

The relationship between the physical home environment and the event of tuberculosis

Lili Amaliah¹, Arie Ardiyanti Rufaedah¹, Sri Nurcahyati¹, R. Nur Abdurakhman² and Abas Hidayat^{2,*}

¹ Public Health Study Program, STIKes Mahardika Cirebon, West Java, Indonesia

² Department of Nursing, Sekolah Tinggi Ilmu Kesehatan Cirebon, West Java, Indonesia.

World Journal of Advanced Research and Reviews, 2022, 14(03), 623–628

Publication history: Received on 21 May 2022; revised on 23 June 2022; accepted on 25 June 2022

Article DOI: <https://doi.org/10.30574/wjarr.2022.14.3.0627>

Abstract

The home environment is one of the factors that significantly influence the health status of its residents. Tuberculosis is an infectious disease that is caused mainly by tuberculosis bacteria. This research is a quantitative method with a cross-sectional design. The sampling technique used is total sampling. The sample is patients with tuberculosis, with as many as 41 respondents. The results showed that those who did not meet the requirements of the physical home environment were 31 (75.60%), and the event of AFB+ (acid-fast bacteria +) tuberculosis was 30 (73.2%). The statistical hypothesis test results showed a significant relationship between the physical home environment and the event of tuberculosis. These results contribute to the community and government paying more attention to and improving the quality of the physical home environment to reduce the number of tuberculosis spreads in the community.

Keywords: Tuberculosis; Spreads; Physical Home; Environment Home; Environmental Health; Community

1. Introduction

Globally, tuberculosis (TB) incidence per 100,000 population fell by about 2% per year. The regions that experienced the fastest decline in 2013-2017 were Europe, at 5% per year, and Africa at 4% per year. In 2017, a significant decrease (4-8% per year) occurred in South Africa, for example, Eswatini, Lesotho, Namibia, South Africa, Zambia, and Zimbabwe. Expansion of TB prevention and care in Russia by 5% per year through intensive efforts to reduce the TB burden [1].

The number of tuberculosis cases in Indonesia was 420.994 in 2017 (May 17, 2018) [2]. Based on gender, the number of tuberculosis cases in 2017 was 1.4 times greater for men than women. Even based on the tuberculosis prevalence survey, the prevalence in men is three times higher than in women. The same is happening in other countries. It may be because men are more exposed to risk factors for tuberculosis, such as smoking and lack of medication adherence. This survey found that 68.5% of all male participants smoked, and only 3.7% of female participants smoked [3].

Bacteriological in Indonesia is 759 per 100,000 population aged 15 years and over, and the prevalence of smear-positive TB is 257 per 100,000 people aged 15 years and above [4]. Based on the Riskesdas survey, the older the age, the higher the prevalence [3].

The possibility of TB re-activation and the duration of TB exposure is longer than in the younger age groups [5,6]. On the other hand, the higher the ownership index (which describes socio-economic capabilities), the lower the prevalence of TB [7,8].

* Corresponding author: Abas Hidayat
Department of Nursing, Sekolah Tinggi Ilmu Kesehatan Cirebon, West Java, Indonesia.

Tuberculosis (TB) is still a health problem, especially in developing countries, including Indonesia. In Indonesia, the estimated number of tuberculosis cases was 842,000, and the notification data for tuberculosis cases was 569,899 in 2018 [9,10]. Data on the Cirebon District Health Profile in 2018 stated that the Case Notification Rate (CNR) of all tuberculosis cases in the Cirebon district reached 203 per 100,000 population. This number has increased compared to 2017, which only got 169 per 100,000 people. The CNR showed the number of new patients found and recorded between 100,000 residents in a particular area [11]. Meanwhile, data from the district health office in 2020 reached 3,079 tuberculosis cases, and in the Mundu Health Center working area, 125 tuberculosis cases. Meanwhile, data from TB patient visits to UPTD Mundu Health Center, Cirebon district, in 2020 revealed 41 BTA⁺ and BTA⁻ patients.

The environment is an internal and external condition that influences and relates to individual and group behavior development. Environmental health includes all physical, chemical, and biological factors affecting health [12]. Several factors become the risk of tuberculosis, one of which is the physical environment of the house, such as ventilation area, occupancy density, light intensity, type of house floor humidity, and temperature [13,14].

Tuberculosis is closely related to the home environment. Home sanitation significantly affects mycobacterium tuberculosis bacteria [15]. These bacteria can survive up to 1-2 hours and even days to weeks depending on the presence or absence of sunlight, ventilation, the density of occupants of the house, temperature, and floor [16]. Therefore, the incidence of tuberculosis results from an interactive relationship between humans and their behavior with components of environmental factors that have the potential for disease.

