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Determinants of Pulmonary TB Incidence in Children Aged 0-14 Years in the Work Area of UPTD Puskesmas Sukorame

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ABSTRACT
Tuberculosis is an infectious disease that can affect people of all ages caused by the bacteria Mycobacterium tuberculosis. Knowledge, exposure to cigarette smoke, nutritional status, and BCG immunization play a role in the body's immunity that can prevent TB transmission. The purpose of this study was to determine the determinants of the incidence of pulmonary TB in children aged 0-14 years. The type of research used was cossectional with samples being children suffering from TB and not TB (TB suspects) recorded in the Sukorame Health Center work area which was taken by purposive sampling. Data were analyzed using the chi square statistical test. Based on the results of the analysis, it showed that smoking habits in families had an effect on the incidence of pulmonary TB in children (0.021), while parental knowledge (0.059), child nutritional status (1.000), immunization status (0.577) had no effect on the incidence of pulmonary TB in children. Cigarette smoke contains hazardous chemicals that can damage the lungs, so it is a risk factor for the incidence of pulmonary TB.

Keywords : BCG, Cigarette, Knowledge, Nutritional, Tuberculosis

INTRODUCTION

Pulmonary Tuberculosis (pulmonary TB) is an infectious disease caused by bacillus-shaped bacteria known as Mycobacterium Tuberculosis. This disease can affect all age groups (WHO, 2022). Tuberculosis is usually transmitted through the air contaminated by bacteria that are released when the sufferer coughs by releasing droplets without using a mouth cover. Cases of incidents in children often occur because they are infected by adult TB sufferers.

TB is the 13th leading cause of death in the world and the second leading cause of death from infectious diseases after COVID-19 (above HIV/AIDS). According to the latest data in the Global TB report in 2023, the percentage of the number of cases in the world of TB cases in Indonesia is still ranked 2nd in the world, an estimated 10 million people suffer from TB worldwide. With a total of 5.6 million men, 3.3 million women, and 1.1 million children. TB is present in all countries and in all age groups.

According to the WHO Global TB report (2022) TB deaths are more than 95% and occur in low- and middle-income countries, namely India, Indonesia and the Philippines. In 2021, the number of TB cases found in Indonesia was 397,377 cases, an increase compared to all tuberculosis cases found in 2020, which were 351,936 cases. The highest number of cases in provinces with large populations, namely West Java, East Java, and Central Java. Tuberculosis cases in these three provinces contributed 44% of the total number of tuberculosis cases in Indonesia (Ministry of Health of the Republic of Indonesia 2022).

The results of several studies related to risk factors for the occurrence of Pulmonary TB in Indonesia and other countries show that the occurrence of Pulmonary TB in children is influenced by factors related to child factors, parental factors, socio-economic factors, environmental factors and contact with adult TB sufferers (Karimet al, 2016; Haqetal, 2018). The results of the study by Susanto et al., (2016) stated that there is a relationship between BCG immunization and the incidence of pulmonary TB in children, where children who are

not immunized are at greater risk of developing pulmonary TB, compared to children who have had pulmonary TB. Another study conducted by Apriliasari et al., (2018) also stated that apart from immunization, parental knowledge about pulmonary TB also has a relationship with the incidence of pulmonary TB in children, good parental knowledge about TB will also affect parental behavior in maintaining their children's health from TB transmission around their environment (Widiawati et al., 2021).

According to Abimulyani et al., (2023) apart from parental knowledge and immunization in children, there are other important things that influence the incidence of pulmonary TB in children, namely the behavior of adult pulmonary TB sufferers in the same house, the lack of awareness of pulmonary TB sufferers regarding the process of TB transmission to others, especially in children as a vulnerable group that has the most important risk to be prevented in society, so that we can break the chain of TB transmission in children (Noviansyah et al., 2021).

Based on initial data obtained by researchers, in 2023 there were 1380 TB cases in Kediri City, 354 TB cases in children and this is still quite high. Based on the description above, the purpose of this study is to conduct research on the analysis of the determinants of the incidence of Pulmonary TB in Children Aged 0-14 years in the Sukorame Health Center UPTD Work Area.

