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Prevalence and Physical Environmental Conditions as Risk Factor for Pulmonary Tuberculosis in Indonesia 2015

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Abstract

Objective: The number of tuberculosis (TB) cases in Indonesia is currently very high, so the analysis is needed to describe the environmental conditions at risk of TB disease. The aim of the study was to look at the prevalence of pulmonary TB in 2013-2014 in Indonesia based on the area of residence of the respondents and to see the relationship between the environmental conditions of the prevalence of TB in Indonesia.

Material and Methods: The Prevalence SPTB 2013-2014 was used cross-sectional design with national coverage. Sampling selection used multi-staged cluster sampling in the population aged 15 years and above. The analysis data used SPSS program; first analysis was used bivariate and continuing to multivariate analysis.

Result: Tb prevalence rate with bacteriological confirmed was 759 [95% CI: 590, 961] per 100,000 population in aged 15 years and above. The bivariable analysis shown those participant who live at house with floor <8m2/person [95% CI:1,053,1,710] and those participant who lived in house with kitchen was not separated from the main living area in the house [95% CI: 1,034,1,669], that was significant related with TB. In the multivariable model, the density characterized by family members with a floor surface <8m2/person [95% CI: 1,017,1,671]is at risk of developing TB.

Conclusion: This study shows that the effect of the physical environment of living in a crowded household can be a risk factor for TB transmission. The other factor might be influence of infection Tb in the community.

Keywords: Prevalence, Pulmonary tuberculosis (TB), Environmental, Risk factor

1. Introduction

Tuberculosis (TB) is a major communicable disease health problem and leading cause of morbidity and mortality worldwide. Accounting for about 9.6 million new cases and 1.5 million deaths annually (Indonesia National TB Program (NTP), 2018; Ministry of Health, 2018). More than two thirds of the global TB burden is reported in Africa and Asia, and in absolute terms India, Indonesia and China account for the highest number of TB cases amounting to 43% of the global burden. (Raviglione& Sulis, 2016) One of MDGs action in point seven that focus on ensure environmental sustainability before accelerating to Sustainable Development Goals (SDGs) (World Health Organisation, 2015; UNDP & World Bank Group, 2016). Base on SDGs 2016 agenda about TB Strategy to prevent, control and end the TB epidemic that is cover three dimensions: economic, social and environmental. The health scope in SDGs has been considerably broadened compared to the MDGs (Lönnroth & Raviglione, 2015).

Indonesia carries the fifth highest tuberculosis (TB) burden in the world. According to Indonesia National TB program, the TB incidence all case was 391 per 100.000 populations. TB Incidence In 2017 was 898.000 in range 821.000 – 984.000. While in 2017 the number of TB cases is currently 254 per 100,000 or 25.40 per 1 million population.(Data and Information Centre, Ministry of Health, Indonesia, 2018) the number of new TB cases in Indonesia was 420,994 cases in 2017(Data and Information Centre, Ministry of Health, Indonesia, 2018; Ministry of Health, 2018). In 2015, Regulation of the Minister of Health No. 67 of 2016 concerning Tuberculosis Prevention sets the national TB Control Program target of elimination in 2035 and Indonesia Free of TB in 2050 (Ministry of Health, 2019).

Indonesia data Ministry of Health 2018 reported an epidemiological perspective that looks at disease events as a result of interactions between three host components (hosts), causes (agents), and environment (environment) can be examined the risk factors(Data and Information Centre, Ministry of Health, Indonesia, 2018). Srivastava, 2015 study was discussed an increase in the number of cases of positive smear pulmonary TB is due to the risk factors that trigger it such as environmental, demographic, socio-economic, and behavioural risk factors(Sirvastava, Kant and Verma, 2015). The study from Central Java shown that people is living at a home with an unhealthy condition will accelerate the transmission of TB disease (Wulandari, Nurjazuli, & Adi, 2015). Another study from Pakistan proved of ventilation that does meet the requirements residents of the house, and house contact with pulmonary TB sufferers are risk factors for infection with M. tuberculosis germs (Khaliq et al., 2015). Study in North Minahasa District shown Indoor air pollution can increase the risk of Germs infection (L. et al., 2015). Tuberculosis can be develop with the source of indoor air pollution is usually from kitchen smoke, and cigarette smoke (Sayuti, 2013). Case Control study in Northern Quebec determined Reducing household crowding may contribute to TB prevention (Khan et al., 2016). There are several factors that contribute to the prevalence of pulmonary tuberculosis including population risk factors such as age group(Negin, Abimbola, & Marais, 2015), gender and regional classification, while the factors that most influence the onset of this disease are environmental risk factors such as; floor area, type of floor, ventilation, window, light, kitchen location, fuel used in the house and the presence of family members who smoke in the house(TB DOTS Strategy Coordination, 2014).

