127 Correlation between Leprosy Children with Nutritional Status, Personal Hygiene, BCG Vaccination History and Occupancy Density in Gresik Regency

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Correlation between Leprosy Children with Nutritional Status, Personal Hygiene, BCG Vaccination History and Occupancy Density in Gresik Regency

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ABSTRACT

Even though Indonesia has achieved elimination status, leprosy is still an important health problem in Indonesia because of its debilitating nature. East Java is one of the provinces with the highest leprosy burden in Indonesia, with a high percentage of children cases. Many factors are thought to affect leprosy transmission. Among them are nutritional status, personal hygiene, BCG vaccination history, and occupancy density. The purpose of this study was to determine the relationship between nutritional status, personal hygiene, BCG vaccination history, and occupancy density with the incidence of leprosy in children in the Gresik Regency. This is an analytic observational research with a case-control approach. This research was conducted in December 2019. The number of samples were 60 respondents, consisting of 30 cases and 30 controls. The results of multivariate analysis showed that there was a relationship between nutritional status (p = 0.041; OR = 9,628), history of BCG vaccination (p = 0.032; OR = 22,164) and occupancy density (p = 0.003; OR = 14,810) with leprosy in children. Nutritional status, personal hygiene, BCG vaccination history, and occupancy density are significantly associated with the incidence of leprosy in children, with occupancy density as the most significant factor and history of BCG vaccination as the strongest risk predictor associated with the development of leprosy in the pediatric population.

Keywords: Nutritional status, Personal hygiene, BCG Vaccination, Occupancy Density, Leprosy in children

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INTRODUCTION

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*.[1] Leprosy affects various parts of the body, including nerves and skin, which is if not getting treatment, will cause damage to the skin, nerves, limbs, and eyes.[2] Currently, leprosy is still a national problem because of its debilitating aspect where leprosy invokes negative stigma to those affected and influences their interaction with the community they belong to.[3]

Leprosy had been reported to affect two to three million people worldwide. The highest number of annual new leprosy cases can be found in India with 134,752 cases, followed by Brazil with 33,303 cases, and Indonesia with 16,825 cases. Leprosy has a disability rate of 6.82 people per million population.[4] Since 2000, Indonesia had achieved leprosy elimination status, when there was less than one case per 10,000 populations. However, this number does not directly translate to Indonesia as a leprosy-free country. In 2015-2016, almost all provinces in eastern Indonesia had a high leprosy burden. East Java is the only Indonesian province in the western part with high leprosy burden.[2] The result of a study on the prevalence of leprosy in the Gresik Regency from 2010 to 2017 shows that there are 140-150 leprosy sufferers. Leprosy prevalence was 1.24 out of every 10,000 populations in 2011, most of which were children (5-7%), with a 12.38% second-grade physical disability rate.[3] Another study showed that in Gresik Regency, there were eight districts with high leprosy case burden, namely: Wiringanom, Tambak, Pancen, Ujungpangkah, Bungah, Sidayu, Shaman, and Kedamean.[3]

Children are believed to be the most vulnerable group towards *M. leprae* infections due to their immature immunity. Many factors are thought to affect leprosy infection, including nutritional status, personal hygiene, BCG vaccination history, and occupancy density. Previous studies reported that nutritional status was correlated with leprosy (p-value 0.002). Food consumption heterogeneity varies across households, with the same food intake affects the nutritional intake.[5] In contrast with this finding, Hidayatun's study stated that the nutritional status did not have a significant relationship with leprosy (OR 0.210, p-value 0.148).[6]

Personal hygiene is another factor that also can influence the occurrence of leprosy. Poor personal hygiene will increase body susceptibility towards various skin

infections and can diminish skin barrier function. Poor personal hygiene can be a reflection of the unhealthy environment and individual's behavior.[6]

Another factor that has been reported to correlate with the incidence of leprosy is BCG vaccination history.[7] Bacillus Calmette Guerin vaccine (BCG) is known for its protective effect towards *Mycobacterium tuberculosis* infection, but this vaccine also has been reported to protect against *Mycobacterium leprae* infection. Protection from BCG vaccine for *M. leprae* ranges from 10% to 80%.[8] BCG can increase Th-1 immune response and IFN- γ production that is useful for controlling mycobacterium infection. IFN-γ is related to macrophage cell activation, increasing Cell-Mediated Immunity (CMI), and destroying *M. leprae*.[9] Research conducted by Mayangsari *et al.*[9] regarding Interferon-γ profile and BCG score as an illustration of the immune response in pediatric leprosy patients shows that BCG vaccination protection was only 58%. It means BCG vaccination has not been entirely successful in dealing with leprosy, hence a repeated dose is needed.

