Jurnal Keperawatan *Priority*, Vol 8 No.2, Juli 2025
ISSN 2614 - 4719

Factors Influencing Tuberculosis Infection in Children with Close Contact of Adult Pulmonary Tuberculosis Patients

Fadhliani Putri Mayasari[1*], Wisman Dalimunthe[2], Pertin Sianturi[3], Rina Amelia[4], Rini Savitri Daulay[5], Fathia Meirina[6]
[1,2,3,4,5,6]Universitas Sumatera Utara
E-mail: fathdlianipm@students.usu.ac.id

ABSTRACT

This research aims to determine the factors that influence tuberculosis infection in children with close contact with adult pulmonary tuberculosis sufferers. This research is an analytical observational study with a consecutive sampling method at the Glugur Darat Health Center in November 2024 until January 2025. Bivariate analysis using chi-square to determine whether there is a relationship between the independent and dependent variables. The type of test used is the Fisher Exact and Kruskal Wallis Test. There is no multivariate test because there are no significant variables in the bivariate test. In total, in 42 samples there were 10 children with positive Mantoux tests. Of the 23 female children there were 7 (30.4%) with positive results and of the 19 male children there were 3 (15.8%) positive results. Of the 39 children with a history of BCG immunization, there were 10 (25.6%) with tuberculosis infection. Of the 37 children with parents whose income was <UMR, 10 children (27%) had tuberculosis infection. 37 children whose parents had junior high school education, 9 people (24.3%) had tuberculosis infection. 10 children aged 1-5 years and 6-10 years, there were 2 (20%) each with tuberculosis infection. 26 children aged 11-18 years, there were 6 people (27.3%) with tuberculosis infection. There was no significant relationship between age, gender, immunization status, nutritional status, parental income and parental education level in this research.

Keywords: incidence of tuberculosis, children, adult pulmonary tuberculosis patients

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis (MTB) that spreads from one person to another through airborne transmission, for example through coughing and sneezing. TB is one of the 10 leading causes of death worldwide caused by the infectious agent tuberculosis bacillus which can affect the lungs but can also be extrapulmonary (Zhu et al., 2020). The number of tuberculosis cases worldwide is increasing every year. In 2023, it is estimated that 10.8 million people will suffer from TB, 10.7 million cases in 2022, 10.4 million cases in 2021 and 10.1 million cases in 2020. In 2023, it is estimated that there will be 1.3 million cases of children and adolescents suffering from tuberculosis. Two-thirds of cases worldwide are in 8 countries including India, Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh and the Republic of Congo (World Health Organization, 2023).

From the data of Tuberculosis Information System (SITB) in 2023, as many as 821,200 TB cases have been notified in Indonesia. [3] In 2022, the number of cases of TB in children <15 years is estimated to be 100,726 or around 14.5% of all TB cases in Indonesia. TB in children is not considered a priority in national TB programs in almost all countries because it is not considered the main source of TB transmission in the community, even though handling TB in children contributes to national efforts to control tuberculosis and reduce the number of tuberculosis cases in the future (Ministry of Health of the Republic of Indonesia, 2023b). Children are more susceptible to TB because their body development is not yet perfect. Some risk factors are children under 5 years old whose immune system is not yet mature so that MTB bacteria that were previously in the body can be easily activated. Poor nutritional status in children reduces the body's resistance to tuberculosis infection. Children with comorbidities such as Human Immunodeficiency Virus (HIV) and children with household and close contact with TB patients are at risk of being infected with TB bacteria (Ministry of Health of the Republic of Indonesia, 2023a).

Public perception and stigma also influence the high rate of tuberculosis infection in Indonesia. Some people still consider TB to be a shameful disease, making them reluctant to seek treatment (Jataunamo, 2025). Tuberculosis control programs are prioritized especially for household contacts and children. A study shows that every child with TB has contact with an adult TB patient in the same household. TB transmission can occur at any time from the index case to contacts. Tuberculosis screening is carried out by active or passive detection. The discovery of active TB screening with initiation of treatment can reduce the risk of developing severe TB disease and increase the coverage of TPT provision for those indicated and minimize ongoing transmission in the community (Anam & Mayasari, 2025).