Various efforts have been made by the government and the community to eliminate the incidence of TB has not shown satisfactory results. Many obstacles were encountered in an effort to suppress the spread of this case. The increase in TB cases throughout Indonesia is still so high that an analysis is needed that aims to look TB prevalence by location and demographic characteristics and association between living condition and TB. The results of this analysis are expected to be used as useful information for all parties, as an effort to prevent, mitigate and control the spread of TB.

2. Method

2.1 Study Design and Setting

The Prevalence SPTB 2013-2014 was used cross-sectional design with national coverage. Sampling selection used multi-staged cluster sampling in the population aged 15 years and above. Data cleaning and analysis finished in April 2015. The survey was conducted by the National Institute of Health (Ministry of Health, 2015).

This research is a survey conducted specifically to obtain national tuberculosis (TB) prevalence data in the community that was carried out in 156 clusters, 136 districts / cities in 34 provinces. The number of clusters was distributed in proportion to the size of the population (2010 census): 46 for Sumatera, 64 for Java Bali, and 46 for other regions. Data collection started in April 2013 and finished in June 2014 (Ministry of Health, 2015).

The nationally representative, community-based survey, covering the characteristics of respondents (Age 15 years and above, sex, education level and region), the characteristics of the area (urban and rural), the condition of residential buildings such as floor type, sufficient ventilation, sufficient natural light and location of kitchen. Another behaviour variable such as floor surface (density of member house hold), open windows regularly, fuel used in the house, any family member smoked in the house.

2.2 Participant Characteristic

Age was calculated based on the length of the participant life in accordance with the last birthday, grouped into 3 groups i.e. 15-34 years, 35-54 years, and more than 55 years. Regional classifications are grouped into urban and rural areas. The region is divided into three clusters i.e. Sumatra, Java-Bali and Eastern Indonesia (KTI). Classification of regions and regions is based on groupings from the Central Statistics Agency.

2.3 Data Collections

Data was collected using questioner design by SPTB 2013 – 2014 base on WHO recommendation and survey observation. Some variable for measurement such as: Education is the level of formal education completed (the last diploma owned by participants) grouped into graduate junior high school and above (≥ Junior high school/≥ SMP) and non-graduate Junior high school and below (< junior high school/<SMP). Environmental factor variables include floor surface, floor type, open window regularly, sufficient ventilation, sufficient natural light, location of kitchen, fuel used in the house and any family members smoke in the house. Any member was smoking behaviour inside the house was collected from bacteria confirmed. The variable density of member house hold is calculated based on the number of households that occupy one house divided by the size of floor surface(Ministry of Health, 2011; Darmiah, Santoso and Maharso, 2015; Kurniawati and Sulistiyorini, 2019). We were chosen aged 15 years and above as it corresponds to the age group within the age range defined as adolescent in Indonesia. It

clarified that the age range of adolescent is mature in thought and capable of decision taking (Dogin, 1895; Curtis, 2015; Vaughan, Waisman, William, & Rodgers, 2015).

2.4 Data Analysis

The study was secondary analysis of the Survey Prevalence Tuberculosis in 2013 – 2014 (SPTB 2013-2014). The analysis data was used a subset data of SPTB 2013-1014. The main objective was bacteriologically confirmed TB prevalence rates for people aged 15 years and over, in addition to some data on risk factors, knowledge, attitudes and behaviour of the community about TB disease (Ministry of Health, 2015).