The environment has also been thought to play a crucial role in the incidence of leprosy. The environment which affects various aspect of the patient's life is one of the biggest factors contributing to the disease. Occupancy density is part of the physical environment that can affect people's health. Dense housing increases humidity that can promote bacterial growth, including leprosy bacteria.[10] Based on Nurcahyati's study, residents in dense housing have a 6-7 times higher risk of leprosy because they have closer contact with leprosy patients.[11]

Considering several findings that have been stated above, the authors were interested to study the relationship between nutritional status, personal hygiene, BCG vaccination history, and occupancy density with the incidence of children leprosy in the Gresik Regency. This study hopefully can shed some clues for a better leprosy eradication strategy which will be focused not only on the therapeutic aspect but also on promotive and preventive efforts to break the chain of leprosy transmission.

MATERIALS AND METHODS

This research was conducted in Gresik Regency on 19-23 December 2019 using an analytic study with a case control design. Consecutive sampling technique was used to obtain the sample. This study involves leprosy patient from children aged 5-18 years who were willing to be the research subjects. Sample allocated were 30 cases of leprosy patients and 30 controls who did not have leprosy. Data collection was carried out with interviews accompanied by the respondent's parents. The type of data collected were separated into two, namely primary data (obtained through observation and interviews with respondents) and secondary data (obtained through data from the Gresik Regency Health Office).

Interview were conducted to obtain nutritional status, personal hygiene, BCG vaccination history, and residential density data. Nutritional status was defined using WHO criteria for BMI based on age with <-3 SD, -3 SD to <-2 SD,> 1 SD to 2 SD,> 2 SD categorized as abnormal nutritional status and -2 SD to 1 SD categorized as normal. Personal hygiene was assessed using a personal numeric scale from 1 to 10 with <5 score considered as poor personal hygiene and ≥5 considered good personal hygiene. BCG vaccination history was obtained from the BCG score and the MCH handbook which categorize the study subject into vaccinated and not vaccinated groups. Assessment of residential density was done by direct observation. The design of this study was approved by the Health Research Ethics Commission Dr. Soetomo Surabaya (Number: 1664 / KEPK / XI / 2019). The final data were analyzed using SPSS with univariate analysis using frequency distribution, bivariate analysis using chi-square test and multivariate analysis using logistic regression test with a value of $\alpha = 0.05$.

RESULTS

The data were retrieved from 60 subjects, amongs whom 30 contracted leprosy and 30 were the control group. Table 1 shows the general characteristics of the subjects. A quarter (15/60) of the subjects have an abnormal nutritional status and 15% (9/60) of subjects did not undergo BCG vaccination. Meanwhile, personal hygiene splits at the same percentage between those with good habits and those who did not have. During the study period, we also found that 60% (36/60) of the subjects' household did not meet the minimum recommended density; in other words, they lived in a cramped housing environment.

Table 1. Demographic Characteristics of Respondents

Variable	Frequency	%
Child Leprosy		
Leprosy	30	50
No leprosy	30	50
Nutritional status		
Abnormal	15	25
Normal	45	75
Personal Hygiene		
Less	30	50
Good	30	50
History of BCG Vaccination		

No	9	15
Yes	51	85
Household Density		
Didn't meet the requirement	36	60
Meet the requirement	24	40

Table 2. Results of Bivariate Analysis of Chi-Square Test

Variable	Child Leprosy Condition				*p*-value	OR
	Leprosy		Without leprosy			
	N	%	N	%		
Nutritional status						
Abnormal	12	20	3	5	0.007	6.00
Normal	18	30	27	45		
Personal Hygiene						
Less	20	33.3	10	16.7	0.010	4.00
Good	10	16.7	20	33.3		
History of BCG Vaccination						
No	8	13.3	1	1.7	0.026	10.55
Yes	22	36.7	29	48.3		
Household Density						
Meet the requirement	26	43.3	10	16.7	0.000	13.00
Didn't meet the requirement	4	6.7	20	33.3		

The results from statistical analysis were shown in table 2 as well as the frequency amongst leprosy and non-leprosy group regarding each of the variables. All variables show a significant difference between the children with leprosy and those without leprosy i. e. nutritional status (p=0.007), personal hygiene (p=0.010), history of BCG vaccination (p=0.026), and occupancy density (p=0.000).

Subjects with leprosy accounted for 80% (12/15) of those with abnormal nutritional status. Given the OR value, children with poor nutritional status is at six times higher in odds to develop leprosy compared to the children with normal nutritional status. On personal hygiene, half of the subjects had poor personal hygiene, amongst whom 33.3% (20/60) had leprosy.