METHODS

This type of research is quantitative research with a cross-sectional approach. The sample in this study were children aged 0-14 years who suffered from TB, totaling 8 children and non-TB (TB suspects) totaling 47 children recorded in the register data at the Sukorame Health Center in 2024. The sampling technique used was purposive sampling technique. Data analysis was carried out using univariate and bivariate analysis. Univariate analysis aims to see the frequency distribution, the magnitude of the spread and the average value of each research variable presented in the form of a table or graph. While for bivariate analysis to determine the relationship between the independent variable and the dependent variable using the chi square statistical test.

RESULTS

A. Univariate Analysis

The following is the frequency distribution of respondent characteristics as follows.

Table1. Frequency Distribution of Respondents Based on Respondent Characteristics.

Variables	Number (n)	Percentage (%)
Child Age		
Toddlers (<5 years)	22	40.0
Children (5-9 years)	19	34.5
Adolescents (≥10 years)	14	25.5
Child Gender		
Man	24	43.6
Woman	31	56.4
Age of Parents		
Late Adolescence (≤25 years)	7	12.7
Early Adulthood (26-35 years)	26	47.3
Late Adulthood (36-45 years)	18	32.7
Early Elderly (>45 years)	4	7.3
Parent Education		

SD	0	0.0
JUNIOR HIGH SCHOOL	5	9.1
SENIOR HIGH SCHOOL	35	63.6
College	15	27.3
Level of Knowledge		
Not good	25	45.5
Good	30	54.5
Family Smoking Habits		
Smoke	20	36.4
Do not smoke	35	63.6
Nutritional status		
Malnutrition	1	1.8
Malnutrition	9	16.4
Normal Nutrition	38	69.1
More Nutrition	7	12.7
BCG Immunization Status		
No immunization	7	12.7
Immunization	48	87.3

Based on the table above, it is known that most of the respondents are children in the toddler age group (<5 years) as many as 22 respondents (40.0%). Based on the gender of the child, most are female as many as 31 respondents (56.4%). Based on the age of the parents, most of the respondents are in the early adult age group, namely 26 to 35 years old, as many as 26 respondents (47.3%). Meanwhile, based on the last level of education, most of the parents have a last education of high school as many as 35 respondents (63.6%).

Based on the characteristics of the level of parental knowledge about pulmonary TB, most of them have a good level of knowledge about pulmonary TB in children, as many as 30 respondents (54.5%). Based on the characteristics of family smoking habits, most of the respondents do not have a smoking habit in the family, as many as 35 respondents (63.6%). Based on the characteristics of the nutritional status of children, most of the respondents have normal nutritional status, as many as 38 respondents (69.1%). Based on the characteristics of BCG immunization status, most of the respondents have BCG immunization status, as many as 48 respondents (87.3%).

B. Bivariate Analysis

The following are the results of the chi square statistical test as follows.

Table 2 Statistical Test Results Chi Square

Independent Variables	Childhood Pulmonary TB Incident				Total		p-value	PR
	Positive		Suspect					
	n	%	n	%	N	%		
Knowledge								
Not good	1	4.0	24	96.0	25	100.0	0.059	0.137
Good	7	23.3	23	47.7	30	100.0		
Family Smoking Habits								
Smoke	6	30.0	14	70.0	20	100.0	0.021	7,071
Do not smoke	2	5.7	33	94.3	35	100.0		
Nutritional status								
Abnormal	3	17.6	14	82.4	17	100.0	0.692	1,414

Normal	5	13.2	33	86.8	38	100.0		
BCG Immunization Status								
No Immunization	0	0.0	7	100.0	7	100.0	0.577	-
Immunization	8	16.7	40	83.3	48	100.0		

Based on the table above, it is known that in the variable of parental knowledge with the incidence of pulmonary TB in children, a p-value of 0.059 was obtained, which indicates that there is no relationship between knowledge and the incidence of pulmonary TB in children. In the variable of family smoking habits with the incidence of pulmonary TB in children, a p-value of 0.021 was obtained, which indicates that there is a relationship between family smoking habits and the incidence of pulmonary TB in children. In the variable of child nutritional status with the incidence of pulmonary TB in children, a p-value of 0.692 was obtained, which indicates that there is no relationship between nutritional status and the incidence of pulmonary TB in children. While in the variable of BCG immunization status with the incidence of pulmonary TB in children, a p-value of 0.577 was obtained, which indicates that there is no relationship between BCG immunization and the incidence of pulmonary TB in children.