TB prevalence estimate (p), design effect (def), estimated proportion of population aged 15 years and above (a), relative precision (d), and minimum participation rate (r). Estimated TB prevalence based on the results of NPS 2004 was 104 per 100 000 population (Soemantri, Lolong, & Senewe, 2005). Considering the geographic similarity and low HIV prevalence of Indonesia, doubling the notification might serve as an alternative, conservative way to estimate smear-positive TB prevalence. Smear-positive notification was 78 per 100 000 population in 2010. Therefore, we assumed a prevalence of 156 per 100 000. The parameters used to calculate the sample size were: Estimated prevalence (p): 156/100 000; Proportion of population aged 15 years and above (a): 71.1%; Confidence interval of 95% or $\alpha = 5\%$; Relative precision (d): 20%, according to WHO recommendation; Minimum participation rate (r): 85% according to WHO recommendation; Cluster size (M): 500 considering weekly operation cycle and following WHO recommendation (400–800); Design effect (def): 1.5 (k>0.6 cluster variation was estimated to be high based on 2004 experience). Calculation of sample size applied the formulas below:

$$n_0 = \frac{1.96^2(1-p)}{d^2 p} \times deff \rightarrow n_0 = \frac{1,96^2(1-0.00156)}{0.2^2 \times 0.00156} \times 1,5 = 92,202.09$$

Because the survey considered those aged 15 years and above to be the eligible population, sample size was calculated as follows:

$$n_a = n_0 \times a \rightarrow n_a = 92,202.09 \times 0.711 = 65,555.69$$

Minimum participation rate was 85%, so the sample size was adjusted as follows:

$$n = \frac{n_a}{r} \rightarrow n = \frac{65,555.69}{0.85} = 77,124.34 \approx 78,000$$

This article is a descriptive analysis using SPSS program with cross-sectional design. First data analysis was used bivariate variable and continuing to multivariate analysis after result significant was shown. Variables were taken the characteristics of respondents who were positively diagnosed on microscopic examination of smears, and did not take respondents who only had pulmonary TB symptoms, with consideration to get a clearer picture of the relationship between the cases of pulmonary tuberculosis by confirmed smear positive Mycobacteria Tuberculosis (MTB) as a dependent variables. The independent variables studied include characteristics of the living environment and behaviour that influence the incidence of pulmonary TB.

2.5 Ethical Approval

The study protocol was approved by The Committee on Health Research Ethic of The National Institute Health Research and Development, Ministry Of Health, Indonesia (KE. 01.01/EC/651/ 2012). Informed consent was confirmed (or waived) by the Ethic Committee.

3. Results

The socio-demographic characteristics of the participants were given in Table 1. A total participant who was analyse were 63.202 participants (26.703 household) in rural and urban areas in all provinces were included in the analysis. The number of participant who have positive bacteriological confirm of TB case 426 participants but after cleaning as the variables needed only 390.

The prevalence survey tuberculosis results estimates both smear-positive and bacteriologically confirmed were higher among men (1082.7 per 100.000 population) than among women (460.6 per 100.000 population). The prevalence increased in age with the highest estimated prevalence of pulmonary TB are in 65+ age group (1581.7 per 100.000 population).

Table 1. Estimated bacteriologically confirmed pulmonary TB prevalence among population aged 15 years and above by age groups, sex, urban/rural classification, and region (per 100.000 population)

Characteristics	Prevalence estimates	SE	CI 95%	RSE (%)
Age group				
15–24	360.8	61.5	254.3–494.7	17.0
25–34	753.4	110.3	561.8–995.0	14.6
35–44	713.8	105.5	527.4–941.0	14.8
45–54	835.5	127.9	608.9–1 108.3	15.3
55–64	1029.5	169.7	734.1–1 398.5	16.5
65+	1581.7	263.3	1122.7–2153.7	16.6
Sex				
Male	1082.7	118.5	872.8–1 337.3	10.9
Female	460.6	60.6	353.6–590.8	13.2
Urban/rural classification				
Rural	674.2	92.2	511.9–873.6	13.7
Urban	845.8	94.4	678.2–1047.7	11.2
Region				
Java-Bali	593.1	82.8	447.2–770.6	14.0
Sumatera	913.1	122.7	696.7–1176.7	13.4
Others	842.1	116.4	634.7–1091.8	13.8
TOTAL	759.1	95.1	589.7–960.8	12.5

Source: Survey Prevalence Tuberculosis 2015.

