



Literature Study: Risk Factors for Tuberculosis in Children

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ABSTRACT

Tuberculosis (TB) is one of the most deadly diseases in the world. Every day nearly 4,400 people lose their lives due to tuberculosis and nearly 300,000 people fall ill due to this disease. The aim of this research is to find out what factors influence the incidence of tuberculosis in children. The method used in this research is literature review. The results show that risk factors that influence the incidence of pulmonary tuberculosis in children include parental knowledge, nutritional status, BCG immunization status, history of contact with sufferers, exposure to cigarette smoke and residential density

INTRODUCTION

Tuberculosis (TB) is one of the most deadly diseases in the world, and is still one of the biggest health problems in the world. If this disease is not treated or the treatment is incomplete, it can cause dangerous complications and even death. Every day almost 4,400 people lose their lives due to tuberculosis and almost 300,000 people fall ill because the morbidity (10 million sufferers) and mortality rates (1.5 million sufferers) are still high, especially in developing countries like Indonesia.

Tuberculosis is an infectious disease that attacks all age groups, including children. Tuberculosis in children occurs at the age of 0-14 years. In developing countries, there are 40-50% or around 500,000 children aged less than 15 years in the world who suffer from tuberculosis every year. Currently, the situation of tuberculosis cases in Indonesia has risen to second place in the world after India, with a total of 969,000 cases and a death rate of 98,000 per year or the equivalent of 11 deaths per hour. In 2021, tuberculosis cases in children were 42,187, then in 2022 they increased rapidly by 100,726 (Ministry of Health, Republic of Indonesia 2022). This data was obtained through tuberculosis epidemiological surveillance activities. Tuberculosis surveillance has a role in providing valid data to determine the right decisions in preventing and controlling tuberculosis (Martyastuti & Maulana, 2023).

Susceptible children aged 0-14 years were found to be quite frequently affected by childhood tuberculosis (Baun et al., 2023). Tuberculosis in children will continue to be a global problem as long as the incidence of pulmonary tuberculosis in adults remains high. Tuberculosis endemic countries are the cause of the majority of tuberculosis cases in children. Pulmonary tuberculosis in children will continue to be a global problem as long as the incidence of pulmonary tuberculosis in adults remains high. TB endemic countries are the cause of the majority of pulmonary TB cases in children (Fitriyani et al., 2019). Pulmonary tuberculosis (TB) is an infectious disease caused by infection with the bacteria *Mycobacterium tuberculosis*. There are several types of *Mycobacterium*, including *M. tuberculosis*, *M. africanum*, *M. bovis*, *M. leprae*, etc. Which can also be called Acid-Resistant Bacteria (BTA). This disease can be transmitted through aerosols or droplet nuclei which are very small (5 μm) in size and can be inhaled and can reach the alveoli. The incubation period for tuberculosis varies from 2-12 weeks, usually lasting 4-8 weeks. During the incubation period, the germs multiply until they reach 10^3 - 10^4 , which is a sufficient number to stimulate a cellular immune response. Most *Mycobacterium tuberculosis* bacteria attack the lungs, but can also affect other body organs.

