RESPONDENT CHARACTERISTICS AND DOMESTIC ENVIRONMENTAL FACTORS THAT INFLUENCE THE TB CASES IN WIDASARI SUBDISTRICT, INDRAMAYU

Bachtian AW[*] and **Titik Respati Gilarsi**[**]

ABSTRAK

Penelitian ini difokuskan kepada karakteristik responden dan factor lingkungan domestik yang mempengaruhi kasus TB. Tujuan penelitian ini adalah untuk meningkatkan pengetahuan kita mengenai kedua hal tersebut yang mempengaruhi TB terutama di Kecamatan Widasari, Kabupaten Indramayu, Jawa Barat.

Desain penelitian adalah case-control dengan memeriksa 30 kasus TB yang terdaftar di Puskesmas Widasari dan 30 kontrol. Hasil penelitian menunjukkan bahwa ada hubungan yang signifikan antara kasus TB dengan merokok di dalam rumah, tipe dan luas lantai rumah, tinggi atap dan volume ruang tidur serta ventilasi. Hasil analisis regresi logistik menunjukkan bahwa factor yang paling menentukan adalah tipe lantai rumah dan status merokok dari responden. Beberapa rekomendasi untuk mengurangi jumlah kasus TB termasuk strategi promosi "rumah sehat", program promosi kesehatan yang intensif berfokus pada factor lingkungan domestik yang berpengaruh pada angka prevalensi TB. Pemerintah sebaiknya memberikan keluarga dari golongan ekonomi lemah suatu dukungan berupa skema renovasi rumah untuk membangun rumah sehat.

***Key words**: Tuberculosis*

BACKGROUND

Tuberculosis is a communicable disease caused by *Mycobacterium tuberculosis*. This disease has an effect on both the pulmonary and non pulmonary tissues. Moreover, the disease is found almost everywhere in the world, in developing countries and developed countries.

Worldwide, tuberculosis (TB) is one of the most common infections of human beings and contributes considerably to illness and death. It is estimated that approximately one-third of the world

[*]) Kantor Kesehatan Pelabuhan Padang

[**]) Peneliti Puslitbang Pelayanan dan Teknologi Kesehatan

Family Size and Overcrowding

The study found that the largest number of respondents (17 people) lived in a household of less than 4 people. Thirteen respondents lived in a household of more than 4. Analyses showed that there is a relationship between TB prevalence and household size. The risk was 4.9 times higher for respondents whose household had 5 people or more compared with respondents whose household had 4 people or less. Reider (1999) states that the probability of infectious tuberculosis occurring is reduced if the number of exposed children is less than two. Antunes and Waldman (2001) suggest that there is significant association between overcrowding and TB cases. Mangtani et al (1995) suggested that the notification rate increases by twelve percent for each one percent rise in the number of person living in overcrowded conditions.

THE STUDY LIMITATION

There are several limitations for this study. Firstly, the sample size is not large and it will be difficult to obtain statistically significant results. Secondly, cases were selected and taken from health centre without involving the cases who were detected by other health facilities like private practitioners, private hospitals, traditional healers and others clinics in Widasari Sub District.

There are therefore not a completely representative sample, the small sample size also did not allowed adjustment for confounding to be perform.

CONCLUSIONS

This study examined three sets of factors that influence TB cases. Firstly, housing condition such as ventilation, type of floor, floor area, bed room volume, type of wall, kitchen location and ceiling height. Secondly, environmental factors namely family size, smoking in the room, family members smoking and smoking status. Thirdly, respondent characteristics factors namely level of education, socio-economic status and nutritional status.

Analysis of those factors using logistic regression; found that the prominent variables that influence the prevalence of TB cases are the type of floor in houses and the smoking status of respondents.

