

The Features of Children with Tuberculosis at Sidawangi Pulmonary Hospital in Indonesia: Interactions within the Home as a Potential Transmission Risk

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DOI: [10.35898/ghmj-811203](https://doi.org/10.35898/ghmj-811203)

ABSTRACT

Background: Tuberculosis (TB) is an infectious disease that can infect children. The prevalence of pediatric TB in Indonesia has increased in recent years, causing a major burden on children's health.

Aims: To determine the characteristics of pediatric TB patients at Sidawangi Pulmonary Hospital, West Java Province, Indonesia.

Methods: A cross-sectional study was conducted at Sidawangi Pulmonary Hospital, West Java Province, Indonesia. The samples were new cases of pediatric TB from January 2020 to July 2023. Data were collected and analyzed from outpatient and inpatient medical records. Logistic regression was used to analyze the association between age and household contact.

Results: There were 190 pediatric TB patients collected during the study period. Most of them were less than 5 years old (37.9%). The proportion of male and female was almost same. Most pediatric TB patients had household contacts (73.7%), especially those <1 year old. TB patients aged <1 year had an AOR of 31.94 (95%CI 3.8–268.35) for household contact compared to those aged 10-17 years.

Conclusion: Pediatric TB patients at Sidawangi Pulmonary Hospital are mostly less than 5 years old. Compared to older age groups, pediatric TB patients aged <1 year had the highest proportion of household contacts. The government needs to pay attention to the risk of TB transmission to children through household contact, especially in younger children.

Keywords: *Child health; Childhood tuberculosis; Household contact; Pediatric TB; Tuberculosis.*

Received: 27 January 2025

Reviewed: 11 February 2025

Revised: 22 February 2025

Accepted: 23 February 2025

1. Introduction

Tuberculosis (TB) is an infectious disease caused by the *Mycobacterium tuberculosis*, which primarily infects the lungs and can be transmitted through the air when a person coughs, sneezes, or spits (Besozzi et al., 2020; Centers for Disease Control and Prevention, 2023). According to the World Health Organization (WHO) data in 2022, there were at least 10.6 million people infected with TB worldwide, consisting of 5.8 million men and 3.5 million women, and 35% of them were found in Southeast Asia (World Health Organization et al., 2022). About 1.3 million people died from TB worldwide, as the second leading cause of death after COVID-19. Children and adolescents under 15 years old represent 11% of TB cases in the world in which 1.3 million of them were children (World Health Organization, 2023a, 2023b). Mortality was highest in children under the age of 5, especially those with malnutrition (UNICEF, 2023).

By 2020, an estimated 1.1 million children worldwide have TB. The proportion of pediatric TB cases treated in Indonesia from 2010 to 2018 were 9.4% to 11%. From January to November 2022, TB patients were 503,712 in which 61,594 of them were children. The number of people infected TB in 2021 was 443,235 people which increased to 661,784 people in 2022. The West Java Province was the largest contributor to TB cases with 9,368 patients in 2021 (DataIndonesia.id, 2022; Kementerian Kesehatan Republik Indonesia, 2023; Lusiana, 2019). The number of pediatric TB patients in West Java in 2022 was 39,913 and increased to 50,993 in 2023 (Satu Data Indonesia, 2024). Epidemiological data from the Global TB Report 2021 showed that Indonesia was the third country with the highest TB cases in the world, after India and China. Therefore, tuberculosis remains a major health problem in Indonesia (World Health Organization, 2022).

At least 824,000 TB cases in Indonesia, but only 48% were detected, treated and reported in the national information system. The high number of reported TB cases as the results of active case finding by Ministry of Health and an optimal surveillance system. Hopefully, with high case finding, followed by proper management and prevention measures could be undertaken to prevent further TB transmission (Kementerian Kesehatan Republik Indonesia, 2024b).

Several factors of pediatric tuberculosis are mother's knowledge, lack of BCG vaccination, nutritional status, overcrowding, measles, use of steroid and household contact with active TB patients (Intan Salsabila et al., 2023; Kementerian Kesehatan Republik Indonesia, 2022). Due to the high number of pediatric TB cases, need a comprehensive efforts of Ministry of Health to undertake the treatments, preventive and promotive measures. Especially in the transmission of TB to children by adult TB patients through household contact (Abimulyani et al., 2023; Dodd et al., 2022). Therefore, the characteristics of pediatric TB patients, including household contact among pediatrics TB are needed. The aim of the study were to determine the risk factors and characteristics of pediatric TB patients, especially household contact at Sidawangi Pulmonary Hospital, in West Java, Indonesia.

