Environmental factors, demographics, and nutritional status in People with Subclinical Leprosy in Brebes

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Environmental factors, demographics, and nutritional status in People with Subclinical Leprosy in Brebes

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Abstract

Background: The main concern of leprosy countermeasures is more focused on patients with clinical manifestations. Meanwhile, leprosy clinical manifests can act as a source of transmission and increase the potential of local people to experience seropositive. Brebes is one of the areas with a high leprosy burden in Central Java. This study aims to find out the condition of environmental factors, demographics, and nutritional status ofSubclinical Leprosy in Brebes.**Aims:**To find out the condition of environmental factors, demographics, and nutritional status of Subclinical Leprosy in Brebes.

Settings and Design: Brebes was selected as the observation site, and cross-sectional design was used as the research design.**Methods and Material:**The research population was clinical leprosy sufferer residents in one of the rural areas in Brebes with fairly high leprosy, and thesamples were around 58 people.**Statistical analysis used:**Descriptive analysis was used to present the data.

Results: Out of the 58 research subjects, around 37.9% sufferedsubclinical leprosy; while 60.3% of them lived with leprosy patients. Ineligible environmental factors found in this study were the natural light intensity with a total of 100% percentage, the type of sewerage at 90.9%, and the average room humidity at 95.5%. A total of 81.81% of subclinical leprosy sufferers are women, while 68.2% are elementary school graduates, and 70.0% are adults. **Conclusions:**Subclinical leprosy in Brebes is associated with household contact with leprosy patients. The characteristics of subclinical leprosy are mostly adult women with low education levels. Environmental conditions including sewerage, room humidity, and natural lighting levels that are ineligible with health requirements contribute as the most common environmental factors in subclinical leprosy in Brebes.

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Keywords:subclinical leprosy, nutritional status, demographics, environment

Key Messages:

Subclinical leprosy in Brebes is associated with household contact with leprosy patients. Community empowerment efforts are needed to encourage changes in people's behavior for a clean and healthy lifestyle to prevent leprosy transmission, especially for those who have close contact with leprosy patients. It is due to demographic and environmental factors can increase the contagion potential of leprosy patients to household contact.

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Introduction

Leprosy is an infectious disease caused by *Mycobacterium lepra*eoriginated in East Africa and spread across Asia and South America.(1) Leprosy is an old disease that continues to be a crucial public health problem in several developing countries, and affecting many populations in low and middle-income countries. (2)

Global data on leprosy trends are influenced largely by India and Brazil to less degree. Several countries have recently published a detailed analysis of their leprosy trends, (3) one of which is Indonesia.(3) In Indonesia, the prevalence of leprosy in 2017 was 0.7 / 10,000 population with NCDR (New Case Detection Rate) of 0.68 / 100,000 population and total cases of 15,920 cases, while in Central Java the prevalence of cases was 6.8 / 100,000 population. Although the prevalence of leprosy in Central Java remains lower than the prevalence in Indonesia, the highest number of leprosy cases in Brebes is 422 cases.(4)

The transmission of leprosy is not fully understood, although the main route of transmission is most likely person-to-person via nasal and mouth dispersion. (5,6) The dynamic transmission and causes of leprosy are very complex. Apart from individual factors, including immunity and proximity to infecting contacts, they also involve the composition of the local population (sex, age, education, occupation, ethnicity, housing, and social level), which may be related to their geographic distribution.(7)

Epidemiology of leprosy determinants includes environmental factors, host factors, and agents that can be predictive factors of leprosy in the community. Environmental factors include environmental hygiene, house hygiene, residential density, and temperature. WHO Global Leprosy Strategy 2016-2020 recently failed to mention the quality, quantity, and access to water as the tools to

manage or prevent disease.(8) The main concern in overcoming leprosy lies within the patients with clinical manifestations.

In fact, people with leprosy can act as a source of infection and increase the potential of those around them to suffer subclinical leprosy. Subclinical leprosy is a condition where a person has been infected with *M. leprae*, but has yet to show clinical symptoms.(9) The prevalence of subclinical leprosy is greater than those of clinical leprosy. In the same area leprosy prevalence of subclinical was found to be 200 times greater than the clinical leprosy. (10)

The current evidence of leprosy showed that household contact with leprosy patients increases the risk of leprosy.(11,12) The increase in the incidence of leprosy in household contacts is most likely related to a combination of increased exposure to infectious cases (for example, contact with a patient with multibacillary leprosy has a 5 to 10 times greater risk of developing leprosy than the general population) and shared social risk factors in certain families (e.g., family with lower income and unfavorable household living conditions).(12,13)