According to a preliminary study I did on February 10, 2021, the surrounding environmental conditions are still not good. It can see from environmental conditions such as windows that are rarely opened during the day so that sunlight does not enter the house, and air circulation in ventilation is not good.

Based on the above phenomenon, the authors are interested in knowing the relationship between the physical home environment and the event of tuberculosis in the UPTD Puskesmas Mundu, Cirebon, Indonesia, working area. This study aimed to determine the relationship between the physical home environment and the event of tuberculosis.

2. Methods

This research is a quantitative method with a cross-sectional design. The sample is patients with tuberculosis, with as many as 41 respondents. The sampling technique used is total sampling. The total sampling technique makes all the total population used as a sample [17]. This research was conducted from 12 June until 19 June 2021 in the UPTD Puskesmas Mundu (Health Center), Cirebon, West Java, Indonesia.

The research instrument is an observation sheet. The independent variable is the relationship between the physical home environment, while the dependent variable is the event of tuberculosis. The following is the research hypothesis.

H₀: There is no significant relationship between the physical home environment and the event of tuberculosis in the working area of UPTD Puskesmas Mundu, Cirebon, Indonesia.

H_a: there is a significant relationship between the physical home environment and the event of tuberculosis in the working area of the UPTD Puskesmas Mundu, Cirebon, Indonesia.

To determine the accepted hypothesis, using the chi-square test with a significant level of 0.05. If the p-value is less than 0.05, then H₀ is rejected [18,19].

3. Results and discussion

3.1. Description of home physical environment and event of tuberculosis

Table 1 below is the frequency distribution of respondents in this study based on the physical home environment.

Table 1 shows that the physical environment of the respondent's home that meets qualifications is 10 (24.40%) lower than the respondent who does not meet the qualifications as much as 31 (75.60%).

Table 1 Frequency distribution of physical home environment

Physical Home Environment	Frequency	Percentage
Qualify	10	24.40
Not Qualify	31	75.60
Total	41	100

Source: Processed primary data in 2021

Table 2 Frequency distribution of respondents based on the event of tuberculosis

The event of tuberculosis	Frequency	Percentage
TB patients with AFB (acid-fast bacteria) +	30	73.2
TB patients with AFB (acid-fast bacteria) -	11	26.8
	41	100

Source: Processed primary data in 2021

Table 2 shows that most of the respondents suffer from AFB+ tuberculosis, as many as 30 respondents with a percentage of 73.2%. A small proportion of respondents suffered from AFB- tuberculosis, as many as 11 respondents with a percentage of 26.8%.

3.2. Results of Hypothesis Testing

The hypothesis of this research is H_0 = there is no significant relationship between the physical home environment and the event of tuberculosis in the working area of UPTD Puskesmas Mundu, Cirebon, Indonesia. H_a = there is a significant relationship between the physical home environment and the event of tuberculosis in the working area of the UPTD Puskesmas Mundu, Cirebon, Indonesia. Table 3 below is the statistical result using Chi-Square.

Table 3 Chi-Square Test

Physical Home Environment	The Event of Tuberculosis				Total		P-Value
	AFB+		AFB-		Frequency	%	
	Frequency	%	Frequency	%			
Qualify	3	30.0	7	70.0	10	100	0.001*
Not Qualify	27	87.1	4	12.9	31	100	
Total	30	73.2	11	26.8	41	100	

Source: Processed primary data in 2021; * Significant level 0.05

Table 3 shows that respondents with AFB+ tuberculosis incidence in the physical home environment that meet the requirements are 3 (30.0%) and 27 (87.1%). The results of statistical tests with the chi-square test obtained a p-value = 0.001, less than 0.05. It means that H_0 is rejected, and H_a is accepted. There is a relationship between the physical home environment and the event of tuberculosis in the working area of the UPTD Puskesmas Mundu, Cirebon, Indonesia.

3.3. Physical Home Environment

This study shows that the respondent's home's physical environment with a ventilation area that does not meet the requirements is 22 (53.7%). The physical environment of the respondent's home has a residential density that does not meet the criteria is 28 (68.3%), and the physical environment of the respondent's house has lighting that does not meet the requirements of 25 (61.0%). The respondent's house's physical environment with humidity that does not meet the criteria is 24 (58.5%). The physical environment of the respondent's house with a room temperature that does not meet the requirements is 24 (58.5%), and the physical environment of the respondent's home that does not meet the criteria is as many as 31 (75.60%).

