



Relationship between House Condition and Tuberculosis Incidence in Timor Tengah Utara District

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Abstract

Tuberculosis (TB) disease is still a major public health problem in NTT Province. PHC Sasi has a fairly high TB cases in the past three years. The increasing incidence of TB can be caused by several factors such as population and housing conditions. This study aimed to determine the relationship of housing conditions with TB disease incidence in PHC Sasi Timor Tengah Utara District. This observational analytic research using case-control study. All patients with tuberculosis smear (+) in January-December 2013 and January-February 2014 as many as 35 people were sampled cases. Control sample is a neighbor group who had never suffered from a case of TB as many as 70 people. The collection of data by direct observation and the data processed by the Chi-square test (α 0.05). This research found significant association between the floor of the house (X^2 19.227; OR 16.9), home ventilation (X^2 35.979; OR 16.3), natural lighting (X^2 35.076; OR 4.5), the temperature of the house (X^2 11.748; OR 0.176), home humidity (X^2 7.851; OR 4.2), and population density (X^2 19.227; OR 15.4) with the incidence of TB. Value OR shows people who have the condition of the house does not qualify at risk for TB is greater than people with the condition of the house qualifies, except for home temperature variables.

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The research concludes that there is a relationship between housing conditions with the incidence of TB so that it is important to held more intensive outreach activities health promotion toward community by health workers involving related other departments especially in order to prevent TB disease by improving house condition.

Keywords: floor; ventilation; lighting; temperature; humidity; density; Tuberculosis.

1. Introduction

Housing conditions that do not meet health requirements will affect the health of the occupants and can lead to the emergence of disease-based environment, one of which is a disease of tuberculosis (TB). For the requirements of a healthy home must meet physiological needs, psychological, protecting the occupants of the possibility of disease transmission or hazardous substances, protecting the occupants from possible dangers and accidents [1]. World Health Organization (WHO) estimates that TB-causing bacteria can kill about 2 million people each year. In the year 2002 up to 2020 is estimated at around 1 billion people will be infected with TB [2]. TB disease is a major public health problem in the province of East Nusa Tenggara (NTT), where in 2013 the notification rate in NTT Province 88,1 cases BTA (+) every 100,000 people. This rate was higher than the average rate in Indonesia [3]. In 2010, there were 3,705 cases of BTA (+), with a cure rate of 70%, in 2011 decreased to 1,545 cases, with a cure rate of 81.2%, where the cure rate is still below the target that should be more than 85% [4]. In cases of TB each year Timor Tengah Utara District (TTU) high enough that in 2011 there were 199 cases of TB BTA (+) [5]. A high case of BTA (+) is always existed at Health centers Sasi, as one of the areas in TTU, in the last 3 years.

The increasing incidence of TB can be caused by several factors such as population and environmental house factors. Population factors consists of gender, age, and economic conditions, while environmental house factors consist of density residential housing, house floor, ventilation, lighting, temperature and humidity. Here, the environmental house factors are estimated to be very instrumental in the development of TB. Therefore, knowledge about risk factors for TB incidence is needed, especially housing conditions such as the condition of the floor, ventilation, lighting, temperature, humidity, and population density, which is hoped that it can be used to provide input in the prevention of TB disease, especially from the aspect of a healthy housing conditions.

2. Materials and Methods

This observational analytic study using case-control studies, in which case is numbered 35 TB patients and controls is people who had never suffered TB which is living close to the patients with ratio of 1: 2, or 70 people for control. Data were obtained by direct observation and measurement of the sample house. Chi-square test is used to find the relationship between the house condition with a TB incidence ($\alpha = 0.05$).

3. Results

Based on the results of the Chi-Square test, this study showed there is relationship between the condition of the house floor, ventilation, lighting, temperature, humidity and density of the house with the incidence of TB. Value Odds Ratio (OR) show all housing conditions that do not qualify for the residents at risk for TB infection

is greater than the residents who qualify, unless the temperature house variable that does not qualify at risk (OR) of developing TB is lower than the one that qualifies, as shown in Table 1.

Table 1: Relationship between House Condition and Tuberculosis Prevalence

Variable	Category	Case		Control		Total	%	X ² table 3,841 X ² quotation	OR
		Σ	%	Σ	%				
Floor	Not qualify	24	75	8	25	32	100	19,227	16,9
	Qualify	11	15	62	85	73	100		
	Total	35	33	70	67	105	100		
Ventilation	Not qualify	27	69,2	12	30,8	39	100	35,979	16,3
	Qualify	8	12	58	88	66	100		
	Total	35	33	70	67	105	100		
Lighting	Not qualify	20	56	16	44	36	100	35,076	4,5
	Qualify	15	21,8	54	78,2	69	100		
	Total	35	33	70	67	105	100		
Temperature	Not qualify	5	12,8	34	87,2	39	100	11,748	0,176
	Qualify	30	45,4	36	54,6	66	100		
	Total	35	33	70	67	105	100		
Humidity	Not qualify	30	42,2	41	57,8	71	100	7,851	4,2
	Qualify	5	14,7	29	85,3	34	100		
	Total	35	33	70	67	105	100		
House Density	Not qualify	26	70,3	11	29,7	37	100	19,227	15,4
	Qualify	9	13,2	59	86,8	68	100		
	Total	35	33	70	67	105	100		

4. Discussions

Home floor conditions in this study relates to the incidence of TB, where the risk of people who do not qualify house floor which is not watertight and dusty had the risk of developing tuberculosis 16.9 times higher than those whose homes have impermeable and clean floor. This can be explained according Kepmenkes [6] that house floor damp facilitate the growth of bacteria, so that the required conditions for healthy flooring qualified is the floor that is watertight, clean and easy to clean. It is explained that soil floor also tends to cause moisture in rainy season and dust during the dry season so that could damage the health of the occupants [7].