2. Methods

Study design and sample

A cross sectional study at Sidawangi Pulmonary Hospital which is a referral centre for lung disease in West Java Province, Indonesia was done. Sidawangi Pulmonary Hospital was chosen as the study site in order to describe the characteristics of pediatric TB patients in West Java. All pediatric TB patients who visited Sidawangi Pulmonary Hospital from January 2020 to July 2023 were taken as samples. The inclusion criteria were patients under 17 years who were newly diagnosed as pulmonary TB clinically which bacteriologically confirmed. The patients with incomplete medical record data were excluded.

Data collecting and analysis

Data were collected from hospital medical records, including age, gender, supporting examination results, diagnosis, treatment phase, resistant TB, household contact, and comorbidities such as type 1 DM and HIV/AIDS. Household contact was categorized if a family member who is TB patient was presence and living in the same house.

Characteristics of pediatric TB patients were presented descriptively as frequencies and percentages. Logistic regression was done to obtain a crude OR value, while multivariate analysis to determine an adjusted OR. All significance difference level of statistical results were used the level of 0.05.

Ethical approval

This study has been approved by Ethical Board Review of Faculty of Medicine, Swadaya Gunung Jati University Cirebon no. 117/EC/FKUGJ/VI/2023. All data collected were kept confidential.

3. Results

There were 190 pediatric TB patients who met the inclusion and exclusion criteria, consist of 94 (49.5%) male patients and 96 (50.5%) female patients. Based on age of WHO classification, neonates patients (<1 year) were 9.5%, pediatric patients (1 - < 10 year) were 60.5% which is the most dominant, and adolescence patients (10 – 17 years) were 30%. Patients characteristics of pediatric TB are presented in Table 1.

Table 1. Characteristic of pediatric TB patients

Characteristics	Frequency	Percentage
Age group		
<1 year	18	9.5
1 to <5 years	72	37.9
5 to <10 years	43	22.6
10 to 17 years	57	30.0
Gender		
Male	94	49.5
Female	96	50.5

Most of the patients, 142 children (74.7%) had a positive tuberculin test and 184 (96.8%) had chest X-ray images suggestive of TB. Those 2 clinical characteristics could support to establish pulmonary TB clinically, e.g. 175 (92.1%). Meanwhile, bacteriologically positive only found in 15 (7.9%). A total of 14.7% had a TB score of <6 and 85.3% had a TB score of ≥6. Overall of the patients treatment consist of 86 (45.3%) were in the intensive phase and 104 (54.7%) were in the continuation phase. In this study there were no samples with resistant TB. Clinical characteristics of pediatric TB patients are presented in Table 2.

Table 2. Clinical characteristics of pediatric TB patients

Characteristics	Frequency	Percentage
Tuberculin test		
Negative	48	25.3
Positive	142	74.7
Chest x-ray		
Normal	6	3.2
Suggestive of TB	184	96.8
TB score		
<6	28	14.7
≥6	162	85.3
Diagnosis		
Clinically diagnosed	175	92.1
Bacteriologically confirmed	15	7.9
Treatment phase		
Intensive phase	86	45.3
Continuation phase	104	54.7
TB resistant		
No	190	100
Yes	0	0

No comorbid diseases were found in population studied, neither DM nor HIV/AIDS, while household contact was found in 140 (73.7%). Comorbid diseases and household contact are presented in Table 3.

Table 3. Comorbid diseases and household contact

Characteristics	Frequency	Percentage
Type 1 DM		
No	190	100
Yes	0	0
HIV/AIDS		
Negative	190	100
Positive	0	0
Household contact		
No	50	26.3
Yes	140	73.7

Abbreviations: AIDS: acquired immunodeficiency syndrome; DM: diabetes mellitus; HIV: human immunodeficiency virus

The younger the age of TB patients, the more likely they had household contact, in which the age under 1 year had the highest household contact (94.4%). The proportion of household contact are presented in Figure 1 and Table 4.