TB prevalence with bacteriological confirmed is 759 (95% CI 590–961) per 100,000 population in aged 15 years and above with a design effect of 1.77. Prevalence increases in age, population in urban areas is higher than in rural areas, and Sumatra's density is higher than in other regions. (Table 1)

The analysis bivariate between dependent variable (Urban-Rural) and independent variable (Socio-demographic characteristics and living condition) shown in Table 2. The percentage of 38% participants in the age range of 35–54 years and more of all lived in urban areas. Almost of participants confirmed were males than female. The percentage of TB participants is higher in non-graduate Junior high school and below (< junior high school) than Graduate junior high school and above (≥ Junior high school) with differences around 10,2%. Participants who living in $8m^2$/person floor surface more than participants who living in a floor surface under than $8m^2$/person with large difference of 57%. Participants has living at house with not soil floor more than participants who living at house with soil floor has large differences of 89,8%. Participants who open window regularly has more than participants who not opened window regularly with a differences of percentage as 47,6%. The percentage of participants who have enough sufficient ventilation more than participants who have deficient ventilation with a lot of differences of 73,4%. Likewise for house have enough sufficient natural light more than house with less natural light have a differences of 77%. The percentage participants who lived separated from the main living area (living room or bedroom) in the house more than participants who lived non separated from the main living area in the house with a difference of 55,5%. The percentage of participants who used electric/gas/LPG more than participants who used Wood/Charcoal/Kerosene with a differences of 13,8%. Participants who lived with another family member smoked in the house more than participants who lived without another family member smoked in the house with differences of 44,6%.

Table 2. Socio-demographic characteristics and living condition of TB participants by rural and urban

Characteristic	Total % (n)	Rural % (n)	Urban % (n)	P value
Age				0,001
15-34	32,1 (125)	24,0(43)	38,9(82)	
35-54	37,9(148)	38,0(68)	37,9(80)	
55+	30,0(117)	38,0(68)	23,2(49)	
Sex				0,004
Female	32,8(128)	40,2(72)	26,5(56)	
Male	67,2(262)	59,8(107)	73,5(155)	
Education				0,000
Graduate junior high school and above (≥ Junior high school)	44,9(175)	27,9(50)	59,2(125)	
Non graduate Junior high school and below (< junior high school)	55,1(215)	72,1(129)	40,8(86)	
Floor surface (density)				0,545
≥8 m^2/person	78,5(306)	77,1((138)	79,6(168)	
<8 m^2/person	21,5(84)	22,9(41)	20,4(43)	
Floor type				0,007
Not soil	94,9(370)	91,6(164)	97,6(206)	
Soil	5,1(20)	8,4(15)	2,4(5)	
Open the windows regularly				0,058
Yes	73,8 (288)	69,3(124)	77,7(164)	
No	26,2(102)	30,7(55)	22,3(47)	
Sufficient ventilation				0,033
Yes	86,7(338)	82,7(148)	90,0(190)	
No	13,3(52)	17,3(31)	10,0(21)	
Sufficient natural light				0,287
Yes	88,5(345)	86,6(155)	90,0(190)	
No	11,5(45)	13,4(45)	10,0(21)	
Location of kitchen				0,148
Separated from the main living area (living room or bedroom) in the house	77,7(303)	81,0(145)	74,9(158)	
Not separated from the main living area in the house	22,3(87)	19,0(34)	25,1(53)	
Fuel Used in the House				0,000
Electric/Gas/LPG	56,9(222)	36,3(65)	74,4(157)	
Wood/Charcoal/Kerosene	43,1(168)	63,7(114)	25,6(54)	
Any family member smoked in the house				0,030
No	27,7(108)	22,3(40)	32,2(68)	
Yes	72,3(282)	77,& (139)	67,8(143)	

The analysis bivariate between dependent variable (region) and independent variable (Socio-demographic characteristics and living condition) shown in table 3. The total number of participants with bacteria confirmed that living in across regions. Most of participants was in the age range of 35–54 years and lived in Java-Bali region. The

most respondent who bacteria confirmed was males and mostly lived in others region. The participants with education non graduate junior high school and below (< junior high school) are mostly bacteria confirmed and lived in Java-Bali region (62,7%). Density of member house hold based on floor surface that was ≥8m2/person in region Java-Bali which has a higher density than another regions (85,1%). Base on variables which have the highest results came from others region such as floor type (98,4%), open windows regularly 989,8%), Sufficient ventilation (93,8%) and Sufficient natural light(93,8%). Based on the analysis results that participants who live at houses with kitchen locations that are not separate from the main room are mostly in the Java-Bali region, that is equal to 83.6%. In the other hand, using fuel for household purposes are participants who use gas / LPG is in the other region with a percentage of 73.4%. Another thing that supports the finding of participants with bacterial confirmation is participant who lived with family members of smokers were in other areas by 78.9%.

