

Original Articles

## Correlation between BCG Immunization Status and The Incidence of Tuberculosis among Children



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Article Info	Abstract
Article history: Received: 6 January 2020 Accepted: 20 February 2020	<i>Introduction:</i> A children tend to have a high risk on the tuberculosis (TB) infection. BCG immunization is well known as effective way to protect the children from the infection of TB bacteria. Therefore, the study aim was to investigate a correlation between BCG immunization status and the incidence of tuberculosis among children. <i>Methods:</i> A retrospective case-control study design was used. In total 34 children, whose aged between 1 to 12 years old and visited Wonorejo Primary Health Center between September, 12nd to 16th 2019 recruited as study participant. The Chi-square test was used in this study. <i>Results:</i> There was a significant correlation between BCG immunization status and the incidence of tuberculosis among children with P value = .008, < .05. <i>Conclusion:</i> Among five from six children who did not received the BCG immunization were suffered with TB bacteria infection.
Keywords: child, Tuberculosis, BCG immunization	

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## INTRODUCTION

Children are including to a disease high-risk group because of the incomplete immune systems development. The incomplete of children immunity may due to some barriers, including the delayed of BCG immunization administration to prevent the children from TB infection [1]. In many cases, this barrier may cause another complexity of regular TB infection disease into miliary TB and meningitis TB. The incidence of mycobacterial infection among children reflects the effectiveness of the TB control management programs such as case detection, tracing contact and the goals achievement of BCG vaccination program [2].

Tuberculosis is an infectious disease caused by *Mycobacterium Tuberculosis*. Adults who suffer from TB are easily transmitted the bacteria to another person, especially children with in an incomplete immune system development. The administration of the BCG vaccine to every newborn known as the effective way to prevent this infectious disease. A baby who received intradermal BCG immunization will develop a skin reaction which will resulting a formation of tissue scar, popularly called by the BCG vaccine scar [3]. The elevation of TB transmission rates in endemic areas may caused by the highly impacted density and the delayed of the case detection. The mycobacterial infection in children generally occurs after a continous transmission of the bacteria through the environment. Moreover, children also oftenly exposed to the bacteria around the area whereas the disease outbreaks in adult patient were very difficult to be control [4].

WHO data in 2010 showed the total number of TB-related death in Southeast Asia reached 625,000 cases. Three countries were declared as the countries with the highest "disease burden", which were China, India, and lastly Indonesia [2].

The Republic of Indonesia estimated to face about 1 million of new TB cases (647 per 100,000 populations) within 100,000 numbers of deaths (41 per 100,000 populations) per year. Furthermore, based on 2015 TB Prevention Program routine data, an uplift trend of the Case Finding Rate (CFR) was notified to 330,812 new TB cases, and 28,418 (9%) among the total new case were suffered by the children group. The proportion remains significant from 9.4% in 2010, then slightly decrease to 8.5% in 2011, 8.2% in 2012, 7.9% in 2013, 7.16% in 2014, and increase by 9% in the year of 2015. These proportions were varied on each province, from 0.12% to 50%. The East Java Province had the second largest number of pulmonary TB patient, within the age of range between 0-14 years old as many as 190 cases. First placed, was taken by The West Java Province with the 203 cases of pulmonary TB [5].

Around 2018, the TB prevalence among children at Situbondo regency reached 152 cases [6]. Based on a preliminary study conducted by researchers on Friday, January 27th 2019 at the Wonorejo Community Health Center, there were in total 12 children positive diagnosed by TB [7].