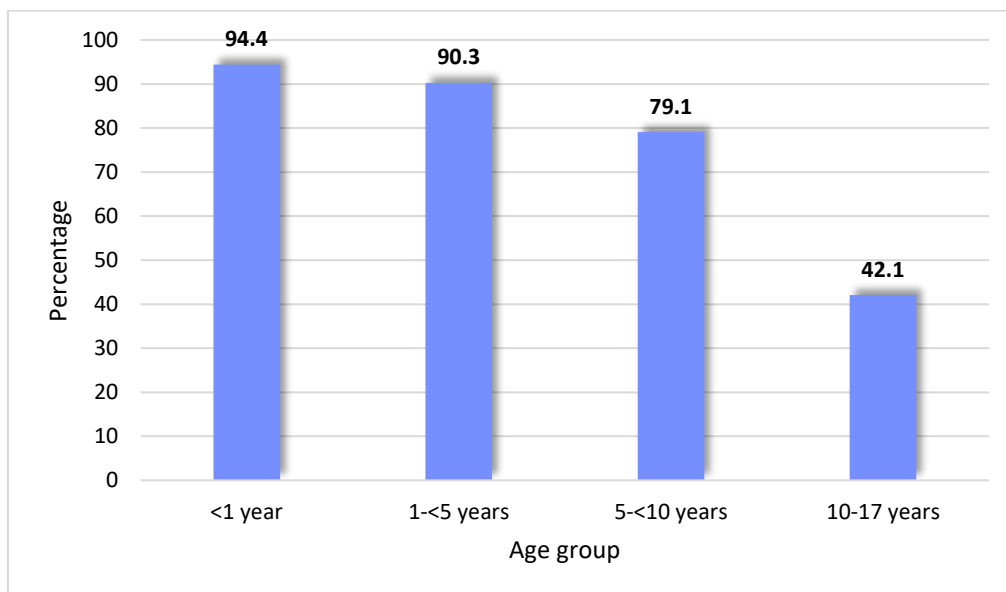


Figure 1. Proportion of household contact by age group

All other age group were had a significantly bigger OR value for household contact compare to age of 10 – 17 years, in which the age group of under 1 year had the highest. Crude OR and adjusted OR are presented in Table 4.

Table 4. Relationship between age and household contact in pediatric TB patients

Age group	Crude OR	95%CI	p-value	Adjusted OR*	95%CI	p-value
<1 year	23.38	2.91 – 187.89	0.003	31.94	3.80 – 268.35	0.001
1 to <5 years	12.77	4.99 – 32.70	<0.001	16.50	6.05 – 44.98	<0.001
5 to <10 years	5.19	2.11 – 12.82	<0.001	6.47	2.47 – 16.94	<0.001
10 to 17 years	Reff.			Reff.		

*adjusted by gender

4. Discussion

A total of 190 pediatric a new pulmonary TB patients were recruited under the study period of January 2020 to July 2023 at Sidawangi Pulmonary Hospital, West Java Indonesia. The study showed that almost half of pediatric TB patients were toddlers aged 0 to 5 years (9.5% aged <1 year and 37.9% aged 1 to <5 years). Meanwhile, 22.6% of pediatric TB patients aged 5 to <10 years and 30% aged 10 to 17 years. These results are in accordance with national data on childhood TB reported by the Indonesian Ministry of Health that the under-five age group is the age group that suffers the most from TB. Data from the Ministry of Health for the last 3 years shows that the proportion of TB patients aged under 5 years from 2021 to 2023 (56.12% to 57.19%) (Kementerian Kesehatan Republik Indonesia, 2024a).

The gender of patients showed an almost equal proportion of males and females in childhood TB, namely 49.5% males and 50.5% females. This study is little bit different from the study at health centres in South Tangerang, Indonesia which found that the proportion of males was 54.5% while females was 45.5% (Farsida & Kencana, 2020). Noviarisa in study in Padang, Indonesia also found a higher proportion of TB in males (66.7%) than females (33.3%) (Noviarisa et al., 2019). Even though the meta-analysis showed no significant difference in the incidence of pediatric TB between males and females. Gender-based risk differences begin to occur after children reach puberty. Androgen and estrogen play an important role in gender immunological dysmorphism. Males and females who have reached puberty have different innate and adaptive immune responses. This causes why males to be more susceptible to TB infection than females (Gupta et al., 2022; Siddalingaiah et al., 2023; Stival et al., 2014). In addition, males are also more at risk of developing active TB than females due to genetic and hormonal factors (Gupta et al., 2022).