Table 3. Socio-demographic characteristics and living condition of TB participants across regions

Characteristic	Java-Bali % (n)	Sumatera % (n)	Other % (n)	P value
Age				0,214
15-34	28,4(38)	32,8(42)	35,2(45)	
35-54	40,3(54)	32,0(41)	41,4(53)	
55+	31,3(42)	35,2(45)	23,4(30)	
Sex				0,004
Female	33,4(45)	42,2(54)	22,7(29)	
Male	66,4(89)	57,8(74)	77,3(99)	
Education				0,003
Graduate junior high school and above (≥ Junior high school)	37,3(50)	40,6(52)	57,0(73)	
Non graduate Junior high school and below (< junior high school)	62,7(84)	59,3(76)	43,0(55)	
Floor surface (density)				0,047
≥8 m^2/person	85,1(114)	72,7(93)	77,3(99)	
<8 m^2/person	14,9(20)	27,3(35)	22,7(29)	
Floor type				0,050
Not soil	91,8(123)	94,5(121)	98,4(126)	
Soil	8,2(11)	5,5(7)	1,6(2)	
Open the windows regularly				0,000
Yes	51,5(69)	81,3(104)	89,8(115)	
No	48,5(65)	18,8(24)	10,2(13)	
Sufficient ventilation				0,001
Yes	78,4(105)	88,3(113)	93,8(120)	
No	21,6(29)	11,7(15)	6,3(8)	
Sufficient natural light				0,005
Yes	81,3(109)	90,6(116)	93,8(120)	
No	18,7(25)	9,4(12)	6,5(8)	
Location of kitchen				0,098
Separated from the main living area (living room or bedroom) in the house	83,6(112)	72,7(93)	76,6(98)	
Not separated from the main living area in the house	16,4(22)	27,3(35)	23,4(30)	

Fuel Used in the House				0,000
Electric/Gas/LPG	66,4(89)	30,5(39)	73,4(94)	
Wood/Charcoal/Kerosene	33,6(45)	69,5(89)	26,6(34)	
Any family member smoked in the house				0,077
No	33,6(45)	28,1(36)	21,1(27)	
Yes	66,4(89)	71,9(92)	78,9(101)	

The crude odds ratio association between socio-demographic and living condition and TB shown that the participants in aged range 35–55^{+} in rural areas in others region were more likely to TB bacteria confirm. In all regions, Female were less likely to report TB bacteria confirmed compared to males in urban area. Education was significantly associated with TB bacteria confirmed in all regions. (Table 4) Those participants who attended Non graduate Junior high school and below (< junior high school) more reported of TB bacteria confirmed in rural area in Java-Bali region (Odd ratio [OR] = 1.464, 95% confidence interval [CI] = (1,199–1,789). Base on location, those participants who live in urban area more likely reported TB bacteria confirmed (OR=1,327, 95% CI 1,087–1,620) compared with those who lived in rural area. In the other hand, those participants who live in Sumatera (OR=1,472, 95%, CI1,154–1,877) and Other (OR=1,427, 95%, CI 1,119–1,819) region more likely reported TB bacteria confirmed than Java-Bali region.

Bivariate analysis of the physical environment with the dependent variable, obtained significant variable results shown only two variables whose related significantly with TB bacteria confirmed, i.e. those participant who live at house with floor <8m2/person (OR=1,342, 95% CI 1,053–1,710) and those participant who lived in house with kitchen was not separated from the main living area in the house (OR=1,314, 95% CI 1,034–1,669).