Generally, the administration of BCG vaccine has been proven to be an effective way to eliminate the severe incidence of TB cases, such as milliary TB and meningitis TB, which were often found in children or younger people. However, several studies shows that

the current BCG vaccination has another risk due to the availability of the vaccine protection. An attention were needs in the administration of BCG vaccination especially for the babies who born from the positive pulmonary TB mother (indicated by positive examination finding from physical exam and blood/imaging test). The special attention need to start at the last of the trimester, during this period the baby tend to be high risk infected by the mycobacteria through the placenta, amniotic fluid or haematogenous. The babies who born from pulmonary TB mother during the postnatal period will also tend to be high risk infected by the Mycobacterium Tuberculosis through micro-splashes. Moreover, the babies who born from mothers who were indicated HIV + / AIDS were not recommend to get the BCG immunization due to the immunocompromised condition. It is highly recommended to do the immediate baby referral to ensure whether the baby neither indicated and positively infected with HIV. The special intervention will be given to the baby who positively infected with HIV [5]. This study purpose was to investigate the relationship between BCG immunization status to the incidence of TB among children at Wonorejo Public Health Center area, Situbondo Regency.

## **METHODS**

A retrospective case-control study design was used. In total about 34 children were recruited by simple random sampling technique. The inclusion criteria in this study were any children (1 to 12 years old) visited the Wonorejo Public Health Center around

September, 12nd to 16th year of 2019. The parents (mother) then given the inform consent and sign the agreement to represent the study participant. Exclusion criteria in this study were any parents who rejected the consent. The study was approved by STIKES Banyuwangi, and the letter of approval handovered to the Head of the Wonorejo Public Health Center, Situbondo Regency. The Data collection begin within an observations on the children admission status card, KMS (Kartu Menuju Sehat) health record book and physical examination at the left upper arm area. The children who received BCG vaccine will showed a BCG vaccine scar. The collected data then modified to nominal scale and statistically analyze with the Chi-square test.

## **RESULTS**

Table 1 shows the majority of the study participants are male (N=18, 53%), attain the age between 6-12 years old (N=27, 79.4%). The parents (mother) educational background majority are senior high school (N=23, 68%) and attain the age between 23-28 years old (N=13, 38%). The data also shows the majority of the study participant have no TB infection history around the family (N=23, 68%).

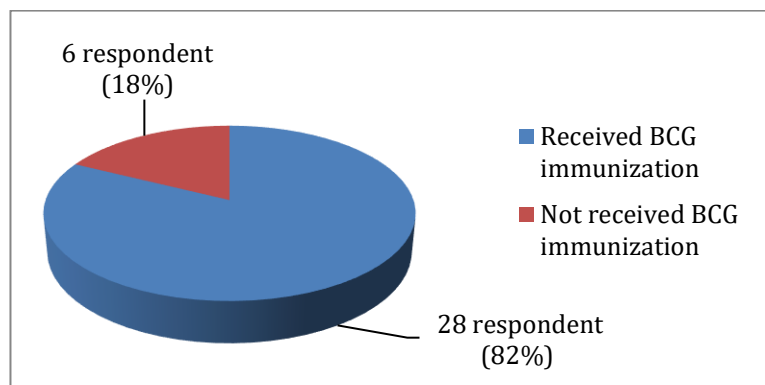
Figure 1 shows the proportion of the BCG Immunization status (received and not received) at the Wonorejo Public Health Center, Situbondo Regency. Majority of the participant were received the BCG immunization (N=28, 82%). Figure 2 shows the majority of the study participant were indicated as non-TB patient, within the total number are 23 respondents (65%).

Table 2 shows the results of Chi-square test within 34 of total respondents succeed to reach the significance level less than .05 level (2-tailed). The significance value shows  $P = .008 < .05$ . The results indicate there is a