Glugur Darat Health Center provides health services to 11 sub-districts in the working area of Medan Timur District and there is 1 Assistant Health Center located in Pulo Brayan Bengkel Village. Since 2021, Glugur Darat Health Center has provided Molecular Rapid Test (TCM) services. In 2023, there were 198 pulmonary and extrapulmonary tuberculosis patients treated at the Glugur Darat Health Center. In 2024, there were 180 cases of tuberculosis infection treated. The data collection of all TB patients is well recorded in medical records and in the TB Reporting System (SITB) which is connected nationally and has the resources to diagnose and treat tuberculosis infections in children, which is the reason I chose Glugur Darat Health Center as the research site. The aim of this study was to determine the factors that influence the

transmission of tuberculosis infection in children with close contact with adult pulmonary tuberculosis sufferers.

METHODS

This study is an analytical observational study with consecutive sampling method. The research was conducted at the Glugur Darat Health Center until the minimum number of samples was met. This research was conducted in November 2024-January 2025. The population in this study were child patients with parents suffering from pulmonary tuberculosis at the Glugur Darat Health Center. The sample in this study includes a population that meets the inclusion and exclusion criteria. The sampling technique in this study is consecutive sampling, namely taking samples sequentially until the minimum number of samples is met. The sample in this study was taken from an accessible population using purposive sampling, totaling 39 children. The inclusion criteria consisted of: children aged 0-18 years who had close contact with adult pulmonary tuberculosis sufferers, contact with adult TB patients (bacteriologically/clinically confirmed), and no TB disease.

Data were analyzed using SPSS version 20 after confirming the completeness of the data. Descriptive data is presented in the form of frequencies and percentages for categorical data. Meanwhile, numerical data is presented by displaying the average, standard deviation, median, minimum and maximum values. Bivariate analysis is used to determine whether there is a relationship between independent and dependent variables. The types of tests used are the Fisher Exact Test and Kruskal Wallis Test. There was no multivariate test because no variables were significant in the bivariate test.

RESULT

The results of this study are described in the subject characteristics table and bivariate table as follows.

Table 1. Characteristics of Child Patients with Parents Suffering from Pulmonary Tuberculosis

Characteristics	n (%)
Gender	
Man	19 (45.2)
Woman	23 (54.8)
Age, years	
15 years	10 (23.8)
6 - 10 years	10 (23.8)
11 - 18 years	22 (52.4)

Characteristics	n (%)
BCG immunization	
There isn't any	3 (7.1)
There is	39 (92.9)
Nutritional Status	
Malnutrition	10 (23.8)
Good	26 (61.9)
More	6 (14.3)
Parents' Income	
< Minimum wage	37 (88.1)
Equivalent to UMR	3 (7.1)
> Minimum Wage	2 (4.8)
Parental Education	
Elementary school	1 (2.4)
Middle and high school	37 (88.1)
Higher education	4 (9.5)
TB Type of Contacts	
Drug sensitive	37 (88.1)
Drug resistance	5 (11.9)
Mantoux Test Results	
Positive	10 (23.8)
Negative	32 (76.2)

The subjects of children were mostly female, totaling 23 people (54.8%). Children aged 11-18 years were 22 people (52.4%). Children with a history of BCG immunization were 39 people (92.9 %). Children with undernutrition and overnutrition were 10 people (23.8%) and 6 people (14.3%) respectively. Most of the children's parents had income <UMR, namely 37 people (88.1 %). The majority of the children's parents (88.1%) had junior high and high school education. As many as 37 people (88.1 %) of contacts included drug-sensitive tuberculosis. The results of the Mantoux test showed that 10 people (23.8 %) had positive results.