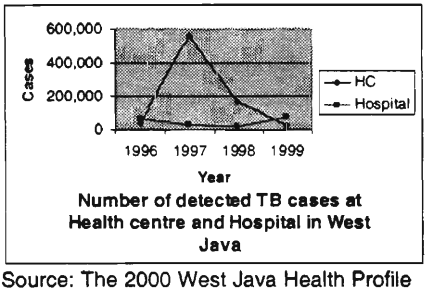
The major limitation of this study is the small number of sample used. From this finding, it is essential that a "healthy housing" program be developed especially for the lower some economic members of the communities. Community participation is also important to reduce TB cases.

population is infected with *Mycobacterium tuberculosis* and that seven to eight million new cases of tuberculosis occur each year (Chaisson, 1999).

Annual tuberculosis mortality is between two and three million people, making this disease the most common infectious cause of death in the world. Most tuberculosis cases and deaths occur in developing countries, notably in Asia and Africa. For example, in the developing world the disease is most prevalent in China and India. In contrast, in the United States, the annual incidence of tuberculosis is considerably lower than in developing countries. Nevertheless, tuberculosis remains an important problem in that country and the impact of tuberculosis has worsened in recent years (Hopkins, 1999). Australia as a developed country displays a similar low incidence of the disease (Lawson and Bauman, 2001).

Indonesia has one of the highest TB prevalence in the world, ranking third after India and China, and the disease is a major public health problem. Over the past five years it has re emerged as the second highest cause of death after cardiovascular disease. There are roughly 583,000 new cases reported per year with approximately 130 new cases per 100,000 people reported as Acid Fast Bacillus (AFB) positive indication each year (Annual Report, Indonesia Ministry of Health, 2000).

TB is one of the 10 most common diseases reported by health centre in West Java. On average the detected cases are approximately 614 per 100 000 population. The TB prevalence has increased significantly in West Java since 1996 and the provincial Government has identified TB as a national priority and a major public health threat. West Java is the most populous province in Indonesia and there has been a significant increase in the number of TB cases every year since 1996. For example, 257,894 TB cases (44% of the national number) were detected by health centres and this was 65% higher than the previous year (West Java Health Profile, 2000).



Source: The 2000 West Java Health Profile

The number of recorded TB cases in West Java from 1995-1999 is shown in figure 1.

Figure 1 shows that there was an incredible increase in the number of detected TB cases in 1997, almost 14 times the level recorded the previous year. However, it decreased in the following year. This may have been due to more intensive case detection activities or better recording and reporting systems at health centres.

In Indramayu District TB is still a major public health problem. The SP3 (Health Centre monthly report) reported that there were 753 TB cases in 1999 and 756 TB cases in 2000 with Acid Fast Bacillus (+) from the total population of 1,585,578 (Health profile Indramayu District, 2001).

Widasari is one of the Sub Districts in Indramayu District which has 52, 951 inhabitants, living in 16 villages. There were nearly 30 TB cases in 2000 with AFB (+). (Health profile Indramayu District, 2001).

These data indicate that TB is a severe public health problem in West Java Province, Indramayu District, especially Widasari sub District. This situation indicates that TB needs to be handled seriously, effectively and comprehensively by governments with the participative involvement of communities (National Annual Reports, 2000).

The policies for the national tuberculosis control program for Indonesia focus on the implementation of Directly Observed Treatment Short Course (DOTS) strategy program. However, the DOTS Strategy does not deal with the domestic environment risk factors, such as: dilapidated housing, social economic status, poor ventilation, overcrowding by way of number of house hold members per room and habitual smoking. Arguably, these factors need to be taken into account when assessing causes of the rapid increase in the prevalence of the disease in West Java.

Currently the West Java TB Control Program has only been carrying out chemotherapy as DOTS at health centres. This is being done without involving other health facilities such as the general hospitals, private clinics and even TB hospitals and chest clinics.

According to several researchers, there are significant associations between housing overcrowding and death from TB. The research indicated also that prolonged contact is needed for disease transmission (Leopoldo et al, 2001). Specifically, TB transmission occurs almost exclusively in enclosed environments. Hence, improvement in housing, with better ventilation and reduction of crowding are likely to be important changes that will help to reduce the prevalence of the disease.

Aim and Objectives

The aim of the research is to raise the level of understanding of respondent characteristics and the domestic environmental risk factors that contribute to the prevalence of Tuberculosis cases in Widasari Sub District, Indramayu District, West Java Province.