Table 4. Determinants of having TB in Indonesia, 2015

	Crude Odds Ratio (95% CI)	Adjusting for location (urban/rural) and region, Odds ratio (95% CI)	Adjusting for age, gender, education, location and region, Odds ratio (95% CI)	Adjusting for all variables, Odds ratio (95% CI)
Age				
15-34				
35-54	1,332 (1,049–1,691)			1,275 (0,997–1,630)
55+	2,271 (1,763 - 2,925)			2,046 (1,548–2,703)
Sex				
Female				
Male	2,360 (1,909–2,917)			2,402 (1,940–2,974)
Education				
Graduate junior high school and above (≥ Junior high school)				
Non graduate Junior high school and below (< junior high school)	1,464 (1,199–1,789)			1,443 (1,145–1,818)
Location				
Rural				
Urban	1,327 (1,087–1,620)			1,528 (1,218–1,917)

Region				
Java - Bali				
Others	1,427 (1,119–1,819)			1,444 (1,103–1,890)
Sumatera	1,472 (1,154–1,877)			1,524 (1,172–1,981)
Floor surface				
≥ 8 m^2/person				
< 8 m^2/person	1,342 (1,053–1,710)	1,267 (0,992–1,617)	1,303 (1,017–1,671)	1,298 (1,010–1,668)
Floor type				
Not soil				
Soil	0,805 (0,513–1,264)	0,974 (0,616–1,542)	0,918 (0,579–1,454)	0,874 (0,550–1,390)
Open the windows regularly				
Yes				
No	0,849 (0,677–1,064)	1,008 (0,792–1,282)	0,992 (0,778–1,264)	0,933 (0,718–1,213)
Sufficient ventilation				
Yes				
No	0,981 (0,732–1,314)	1,104 (0,820–1,487)	1,069 (0,793–1,441)	0,982 (0,688–1,403)
Sufficient natural light				
Yes				
No	1,084 (0,794–1,480)	1,181 (0,863–1,619)	1,164 (0,849–1,595)	1,172 (0,802–1,711)
Location of kitchen				
Separated from the main living area (living room or bedroom) in the house				
Not separated from the main living area in the house	1,314 (1,034–1,669)	1,189 (0,931–1,517)	1,178 (0,922–1,504)	1,178 (0,922–1,507)
Fuel Used in the House				
Electric/Gas/LPG				
Wood/Charcoal/Kerosene	1,068 (0,874–1,306)	1,173 (0,936–1,469)	1,062 (0,845–1,333)	1,048 (0,833–1,318)
Any family member smoked in the house				
No				
Yes	1,101 (0,882 - 1,376)	1,117 (0.893–1,397)	1,049(0,837–1,317)	1,035 (0,824–1,299)

The association between socio-demographic characteristics and living conditions and TB bacteria confirmed for location (urban/rural) and region for TB determinants were indicate in Table 4. The adjust association between living condition and TB bacteria confirm to for age, sex, education, location and region in the multivariate analysis. All variable entered simultaneously for multivariate analysis using logistic regression. Variables that have a P value > 0.05 in multivariate analysis are thought to not affect the occurrence of TB excluded one by one by looking at the largest P value. Variables that have a P value > 0.05 but are substantially thought to influence the occurrence of TB, then these variables are still included in the analysis. Variables related to the occurrence of TB but have a value of P > 0.05 but in substance these variables are strongly suspected to influence the occurrence of TB, so in the final analysis these variables are still included in multivariate analysis.

The multivariate analysis adjusted for location and region were shown none of variable was significant. In the other hand, the analyses for age, gender, education, location and region that the significant variable only floor surface (OR = 1,303, 95%, CI = 1,017–1,671). The multivariate analysis adjusting for all variables were shown the

demography variable was significant, but for physical environment only floor surface was significant with OR = 1,298, 95%, CI=1,010–1,668.

4. Discussion

All research variables related to risk factors were taken in this study,(Ministry of Health, 2015) but not all variable in survey research discussed in this article. This study has some limitations which variable was members smoked in house only based on interview from member and other member of house hold; In the variable floor surface is not seen by individually but the measure was used households; and the all participants was analysed who diagnosed with pulmonary TB were only based on microscopic confirmation of the bacteria.

