

Rate of administration of tuberculosis preventive treatment to pediatric household contacts and influencing factors

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Abstract

Background Providing tuberculosis preventive treatment (TPT) to household contacts is an important measure for preventing disease transmission. Various child-, parent-, and healthcare-related factors influence TPT provision.

Objective To determine the rate of pediatric TPT administration in household contacts of pulmonary TB patients and its influencing factors.

Methods An observational analytical study was conducted from May-August 2024 at primary healthcare facilities in Palembang, Indonesia. We included children in household contact with bacteriologically-positive pulmonary TB patients confirmed by molecular rapid diagnostic test who were registered for treatment in community health centers in Palembang that had a TB treatment program.

Results Among 364 household contacts of 114 TB cases, only 3.3% received TPT. The majority of parents or guardians were <35 years of age, were biological parents of the included children, had sub-minimum wage incomes, demonstrated good understanding of TPT, and had completed at least secondary education. The majority of children were female, over 5 years of age, and well-nourished according to parent or caregiver subjective perception. At the participating community health centers, healthcare workers in charge of the TB treatment programs were mostly paramedical staff and had good TPT knowledge, and drug availability was adequate. Children with caregivers aged ≥35 years were 12 times more likely not to receive TPT ($aOR=12,093$; 95%CI 1,544 to 94,713; $P=0.018$). Caregiver role in the family, economic status, knowledge level, education, travel distance, child factors, and health facility factors showed no significant association with TPT provision.

Conclusion The rate of TPT provision in Palembang is low, far below the national target of 50-90%. Guardian age of ≤35 years was the only factor significantly associated with TPT provision. [Paediatr Indones. 2025;65:422-30; DOI: <https://doi.org/10.14238/pi65.5.2025.422-30>].

Keywords: tuberculosis; preventive treatment; household contacts

Tuberculosis (TB), an infection by *Mycobacterium tuberculosis*, remains a global health problem. The *World Health Organisation* (WHO) reports that Indonesia has the second highest number of TB patients globally.¹ Among cities and districts in South Sumatra Province, the city of Palembang has the highest number of TB patients, with 6,927 new case findings in 2023.^{2,3}

In the government's efforts to make Indonesia TB-free by 2030, TB preventive therapy (TPT) is an important part of the program.^{3,4} The government has set target rates for TPT administration of 50% for children aged 5 years and older and 90% for children below 5 years of age, to be implemented by 2024. However, national TPT uptake was only 1.11% in 2021.^{3,4} South Sumatra Province ranked 22nd nationally, with a TPT coverage of 0.71%, far below the national average.^{4,5}

Providing TPT is essential due to the high potential for TB transmission through household

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contact. The presence of mycolic acid in *M. tuberculosis* makes it highly specific in defending itself from the immune system, with the ability of becoming dormant for many years.⁶ During times of weakened immunity, *M. tuberculosis* may reactivate without showing symptoms, known as latent tuberculosis infection.⁷ Populations at risk of latent infection need attention, as they may develop symptomatic TB disease and infect other individuals if TPT is not given.^{4,8}

Factors that have been shown to influence provision of TPT in other regions include the level of education and knowledge of parents, family economic status, distance from residence to a healthcare facility, and healthcare workers' knowledge and belief in the benefits of TPT.⁹⁻¹³ Considering the number of new cases and the absence of data on the rate of TPT provision in Palembang, this study aimed to determine the rate of pediatric TPT administration among household contacts of pulmonary TB patients and its influencing factors in this region.

Methods

This observational study was conducted from May to August 2024 at community health centers in Palembang. We included children who were in

household contact with bacteriologically-positive pulmonary TB cases based on molecular rapid diagnostic test who were registered to receive treatment in community health centers in Palembang. Exclusion criteria were refusal of participation by parents or guardians, children diagnosed with TB/HIV, children proven negative for TB infection by tuberculin skin test (TST) or interferon gamma release assay (IGRA) within the past month, and incomplete questionnaires. We recruited the subjects from community health centers that had a TB treatment program in place and a staff member willing to facilitate the study. This study also involved 70 community health center staff from 16 community health centers, each representing their respective sub-district (**Figure 1**). The TPT status of the included children were obtained from community health center records.

Data normality tests were conducted on ordinal and numeric variables. We presented the distribution of descriptive data as frequencies and central tendency measures. Bivariate analysis of the association between independent and dependent variables was done using the Chi-square test or Fisher's exact test with. A P value of <0.05 was considered significant. Multivariate analysis was performed on variables with $P < 0.25$ in the bivariate analysis. Variables with more than two categories were regrouped into dichotomous groups.

