

## THE EFFECT OF HOME VENTILATION ON THE INCIDENCE OF LUNG TUBERCULOSIS IN PONOROGO REGENCY

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### **Abstract**

Lung tuberculosis (TB) is an infectious disease directly affects the lungs caused by tuberculosis bacteria (*Mycobacterium tuberculosis*). A variety of causes associated by the incidence of the current disease threatens the health both national and global; one of them is the home ventilation. This study aims to determine how the home ventilation influences on the incidence of lung tuberculosis in Ponorogo regency. The methods of this study used a case control method where the population and the sample are men and women who visit Badegan Health Centers of Ponorogo both outpatient and inpatient care during the study period adjusted to the criteria of the study. The technique of collecting data was observation at the respondent's house using a Luxmeter. The results of the study showed that respondents who have a home with the level of ventilation <60 lux have risk of lung tuberculosis infection 3.2 times greater than respondents who have a home with level of ventilation ≥60 lux (OR = 3.2; CI = 95 %). According to the study above, the advice for patients; it is expected to open the house more often, maximize ventilation and equip the house with glass tiles which allows and access sunlight can enter into the house, so it is expected to kill the bacteria of *mycobacterium tuberculosis*.

*Keywords: Ventilation, Lung Tuberculosis*

### **Introduction**

Tuberculosis is an infectious disease caused by *Mycobacterium Tuberculosis*, an acid-resistant of aerobic bacillus, which is transmitted by the air (airborn) (Asih & Effendy, 2004). A person who is infected can spread the small particles through coughing, sneezing, or talking (Digiulio, et al 2014). Tuberculosis (TB) keeps being a health problem in the world, especially in developing countries. Although the anti-tuberculosis drugs (OAT) has been found and vaccination of *Bacillus Calmette Guerin* (BCG) has been

implemented, TB still can not been eradicated completely (Depkes RI, 2012).

In developing countries the death of TB is 25 % of all deaths, actually it can be prevented. Around 95 % of TB cases and 98 % of TB deaths in the world occur in developing countries, 75 % of TB patients are productive group (15-50 years). WHO estimates that in 2011 there were 8.7 million new cases of tuberculosis (13 % are co-infected by HIV) and 1.4 million people died because of tuberculosis (WHO, 2012). In a WHO report in 2013 estimated that there were 8.6 million cases of TB, in

2012 where 1.1 million people (13 %) were HIV-positive of TB patients (Depkes RI, 2014).

In Indonesia TB disease is a major problem of public health center. Based on the calculations of economic health using the indicator of DALY (Disability Adjusted Life Year) introduced by the World Bank, TB was 7.7 % of the total disease burden in Indonesia, this number was higher than in other Asian countries was only 4 %. In 1995, the results of the Household Health Survey showed that tuberculosis was the third cause of death after cardiovascular diseases and respiratory infections in all age groups, and it was the first group of infectious diseases. In 1999, WHO estimated that each year there were 583,000 new cases of tuberculosis, by the deaths was about 140,000. Roughly it was estimated that per 100,000 population of Indonesia there were 130 new tuberculosis patients of BTA-positive. In 2004 it was estimated that every year there were 539,000 new cases and 101,000 people were deaths. Based on World Health Organization (WHO) in 2007 stated that the number of tuberculosis patients in Indonesia were about 528 thousand and it was in the top three world after India and China. The latest report of WHO in 2009 reported that Indonesia rank decreased into the fifth position by the number of tuberculosis patients was 429 thousand people. Indonesia included the top 10 countries of patients of lung tuberculosis cases in the world.

According to WHO (2012) in the report of the Global Report 2011 stated that the prevalence of tuberculosis was about 289 cases per 100,000 population, the incidence of tuberculosis was 189 cases per 100,000 population and a mortality rate was 27 cases per 100,000 population.

Patients with lung tuberculosis were the highest in the productive age group (15-50 years), they were about 75 %. Adult tuberculosis patients were estimated they lost an average of work 3-4 months, so it caused in loss of household income about 20-30 %. If someone dies cause of TB, then he would lose his revenue about 15 years. Besides it adversely economically, tuberculosis was also giving a bad effect, namely ostracized by the community (stigma) (WHO, 2012).