Most of the investigations of contact with leprosy are focused on households, as they provide easilyidentifiable groups of individuals living close to each other. Not only it is believed that the risks associated with household contact reflect the intimacy of contact within the house, but it can also reflect other risk factors that the household members have, such as genetic traits, behavior, diet, accompanying infections, physical characteristics house and surroundings (including possible environmental sources of *M. leprae*). Few studies attempt to elucidate these factors. Most studies have not differentiated between family and household members, confusing genetics with household proximity. The only study that attempted to isolate these factors, based on the data from Uganda, concluded that the apparent grouping among closest relatives could be explained by more intimate household contact. (14)

This study aims to describe the conditions and environmental factors, demographics, and nutritional status of leprosy subclinical cases in Brebes, so that it can explain the possible linkages of factors in the emergence of subclinical leprosy.

Subjects and Methods

This cross-sectional study was conducted in 2019. The subjects of the study were household contacts who live under the same roof and/or eat from the same kitchen as the index case (leprosy sufferers) from the main family (parents, children, or siblings) and others, either multibacillary (MB, contact of 'cutaneous') or comparable to tuberculoid or paucibacillary (PB).

The population in this study was a family whose members had had leprosy in one of the endemic health centers in Brebes, Central Java. The research sampleswere 58 respondents whose members had had leprosy and leprosy patients that had been diagnosed and the registration data were listed in the clinic. The inclusion criteria were: 1) have yet to show symptoms of leprosy, 2) not taking anti-leprosy, 3) not taking immunosuppressive drugs within the last three months before the blood sample was taken.

Ethical approval for the study protocol provided by the Ethics Committee of School of Public Health, Diponegoro University. Respondents who were willing to participate in the study signed the informed consent beforehand.

The subclinical leprosy was determined by conducting an enzyme-related immunosorbent test (rabbit polyclonal anti-IgM / HRP (Dako) that was used in the examination of anti-PGL1 IgM levels. The seropositive cut-off point for anti-PGL IgM levels was 600 units/ml (Sujagat, 2015). The blood was centrifuged to separate the serum, which was then stored at -20 ° C. The IgM anti-PGL-1 levels of all subjects were recorded.(15)

Assessment variables in this study included individual factors (gender, age, education level, relationship with leprosy patients), environmental factors (clean & drinking water, sanitation), and nutritional status (expressed as BMI). The data were collected using a questionnaire for each family who participated as the respondent. Each family was a family that had contact with lepers who live in the vicinity of their house. The data were analyzed using univariate analysis.

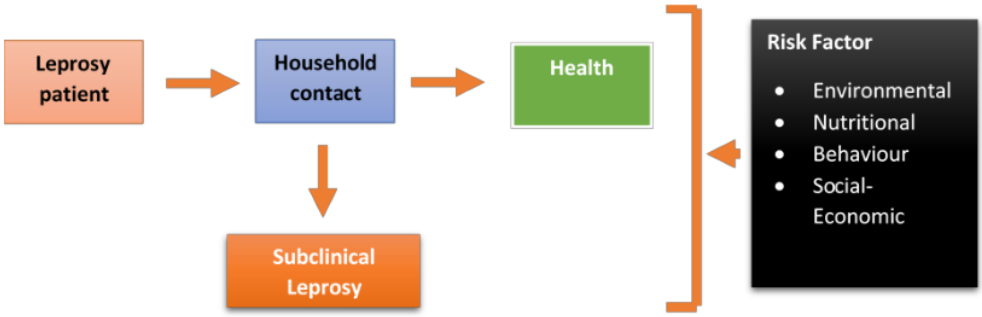

Figure 1. Framework of the study

Results

The total subjects of this study were 58 people, and the results showed that 37.9% of them suffered subclinical leprosy, while 60.3% of them lived with leprosy patients in the same house. The environmental factors observed in the houses of subjects of the study showed the conditions of an average humidity at 52.59%, average of natural lighting intensity at 28.28 Lux, and occupancy density at 19.09 m^2 / person.

The characteristics of 22 subjects with subclinical leprosy showed that around 81.8% of people with subclinical leprosy were women and 68.2% of them were graduated from elementary school, while 70% were adults (26-45 years) and the majority had normal BMI (54.5%) (Table 1).