The study before also found that people with in qualify home floor have 4.7 higher risk to get TB infection than people with qualify home floor [8]. The authors in [9,10] said that the soil floor has a role on the incidence of TB disease because the ground floor tends to cause moisture that will prolong the survival of the TB germs and will eventually lead to the potential transmission of TB to be great.

Ventilation home in this study is also associated with the incidence of TB, with OR 16.3, which means that the house whose windows do not qualify, that is the window wide ventilation <10% of the floor area of the occupants had the risk of developing TB 16.3 times higher than the house with ventilation qualify. Bad influence of lack ventilation reduces oxygen levels and increases levels of CO₂, and rises temperature and humidity of the room. The presence of elevated CO₂ can support bacterial growth [11]. Ventilation also affect the process of dilution air, in other word it dilutes the concentration of TB bacteria and other germs are carried out and die exposed to ultraviolet light so it will decrease the transmission of air borne disease including TB disease [11, 12]. So according to Kepmenkes [6] the broad permanent ventilation is required $\geq 10\%$ of the floor area.

This study agrees with previous studies that the more ventilation that is not eligible, the more TB cases, otherwise the more ventilation that is eligible, the less TB cases. Ventilation air exchange serves as a place to keep the room fresh and contains enough oxygen[13]. The house with less ventilation causing light not being able to enter into the house, resulting the increase of humidity and temperature inside the house in result the TB germs can grow well and can infect residents [10, 14, 15].

The relationship between natural lighting with the incidence of TB is also evident in this study, where the value of OR 4.5, which means that the natural lighting homes do not qualify namely <60lux have the risk of getting TB 4.5 times higher than people with home lighting meets requirements. The lack of light that comes into the house, especially sunlight can make the room uncomfortable and also as a good place to live and the development of germs. For incoming sunlight is expected to be at least 60 lux. [6, 13, 16].

This result is similar with previous study that people with inqualify home lighting have the risk of getting TB 3.89 than people with qualify home lighting [8]. Moreover, previous research stated that someone who lived in the house, with lighting that does not qualify, have 16,9 times greater risk of suffering TB than people who live in the house with qualified lighting [17]. Many types of bacteria can be turned off if the bacteria gets direct sunlight, as well as TB germs can die because of sunlight into the room [10, 14]. Natural light is obtained with the entry of sunlight into the house. Besides being useful to kill germs, natural lighting can reduce the humidity of the room, and repel mosquitoes [7]. The study before showed that the increasing of lighting 1 lux will make the risk of TB in children become 0.9 times [17]. It means that the higher lighting the lower risk to be infected by TB. This study proves that there is a significant relationship between the temperature of the house with the incidence of TB, which the relationship is protective that is homes that do not meet the temperature requirements for <18°C and > 30°C. It shows that the inhabitants had 0.18 times the risk of developing TB is lower than the ones whose house temperature is 18°C - 30°C.

It is inexplicable that at low temperatures (<18°C) TB germs difficult to live and breed, as well as at high temperatures (>30°C), the TB germs difficult to live and breed. In contrast, at a comfortable temperature (18°C - 30°C) bacterial diseases including TB germs easily live and breed. As written by Fatima that warmer temperatures make the TB germs cannot survive [14]. Wahyuni also explained that *Mycobacterium tuberculosis* is not able to survive when it is in a hot room or in direct sunlight [18].

Humidity in the incidence of TB disease proved meaningful relationship, with OR 4.2, which means people with unqualified home humidity (<40% RH or >70% RH), had the risk of developing TB disease 4.2 times higher than people with a qualified home humidity (40⁰C – 70⁰C). The study before had similar result that people with unqualified home humidity had risk to get TB infection 4.0 times higher than people with qualified home humidity [8].

Humidity must be maintained in such moderate temperature. High humidity will cause the house always wet, and is a good place for bacteria including tuberculosis bacteria, where the optimal growth of TB germs in humidity > 60%. High humidity can also cause nasal mucous membranes become dry and thus less effective as a filter microorganisms that enter the respiratory tract [6]. In high humidity, which is supported by the lack of natural light, especially ultraviolet light, germs can survive for days to months [19].

The study also found correlation between population density in the incidence of TB disease, with an OR of 15.4, which means houses with ineligible residential density (<8m²/person) made occupants have the risk of developing TB 15.4 times higher than the occupants with qualified density. Residential density is a source of transmission of the disease. The more dense residential, the easier and quicker the displacement of air borne diseases, especially diseases from human to human [20].

5. Conclusion

There is a significant relationship between the floor of the house, home ventilation, natural lighting, house temperature, humidity homes, and residential density in the incidence of TB. OR value shows all the variables that do not qualify increased risk of TB, except for the temperature of the house.

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