The objectives of the research are as follows:

1. To document the coverage and reported relationships between housing conditions (ventilation measurement, type of floor, and type

of wall, ceiling height, floor area, bed room volume and kitchen location) and TB prevalence.

2. To document the coverage and reported relationship between environmental conditions (social economic status, smoking status and the family size, smoking in the room, family members smoking, and number of people in the bed room) and TB prevalence.
3. To propose intervention policies for reducing TB prevalence based on domestic environment factors.

APPROACH

A case control design was followed for the study. A structured questionnaire was used to collect primary data from reported TB cases in the study area. The primary data collected include personal information as well as domestic environmental information on cases and controls. Controls were selected from the same population, who had similar demographic characteristics. Secondary data by way of results of laboratory test was collected to support and confirm the primary data. The researcher and health centre staff as well as the vice supervisor in the District helped to select and interview the cases and controls. The Interviewers sought general information, as well as information on the housing conditions of the respondents.

The other data sources which were used to support the primary data included: the Quarterly and Annual TB Report of West Java Province and Indramayu District; geographic and demographic data for each administrative level (Province, District and Sub-District); and Health Center data.

POPULATION AND SAMPLE

The research population is drawn from the Widasari Sub District in Indramayu District. Cases were all 30 patients who were registered as smear positive pulmonary TB patients and who had undergone treatment at Widasari Health Center in Indramayu District in 2001. Sample selection was based on the fact that the Health Centre has been carrying out the WHO Directly Observed Treatment Short (DOTS) strategy. The Health Centre contains comprehensive laboratory facilities to diagnose TB cases. All cases were fully diagnosed as pulmonary patients and there are low error rates for TB examination.

The control population was selected and drawn from the neighbours of the cases. To check that controls were free of pulmonary TB, a sputum sample was taken and checked for Acid Fast Bacilli (AFB) at the Health Centre.

The study analyses association between tuberculosis prevalence and both characteristics of respondent and the domestic environmental variables. Using the Odds ratio analyze the degree of risk for the domestic environmental factors.

CONCEPTUAL FRAMEWORK

The conceptual framework for this study is shown in figure 2. It centers on the relationship between TB cases and respondent characteristics and domestic environmental factors. The domestic environmental factors include the housing conditions and environmental conditions which contribute to TB prevalence. Housing condition is defined by the quality of ventilation, type of floor and type of wall, floor area; ceiling height, bed room volume and kitchen location. Environmental conditions are defined as smoking in the room, family member smoking, family size and number of people in bedroom. Respondent characteristics are defined as sex, occupation, education, socio economic status, marital status, smoking status nutritional status and cigarette consumption. Housing and environmental conditions and respondents characteristics variables are analyzed.