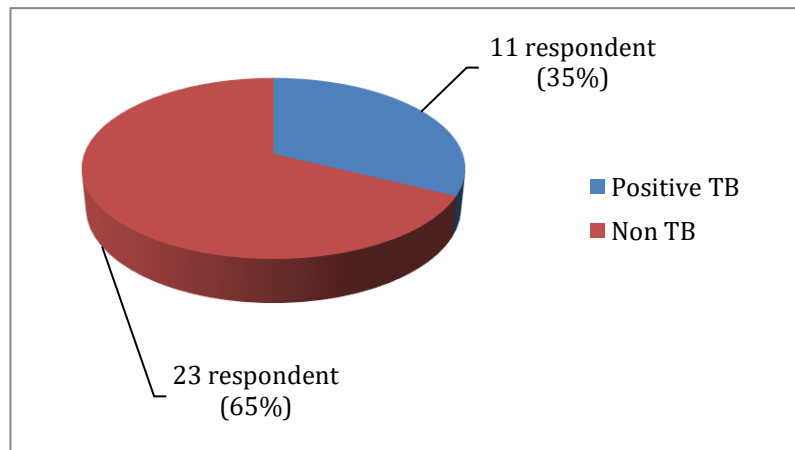
strong and positive relationship between BCG immunization status to the incidence of TB among children at Wonorejo Public Health Center, Situbondo Regency.

**Table 1**  
Demographic characteristic of study participant

Variable	Total (N)	Percentage (%)
<b>Age (years)</b>		
1-5	7	21
6-12	27	79.4
<b>Gender</b>		
Male	18	53
Female	16	47
<b>Mother's educational background</b>		
Elementary	2	5
Junior High School	6	15
Senior High school	22	68
College	4	12
<b>Mother's age (years)</b>		
17-22	9	26
23-28	13	38
29-34	7	21
35-40	5	15
<b>TB infection history in the family</b>		
Yes	11	32
No	23	68



**Fig. 1.** The proportion of BCG immunization status among study participant



**Fig. 2.** The proportion of indicated non indicated as TB patients among study participant

**Table 2**

Results of correlation analysis between BCG Immunization status and the incidence of TB among Children at Wonorejo Public Health Center, Situbondo Regency

BCG Immunization status	Children status				P
	Positive TB		Non TB		
	n	%	n	%	
Received	6	54.5	22	96	.008
Not received	5	45.5	1	4	
Total	11	100	23	100	

## DISCUSSION

### *The Provision of BCG Immunization in Children*

Based on the Figure 1, majority of the total respondents who received the BCG immunization are 28 respondents (82%). The Bacillus Chalmette Guerin (BCG) immunization is a vaccine primarily used against Tuberculosis (TB). BCG vaccine contain the Micobacterium tuberculosis germs that have been weakened [8].

Any factors which can affect the provision of BCG immunization among children were include the parent's age and educational background. Based on the Table

1, the parent's (mother) majority educational background were at Senior High School level (N=23, 68%). The parent's educational background is reflects to the level of parent's knowledge on the importance of BCG vaccination. Theoretically, within a high school level of educational background the parents will responsible enough to become a decision maker for their children, providing access in any health care facilities, especially if the parents comprehend the importance of immunization. Adult age is a period of adjustment to the new social life, the social life here defined as the role as a husband, a wife, a parents for children, a breadwinner's and any values according to new duties [9]. While the

other factors that influence the BCG immunization are the parent's age. Table 1 shows that almost half of the participant's parents (mother) were attain the age between 23-28 years old (N=13, 38%). The influence of parent's age as decision maker are important for the children to access the BCG immunization, otherwise if the parents are too young the responsibility as decision makers are move to their grandmothers.

### ***The Incidence of TB in Children***

Based on Figure 2, the majority of participants were indicated as non-TB children (N=23, 65%). Tuberculosis is a direct infectious disease caused by TB bacteria (*Mycobacterium tuberculosis*). Most of the TB bacteria infect the lung tissues, and had another possibility to infect the other organs. The occurrence of TB in children mostly around the age of 0 to 14 years old. The children who are presumed as TB suspect will shows clinical symptoms related to the disease and shows confirmed test on TB bacteria. The doctor will validate and responsible on the TB treatment also decide the treatment based on results of TB bacteria test [5].