DISCUSSION

A. Relationship between Knowledge and the Incidence of Pulmonary TB in Children

Based on the results of statistical tests, it was found that there was no relationship between parental knowledge about childhood pulmonary TB and the incidence of childhood pulmonary TB in the Sukorame Health Center work area. According to the researcher's assumption, there is no relationship between parental knowledge and the incidence of childhood pulmonary TB in the Sukorame Health Center work area because most respondents from both positive and suspect groups have good knowledge, although several indicators still show that most respondents still do not know. So in this study, knowledge is not a causal factor in the incidence of childhood pulmonary TB in the Sukorame Health Center work area and there are factors that play a greater role in the incidence of childhood pulmonary TB.

The results of this study are in line with researchRasyid et al., (2024) where there is no relationship between knowledge and the incidence of pulmonary TB where both the case and control groups have good knowledge. This shows that in fact the education program on pulmonary TB has been running in the community quite effectively in increasing public knowledge in general. With this, it indicates that the education program that has been carried out previously needs to be improved, repaired and sharpened to cover the shortcomings in the community.

The results of this study contradictAzilah et al., (2025)that there is a relationship between knowledge and the incidence of pulmonary TB. According toAzilah et al., (2025)lack of knowledge is a risk factor in the occurrence of pulmonary TB. The higher a person's education level, the better the knowledge obtained, especially in preventive measures in the health sector. In addition, with good knowledge possessed by parents, it will increase parental sensitivity to their children when TB symptoms occur so that preventive efforts can be given immediately.

Parents with poor knowledge of tuberculosis generally will not understand if their child suffers from tuberculosis and how this disease affects their child. They tend to just think they have a fever or an ordinary illness. This shows that the lower the knowledge of the sufferer or their family, the greater the risk of the sufferer or their family becoming a source of infection either in their home or in the surrounding environment.(Yusuf, 2022).

The results of this study have not shown any influence of knowledge, because there may be several interfering factors in this study. Existing knowledge may not be significant in

the context of this study, or because there are other factors that have a greater influence on the incidence of TB in children. Incorrect knowledge can also trigger incorrect findings. In addition, existing knowledge is not specific enough to explain the phenomenon being studied, or there may be other factors that are more influential.

B. Relationship between Family Smoking Habits and the Incidence of Pulmonary TB in Children

Based on the results of statistical tests, it was found that there was a relationship between smoking habits in families and the incidence of pulmonary TB in children in the Sukorame Health Center work area. These results are in line with research Muharam et al., (2023) that there is a relationship between family smoking history and the incidence of childhood tuberculosis. The influence of smoking on the family results in children becoming passive smokers who will still be inhaled by active substances from cigarettes. The toxins inhaled by children will accumulate in the child's body. As a result, it will have an impact on the decline in children's health so that children will be susceptible to diseases, especially infectious diseases. Children who are exposed to cigarettes plus a history of contact with tuberculosis sufferers will further increase the risk of tuberculosis in children (Muharam et al., 2023).

According to Giacomo's theory, smoking is an important risk factor for several diseases such as cardiovascular disease. Cigarettes are also often the main cause of death worldwide related to cerebrovascular disease, respiratory tract infections, COPD, TB to cancer. Then smoking directly endangers the integration of physical barriers, increases the permeability of the respiratory epithelium and interferes with mucociliary clearance. Cigarette smoke will increase airway resistance, causing blood vessels in the lungs to leak easily and then damage macrophages. Macrophages are cells that can phagocytose pathogenic bacteria.(Kurniawan, 2020).

The results of this study contradict research Wahidah et al., (2023) where there is no relationship between cigarette exposure and the incidence of pulmonary tuberculosis. According to the researcher's assumption, cigarettes are not a direct cause of tuberculosis, but cigarettes can aggravate and worsen tuberculosis.

Relationship between Nutritional Status and the Incidence of Pulmonary TB in Children based on the results of statistical tests, it was found that there was no relationship between the nutritional status of children and the incidence of pulmonary TB in children in the Sukorame Health Center work area. This result is in line with research Octavia and Suminar (2024) there is no relationship between nutritional status and the incidence of pulmonary TB. The absence of a relationship between nutritional status and the incidence of tuberculosis according to the researcher's assumption is because children with good nutritional status still experience tuberculosis. With this, there are other factors that are more dominant than the nutritional status factor.