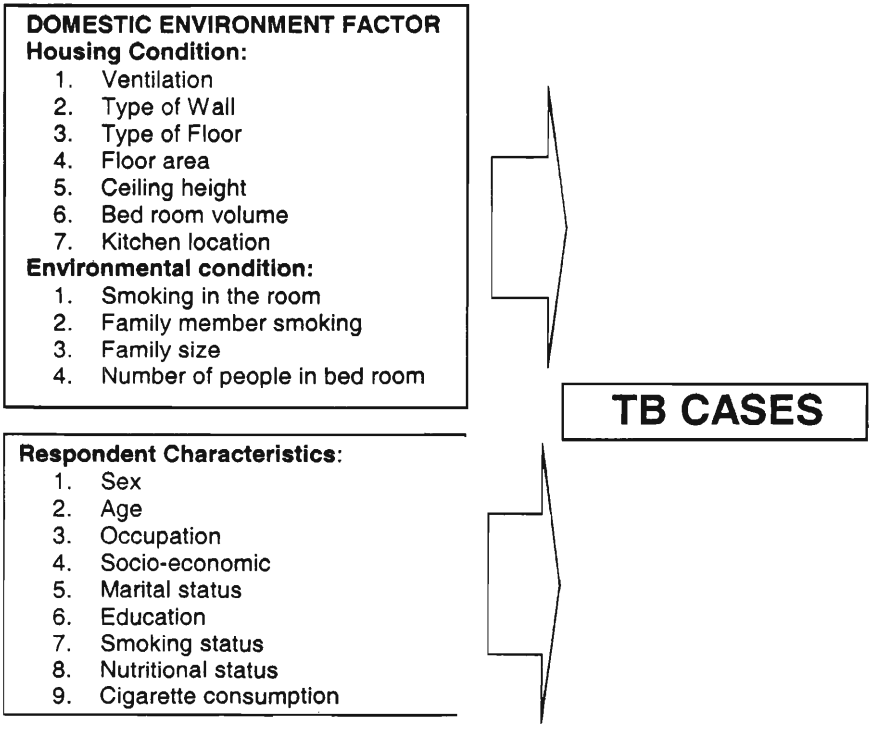


Figure 2 Conceptual Framework

In this study, the independent variables are: housing condition, environmental condition and respondent characteristics.

RESULTS

Relationship between respondent characteristics and TB cases

The result of the analysis indicates that there is a statistically significant relationship between respondents education and TB cases in Widyasari Sub District. The OR was 12.43 (p = 0.006). The risk was 12.4 times higher for illiterate respondents than for literate respondents (with 95% confidence interval between 1.461 and 105.74).

For smoking status of respondents, there was a statistically significant association between smoking status and TB cases in Widyasari Sub District. Finding p = 0.000, and OR 11.000. The risk was 11 times higher for respondents who smoke than for respondent who do not smoke with 95% confidence interval (between 3.292 and 36.751).

There was a statistically significant association between nutritional status and TB cases in Widyasari Sub District. Finding p = 0.000, and OR 2.765. The risk was 2.8 times higher for respondents with less than normal nutritional status than for respondents with normal nutritional status with 95% confidence interval (between 1.891 and 4.042).

There were no significant associations between gender, age group, occupation, cigarette consumption or marital status and TB cases in Widyasari Sub District.

Table 1. Relationship Between Respondents' Characteristics and TB Cases

No	Variable	Category	Odd Ratio	95% CI		P Value
				Lower	Upper	
1.	Gender	Male/Female	1.240	0.342	4.487	0.743
2.	Age Group	15–30/30 years>	1.643	0.527	5.120	0.390
3.	Education	Illiterate/Literate	12.429	1.461	105.737	0.006 #
4.	Occupation	Farmer/Non farmer	1.000	0.363	2.758	1.000
5.	Marital Status	Married/Not married	0.172	0.019	1.576	0.195
6.	Smoking status	Smoking/not smoking	11.000	3.292	36.751	0.000 # (<.001)
7.	Cigarette consumption	Heavy/not heavy	3.214	0.321	32.206	0.633
8.	Nutritional status	underweight/ normal+ overweight	2.765	1.891	4.042	0.000 # (<.001)

= significant

Relationship between environmental factors and TB cases.

There was a statistically significant relationship between smoking in the room and TB cases in Widasari Sub District. Finding p = 0.028, and OR 4.500. The risk was 4.5 times higher for respondents whose family members who smoke in the room than for respondents whose family member do not smoke in the room, with 95% confidence interval (between 1.094 and 18.503).

There was a difference in TB prevalence between large families (> 4 members) and small families (< 4 members) in Widasari Sub District. Finding p = 0.010, and OR 4.971. The risk was 4.9 times higher for respondent whose family had 5 people or more than for respondents whose family had 4 people or less with 95% confidence interval (between 1.387 and 17.816).

There is strong relationship between floor areas of the house with TB cases in Widasari Sub District. Finding p = 0.002, and OR 9.333. The risk was 9.3 times higher for respondents with below standard floor area (below 50 m^2 per dwelling) than for respondents in house with standard floor area, with 95% confidence interval (between 1.866 and 46.684).

There is statistically significant relation between ceiling heights and TB cases in Widasari Sub District. Finding p = 0.037, and OR 3.763. The risk was 3.8 times higher for respondents in house with ceiling height with under standard (below 2.75 m) than for respondents in house with standard roof height, with 95% confidence interval (between 1.038 and 13.646).