Another factor that influence the incidence of TB among children is the historical TB infection in the family. Based on Table 1, majority of the study participant have no infected TB history among the family with the total of 23 respondents (68%) and around 11 respondents (32%) confirmed the TB infection in their familial history. TB bacteria are very easily transmitted through droplets, which defined as drops of contaminated sputum in the air that are produced when a person coughing, breathing or sneezing. The

children who living together with the patient of TB tend to increase the susceptibility in mycobacterial infection.

### ***The Relationship between BCG Immunization status and the Incidence of TB among Children***

The results of Chi-square tests shows  $p = 0.008, < 0.05$ . It was indicated a significant association between BCG immunization with the incidence of TB among children. The BCG immunization is the most beneficial and cost-effective TB prevention among children groups, on the other hand maintain the immunity become the preventive way to the mycobacterial infection. The adequate nutritional status will significantly increases the children endurance. Keep the cleanliness of the environment also important, characteristics of mycobacteria are resistant in the humid and lack of sunlight areas. The parent's age and educational background also influence the healthy lifestyle and parent's efforts in utilizing the health facilities. Another factor is familial history of TB infection, children are classified as vulnerable group to the micobacterial infection.

Based on results on the Table 2, the majority of the respondents who received the BCG immunization did not showed the indication of TB, within the total number of 22 respondents (65%). About six children who received the BCG immunization and had positive TB infection were exposed to the mycobacteria from familial history, yet vaccination succesfully build the defense system and prevent regular TB development to the miliary TB or meningitis TB. The exposure of mycobacteria from the familial history was the major cause among the

children who received the BCG immunization and indicated positive on TB infection. Another finding shows after physical examination and direct observation to the other five children (45%) who had positive TB infection and did not receive the BCG immunization. Researcher notice that the participant did not receive the BCG immunization based on the children KMS (Kartu Menuju Sehat) health record book and no sign of BCG vaccine scar at their upper left arm. Theoretically after intradermal administration of the BCG vaccine, a scar will developed at the site of injection, except for some minor case the scar are not developed due to an incorrect injection position or the body does not adequately respond to the vaccine. The non-developed BCG vaccine's scar increase the possibility that the respondents did not received the BCG immunization during 0 - 2 months old. There was only one respondent who did not received the BCG immunization however indicated as non-TB patient, this condition may happen due to the strenght of the defense body system, or the respondent received the BCG immunization without skin reaction and the health record book was disappeared.

A study conducted by Livana and Muniarsih (2007) stated that there was a relationship between BCG immunization in children with the incidence of tuberculosis [10]. Another research conducted by Briassoulis et al. (2005) mentioned the BCG immunization does not fully protect the children from mycobacterial infection [11]. This statement was also in line with another study on BCG immunization by Rachim (2012), the children who received BCG immunization was apparently still had a

possibility to infect by the mycobacteria [12]. The BCG immunization does not prevent the primary tuberculosis infection but prevents severe complications of the disease, especially development to severe meningitis TB and pleural effusion-related to mycobacterial infection [13].

Another study by Rosandali (2016) mentioned that immune system among newborn baby was immature, as an administration of the vaccine right after the baby born will helps to develop a better immune response to any infection, especially in the cellular rather than humoral level of immune response [3]. In the study, immune response defined as the human body's response to the infection, this finding indicate the administration of BCG immunization will develop the body resistance from mycobacterial infection.

## CONCLUSION

A significant association between BCG immunization status to the incidence of TB among children at Wonorejo Public Health Center, Situbondo Regency was proved in this study. The majority of the study participant were non-TB patient as many as 23 respondents (65 %) and the rest of 11 respondents (35%) were children who indicated as positive TB patient. The Chi-square test showed significance value at  $P = .008$  less than the significance level at .05 (two-tailed test).

A significant finding on this study can be used as reference for further research. A development on the allied research topic within an additional of specific significant

factors that influence to the mycobacterial transmission among children are needed.

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