According to Riskesdas in 2010 in East Java, the prevalence of TB in people aged  $\geq 15$  years was 0.628 % and suspected tuberculosis was 1,843 %. Lung tuberculosis patients who used medical facilities through public health centers were 44.2 %. While cases of lung TB in Ponorogo, based on data from the Health center of Ponorogo in 2014 the discovery of new cases of tuberculosis with BTA (+) were 300 people, the condition was scattered in various health centers in Ponorogo regency, where 3 highest health center were in Badegan there were 28 people, in Babadan 28 people, and in Kauman 25 people (Dinkes of Ponorogo, 2015).

Lung tuberculosis disease is influenced by a variety of risk factors one of them is the home ventilation. Lack of ventilation comes into the room of the house, especially sunlight, it is not only uncomfortable but also as a media or a good place to live and develop germs (Notoatmodjo, 1997), one of them is the tuberculosis germ. This bacil of tubercolosis can live for months at room temperature and in a humid room (Alsagaff and Mukty, 2005). Droplet nuclei can last for several hours in the dark and humid (DEPKES RI, 2006). This bacteria is not resistant to ultraviolet, because it is transmitted mainly at night (Wed, 1996). Therefore, a healthy home should have sufficient ventilation. Actually ventilation way (windows) is 15 % -20 % large of the floor at home (Notoatmodjo, 1997), this in order to sunlight or ultraviolet can maximally come into the room of the house, because the germ is very sensitive to heat, sunlight and ultraviolet rays. Direct exposure to ultraviolet ray causes most germs will die within a few minutes (Kemenkes RI, 2014).

Based on the above description the researcher is interested in studying the effect of home ventilation to lung tuberculosis happened in Ponorogo regency.

## **METHOD**

This type of research is analytic using case-control. Population of cases in this study was all patients who expressed by lung tuberculosis aged

≥15 and recorded in the register of TB inenter of Ponorogo until March 2015 with the inclusion criteria are;

1. They are ready to be the subject of research by signing the agreement letter has been provided (informed consent).
2. They are expressed lung tuberculosis by health centers
3. They domiciled in Badegan Health Center of Ponorogo.

While the control population in this study was the visitors patients aged ≥15 and they did not suffer lung tuberculosis obtained from a visitor registers at the Badegan Health Center of Ponorogo until March 2015, with the inclusion criteria are;

1. They are ready to be the subject of research by signing the consent letter has been provided (informed consent)
2. They are recorded in the register as a visitor patient and they did not suffer from lung tuberculosis and Upper Respiratory Infection (ISPA (Indonesian)).
3. They domiciled in Badegan Health Center of Ponorogo regency.

Selection of samples taken from the register of TB cases in Badegan Health Center of Ponorogo started from 2012 until March 2015 fulfilled the inclusion criteria, they were patients aged ≥15 years, until the number of sample cases fulfilled. Control samples taken from the register of visitor patients in Badegan Health Center of Ponorogo in 2012 until March 2015 fulfilled the

inclusion criteria, they were patients aged 15-80 years and they did not suffer from lung tuberculosis and respiratory infection. A control characteristic was

similar to cases by age and sex. Techniques of collecting data used observation method at the respondent's house using a Luxmeter.

### The results and discussions

**Tabel 1 Distributions of respondents according to age, gender, education, marriage status, dan occupation.**

Variabel	Case (Suffered lung TB)		Control (Not suffered lung TB)		Total	
	Total	%	Total	%	Total	%
<b>Aged group</b>						
15 - 55 years	21	70	19	63,3	40	66,7
56 - 80 years	9	30	11	36,7	20	33,3
Total	30	100	30	100	60	100
<b>Gender</b>						
Male	20	66,67	18	60	38	63,33
Female	10	33,33	12	40	22	36,67
Total	30	100	30	100	60	100
<b>Education level</b>						
Low	20	66,67	19	63,3	39	65
High	10	33,33	11	36,7	21	35
Total	30	100	30	100	60	100
<b>Marriage status</b>						
Married	21	70	22	73,33	43	71,66
Not married	9	30	8	26,67	17	28,33
Total	30	100	30	100	60	100
<b>Occupation history</b>						
Employed	22	73,33	24	80	46	76,67
Unemployed	8	26,67	6	20	14	23,33
Total	30	100	30	100	60	100

Source: Primary Data, 2014

Based on table 1 above it can be concluded that the age of majority in the case group and the control group is the 15-55 years where 21 people (70 %) are in the group of cases and 19 people (63.3 %) are in the control group. According to sex showed that the most sex is male, where there are 20 people (66.67 %) in the case group, while the control groups are 18 people (60 %). Based on the level of education can be

stated that the highest level of education is low

where in the case group are 20 people (66.67 %), while the control group are 19 people (63,3 %).Based on marital status can be seen that most marital status in the case group and the control group is married, where there are 21 people (70 %)in the case group and there are 22 people (73.33 %) in the control group.