In present study, 92.1% of pediatric TB patients were diagnosed clinically and 7.9% were bacteriologically confirmed. Diagnosis of pediatric tuberculosis is challenging. The spectrum of disease in pediatric TB is age-dependent with younger ages often showing paucibacillary intrathoracic and disseminated disease. Pediatric TB patients present with a wide range of clinical symptoms, making clinical diagnosis difficult (Basile et al., 2022; Gunasekera et al., 2022; UNICEF, 2023). One of the diagnostic approaches to pediatric TB used in Indonesia is a scoring system. The scoring system uses parameters including: [1] TB contact, [2] tuberculin test, [3] weight or nutritional status, [4] fever of unknown cause, [5] chronic cough, [6] enlarged lymph nodes of the neck, axilla, inguinal, [7] swelling of the bones or joints of the pelvis, knees, phalanges, [8] chest x-ray (Lusiana, 2019). Our study found 14.7% of pediatric TB with TB score <6 and 85.3% with TB score ≥6.

The results of this study found that the majority of pediatric TB patients had household contacts, 73.7%. The sub-analysis showed that pediatric TB patients aged <1 year had the highest proportion of household contacts (94.4%). The results suggested that the younger the age, the greater the proportion of household contacts. The proportion of household contacts of pediatric TB patients in this study was higher than a previous study in Lampung, Indonesia. The study was conducted in public health centre (Puskesmas) and found that the proportion of household contact contacts was 49.3% (Wardani et al., 2020). However, another study conducted at a hospital in Jember, Indonesia found a higher proportion of household contacts (87.5%) in pediatric TB patients (Nurwitasari & Wahyuni, 2015).

Children are a vulnerable group to TB exposure from TB patients. TB patients aged <1 year had an AOR of 31.94 (95%CI 3.80-268.35) for household contact compared to those aged 10 to 17 years, while those aged 1 to <5 years had an AOR of 16.5 (95%CI 6.05-44.98). Exposure from household contacts can easily lead to TB infection in children, especially children aged <5 years due to immunologic immaturity (Roy et al., 2019). Children less than 3 years old are at highest risk of rapidly developing active TB. This is due to the low level of CD4+ T cells that are specific for *Mycobacterium tuberculosis* ESAT-6 (Early Secretion Antigen Target-6) (Gutiérrez-González et al., 2021).

It is important to screen children for the presence of pulmonary TB in TB-positive in family members, known as household contacts. Since 2018, the Ministry of Health has been launching program to improve pediatric TB case finding by developing a more aggressive model of tracing people in close contact with TB patients, including children, known as contact investigation. These activities are carried out in Puskesmas and involve not only health workers, but also health cadres and community organizations in the area. By finding cases of household contact, prevention can be done through education and proper management to break the chain of TB transmission could be implemented. The coverage of pediatric TB case finding in Indonesia increased sharply from 63.57% in 2020 to

60.22% in 2021 and 158.47% in 2022. Based on the data, West Java ranks first in child TB case finding in Indonesia in 2022, which is 401% (Kementerian Kesehatan Republik Indonesia, 2023).

One way to prevent TB in children due to household contact is to administer TB prophylaxis therapy to those exposed to adults with pulmonary TB, by giving isoniazid for 6 months. This prophylaxis TB treatment has been shown effective in preventing progression to active TB in children (UNICEF, 2023).

The limitation of this study is that the sample was taken from a referral hospital for pulmonary diseases, so the characteristics and risk factors of children pulmonary TB may differ from those of pediatric TB patients in the community. Therefore, risk factors of children pulmonary TB in community need to be identified.

5. Conclusion

This study concluded that most pediatric TB patients at Sidawangi Pulmonary Hospital were less than 5 years old. Younger children are more at risk of getting TB due to household contact. Children aged <1 year had an adjusted OR of 31.94 (95%CI 3.80–268.35) for household contact TB compared to those aged 10 to 17 years. Children aged 1 to <5 years had an adjusted OR of 16.50 (95%CI 6.05–44.98) and those aged 5 to <10 years had an adjusted OR of 6.47 (95%CI 2.47–16.94). Regarding this, the government needs to intensify efforts in community education and preventive actions for TB transmission in children through household contact.

Funding

None to declared.

Conflict of Interest

No conflict of interest to be disclosed.

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Cite this article as:

Pratiwi, W., Toipah, I., Rachmawan, Y. P., & Reki, W. (2025). The Features of Children with Tuberculosis at Sidawangi Pulmonary Hospital in Indonesia: Interactions within the Home as a Potential Transmission Risk. *GHMJ (Global Health Management Journal)*, 8(1), 55–61. <https://doi.org/10.35898/ghmj-811203>