During period when the incidence of TB dramatically increased in this country, the number of people was the only housing characteristic associated with newly diagnosed TB infection. It was associated among participants who had lived with TB participants. The TB prevalence rate was the highest among older age groups (55 years and above). This is slightly different from the Basic Health Research (RISKESDAS, 2013) data which states that the prevalence of pulmonary TB participants is higher in the age group > 35 years (Data and Information Centre, Ministry of Health, Indonesia, 2016). TB reactivation and longer duration of exposure may be the reasons. However, if we calculated the absolute TB prevalence, the burden is still very high among productive age groups (Data source in Prevalence Survey Tuberculosis 2013-2014, Ministry of Health, 2015)(Ministry of Health, 2015). This indicates that TB transmission is still high (Ministry of Health, 2015; Khan et al., 2016).

Comparisons of sex in TB prevalence and notification highlight sex differences in the number of male are more likely than female to have a timely TB diagnosis. This number is related to the presence of men who come more during the survey than those who want to come to health facilities. In addition, there are more likely men who do not pay attention to health than women, so the possibility of treatment and recovery is more women than men. This is in line with the meta-analysis conducted by Katherine et al. in 2016, which stated that the number of pulmonary TB participants seeking treatment were more women than men (Horton *et al.*, 2016). According to WHO, TB prevalence among males were higher than among females (smear-positive TB prevalence of 393 per 100 000, and bacteriologically confirmed TB prevalence of 1.082 per 100 000 among men vs smear-positive TB prevalence of 131 per 100 000 and bacteriologically confirmed TB prevalence of 461 per 100 000 among women) (WHO, 2014). In TB NPS in other countries, TB prevalence in men were also higher than in women (Ministry of Health of Myanmar, 2010; Kebede et al., 2014; Mao et al., 2014). It is possible that men were more exposed to TB risk factors such as smoking and that they did not seek treatment as early as women. In this survey the proportion of male participants who reported smoking were 68.5%, while it was just 3.7% among females. Basic health survey results of 2013 found that the proportion of men who smoked were 56.7% compared to 1.9% of women (National Institute Health Research and Development, 2013). In addition to age and sex differences in susceptibility related to biologic mechanisms, socioeconomic and cultural factors may also play a role in determining age and sex differences in the rates of infection, progression to disease, and treatment outcome. Many factors may changes the structural and immunological host defence system which increases the risk of the infection (Khaliq et al., 2015).

The distribution of pulmonary TB participants in 2015were more likely to live in cities. One factor that causes a high number of cases, is the possibility that the population in urban areas is more than those who live in rural areas. Occupancy density is probably one of the risk factors that can cause high rates of pulmonary TB participants in urban areas (Union, Tuberculosis and Disease, 2014). There is no different from research conducted on Solomon Island where residents residing in urban areas have higher TB cases than in rural areas (Union, Tuberculosis and Disease, 2014). This is because many industry sectors and air pollution from vehicles. In addition, there is transmission from outside the region that migrates with the term transfer out to the city (Union, Tuberculosis and Disease, 2014; Aldridge et al., 2016). Another thing mentions the number of TB participants who seek treatment in urban areas because of supporting facilities, so the number of participants recorded in urban areas is more than in rural areas (Tobin-West & Isodje, 2016; Rahman & Ahmed, 2017).

According to the results above, other regions of Indonesia covering the eastern region, are the highest endemic areas of pulmonary TB. Possible cases are high in the area due to poor nutritional status, improper living environment, and poorly maintained hygiene (Ministry of Health, 2011). Besides that, health facilities in the eastern part of Indonesia are still inadequate, so that treatment and public access to health facilities are still needed (Ministry of Health, 2011). There is still a lack of public knowledge about the importance of maintaining health in order to avoid TB disease (Ministry of Health, 2011).

Environmental factors (floor surface, type of floor, windows opened regularly, adequate ventilation, sufficient natural lighting, kitchen location, for households with kitchen not separated from the main living area, any family member smoked in the house influences the development of TB disease(Data and Information Centre, Ministry of

Health, Indonesia, 2018). The results of this study state that the significant cases of TB with bacteria confirm are obtained in environment with a floor area of < 8 m^2 / person that relevant with bacteria transmission can spreading in small area inside house.