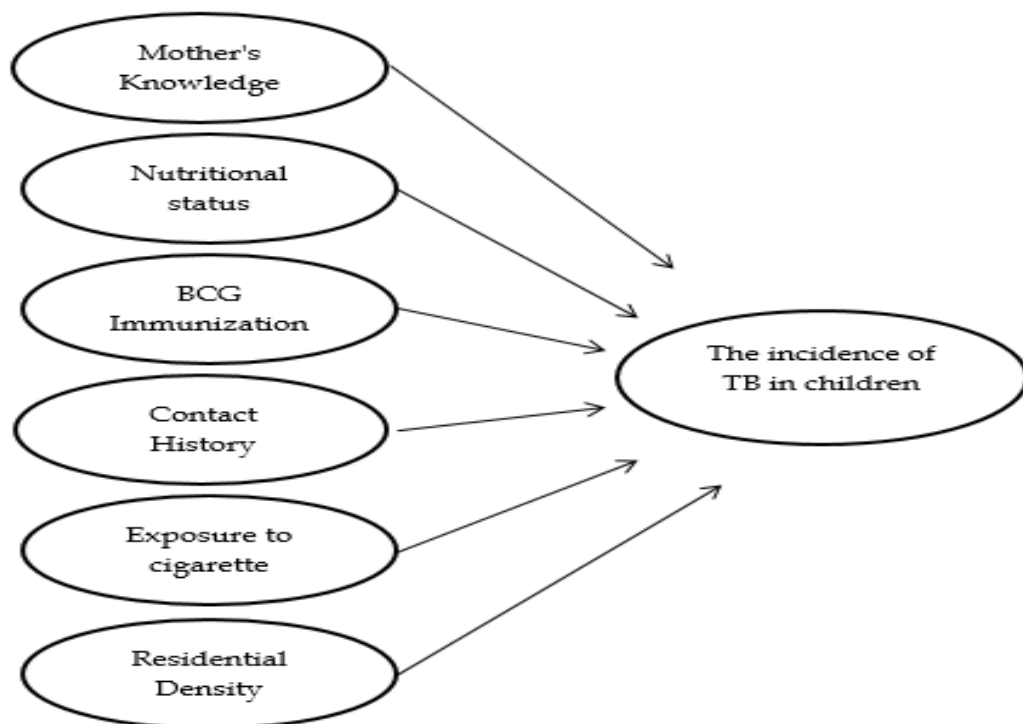
Children under five years of age are more susceptible to pulmonary tuberculosis because their immune systems are still developing (Mardiati & Fitri, 2023). Children suffering from tuberculosis often experience continuous coughing, weight loss or failure to thrive, persistent fever, lethargy and children tend to be passive. These symptoms are often considered atypical because they are also found in other diseases (Wijaya et al., 2021).

According to John Gordon (1951) the occurrence of infectious diseases is caused by the interaction of 3 disease components, namely humans (host), causes (agent) and the environment (environment). Gordon believes that disease arises because of an imbalance between the cause (agent) and the human (host)(Sulaiman et al., 2023). Factors that cause TB transmission to children are parental knowledge, child nutritional status, history of contact with TB sufferers, BCG immunization status, and exclusive breastfeeding (Yani at el, 2018). Risk factors for pulmonary TB in children are a history of contact with adult pulmonary TB sufferers, parents' income level, parents' education level, and parents' level of knowledge. Children are usually infected with tuberculosis from adults who have progressive cavitory lesions that release infected droplets into the air (Rita & Qibtiyah, 2020). Compared with the general population, those living with tuberculosis sufferers have a higher risk of contracting the disease in their household. M.tuberculosis is a bacterium that is very dependent on humid environmental conditions, so residential density is also a factor that influences the incidence of pulmonary TB in children. Based on the background provided previously and considering the role of children representing the future generation of this country, the author believes that it is important to examine the risk factors associated with tuberculosis in children.

LITERATURE REVIEW

Author and Year	Results
Tantri Muharam, Andi Akifa Sudirman, and Dewi Modjo (2023)	The results of univariate analysis show risk factors that influence the incidence of tuberculosis in children. Family smoking history (p=0.002), parental knowledge of the results (p=0.000) (OR= 15,000), and history of BCG immunization p = 0.006 (OR= 8.333)
Aminah Haslinda Baun, Ince Picauly, and Rafael Paun (2023)	The results of the multivariate analysis test showed that there was a significant relationship between contact history (p = 0.001 = OR = 157.566), and nutritional status (p = 0.047 = OR = 9.801)
Devial at el (2022)	The results of the analysis show that the risk factors that influence the incidence of pulmonary tuberculosis in children are smoking habits (p=0.029 OR= 2.62), household contacts (p=0.00) and bedroom lighting (p=0.018 OR= 2.83)
Faradina Pramesti Nandariesta, Lintang Dian Saraswati, Mateus Sakundarno Adi, dan Martini (2019)	Bivariate results show risk factors for the incidence of TB in children in Wonosobo Regency, history of contact with sufferers (p= 0.001) OR 2.674 (95%CI = 0.493 – 14.519), as well as children's nutritional status (p= 0.435) and economic status (p= 0.306) is not a risk factor for the incidence of childhood TB in Wonosobo Regency.

