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The Level of Environmental Sanitation and the Incidence of Tuberculosis in Jember and Situbondo, Indonesia

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ABSTRACT

Tuberculosis is an important public health problem in worldwide, which World Health Organization (WHO) declares tuberculosis (TB) as "Global Emergency" in 1992. The aim of this study was to describe the hygiene and environmental sanitation conditions, and to determine the association between hygiene and environmental sanitation and Tuberculosis incident in Indonesia. The design of the study was cross sectional. The sample of the study was selected using simple random sampling. Data was analyzed using coefficient contingency test. The result of coefficient contingency test was 0.7. The most of TB patients have low hygiene and environmental sanitation, and environmental sanitation level and TB patients have strong association.

Keywords: *Tuberculosis, Hygiene, Sanitation, Environment*

INTRODUCTION

WHO reports in 2018 noted that tuberculosis is one of the top 10 causes of death worldwide. In 2016, 10,4 million people fell ill with TB and 1,7 million died from the disease[1]. Furthermore, an estimated 1 million children became ill with TB and 250,000 children died of TB in 2016. Most of the estimated number of incident cases in 2016 occurred in the South-East Asia (45%), Africa (25%) and Western Pacific (17%), and then the smaller proportions of cases occurred on Eastern Mediterranean (7%), Europe (3%) and America (3%)[2].

Indonesia is one of countries that has high cases of TB. Indonesia has tropical climate, and this circumstance make Indonesia as one of the TB endemic countries. Tuberculosis is the third leading cause of death in Indonesia after cardiovascular disease and respiratory disease, then the first causes on infectious disease[3]. Based on WHO report, Indonesia has the highest TB cases in the world after India. In 2016, 351,893 cases were found in Indonesia, and the highest TB cases were reported in province with high population density, such as West Java, East Java and Central Java, respectively[4].

Tuberculosis is caused by members of the *Mycobacterium tuberculosis* complex; usually the human tubercle bacillus, *M. tuberculosis*, but occasionally by the bovine tubercle bacillus, *M. bovis*, or by *M. africanum*[5]. The main cause of tuberculosis is: Poverty on community in development country, TB treatment failing (inadequate commitments of political and funding aspect, inadequate TB service organization, inadequate case management, misperception of benefits and effectiveness of Bacillus Calmette-Guerin, BCG), Demographic changes due to both the increasing of world population and the changing of age structure, The impact of pandemic[3]. Indonesian Health office also noted TB is often associated with low sanitation level and limited access of healthy living behavior in community[6]. Environmental plays a role in disease development such as humidity and number of people living in the house, then adult crowding, increased family size, use of biofuels, overcrowded housing and poor ventilation increase both the likelihood of exposure to Mycobacterium tuberculosis and progression to disease[7],[8]. Furthermore, indoor air pollution and tobacco smoke play a significant role at both the individual and population level related with tuberculosis incident[9]. Therefore hygiene and environmental sanitation aspects have important role on Tuberculosis incident.

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The aim of this study was to describe the hygiene and environmental sanitation conditions among Pulmonary TB patient and to determine the association between hygiene and environmental sanitation and Tuberculosis incident in Situbondo and Jember Regency, Indonesia.

MATERIAL AND METHOD

Jember Regency area is a land area of 3,294.34 km2, which has 31 sub-districts, 248 villages and 49 Public Health Center[10]. Furthermore, Situbondo Regency is a land area of 1,638.5 km2 with a position in between 7035'-7044 at the South Latitude and 113030'-114042' at the East Longitude. Situbondo Regency has 17 sub-districts, 132 villages, and 17 Public Health Center[11]. The study was held on 22 February 2013 until 23 September 2013.

Population is a generalization of region consisting of object or subject that have certain qualities and characteristics set by the researcher to be studied and drawn conclusions[12]. The population of the study was all new positif patient of pulmonary TB that perform treatment at primarly health office in Jember and Situbondo Regency. Population size was 2,733 new pulmonary TB patients, which the proportion of pulmonary TB patients both in Jember Regency and in Situbondo Regency were 2,176 patients and 557 patients, respectively. Sample selected using simple random sampling[13]. Sample size was 183. However, the author taken 190 pulmonary TB patients as sample to get both valid and heterogenous data. The inclusion critera of sample was the age of respondent ≥15 years old.