The environment is everything that exists outside the host, both inanimate objects and living objects, real or abstract. Like the atmosphere that is formed due to the interaction of all these elements, including other hosts, environmental factors play an important role in transmission, especially the home environment that does not meet the requirements.

3.4. The Event of Tuberculosis

This study shows that most of the respondents suffer from AFB⁺ tuberculosis and a small number suffer from AFB⁻. Tuberculosis is an infectious disease that is mostly caused by mycobacterium tuberculosis [20]. These germs usually enter the human body through the air that is inhaled into the lungs. Then Mycobacterium tuberculosis germs can spread from the lungs to other body parts through the circulatory system, lymphatic system, the respiratory tract, or direct spread to other factors [21,22].

Pulmonary tuberculosis is an infectious disease caused by the bacterium Mycobacterium tuberculosis. These bacteria are rod-shaped and acid-fast, so they are also known as acid-fast bacteria (AFB) [1,23].

3.5. The Physical Home Environment and The Event of Tuberculosis

The results of statistical tests with the chi-square test showed a p-value = 0.001 less than 0.05, meaning there is a significant relationship between the physical home environment and the event of tuberculosis in the working area of the UPTD Puskesmas Mundu, Cirebon, Indonesia.

The environment is an internal and external condition that affects and results in the development and behavior of a person or group. The internal environment is a state of mental processes in the individual's body (in the form of experience, emotional abilities, and personality) and procedures that trigger biological stressors (cells and molecules) from within the individual's body. The external environment can be in the form of physical, chemical, or pathological conditions or factors that are accepted by the individual and perceived as a threat [12–14].

The physical environmental factors of the house that are associated with the incidence of pulmonary TB are the occupants' density, the house's floor, ventilation, lighting, temperature, and humidity [24,25]. Tuberculosis is caused by the bacteria Mycobacterium tuberculosis, which is transmitted through the air (droplet nuclei) when a person with AFB⁺ tuberculosis coughs and splashes of saliva containing bacteria are inhaled by other people while breathing. One cough can produce about 3000 phlegm droplets [26]. These bacteria can survive for 1-2 hours in the air, in a humid and dark place for months but cannot tolerate sunlight or airflow [27]. The occupancy density facilitates transmission between fellow residents because it causes accelerated transmission (cross-infection). Generally, transmission occurs in a room where sputum sprinkling is for a long time. Ventilation can reduce the amount of splashing, while direct sunlight can kill tuberculosis germs.

4. Conclusion

The results showed that those who did not meet the requirements of the physical home environment were 31 (75.60%), and the event of AFB⁺ tuberculosis was 30 (73.2%). The results of the statistical hypothesis test showed that there was a significant relationship between the physical home environment and the event of tuberculosis. These results contribute to the community and government paying more attention to and improving the quality of the physical home environment to reduce the number of tuberculosis spreads in the community.

Compliance with ethical standards

Acknowledgements

The authors would like to thank the Chairperson of STIKes Mahardika and STIKes Cirebon for supporting this research.