The observed conditions of water and sanitation assessment on the subjects of the study showed that from 22 people with subclinical leprosy, a total of 68.18% own proper drinking water supply facilities (both in quality and quantity), andnoneof them drink groundwater directly without processing (all subjects consume drinking water after processing). The sanitary conditions observed in

the houses of the subjects showed that from 22 subjects with subclinical leprosy, only a few of them had unqualified housing density (<9 m2 / person) (9.1%), the average household size was 4.57 with the number of subclinical leprosy around 13.6% (Table 2).

Environmental factors that were ineligible for subjects with subclinical leprosy was natural light intensity (<60 Lux and> 120 Lux) at 100%, the type of SPAL (open and partly open) at 90.9%, and the average room humidity (<45% and <64%) at 95.5% (Table 2).

Table 1. Description variable of subclinical leprosy

Variable	Total (n=58)	Subclinical Laprosy f (%)	Components in subclinical leprosy (n = 22) f (%)
The existence of lepers (in the house)			
Yes	35 (60.3)	12 (34.29)	**12 (54.54)**
No	23 (39.7)	10 (43.48)	
Age, years (mean, SD)	40,57 (10.91)		**14 (70.0) adult**
Sex, n (%)			
Male	13 (22.4)	4 (30.8)	
Female	45 (77.6)	18 (40.0)	**18 (81.81)**
Level of education			
Graduated from elementary school	37 (63.8)	15 (40.5)	**15 (68.2)**
Graduated from junior high school	11 (19.0)	4 (36.4)	
Graduated from high school	8 (13.8)	2 (25.0)	
Graduated from college	2 (3.4)	1 (50.0)	
Subclinical Leprosy			
Positive	22 (37.9)		
Negative	36 (62.1)		
Room humidity, % (mean, SD)	52.59 (5.46)		
The level of natural lighting, Lux (mean, SD)	28.28 (3.18)		
Residential density, m^2/ person (mean, SD)	19.09 (13.07)		
Source of Clean and drinking water			
shallow groundwater	20 (34.48)		
deep groundwater	37 (63.79)		
Municipal water supply (PDAM)	1 (1.72)		
Type of Wastewater Disposal			
Open	26 (44.83)		
Open partly	19 (32.75)		
Closed	13 (22.4)		
Height, cm (mean, SD)	152.16 (6.94)		
Weight, kg (mean, SD)	58.62 (13.95)		
BMI			
Underweight	4 (6.9)	1 (25.0)	
Normal	28 (48.3)	**12 (42.86)**	**12 (54.54)**
Overweight	26 (44.8)	9 (34.62)	

Table 2. Water and Sanitation Condition

Drinking Water	Total f (%)	Subclinical Leprosy f (%)	Components in subclinical leprosy (n = 22) f (%)	Sanitation	Total f (%)	Subclinical Leprosy f (%)	Components in subclinical leprosy (n = 22) f (%)
Drinking water from an improved water source, which is located on premises, available when needed and free from fecal and priority chemical contamination.	38 (65.52)	15 (39.47)	15 (68.18)	Residential density are not eligible (< 9m^2 / person)	5 (8.62)	2 (4.0%)	2 (9.1)
Drinking water directly from ground water.	2 (3.44)	0 (0)	0 (0)	Household size	6 (10.34)	3 (50.0)	3 (13,6)
Carry out drinking water treatment (for example, in a simple way by boiling)	56 (96.55)	22 (39.26)	22 (100)	Types of flooring are not eligible (the floor is not waterproof)	7 (12.06)	2 (28.6)	2 (9.1)
				The level of natural lighting are not eligible (60-120 Lux)	58 (100)	22 (37.93)	**22 (100)**
				Type Wastewater Disposal are not eligible (open or partially open)	45 (77.58)	20 (44,4)	**20 (90.9)**
				Room humidity are eligible (45%-64%)	54 (93.1)	21 (38.89)	**21 (95.5)**

Discussion

A lot of subjects with subclinical leprosy were found in the observed population with leprosy patients in the same house. These findings support the argument that the risk of acquiring *M. leprae* in leprosy is much higher than that indicated by the prevalence of the disease. Moreover, the general result of the interaction between *M. leprae* and the human body appears to be a subclinical infection.(16)

In this study, it can be identified that several dominant factors appear in the observation results of the subjects with subclinical leprosy in Brebes, both from demographic, environmental, and nutritional factors.