The type of the study was observational analytic. Observational analytic is a research to explore how and why health phenomena occur and to analyze the dynamic correlation between risk factors[14]. The design of the study was cross sectional. The hygiene and environmental sanitation variable was consist of housing, clean water source, toilet, sewerage system, bedroom condition, mosque and bathroom, which the total score of each variable was 52, 63, 51, 28, 57,5, 32, 16, 44.5, respectively. Therefore, the total score of hygiene and environmental sanitation was 344.

The classification of the level of hygiene and environmental sanitation of this study were high and low levels. The high sanitation level criterion was shall above 80% from total score. Therefore, to determine the high level, the total score of hygiene and environmental sanitation was multiplied by 80%, thus the high sanitation level was 275.2. Data analyzed using coefficient contingency test.

FINDINGS

Table 1: Housing and Environmental Factor

	Housing and Environmental Factor		
	Group	**Frequency**	**Percentage**
Wall	Brick	163	85.5
	Wood	7	3.7
	Bamboo	19	10
Floor	Tile	66	34.7
	Ceramics	96	50.5
	Soil	19	10
	Others	9	4.7
Roof	Tin/zinc	12	6.3
	Asbestos	28	14.7
	Dried clay	148	77.9
	Others	2	1.1
Clean Water Source	Well	131	68.9
	Artesis	3	1.6
	PDAM1	35	18.4
	Protected Water Source	9	4.7
	Seller	1	0.5
	Others	11	5.8
Toilet	Private	123	64.7
	Public	2	1.1
	River	60	31.5
	Others	5	2.6
Feces Storage	None	38	20
	Saptictank (<7m)	56	29.5
	Saptictank (>7m)	58	30.5
	Digged-hole soil	10	5.3
	Through dam	5	2.6
	Through river	22	11.6
	Others	1	0.5
House waste placement	Not specific	39	20.5
	Tank	45	23.7
	Digged-hole soil	69	36.3
	Others	36	18.9

The most of house used brick as wall, ceramics as floor, clay as roof. The most of respondents used well water as clean water source, used private toilet and used

septictank as feces storage with the radius of >7m from clean water source. Furthermore, 36.3% of respondent used digged-hole soil as house waste placement.

Table 2: The Availability of Environmental Facility

	The Availability of Environmental Facility		
	Categories	**Frequency**	**Percentage**
Garbage Placement	Yes	177	93.2
	No	13	6.8
Waste Placement	Yes	86	45.3
	No	104	54.7
Public Toilet	Yes	118	62.1
	No	72	37.9
Clean Water Source	Yes	177	93.2
	No	13	6.8

The availability of environmental facility that was provided by local government. The garbage placement, public toilet, and clean water source was provided by local government. Furthermore, 54.7% of respondent claim that waste placement was not provided by local government.

Table 3: Hygiene and Environmental Sanitation Level

	Hygiene and Environmental Sanitation Level		
	Frequency		Total (%)
	High (%)	Low (%)	
Housing Location	117 (61.6)	73 (38.4)	190 (100)
Clean Water	148 (77.9)	42 (22.1)	191 (100)
Toilet	101 (53.2)	89 (46.8)	192 (100)
Sewerage System	14 (7.4)	176 (92.6)	193 (100)
Waste Management	36 (18.9)	154 (81.1)	194 (100)
Bedroom	84 (44.2)	106 (55.8)	195 (100)
Mosque	139 (73.2)	51 (26.8)	196 (100)
Bathroom	103 (54.2)	87 (45.8)	197 (100)

The hygiene and environmental sanitation per aspect of respondent. The aspects of hygiene and environmental sanitation are housing location, clean water, toilet, sewerage system, waste management, the condition of bedroom, mosque and bathroom of respondent. The aspect of housing location, clean water, toilet, mosque and bathroom has high level. However, the aspect of sewerage system, waste management, and bedroom condition of respondent has lower level.

Table 4: Cross tabulation between TB Patients and Environmental Sanitation Level

	Environmental Sanitation Level		
	High (%)	**Low (%)**	**Total (%)**
TB Patients	54 (28.4)	136 (71.6)	190 (100)
Statistical Test	Value: 0.7	Approx. Sig: 0.475	

Table 4 showed the cross tabulation between TB patient and environmental sanitation level, which 71.6% of TB patient has low environmental sanitation level. Besides, based on coefficient contingency assessment, the value of TB patients and sanitation level was 0.7.