**Tabel 2 the summary of analysis result of bivariat and how many Crude Odds of Ratio (OR) in lung tuberculosis is (N=30)**

Variabel	TBC case		Control (not TBC)		OR	P
	N	%	N	%		
1. Ventilation						
- TMS (<60 lux)	16	53,3	10	33,3	3,2	0,007
- MS ( $\geq$ 60 lux)	14	46,7	20	66,7		
Total	30	100	30	100		

Source: Primary data, 2014

Based on occupation history can be stated that the majority of employment history is working, where there are 22 people (73.33 %) in the case group, while there are 24 people (80 %) in the control group. Based on the results above, it can be concluded that the respondents who have a home with level of ventilation <60 lux (ineligible) had more tuberculosis infection risk 3.2 times than respondents who have a home with level of ventilation  $\geq$ 60 lux (qualified) (OR = 3.2 ; CI = 95 %).

### **The discussions and the results of the study**

Home ventilation plays an important role on the incidence of lung tuberculosis. Less of home ventilation will cause the house moist, and then it will be an access of convenient place for the growth and development of *Micobacterium Tuberculosis* germs. TB germs can survive for many years, and die when it is exposed to sunlight, soap, lisol, carbolic, and fire heat. The house does not have the sunlight have more 3-

7 times the risk of developing tuberculosis than the house has sunlight (Depkes, 2008).

According to Rusnoto et al. (2005) that there is a significant correlation between home ventilation and incident of lung tuberculosis with an odds ratio (OR) 7.926 with 95 % Confidence Interval (CI) (3.129 -20.080). The circumstance of home does not have enough ventilation, has a ground floor/ cement cracks also has a large proportion of lung tuberculosis (Litbangkes Agency, 2012).

According to Notoatmodjo (2003) that the tuberculosis germs can grow well in moist environments. Sunlight comes into the house can kill TB germs. Germs can only be killed by natural light instead of artificial light. So if the ventilation in the house is less than 60 lux the bacteria can survive for hours or even years in a cool and moist place (Atmosukarto and Soewasti, 2000). Natural light can be obtained through a window that fulfill the health requirements, or glass tiles so the sunlight can come into the house.

Bedrooms should be placed at the east so the sunlight can come into the room. According to Atmosukarto and Soewasti (2000) the number of tuberculosis patients in a home depends on the aDepkes RI of light intensity that comes into the bedroom, family room and living room. According to (Depkes, 2008) houses do not have sunlight have more 3-7 times risk of developing tuberculosis than the sunlight enters the house.

The requirements of healthy home ventilation according to the Ministry of Health No. 829/ Menkes/ SK/ VII/ 1999 is ventilation includes natural ventilation and or direct or indirect artificial can illuminate the whole room by intensity of a minimum light 60 lux and it does not dazzle. Effective light from the sun rays can be obtained from 08.00 until 16.00. Measurements can be done by luxmeter, which is measured in the middle of the room and at a height < 84 cm from the floor (Nurhidayah et al., 2007).

### **The conclusions and suggestions**

From this study, it can be concluded that there is influence between home ventilation and incident of lung tuberculosis. Respondents who have a house with level of ventilation <60 lux (ineligible) and it has more lung tuberculosis infection risk 3.2 times than respondents who have a home with level of ventilation  $\geq$ 60 lux (qualified) (OR = 3.2; CI = 95 %).

One of the causes of lung tuberculosis is home ventilation that does not qualify, because of that advice for patients; it is expected to open the house more often, maximize ventilation and equip the house with glass tiles which allows and access sunlight can enter into the house, so it is expected to kill the bacteria of mycobacterium tuberculosis.

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