Table 2. Relationship between Child Characteristics and Tuberculosis Infection

Characteristics of Children	Tuberculosis Infection		p
	Positive n (%)	Negative n (%)	
Gender			
Man	3 (15.8)	16 (84.2)	0.305[a]
Woman	7 (30.4)	16 69.6)	
Age, years			
15 years	2 (20)	8 (80)	1,000[b]
6 -10 years	2 (20)	8 (80)	
11 - 18 years	6 (27.3)	16 (72.7)	
BCG immunization			
There isn't any	0	3 (100)	1,000[a]
There is	10 (25.6)	29 (74.4)	
Nutritional Status			
Malnutrition	3 (30)	7 (70)	0.828[b]
Good	6 (23.1)	20 (76.9)	

Characteristics of Children	Tuberculosis Infection		p
	Positive n (%)	Negative n (%)	
More	1 (16.7)	5 (83.3)	
Parents' Income			
< Minimum Wage	10 (27)	27 (73)	0.421[b]
Equivalent to UMR	0	3 (100)	
> Minimum Wage	0	2 (100)	
Parental Education			
Elementary school	0	1 (100)	0.855[a]
Middle and High School	9 (24.3)	28 (75.7)	
Higher education	1 (25)	3 (75)	
TB Type of Contacts			
Drug Sensitive	8 (21.6)	29 (78.4)	0.577[a]
Drug Resistance	2 (40)	3 (60)	

[a] fischer's exact, [b] kruskal wallis

Table 2 shows the results of the analysis of the relationship between children's characteristics and tuberculosis infection. Of the 19 male children, there were 3 (15.8 %) with tuberculosis infection. Meanwhile, of the 23 female children, there were 7 (30.4 %) with tuberculosis infection. Using the Fischer's Exact test, it was shown that there was no significant relationship between gender and tuberculosis infection (p = 0.305).

There were 2 children (20%) each infected with tuberculosis. 10 children aged 1-5 years and 6-10 years. Meanwhile, of 26 children aged 11-18 years, 6 people (27.3%) were infected with tuberculosis. The Kruskal Wallis test showed no significant relationship between age and tuberculosis infection (p = 1.000).

None of the 3 children without a history of BCG immunization were infected with tuberculosis. Meanwhile, of the 39 children with a history of BCG immunization, 10 (25.6%) were infected with tuberculosis. No significant association was found between a history of BCG immunization and tuberculosis infection (p=1.000) using the Fischer's Exact test.

It was found that 3 children (30%) had tuberculosis infection out of 10 malnourished children. Meanwhile, of the 26 well-nourished children, 6 (23.1%) had tuberculosis infection. And of the 6 overnourished children, only 1 (16.7%) had tuberculosis infection. No significant relationship was found between nutritional status and tuberculosis infection (p=0.828) after analysis using the Kruskal-Wallis test.

It was found that 10 children (27%) experienced tuberculosis infection in children whose parents earned less than the minimum wage. Meanwhile, of the 3 children whose parents earned the same as the minimum wage, none experienced tuberculosis infection, and of the 2 children whose parents earned more than the minimum wage, none suffered from tuberculosis infection.

No significant relationship was found between parental income and tuberculosis infection (p=0.421) after analysis using the Kruskal Wallis test.

From one child who has parents with elementary school education, no tuberculosis infection occurred. Meanwhile, from 37 children with parents with junior high and high school education, there were 9 people (24.3 %) with tuberculosis infection. From 4 children with highly educated parents, only 1 person (25%) had tuberculosis infection. Using the Kruskal Wallis test showed that there was no significant relationship between parental education and tuberculosis infection (p = 0.855). Of the 37 children whose parents had drug-sensitive tuberculosis, 8 (21.6%) had tuberculosis infection. Meanwhile, of the 5 children whose parents had drug-resistant tuberculosis, 2 (40%) had tuberculosis infection. Using the Fischer's Exact test, it was shown that there was no significant relationship between the type of contact tuberculosis and tuberculosis infection (p=0.577).

DISCUSSION

Close contact is defined as a person who has shared air space with a pulmonary tuberculosis patient at home or other indoor conditions for 15 hours a week or more than 180 hours during the infectious period (Ockenga et al., 2023). This study was followed by 42 pediatric patients with close contact with pulmonary tuberculosis patients at the Glugur Darat Health Center.