There is strong relationship between bed room volumes and TB cases in Widasari Sub District. Finding p = 0.003, and OR 5.231. The risk was 5.2 times higher for respondents with below standard bed room volume (less than 9 m^3) than for respondents with standard bed room volume, with 95% confidence interval (between 1.657 and 16.515).

There is strong relationship between ventilation measurements and TB cases in Widasari Sub District. Finding p = 0.000, and OR 21.000. The risk was 21 times higher for respondents with insufficient ventilation measurement than for respondents with sufficient ventilation, with 95% confidence interval (between 4.198 and 105.038).

There is strong relationship between type of floor and TB cases in Widasari Sub District. Finding p = 0.000, and OR 38.500. The risk was 38.5 times higher for respondents in house with earthen floor than for respondents in house with a non-earthen floor, with 95% confidence interval (between 7.416 and 199.875).

There were no statistically significant relationships between family member smoking, number of people in bed room, kitchen location or type of wall and TB cases.

Table 2. Relationship Between Environmental Factors and TB Cases

No	Variable	Category	Odd Ratio	95% CI		P Value
				Lower	Upper	
1.	Family member smoking	Yes/Not	1.750	0.616	4.973	0.292
2.	Smoking in Room	Yes/Not	4.500	1.094	18.503	0.028 #
3.	Family Size	> 4 people/= 4 people	4.971	1.387	17.816	0.010 #
4.	Floor Area	Under standard/Standard	9.333	1.866	46.684	0.002 #
5.	Ceiling Height	Under standard/Standard	3.763	1.038	13.646	0.037 #
6.	Number of people in bed room	3 >/1–2 people	1.167	0.393	3.467	0.781
7.	Bed room volume	Below standard (< 9 m^3) /standard (> 9 m^3)	5.231	1.657	16.515	0.003 #
8.	Ventilation	Insufficient/sufficient	21.000	4.198	105.038	0.000 #
9.	Type of floor	Earthen/non-earthen	38.500	7.416	199.875	0.000 #
10	Type of Wall	Bamboo/cement	2.154	1.626	2.854	0.112
11	Kitchen location	Not separate/separate	1.947	0.703	5.543	0.19

= significant

MULTIVARIATE ANALYSIS

The study analyses several variables which have p values less than 0.05, using the logistic regression model. The study results show that those variables which had p value less than 0.05 are education level, smoking status, nutrient status group, smoking in room, number of family household members, floor area, ceiling height, bed room volume, ventilation measurement, and type of floor. The results of logistic regression analyses are shown on table 3.

The results point out that two variables have statistically significant association with TB cases in Widasari Sub District. Those variables are type of floor (Earthen/non earthen) and smoking status of respondent (smoking/not smoking).

The model of logistic regression of variable in equation for predicting TB cases of this study is the following:

Log Odds Ratio

$(y) = -7.461 + 4.921\ X_1 + 3.511\ X_2$

Where:

y = TB prevalence

X_1 = Type of floor

X_2 = Smoking status

Table 3. The Result of Variables in the Equation of Logistic Regression Model

No	Variables	Beta	SE	Exp(Beta)	95% CI		P value
					Lower	Upper	
1.	Ceiling Height	-2.720	2.035	0.066	0.001	3.555	0.181
2.	Bed room volume	-1.130	1.986	0.323	0.007	15.853	0.570
3.	Ventilation	3.957	2.290	52.288	0.588	4652.239	0.084
4.	Education	3.484	8.020	32.580	0.000	2.19E+08	0.664
5.	Nutritional Status	10.214	60.482	27285.351	0.000	8.29E+55	0.866
6.	Smoking in room	-0.238	1.749	0.788	0.026	24.301	0.892
7.	Family Size	3.359	1.845	28.747	0.773	1069.147	0.069
8.	Type of floor	4.921	2.090	137.102	2.281	8241.936	0.019
9.	Smoking Status	3.511	1.658	33.490	1.300	862.861	0.034
10	Floor Area	1.947	6.135	7.009	0.000	1169349.6	0.751
	Constant	-7.461	6.711	0.001			0.266

DISCUSSION

Housing Conditions

Assessment of whether the housing was healthy or not have been based on floor area, ceiling height, and type of floor, type of wall, bed room volume, or ventilation measurement. From the results of descriptive analyses, 60% of cases, but 90% of controls had below standard housing floor area in Widasari Sub District.