DISCUSSION

Environment is one of the main factors that affect the morbidity level among society. It is described by H. Blum that environment, heredity, lifestyle, and health care service are factors that affect morbidity level[15]. WHO describes that the determinant factors of health include: social and economic environment, physical environment, and the individual characteristic[16]. Therefore, environment is the important factor of health.

There are several diseases that relate with environmental factor, such as diarrhea, dysentery, dengue fever, tuberculosis and so on[17],[22]. Tuberculosis is caused by bacteria that most often affect the lungs[1]. Smoker, household crowding, history of household exposure to a known TB case, and absence of a ceiling in the house are affecting TB incidence[23]. Coker describes the main risk factors for tuberculosis were low accumulated wealth, financial insecurity, consumption of unpasteurized milk, diabetes living with a relative with tuberculosis, living in crowded conditions, illicit drug use, and a history of incarceration in both pretrial detention centers and prison[24]. Pulmonary TB incident is associated with environmental aspect, which environment is risk factor of TB incident among community.

The aspects of housing and environmental are wall, floor, roof, clean water source, toilet, feces storage, house waste placement. Based on the results, the proportion of respondent used brick as wall material is high. Brick is

ideal material for wall because brick is strong material. Therefore, it prevents the hazard condition among inhabitant. The proportion of respondent used ceramics as floor and dried clay is high. Both waterproof floor and easy to clean is used to prevent the bacteria to grow, whereas dried clay as roof material is used to decrease the temperature in house.

Generally, respondent get the clean water from well as source, and the proportion of respondent used private toilet is high. Most of respondent used saptic tank as feces storage, although the distance is >7m from clean water resource. Water is essential element for human, which daily water-need both male and female is 3.7L and 2.7L, respectively[25]. Therefore, human cannot separate with clean water source to improve their quality of life.

There are several clean water source found in Indonesia, such as well, artesian, PDAM (water provider institution), etc. However, the proportion of respondent used well is high. Budiarti Aqnes on Assessment of The Quality of Well Water showed that well water quality in Gubug Grobogan based on physical parameter have appropriated with standard but well near the Gubug village river have not appropriated with color standard, while based on microbiological parameter Coliform total have not appropriated with standard[26]. The potential components can contaminate well water is liquid waste penetrate of organic and inorganic fertilizer, domestic waste, and the distance of making the well with septic tank[27]. Based on The Regulation of Health Ministry of Indonesia, safe water to drink must fulfill the physics, microbiological, chemistry, and radioactive parameter[28].

The proportion of respondent used digged-hole soil as house waste placement is high. The ideal form of house waste placement is waterproof tank and has cover to prevent vector growing, such as cockroach, mosquitos, fleas, etc. WHO noted that vector-borne disease account for more than 17% of all infectious diseases, causing more than 70,000 deaths annually[29].

Garbage placement, public toilet, and clean water source are provided by local government. However, waste placement facility is not provided. Generally, the availability of environmental facility is important in communities, because it can improve the environmental sanitation level. The availability of clean water source, garbage placement, public toilet, and sewerage system is necessary to prevent disease in community. Based on Health Office of East Java Indonesia, sanitation access related with Open Defecation Free (ODF) has reached 82.88%, and then villages with ODF status has reached 2005 villages (25.96%) by 7724 village in East Java, Indonesia[30].

The hygiene and environmental sanitation level of housing location, clean water, mosque and bathroom is classified as high categories, while sewerage system, waste management, and bedroom aspects are classified as low categories. One of several aspects of bedroom condition is the density of inhabitant, which there are several research mention that pulmonary TB has correlation with high density level[23],[24].

Respondents who has pulmonary TB are classified low level of environmental sanitation. This result is similar with Lienhardt's study that environmental factors may have an impact on the incident of tuberculosis in a given population as a result of their effect on both the risk of infection and the risk of disease once a person is infected[31], and physical condition of the house is a risk factor for pulmonary tuberculosis[32]. The environmental sanitation level and TB patients has strong association.

CONCLUSION

Based on coefficient contingency, the environmental sanitation level and TB patients has strong association. Therefore, most of TB patients have low hygiene and environmental sanitation.

Conflict of Interest: The authors state that there is no conflict of interest in this study.

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Ethical Clearance: This research has passed in ethical assessment at University of Jember.

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