Contact investigation has the function of increasing case detection and preventing TB transmission in the community (Kaswandani et al., 2022). Tuberculin Skin Test (TST) is a skin test by injecting tuberculosis antigen that induces a delayed-type hypersensitivity reaction. In this study Campbell et al. (2020), TST was performed on children with close contact with tuberculosis patients and out of 42 patients, there were 10 children with positive Mantoux test results. The history of contact, especially in positive BTA patients, has a 3.90 times greater chance of being infected with tuberculosis. However, in this study, no index case patients underwent BTA examination but rather Molecular Rapid Test (TCM) examination.

Children under 5 years old are at greater risk of being infected and suffering from tuberculosis. This is because their immune system is not yet mature, making it less effective in fighting mycobacterium tuberculosis. A study in Semarang found that 50% of children with tuberculosis aged between 12 and 23 months had a history of contact with adult tuberculosis sufferers at home, increasing the risk of transmission. In this study Wijaya et al. (2021), the population of children aged 11-18 years had 6 positive people (27.3) and children aged 1-5 years and 6-10

years had 2 people each (20%) and all populations in this study were children who had contact with adult pulmonary tuberculosis sufferers, it was found that males are a risk factor for tuberculosis in children; this may be due to differences in activity or under-reporting.

The first step to prevent children from getting tuberculosis (TB) is Bacillus Calmette-Guerin (BCG) immunization. A study in Indonesia found that children who did not receive BCG immunization had a 6.87 times greater risk of getting tuberculosis compared to children who were immunized. In our study, we found no significant difference between children who were immunized and those who were not. Even all children who had positive results from the Mantoux test had received the BCG vaccine. Similar research Wulanda and Delilah (2021) also found no significant difference between children who received the BCG vaccine and those who did not. Study children with poor or poor nutritional status tend to have a weak immune system, making them susceptible to tuberculosis infection. Larger sample studies are needed to find the link between nutritional status and tuberculosis infection (Estiani, 2025).

In the research we, it was found that 37 people in the research sample (88.1%) of parents of children had a salary <UMR. Medan City Minimum Wage (UMK) for 2025 has been set at IDR 4,014,072. Parents' income will affect their ability to buy food and meet their children's nutritional needs.

In line with the study Fitria and Rita (2021), the analysis of the relationship between family income and the incidence of pulmonary TB in children showed that 65.0% of the families of respondents diagnosed with pulmonary TB had low incomes and 22.7% had high incomes. However, in this study we did not find a significant relationship between parental income and tuberculosis infection (Wulanda & Delilah, 2021).

CONCLUSION

Based on the results obtained in this study, several conclusions were drawn. The prevalence of index cases of adult pulmonary tuberculosis patients confirmed bacteriologically was 35 people and confirmed clinically was 7 people. The prevalence of index cases of drug-sensitive adult pulmonary tuberculosis patients was 37 people and drug-resistant adult pulmonary tuberculosis patients was 5 people. Based on the regional UMR of Medan City, as many as 37 children have income < UMR as much as 88.1%. However, from 10 children with positive Mantoux, no significant relationship was found between parental income and tuberculosis infection. The parents of patients in this study, 37 (88.1%) were mostly of moderate education level (junior

high school and senior high school). However, no significant relationship was found between parental education level and tuberculosis infection in children. Based on gender, namely male and female, no significant relationship was found. In this study, all samples of children in this study were 26 with good nutrition and 16 with malnutrition (undernutrition and overnutrition). Among 10 children who experienced malnutrition, 3 children (30%) experienced tuberculosis infection. Meanwhile, of the 26 children with good nutrition, there were 6 people (23.1 %) with tuberculosis infection. And of the 6 children with overnutrition, there was only 1 person (16.7 %) with tuberculosis infection. No significant relationship was found between nutritional status and tuberculosis infection. In this study, it was found that all children who received positive Mantoux test results had a history of previous BCG immunization.