Chi square analysis showed that there is a strong relationship between floor area of the house and TB. The risk was 9.3 times higher for below standard floor area (below 50 m^2 per dwelling) compared with standard floor area.

Three factors were considered to be the major contributors of TB cases transmission. They are: below standard ceiling height; below standard bed room volume and insufficient ventilation. Work by Smith and Moss, in Bloom Barry (1994) and MOH (1998) supports the concept of healthy house standards, including sufficient ventilation, standard ceiling height (> 2.75 m), standard bed room volume (9 m^3 or more) and standard floor area (50 m^2 or more). Housing not meeting the healthy house standard may contribute to the spread of communicable diseases such as measles, diarrhea, infectious disease and tuberculosis (MOH, 1998).

Ventilation standards are based on engineering criteria aimed at preventing the spread and reducing the concentration of infectious droplet nuclei. Ventilation dramatically dilutes the concentration of infectious droplets (Reider, 1999).

A total of 30 cases had a house with cement walls. There was no a statistically significant relationship between type of wall and TB cases.

The percentage of cases had sub standard ceilings height (less than 2.75 m) was 86.7% whereas 63.3% of controls had sub standard. Chi square analysis showed there is a statistically significant relationship between ceiling heights and TB cases. The risk was 3.8 times higher for below respondents with standard ceiling height (below 2.75 m) than for respondents with standard ceiling height.

Seventeen respondents had below standard bed room volume (less than 9 m^3), while 13 people had standard bed room volume (9 m^3 or more). Chi square analysis showed there is a strong relationship between bed room volume and TB cases. The risk was 5.2 times higher for respondents with below standard bed room volume than for those with standard bed room volume.

Twenty eight of the 30 TB cases had insufficient ventilation measurement. Analysis showed there is a strong relationship between ventilation measurements and TB cases. The risk was 21 times higher for those with insufficient ventilation measurement than for those with sufficient ventilation.

Type of floor is associated with occurrence of TB cases. The study found that most cases had an earthen floor (22 houses of 30 total cases). Chi square analysis showed there is strong relationship between type of floor and TB cases. The risk was 38.5 times higher for those with an earthen floor than for those with a non-earthen floor.

Environmental Conditions

Smoking in the Room

The results of this study show that there was a statistically significant relationship between smoking in the room and TB cases. The risk was 4.5 times higher for respondents whose family members smoke in the room than for respondents whose family members do not smoke in the room.

From the literature it would appear that no other study has noted the relationship between TB cases and smoking in the room. But these do not indicate if smoking in the room or out side or where ever. The results of this study indicate that there was association between TB cases and smoking in the room. Hence, cigarette smoking is viewed as being dangerous not only for active smokers but for others in the house affected by passive smoke.

RECOMMENDATIONS

Based on the findings above, the following recommendations are made regarding the domestic environmental factors and respondents' characteristics. These recommendations seek to reduce the cycle of TB transmission.

1. The findings of this study guide the development of strategies for promoting ? a healthy house project? in Indramayu District, especially in the Widasari Sub District.
2. An intensive health promotion program should be carried out to provide communities with information on the causes, symptoms, transmission and control of TB. Specific focus should be on the key domestic environmental factors which are demonstrated to have a correlation with the prevalence of TB.
3. Step should be taken to ensure that householders move towards meeting the National Healthy House Standard in order to break life cycle of tubercle bacilli and to prevent tuberculosis transmission.
4. Government should provide the families of low socio economic status with resources for community based house renovation schemes to meet the healthy house standard.
5. A further study is needed using a larger sample and area, in order to avoid possible sample and information bias in the small sample used for this study.

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