Demographic and Nutritional Factors

Subjects with subclinical leprosy had a low level of education (elementary school graduates). This finding is aligned with previous studies where more than half of the subjects were female (84.9% who resided in orphanages and 63.3% who lived at home.(17) The education level of subjects with subclinical leprosy is also in line with the previous studies where most of themwere junior high school graduates (people living in orphanages), while those who graduated from high school lived at home.(17) These results are consistent with the research conducted by Iswahyudi in 2013 about subclinical cases of leprosy in school children. The results showed that age, sex, nutritional status, knowledge, lighting, and occupancy density had no effect on the incidence of subclinical leprosy.(18)However, this study can show the proportion of leprosy subclinical cases in many women and people with relatively low education (graduated from elementary school).

Regarding Multi Basiller (MB) prevalence, women were in an advantageous position compared with men and comprise a lower percentage of MB cases according to existing data.(19–23) In 2014-2015, the prevalence rate was 0.68 / 10,000; in 2013-2014, the proportions of women and children affected with leprosy were 36.81% and 9.04%, respectively. Traditionally, a male-over-female preponderance has been reported in various epidemiological studies.(22,24–26) Traditional beliefs, the low status assigned to women, and women's limited mobility, illiteracy, and poor knowledge of leprosy have been suggested as important sociocultural factors responsible for underreporting of cases of women affected with leprosy.(27)

In a study in Nepal, it was determined that most women were illiterate, married at an early age, had a heavy workload, and had poor knowledge and awareness of clinical signs and treatment.(23) It is also obvious that the condition of subclinical cases of Subclinical Leprosy in Brebes are mostly reported by people with low levels of education, so that their knowledge is limited.

The dominance of subclinical leprosy in adulthood in this study is supported by the peak incidence of leprosy in two age groups (10–15 and 30-60 years) and male dominance in most areas with a ratio of 2: 1. The incubation period varies greatly each month with up to more than 30 years, but usually it is prolonged, 10 years in average for lepromatous leprosy.

This study shows that the nutritional status of a person does not play a significant role in causing the incidence of subclinical leprosy since most of the people identified as subclinical leprosy in

this study had normal BMI. Research in Bangladesh reported that a lack of food can contribute as an impact of the increasing cases of leprosy.(28) The difference in the results of this study could be due to differences in the characteristics of research subjects where the study in Bangladesh was conducted on children to adults up to 40 years old. In this study, the subjects did not have clinical symptoms of leprosy. Moreover, the measurement of BMI which hold the weaknesses in this study is based on a questionnaire with a high level of subjectivity.

Environmental Factor

The Average of household size in this study at 4.57 (1.45). In theory; however, a larger household could increase the risk of leprosy, since it increases the chance of transmission. Nevertheless, in an Indonesia-based study an increased risk was found only for households larger than seven people, while in Wagenaar study no more than 9 of 152 households counted more than seven people; where two (3.8%) of them in the patient group and seven (7%) others in the control group.(29) In subclinical leprosy with a large household size, there were 3 out of 6 (50%).

Recent studies indicate reservoir of leprosy in the environment may exist, through the water discharged through the the sewerage. A shared or reused water from a patient's water source may become infectious environmental reservoirs, possibly by aerosolization of *M. leprae*.(30) Contaminated water may be capable of transmitting viable *M. leprae*, as recent studies have found potentially viable bacteria in the water and in amoebas commonly found in untreated water.(31,32) While studies have linked water to possible routes of infection, sanitation has not been implicated as a potential transmission route of leprosy.(33) Potentially viable *M. leprae* has been found in soil samples, but the route of transfer from person to the environment is not understood.

Experiments were carried out to see the resistance of *M. leprae* at a humidity level of 72–80% and a temperature of 29–33 ° C, the bacillus survived approximately 28 days, whereas at a room temperature of 25–32 ° C and ahumidity of 66–44%, the bacillus survived longer, around 46 days. In this study, the room humidity was between 45-64%, so the possibility of leprosy transmission due to contact with family members increased.(34) A study conducted by Rhomdani showed that person with a bedroom that was not exposed to natural lighting had a 3.69 times greater chance of suffering from leprosy than person who slept in a room with natural lighting.(35)

Conclusion

Subclinical leprosy in Brebes is associated with household contact with leprosy patients. The characteristics of subclinical leprosy are mostly women with low education levels. Environmental conditions including sewerage, room humidity, and natural lighting levels that are not eligible with health requirements are the most common environmental factors in subclinical leprosy in Brebes.

Community empowerment efforts are needed to encourage changes in people's behavior in a clean and healthy lifestyle to prevent leprosy transmission, especially for those who have close contact with leprosy patients.

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Conflicting Interest: no conflict of interest

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