In the other hand, that non-significant result for type of floor that is not soil, sufficient natural lighting, adequate ventilation, kitchen location separate from the main room. This shows that physically environment cannot be risk as a factor of TB transmission. Different from some research results that show that physically environmental factors can be a risk of developing TB disease (Sirvastava, Kant, & Verma, 2015; Wulandari, Nurjazuli, & Adi, 2015; Qadeer et al., 2016). The results of the highest prevalence of environmental risk factors in this survey indicate that the type of floor that is not soil has a high prevalence compared to other environmental factors. This shows that floors other than soil have a high risk of TB transmission. This result is in line with research conducted by Agustina 2015 which states that the type of floor has a significant relationship with transmission of TB in the home (Wulandari, Nurjazuli, & Adi, 2015). Little is known about the role of home ventilation in the transmission of M. tuberculosis. Although the level of ventilation in health care settings has been shown to affect the risk of TB infection, the results of the bivariate analysis conducted for this sample indicate that there is no association with transmission of TB in the home. This is in line with the research conducted by Khan 2016 which states that there is no significant relationship between ventilation and transmission of TB in the home, but according to observations that air in the house can circulate properly if sufficient ventilation(WHO, 2014; Khan et al., 2016).

The analysis between environmental risk factors and TB cases in this study shows that the most influential factor in TB incidence in Indonesia is floor surface and location of the kitchen that is separate from the main room. The number of family members increases the risk of TB transmission in the home environment. Likewise with a kitchen that is not separate, this allows when cooking, the smoke in the house cannot circulate properly. Population density is one of the risk factors for TB (Sayuti, 2013; Sejati & Sofiana, 2015). Where the more dense the house, the transfer of disease, especially infectious diseases through the air will be easier and faster, if there are family members suffering from TB with positive smear who accidentally coughs. Mycobacterium bacteria Tuberculosis will remain in the air for approximately 2 hours so that it has the possibility to transmit the disease to members who have not been exposed to M. tuberculosis bacteria (Jendra & Margareth, 2015; Sejati & Sofiana, 2015).

The analysed of relation between the number of cases of high Tb in homes with kitchens that are not separate from the kitchen and burned from wood with TB cases are not related (Rea & Leung, 2018).

Many studies suggest that smoking in the home are a high risk in the development of TB (Sidiq, Wahiduddin, & Sidik, 2013; Denise Rossato Silva et al., 2018). The results of the analysis carried out in this study do not show the relationship of risk posed by family members who smoke in the home with TB cases that occurred. Smoke factors pose a risk for the development of TB in the home environment (Sayuti, 2013). The greatest impact of smoking in terms of public health issues related to infection is probably the increase in the risk of tuberculosis (Silva et al., 2018). The research in Toronto states that exposure to cigarette smoke in a narrow room can increase the risk of TB, while exposure to cigarette smoke outside the room has a lower risk of TB infection (Padrão et al., 2018; Rea & Leung, 2018). Chen's 2014 study mentions a correlation between exposure to cigarette smoke and an increase in TB cases, the risk for TB will increase for individuals exposed to passive smoking or cooking with solid fuel. Behavioural interventions including reducing exposure to passive smoking or cooking with solid fuel (Chen et al., 2014).

4.1 Limitation

All variables measured are only based on interviews and direct observations during the survey, so there is a possibility of misclassification or information bias (Pangaribuan et al., 2020). The study demonstrates that there are several variation of approaches in variables among rural and urban communities living in areas studied.

5. Conclusion

These research study found the more variation than expected in some areas. The participants of survey are pulmonary TB participants who have confirmed bacteriological based on culture examination or microscopic smear examination. The sample of the study were 67.617 population but the number of non-available participant was not include for analyse were 13,415 participants (Ministry of Health, 2015).

The participants with diagnose Tb bacteria confirmed is mostly in men over 34 years. The environment with a floor area of < 8 m^2 /person seemingly and the location of kitchen (Not separated from the main living area in the house) that is important factor of bacteria Tb confirmed, beside other factors could be another risk transmission of TB. The prevention efforts are a factor in strategies to reduce cases across the region and can therefore have critical implications. The reporting and hygiene sanitation as an importance of precautionary measures implemented in the

community are indispensable for this purpose.

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Authors Contribution

The Main contributors are Dian Perwitasari and Oster S. Member contributors are Lamria Pangaribuan, Teti Tejayanti, Dina Bisara Lolong, Kristina, Qian Long.

Competing Interests Statement

The authors have no conflicts of interest associated with the material presented in this paper.

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