table 2. Distribution of respondents' houses based on house lighting in the Working Area of the Arjasa Health Center, Sumenep Regency

Respondent's house based on ventilation

Table 3 shows that most of the respondents' home ventilation is not eligible, namely 38 houses (67.9%). This states that home ventilation can affect the incidence of Tuberculosis in the working area of the Arjasa Health Center, Sumenep Regency.(Table 3)

Category	Total	Percentage (%)
Not Eligible	**38**	**67.9**
Qualify	**18**	**32.1**
Total	**56**	**100**

Table 3. Distribution of respondents' houses based on ventilation in the Working Area of the Arjasa Health Center, Sumenep Regency

3. Discussion

Physical condition of the house of a Tuberculosis patient based on lighting

Sunlight lighting is not only useful for illuminating the space, but also has the power to kill bacteria (Fahim et al., 2024). The sun can be used for the prevention of tuberculosis, by trying to get the morning sunlight into the house (Goel et al., 2024). Sunlight enters the house through windows or glass tiles. Morning sunlight that contains ultraviolet rays that can kill germs is preferred. (Dekhil & Mardassi, 2024). Tuberculosis germs can survive for many years, and die when exposed to sunlight, soap, lysol, carbol and the heat of fire (Humphrey et al., 2019). A house that does not get sunlight has a risk of suffering from tuberculosis 3-7 times compared to a house that enters the sun (Sudoyo et al., 2019).

The results of this study are in accordance with the results of a study conducted by Fitriani which stated that most (69.6%) of homes of Tuberculosis patients do not meet the lighting requirements (Fitriani, 2020). According to the Indonesian Ministry of Health, qualified lighting with a minimum intensity of ≥ 60 lux (Burhan, 2020). Lighting comes from natural light (sunlight) influenced by the location and width of the window, to get maximum lighting for the window at least 20% of the floor area of the room (Kemenkes RI, 2023).

Natural lighting, especially direct sunlight, has an important role in inhibiting the growth of tuberculosis bacteria (Pouzol et al., 2024). Research conducted by Jannah et al. (2023) in Bantul Regency shows that there is a significant relationship between home lighting and the incidence of Tuberculosis, with an odds ratio of 4.667 (Jannah et al., 2023). This means that homes with ineligible lighting have a 4,667 times greater risk for their occupants to develop Tuberculosis compared to homes with good lighting. Ultraviolet rays from the sun can kill or weaken tuberculosis bacteria, thereby reducing the risk of transmission (Phuphisut et al., 2024).

Socioeconomic factors also play a role in this problem. Research by Sulidah found that in addition to lighting, other risk factors for the incidence of Tuberculosis are housing density, ventilation, and economic status (Sulidah et al., 2024). Houses with unqualified lighting are often associated with dense residential conditions and poor building quality. This can lead to an increased risk of transmission of tuberculosis in the community (Dawson et al., 2024). Therefore, home lighting improvement efforts need to consider broader socioeconomic factors (Zakiudin et al., 2021). Given the high percentage of homes with unqualified lighting, comprehensive intervention is needed. A home improvement program that focuses on improving lighting and ventilation can be an effective first step. In addition, it is also important to educate the public about the importance of good lighting and its relationship to respiratory health, as recommended in the National Guidelines for Tuberculosis Control (Kemenkes RI, 2020).

Lighting is very important for humans, in addition to being able to kill tuberculosis germs, it also minimizes the occurrence of transmission to other people and families living in the same house, and most importantly, home lighting has a role in the development of tuberculosis germs (Kemenkes RI, 2020).

Physical condition of the home of a Tuberculosis patient based on Ventilation

Ventilation is an effort to meet atmospheric conditions that are pleasant and healthy for humans. In general, the assessment of house ventilation by comparing the ventilation area and the floor area of the house, using a Role meter. In general, the eligible ventilation area is 10-20% of the floor area (Jannah et al., 2023).

Windows and ventilation holes are not only a place for air to enter and exit, but also as lighting holes from the outside, keeping the air flow in the house fresh (Fitriani, 2020). Based on home surveillance indicators, the ventilation area that meets health requirements is ≥ 10% of the floor area of the house and the ventilation area that does not meet health requirements is < 10% of the floor area of the house. The ventilation area of the house that is <10% of the floor area (not meeting the health requirements) will result in a decrease in oxygen concentration and an increase in the concentration of carbon dioxide which is toxic for its occupants (Hamidah et al., 2023).

Insufficient ventilation will cause an increase in room humidity due to the process of evaporation of fluid from the skin and absorption. High room humidity will be a good medium for the growth and reproduction of pathogenic bacteria including tuberculosis germs (Phuphisut et al., 2024). The absence of good ventilation in a room is increasingly dangerous to health or life, if there is contamination by bacteria such as tuberculosis patients or various organic or inorganic chemical substances in the room (Goel et al., 2024). Ventilation also functions to free the room air from bacteria, especially pathogenic bacteria such as tuberculosis, because there is always a continuous flow of air. Bacteria carried by the air will always flow. In addition, the ventilation area that does not meet health requirements will result in the obstruction of the process of air exchange and sunlight entering the house, as a result of which tuberculosis germs in the house cannot come out and be inhaled with the breathing air (Chiyaka et al., 2024)

This research is in line with research conducted by Biset et al., (2024) in Solok City which states that there is a meaningful relationship between house ventilation and the incidence of tuberculosis with a probability value of 0.016 (Biset et al., 2024). Another related research on home ventilation in Tuberculosis patients was also conducted by Dawson et al., (2024). With the results of the relationship between house ventilation and the incidence of Tuberculosis, where a probability value of 0.005 was obtained and from the results of the OR calculation showed that people/respondents whose house ventilation was not qualified had a 5.2 times greater risk of

suffering from Tuberculosis compared to people/respondents whose house ventilation was qualified (Dawson et al., 2024).

Home ventilation has an important role in air circulation and indoor humidity regulation. Research conducted by Hamidah showed that there was a significant relationship between home ventilation and the incidence of Tuberculosis, with an odds ratio of 3.857 (Hamidah et al., 2023). This means that homes with inadequate ventilation have a 3,857 times greater risk for their occupants to develop Tuberculosis compared to homes with good ventilation. Adequate ventilation helps reduce the concentration of droplets containing tuberculosis bacteria in the air, thereby reducing the risk of transmission.

Environmental and behavioral factors also play a role in this problem. Research by Fitriyani found that in addition to ventilation, other risk factors for the incidence of Tuberculosis are occupancy density, lighting, and smoking behavior (Fitriani, 2020). Houses with unqualified ventilation are often associated with dense residential conditions and low building quality. This can lead to an increased risk of transmission of tuberculosis in the community. Therefore, efforts to improve home ventilation need to consider a wider range of environmental and behavioral factors (Marshall et al., 2024).

Ventilation is very important to meet the criteria of a healthy home, good air ventilation will affect other environmental factors such as temperature, humidity, lighting, floor conditions and can also minimize the transmission of Tuberculosis germs (Chiyaka et al., 2024).

4. Conclusions

Based on the results of the study on the ventilation and lighting conditions of houses of Tuberculosis patients in the Working Area of the Arjasa Health Center, Sumenep Regency, it can be concluded that the majority of respondents' houses have conditions that do not meet health standards, both in terms of ventilation and lighting. This condition shows that there are serious problems related to the sanitation of the living environment of Tuberculosis patients, where inadequate ventilation and less than optimal lighting can create an environment that supports the growth and spread of Mycobacterium tuberculosis bacteria, thus potentially worsening the patient's health condition and increasing the risk of transmission to other family members.

5. Acknowledgements

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