Conflict of interest statement

No conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] World Health Organization. Global tuberculosis report 2018 [Internet]. Geneva: World Health Organization; © 2018 [cited 2022 May 13]. Available from: <https://apps.who.int/iris/handle/10665/274453>
- [2] Tahu SK, Dion Y. Preventing Tuberculosis in Families of East Timor Expatriate Tuberculosis Patients in Indonesia. *KnE Life Sciences*. 2022;934–42.
- [3] Kemenkes RI. Riset Kesehatan Dasar (RISKESDAS) 2013. Jakarta: Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan Republik Indonesia; 2017.
- [4] Ambarwati M. Correlation Between Coverage of Bcg Immunisation and Healthy Houses with Findings of Paediatric Tuberculosis. *Jurnal Berkala Epidemiologi*. 2019;7(3):207–16.
- [5] Menzies D, Al Jahdali H, Al Otaibi B. Recent developments in treatment of latent tuberculosis infection. *The Indian journal of medical research*. 2011;133(3):257.
- [6] Ragonnet R, Trauer JM, Scott N, Meehan MT, Denholm JT, McBryde ES. Optimally capturing latency dynamics in models of tuberculosis transmission. *Epidemics*. 2017;21:39–47.
- [7] Lienhardt C. From exposure to disease: the role of environmental factors in susceptibility to and development of tuberculosis. *Epidemiologic reviews*. 2001;23(2):288–301.
- [8] Nelson LJ, Wells CD. Global epidemiology of childhood tuberculosis [Childhood TB]. *The International journal of Tuberculosis and lung Disease*. 2004;8(5):636–47.
- [9] Rahmi U. Analisis Faktor Kepatuhan Berobat Penderita Tuberculosis Paru di Bandung. *Wiraraja Medika: Jurnal Kesehatan*. 2020;10(1):23–8.
- [10] Pradani FY, Nurindra RW, Usman U. Ethnographic Study of Tuberculosis Treatment Seeker Behavior on the Island of Buru, Maluku, Indonesia. *Insights in Public Health Journal*. 2020;1(2):25–9.
- [11] Dinkes C. Profil Kesehatan Kabupaten Cirebon Tahun 2018. Cirebon: GERMAS; 2019.
- [12] Moeller DW. *Environmental health*. Cambridge: Harvard University Press; 2011.
- [13] Musfirah M. Analysis of Healthy Housing and TB Prevalence in Yogyakarta City. *KEMAS: Journal Kesehatan Masyarakat*. 2022;17(3).
- [14] Satwikasari AF. Exploratory Study of Physical Environment Factors Affecting Tuberculosis Endemics Houses in Kebumen District, Indonesia. *International Journal of Built Environment and Scientific Research*. 2018;2(1):65–74.
- [15] Sartiwi W, Sandra R, Asak AS. The Relationship Environment Conditions with the Risk Event of Pulmonary Tuberculosis at the Sikakap Health Center, Mentawai Islands. In: 2nd Syedza Sainika International Conference on Nursing, Midwifery, Medical Laboratory Technology, Public Health, and Health Information Management (SeSICNiMPH 2021). Atlantis Press; 2021. p. 335–9.
- [16] Muhith A, Saputra MH, Siyoto S. The Correlation Between Healthy House Condition and Dyspnea Frequency of Pulmonary Tuberculosis Patients. *Proceedings of Health Science "FK-DIKUA."* 2017;1:84–8.

- [17] Rokhmatul Hikmat, Syarifah Lubna, R. Nur Abdurakhman, Abas Hidayat. The effect of morning walk therapy on blood pressure elderly. *World Journal of Advanced Research and Reviews*. 2022;14(1):580–3.
- [18] Nuniek Tri Wahyuni, Lin Herlina, R. Nur Abdurakhman, Abas Hidayat, Cecep Supriyadi. Implementation of Buerger Allen exercise in patients with diabetes mellitus type II to improve lower extremity circulation. *World Journal of Advanced Research and Reviews*. 2022;14(1):573–9.
- [19] R Nur Abdurakhman, Abas Hidayat, Didi Taswidi, Alifa Romadoni. Effect of hypertension exercise on blood pressure in the elderly. *World Journal of Advanced Research and Reviews*. 2022;13(3):491–5.
- [20] Sharma D, Sarkar D. Pathophysiology of tuberculosis: an update review. *PharmaTutor*. 2018;6(2):15–21.
- [21] Moule MG, Cirillo JD. Mycobacterium tuberculosis dissemination plays a critical role in pathogenesis. *Frontiers in Cellular and Infection Microbiology*. 2020;65.
- [22] Krishnan N, Robertson BD, Thwaites G. The mechanisms and consequences of the extra-pulmonary dissemination of Mycobacterium tuberculosis. *Tuberculosis*. 2010;90(6):361–6.
- [23] Bentz JS, Carroll K, Ward JH, Elstad M, Marshall CJ. Acid-fast-positive Legionella pneumophila: A possible pitfall in the cytologic diagnosis of mycobacterial infection in pulmonary specimens. *Diagnostic cytopathology*. 2000;22(1):45–8.
- [24] Madhona R, Ikhwan Z, Aminin F. Physical Environment home and incidence of TB disease in Tanjungpinang District. In: 1st Public Health International Conference (PHICo 2016). Atlantis Press; 2016. p. 397–401.
- [25] Aditama W, Sitepu FY, Saputra R. Relationship between Physical Condition of House Environment and the Incidence of Pulmonary Tuberculosis, Aceh, Indonesia. *Int J Sci Healthc Res*. 2019;4(1):227–31.
- [26] Redrow J, Mao S, Celik I, Posada JA, Feng Z. Modeling the evaporation and dispersion of airborne sputum droplets expelled from a human cough. *Building and Environment*. 2011;46(10):2042–51.
- [27] Remuiñán MJ, Pérez-Herrán E, Rullás J, Alemparte C, Martínez-Hoyos M, Dow DJ, et al. Tetrahydropyrazolo [1, 5-a] pyrimidine-3-carboxamide and N-benzyl-6', 7'-dihydrospiro [piperidine-4, 4'-thieno [3, 2-c] pyran] analogues with bactericidal efficacy against Mycobacterium tuberculosis targeting MmpL3. *PloS one*. 2013;8(4):e60933.