The results of this study contradict research Akbar B. et al., (2022) There is a relationship between nutritional status and the incidence of pulmonary tuberculosis in children. Individuals with poor nutritional status will more easily switch from latent pulmonary TB to active pulmonary TB. Low nutritional status indicates that food intake does not match the body's needs. Lack of food intake can be caused by several factors, including lack of knowledge (ignorance and low awareness). Decreased nutrition will affect immunity or the body's immune system, which means that the body's defenses will decrease against various health threats, one of which is Mycobacterium tuberculosis (Akbar B. et al., 2022).

According toWijayanti et al., (2022) Good nutritional status indicates that the body has the ability to defend itself against infectious diseases. Good nutritional status will create good immunity so that nutrients in the body can be used to fight infections. The incidence of

tuberculosis in children is greatly influenced by nutritional status factors which are caused by a lack of energy, protein, vitamins and other nutrients which can later affect the body's resistance so that it is susceptible to infection. (Wijayanti et al., 2022).

Cigarette smoke contains several chemicals that can harm health. Cigarette smoke can also affect the incidence of TB because the chemical content of cigarette smoke can also lower the immune system, especially in the respiratory tract, making it easier to be infected with TB-causing bacteria. In addition, cigarette smoke can trigger latent TB (a condition in which TB bacteria are in the body, but are inactive and not contagious) into active TB.

C. Relationship between BCG Immunization Status and the Incidence of Pulmonary TB in Children

Based on the results of statistical tests, it was found that there was no relationship between the status of BCG immunization in children and the incidence of pulmonary TB in children in the Sukorame Health Center work area. This result is in line with research Octavia and Suminar (2024) There is no relationship between BCG immunization and the incidence of pulmonary TB in children. According to the opinionOctavia and Suminar (2024) There are still respondents who have received BCG immunization but still experience TB. This is because there are several factors that can influence, including the time of immunization, the effectiveness of the BCG vaccine and environmental conditions. BCG immunization only has a protective effect of around 80% for a period of 10-15 years. Children/toddlers who have been given BCG immunization but experience TB are likely to have been infected with TB before receiving BCG immunization or it could also be from other factors, such as smoking habits in the family, an environment that is at risk of TB or it could also be from a history of breastfeeding (Oktavia & Suminar, 2024).

The results of this study contradict Abimulyani et al., (2023) There is a relationship between BCG immunization and the incidence of pulmonary TB in children. BCG immunization is most effective when given immediately after birth or during the first two months of life. BCG immunization is very effective in preventing tuberculosis in children. The effectiveness of BCG varies greatly, ranging from 0-80%. The factors that influence the effectiveness of the BCG vaccine against TB are differences in BCG vaccines, environmental factors, genetic factors, nutritional status and several other factors such as exposure to ultraviolet light on the vaccine, errors in injection techniques and so on. In addition, the timing of immunization is still a debate. Some experts say that BCG immunization should be given at 0 months (the first 3 days after birth) because it is feared that the child will be infected before being given BCG immunization.

Basically, immunization is one of the efforts to prevent infectious diseases, especially diseases that can be prevented by immunization (PD3I) which are given not only to children from infancy to adolescence but also to adults. Babies and children are very susceptible to infectious diseases. This is because their immune system is not yet perfect. In addition, close contact with adults suffering from pulmonary TB also has the potential to be a medium of transmission. This condition is exacerbated if the lack of parental awareness to immediately provide BCG immunization to their children and poor nutritional quality and unhealthy home environmental conditions will greatly increase the possibility of TB infection in children. (Akbar B. et al., 2022).

BCG (Bacille Calmette-Guérin) immunization does not completely prevent someone from getting TB, but it can reduce the risk of getting severe TB and serious complications such as TB meningitis. BCG immunization works by stimulating the immune system to produce antibodies that protect against infection by the bacteria that cause TB.

CONCLUSION

Based on the research that has been conducted, it states that smoking habits in families can affect the incidence of pulmonary TB, but for factors such as the level of parental knowledge about pulmonary TB, nutritional status in children and history of BCG immunization do not affect the incidence of pulmonary TB in children aged 0-14 years in the Sukorame Health Center work area. Cigarette smoke contains hazardous chemicals that can damage the lungs, so it is a risk factor for the incidence of pulmonary TB. So for the program from the local service, it should further prevent children from being directly exposed to cigarette smoke by creating a Smoke-Free Area in places where children gather or do activities.

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