Dianita Ekawati (2019)	The results of the analysis show that there is a significant relationship between Age (p value = 0.031), Gender (p value = 0.005) and Household Contact (p value = 0.029). And there is no significant relationship between history of BCG immunization (p value = 0.240) and the incidence of childhood tuberculosis.
Vierito Irennius Girsanga dan Yovsyah (2023)	The results of the study showed that toddlers who experienced short nutritional status had a 2.92 times risk of pulmonary TB disease and toddlers who experienced very short nutritional status had a 4.22 times risk of pulmonary TB disease after controlling for confounding variables.
Yumi at el (2023)	The results of the analysis show that the risk factor that influences the incidence of tuberculosis in children is parental knowledge (p=0.001), history of BCG vaccination (p=0.001), nutritional value of children (p=0.005), residential density (p=0.001), behavior of tuberculosis sufferers at home (p=0.000), and length of contact (p=0.001).
Sayekti at el (2020)	The results showed that there was a significant relationship between BCG immunization (p=0.031) and body mass index (p=0.001), while household contact factors (p=0.282) and socioeconomic status (p=0.312) were not significant.
Fatahillah Hidayat at el (2022)	Based on bivariate analytical tests using the Fisher's Exact test, a p correlation of 0.615 ($\alpha=0.05$) was obtained, which shows that there is no significant relationship between BCG immunization and pulmonary tuberculosis in children under five.
Julia Fitriany, Rifqa Gusti Andrea Fitasya, dan Harvina Sawitri (2019)	The results of the study showed that the ventilation area of the house (p=0.345), lighting (p=0.762), and house occupancy density (p=0.227)



Picture 1. Conceptual Framework (Image Must be in Good Quality)

METHODOLOGY

This study aims to determine the factors that influence the incidence of tuberculosis in children. This research is a review of the literature and sources used in research from PubMed, BMC, and Google Scholar with the keywords used are "TB risk factors in children", "Risk factors", "risk factors", and "tuberculosis". In this study, full text articles were selected based on inclusion and exclusion criteria

RESULTS

Parental Knowledge

There are two of the 10 articles reviewed in this research that discuss parental knowledge as a risk factor for the incidence of $p=0.000$ and research by Yumi et al with a value of $p=0.001$. Knowledge is a basic guideline for someone, especially parents, to behave. Having good knowledge about TB disease will be a benchmark for preventing this disease. Knowledge about childhood TB will make someone know what the disease looks like and what the impacts of the disease are.

Nutritional Status

A person's nutritional status is an indicator of their physical health which comes from food intake and the way the body uses nutrients. Three of the 10 research journals reviewed in this study stated that there was a significant relationship between nutritional status and risk factors for TB in children, namely the results of Baun et al's research with a p value = 0.047, Yumi et al's research with a p value = 0.001, and the results of Girsanga et al's research with values of OR = 2.92 and OR = 4.22, meaning that children who have a short nutritional status have a 2.92 times risk of getting TB and those who have a very short nutritional status have a 4.22 times risk of getting TB. sick with TB. This occurs due to children having poor nutritional status, because their bodies are weak and thin, resulting in children being more likely to contract pulmonary TB, which will ultimately affect their immune system (Irennius, 2023).

Bcg Immunization Status

Since 1995, all countries with high rates of tuberculosis infection have been advised by WHO to administer one dose of BCG vaccine at birth or after birth (Azikin et al., 2015). There are differences in research results regarding BCG immunization, five journals out of 10 that study BCG immunization. Two of them, namely Ekawati's research with a p value = 0.29 and Fatahillah Hidayat et al's research with a p value = 0.615, said that BCG immunization is not a factor in pulmonary TB in children. Meanwhile, the other three, namely Muharam et al's research with a p value = 0.006, Yumi et al's research with a p value = 0.001, and Sayekti et al's research with a p value = 0.031, said that giving BCG immunization is one of the factors for pulmonary TB in children. The BCG vaccine is a vaccine that contains weakened *Mycobacterium bovis* bacteria. The BCG vaccine, according to the Indonesian Pediatrician Association (IDAI), provides protection against severe tuberculosis (TB) and TB-related brain inflammation. Prevention of latent TB infection reactivity or primary TB infection cannot be achieved entirely through BCG vaccination. Because a child's immune system is not yet mature at <2 months of age, the optimal time for giving the BCG vaccine is between 2-3 months of age, it is not recommended to give a booster injection. Over 10-15 years, the protective effect is around 80%, and is most effective as a prevention of disseminated disease (Nasution & Amalia, 2022). The timing of BCG immunization can influence differences in research findings in the five studies regarding the impact of the vaccine on risk factors for tuberculosis in children. This is because giving the BCG vaccine at the right time will maximize the development of antibodies which will inhibit the growth of *Mycobacterium pulmonary TB* bacteria in children (Ekawati, 2022). In the five research journals, the ages of respondents who received BCG immunization for their research were not stated in detail.