LIMITATIONS

This study only involved 39 subjects. Therefore, future researchers should conduct studies with a larger sample size to determine the factors influencing latent tuberculosis infection in children in close contact with adult pulmonary tuberculosis patients.

REFERENCES

Anam, I. L., & Mayasari, E. (2025). Determinants of pulmonary TB incidence in children aged 0-14 years in the work area of UPTD Puskesmas Sukorame. *Indonesian Journal of Nutritional Epidemiology and Reproductive*, *8*(2), 42–48. https://doi.org/https://doi.org/10.30994/ijner.v8i2.335

Campbell, J. R., Winters, N., & Menzies, D. (2020). Absolute risk of tuberculosis among untreated populations with a positive tuberculin skin test or interferon-gamma release assay result: Systematic review and meta-analysis. *The BMJ*, *368*, 1–10. https://doi.org/10.1136/bmj.m549

Estiani, M. (2025). Faktor-faktor yang berhubungan dengan kejadian tuberkulosis paru pada anak di wilayah kerja Puskesmas Kemalaraja. *Aulad: Journal on Early Childhood*, *8*(2), 811–822. https://doi.org/10.31004/aulad.v8i2.938

Fitria, P. A., & Rita, E. (2021). Karakteristik skrining yang berhubungan dengan kejadian tuberculosis (TB) paru pada anak. *Indonesian Journal of Nursing Sciences and Practices*, *4*(2), 85–92. https://doi.org/https://doi.org/10.24853/ijnsp.v4i2.85-92

Jataunamo, O. J. (2025). Adherence to anti-tuberculosis treatment and soft palate tuberculosis. *Cleft Palate-Craniofacial Journal*, *1*(1). https://hal.archives-ouvertes.fr/hal-05003348

Kaswandani, N., Jasin, M. R., & Nugroho, G. (2022). Infeksi laten TB pada anak: Diagnosis dan tatalaksana. *Sari Pediatri*, *24*(2), 134–140. http://dx.doi.org/10.14238/sp24.2.2022.134-40

Ministry of Health of the Republic of Indonesia. (2023a). *Increase in Tuberculosis Cases in Indonesia in 2023*. Ministry of Health of the Republic of Indonesia. https://sehatnegeriku.kemkes.go.id/baca/rilis-media/20240325/4945138/ cegah-dan-obati-tb-dengan-terapi-pencegahan-tuberkulosis/

Ministry of Health of the Republic of Indonesia. (2023b). *Technical guidelines for the management of tuberculosis in children and adolescents* (Ministry o).

Ockenga, J., Fuhse, K., Chatterjee, S., Malykh, R., Rippin, H., Pirlich, M., Yedilbayev, A., Wickramasinghe, K., & Barazzoni, R. (2023). Tuberculosis and malnutrition: The European perspective. *Clinical Nutrition*, *42*(4), 486–492. https://doi.org/10.1016/j.clnu.2023.01.016

Wijaya, M. S. D., Mantik, M. F. J., & Rampengan, N. H. (2021). Faktor risiko tuberkulosis pada Anak. *E-CliniC*, *9*(1), 124–133. https://doi.org/10.35790/ecl.v9i1.32117

World Health Organization. (2023). *Global Tuberculosis Report 2023*. World Health Organization. https://www.who.int/teams/global-programme-on-tuberculosis-and-lung-health/tb-reports/global-tuberculosis-report-2023

Wulanda, A. F., & Delilah, S. (2021). Efektivitas imunisasi BCG terhadap kejadian tuberkulosis anak di Kabupaten Bangka. *Jurnal Kesehatan Poltekkes Kemenkes RI Pangkalpinang*, *9*(1), 37–41. https://doi.org/10.32922/jkp.v9i1.333

Zhu, Q., Wu, Q., Wang, A., Bao, F., Zhang, Y., Bao, D., Yao, S., & Id, H. P. (2020). Epidemiological characteristics of pulmonary tuberculosis in Anhui Province, Eastern China from 2013 to 2018. *PLOS ONE*, *15*(8), 1–11. https://doi.org/10.1371/journal.pone.0237311