Most of children without prior BCG vaccination (7/8) were in leprosy group. The statistical analysis showed that children with no history of BCG vaccination possess a higher odd about ten times compared to their counterpart who underwent the immunization. The subjects whose occupancy density did not fulfill the requirement only constituted 15.38% (4/26) of leprosy cases. However, the Chi square test showed statistical differences amongst pediatric population with leprosy and those without leprosy (p-0.000; OR 13.00).

Table 3. Results of Multivariate Analysis using Logistic Regression Test

Independent variable	OR exp (B)	95% CI for Exp (B)	Sig
Nutritional status	9,628	1,094-84,763	0.041
Personal Hygiene	4,525	0889-22,786	0.067
History of BCG Vaccination	22,164	1,302-377,282	0.032
House Occupancy Density	14,810	2,476-88,567	.003

Multivariate analysis by logistic regression was done to observe the strength of each parameters i. e. nutritional status, personal hygiene, history of BCG vaccination, and occupancy density. The result were presented on table 3. It was showed that the most significant factor was occupancy density (p=0.003), whilst prior BCG vaccination (p=0.032) is shown to be the most determining factor. Subjects whose occupancy density did not meet the minimum requirements and those who never underwent BCG vaccination had an increased risk of leprosy by 14,810 times and 22,164 times, respectively.

DISCUSSION

This study implied that there is a significant relationship between nutritional status and the incidence of leprosy in children. The result is in accordance with a previous study conducted in Sampang Regency in 2018 that observed significant association between nutritional status and the incidence of leprosy.[6] In addition, another study conducted in Sampang Regency in 2017 also observed a significant relationship between nutritional status and the incidence of leprosy[12]. Nutritional status is one of the factors that can increase the risk of leprosy infection. The previous study suggests that inadequate nutrient intake

can affect the immune response and thus render the body to be more susceptible to contract *M. leprae*.[13,14]

A significant relationship between personal hygiene and the incidence of leprosy in pediatric patients was also observed in this study. Personal hygiene such as overall body hygiene, hair, mouth, skin, eyes, nose, ears, and genitals are known to affect health. Previous studies have also shown significant results.[6,15]

Prior BCG vaccination is showed to be a strong predictor, with the most significant risk associated with the incidence of leprosy in children. Our study found that the children who did not undergo BCG immunization have an OR exp (B) of 22,164 times to contract leprosy. BCG is the only vaccine known to prevent leprosy and plays an important role in controlling leprosy.[13,17] Previous study conducted by Susanti and Azam[7] also observed that people who do not have a history of BCG vaccination tend to develop leprosy later in life compared to those who had undergone the immunization. However, in this study, 26 subjects with prior BCG vaccination but still had leprosy, which is more in number compared to those with leprosy but have never receive BCG immunization. It is thought that multiple BCG immunization of revaccination is needed to protect against *M. leprae*. A booster dose of BCG is believed to help reduce the risk of leprosy. Previous study showed that the protection rate of BCG were found to be 41% in experimental studies and 60% in cohort studies.[16] A study in Brazil revealed the protective effect of BCG vaccination against leprosy varies from 20% to 80% [17]. Other studies in Uganda, Guinea and India obtained protection rates of 81% with a year follow up, 46% after 9 years and 23% after 10 years, respectively. In addition, a meta-analysis study reported the rate of protection for BCG revaccination varied between 26-61%. This procedure is proved to be effective against the development of MB type of leprosy. Besides, another study suggests that BCG revaccination is recommended for people with contact with MB patients, as they have a very high risk to develop infection[18].

Our study also found that occupancy density was the most significant factor associated with the incidence of leprosy in children (p-value = 0.003). Wicaksono *et al* [19] also reported that there was a significant influence between the density of house occupancy with leprosy incidence (OR=4.42; 95% CI = 1.25-15.57).[19]

CONCLUSIONS AND SUGGESTIONS

It can be concluded that nutritional status, personal hygiene, BCG vaccination history, and occupancy density are significantly associated with the incidence of leprosy in children. The most significant factor associated with the development of leprosy in the pediatric population is occupancy density whereas the strongest risk predictor is no prior BCG vaccination. Our study suggests the importance of raising awareness regarding occupancy density, educating the public about the importance of BCG vaccinations and BCG booster vaccination program, and the importance of applying Clean and Healthy Living Behavior in the community.

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DATA AVAILABILITY

The Questionnaire data used to support the findings of this study are included within the supplementary information files.

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