Contact History With Sufferers

To find out the source of transmission of tuberculosis, you can use information regarding the history of contact with sufferers. Children are most susceptible to infection from others around them. Adults with pulmonary TB who experience progressive cavity lesions that emit contaminated droplets into the air are usually the ones who are the source of infection for children. Prolonged contact, such as involving repeated exposure to coughing, must occur before the child develops active disease (Rita & Qibtiyah, 2020). According to the Indonesian Ministry of Health, if a toddler lives with an adult TB sufferer within 3 months before being diagnosed or starting TB therapy, it can be said that the toddler has a history of household contact. There are differences in research results regarding the history of contact with sufferers. Five of the 10 journals examined the history of contact with sufferers. Four of them were examined in this study, stating that there was a significant relationship between contact status with sufferers and the occurrence of TB in children, namely the results of Baun et al's research with a value of $p=0.001$, Ekawati's research with a value of $p=0.029$, Yumi et al's research with a value of $p=0.001$, research by Nandariesta et al found that toddlers who had a history of contact with pulmonary TB sufferers had a 2.674 times greater risk of contracting TB than toddlers without a history of contact with pulmonary TB sufferers. Meanwhile, one of them, namely Sayekti et al's research with a p value = 0.282 615, said that there was no significant relationship between contact with sufferers and the incidence of pulmonary TB in children. This can happen because toddlers aged 24-59 months have received BCG immunization which is a primary measure to prevent being infected with tuberculosis but does not completely protect children from attacks by tuberculosis infection but rather prevents the homogeneous spread of tuberculosis and the occurrence of TB meningitis and Miller's TB.

Exposure to Cigarette Smoke

Parental smoking habits are one of the factors that cause pulmonary TB disease in children. The higher the intensity of parental smoking, which results in the child being exposed to cigarette smoke, the easier it will be for the child to contract Mycobacterium TB infection because the child's immune system is still vulnerable (Altet et al., 2022). There are two of the 10 articles reviewed in this research regarding exposure to cigarette smoke, namely Muharam et al's research with a p value = 0.002 and Devial et al's research $p = 0.029$ which states that exposure to cigarette smoke is related to the incidence of tuberculosis in children.

Residential Density

Residential density according to the research results of Yumi et al with the result $p=0.001$ which states that residential density is one of the risk factors for the incidence of pulmonary TB in children. The comparison between the number of people living and the area of the house occupied in square meters with a minimum requirement of $8 \text{ m}^2/\text{person}$ is what is meant by residential density (Soesanto et al., 2022). The density of residents in a house will have a big impact on its residents. The higher the housing density, the less oxygen consumption there will be, making it easier for TB transmission among the residents of the house. Meanwhile, Fitriyani et al's research with results of $p=0.227$ stated that residential density is not a risk factor for the incidence of pulmonary TB in children. This can happen if the residence meets the requirements or does not meet the requirements but there is no sharing of eating utensils with the sufferer and other family members, so that transmission does not occur.

DISCUSSION

Tuberculosis is an infectious disease that attacks all ages, including children. The occurrence of a disease is due to interactions between humans, causes and the environment. Factors that influence the incidence of tuberculosis in children include parental knowledge, BCG immunization status, history of contact with sufferers, exposure to cigarette smoke and residential density. The most dominant factor in the incidence of tuberculosis in children is a history of contact with sufferers.

CONCLUSIONS AND RECOMMENDATIONS

This study concluded that the factors that influence the incidence of tuberculosis in children are parental knowledge, nutritional status, BCG immunization status, history of contact with sufferers, exposure to cigarette smoke and residential density.

This research recommends that the government and society make prevention and control efforts based on factors that influence the incidence of tuberculosis in children.

FURTHER STUDY

This research still has limitations, so it is necessary to carry out further research related to the topic of Literature Study: Risk Factors for Tuberculosis in Children in order to improve this research and add insight to readers.

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