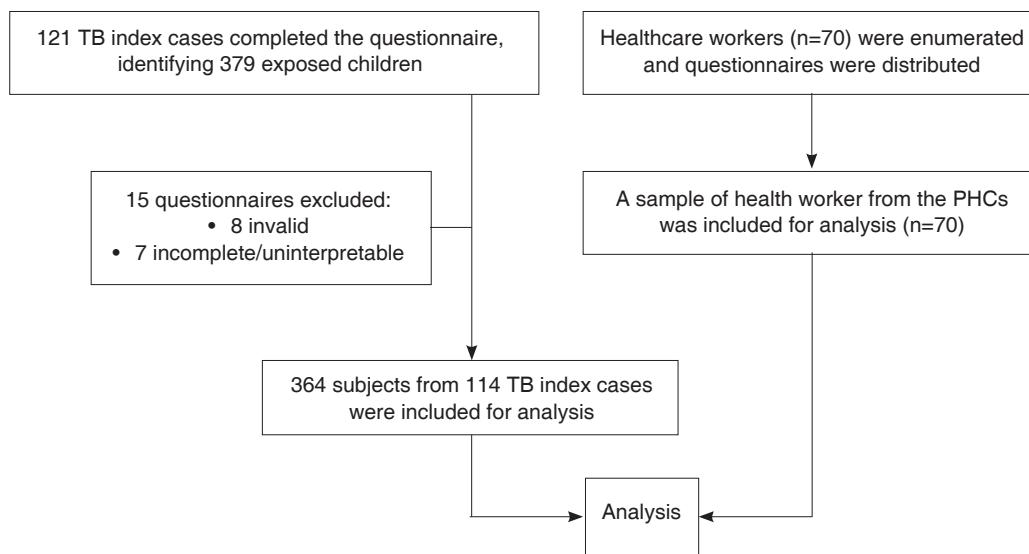


Figure 1. Flow chart of inclusion of pediatric subject and PHC staff

Statistical analysis were performed using SPSS version 27 software (IBM, Armonk, New York, USA).

Results

The study included 364 caregiver-child subject pairs from 114 TB index cases. The mean age of caregivers was 36 years (range 16-72 years). Caregivers were classified into two age groups, ≤ 35 years (49.7%) and > 35 years (50.3%). Most caregivers were biological parents (67.6%) (Table 1).

The majority of the caregivers (75.0%) had an income below the regional minimum wage. Most caregivers had at least a high school education (61.0%) and 65.7% had a good level of knowledge regarding TB and its preventive therapy. Of the 114 households of the index cases, 74 had one to two children (64.9%) and 40 had three or more children (35.1%) (Table 1).

Children's characteristics included gender, age, and perception of nutritional status. There were no significant differences in gender distribution. The mean age of children was 10 years 4 months (range 8 months-15 years 9 months). Based on the subjective perception of parents or caregivers, most

Table 1. Baseline family characteristics

Family characteristics	(N=364)
Age of parents/caregivers, n(%)	
≤ 35 years	181 (49.7)
> 35 years	183 (50.3)
Role of TB patient in the family, n(%)	
Parents	246 (67.6)
Siblings	43 (11.8)
Grandparents	26 (7.1)
Uncle or aunt	24 (6.6)
Other	25 (6.9)
Family economic level, n(%)	
Below minimum wage	273 (75.0)
Minimum wage or above	91 (25.0)
Caregiver knowledge level, n(%)	
Good	239 (65.7)
Poor	125 (34.3)
Education level of caregiver, n(%)	
Not graduated from high school	142 (39.0)
Graduated from high school	222 (61.0)
Distance from place of residence to PHC, n(%)	
≤ 1.5 km	221 (60.7)
> 1.5 km	143 (39.3)

*minimum wage=IDR 3,500,000

children had normal or obese nutritional status. The highest number of respondents were obtained from the sub-district of Kertapati, yielding 40 (11%) of questionnaires submitted, as presented in Table 2.

Healthcare facility factors included healthcare workers' knowledge of TPT, availability of facilities and drugs, and the profession of healthcare workers in charge of the TB treatment program. The community health center with the highest number of healthcare worker respondents involved was Sako, with 8 healthcare workers (11.4%). All healthcare workers involved had good knowledge of TPT, and all health facilities studied reported having adequate facilities and drugs. Most healthcare workers in charge of the TB treatment program were paramedics (41.4%) (Table 3).

Overall, TPT was given to 12 out of 364 children (3.3%). Caregiver's age was significantly associated with TPT provision; children whose caregivers were

Table 2. Baseline characteristics of pediatric subjects

Characteristics	(N=364)
Gender, n(%)	
Male	177 (48.6)
Female	187 (51.4)
Age, n(%)	
< 5 years	62 (17.0)
≥ 5 years	302 (83.0)
Perception of nutritional status of children, n(%)	
Thin	84 (23.1)
Normal/obese	280 (75.9)
Educational status, n(%)	
Not yet in school	85 (23.4)
Primary	137 (37.6)
Secondary	136 (37.4)
School dropout	6 (1.6)
Number of questionnaires submitted from each PHC, n(%)	
4 Ulu	24 (6.6)
Basuki Rahmat	20 (5.5)
Dempo	22 (6.0)
Gandus	20 (5.5)
Kalidoni	20 (5.5)
Kenten	40 (11.0)
Kertapati	22 (6.0)
Makrayu	20 (5.5)
Merdeka	31 (8.5)
Nagaswidak	19 (5.2)
Padang Selasa	20 (5.5)
Plaju	20 (5.5)
Punti Kayu	24 (6.6)
Sako	21 (5.8)
Sematang Borang	21 (5.8)
Talang Betutu	

Table 3. Health facility characteristics

Characteristics	(n=70)
Healthcare staff respondents each center, n(%)	
Basuki Rahmat	6 (8.6)
Padang Selasa	3 (4.3)
Talang Betutu	3 (4.3)
Puntikayu	4 (5.7)
Dempo	5 (7.1)
Sako	8 (11.4)
Makrayu	4 (5.7)
Plaju	7 (10.0)
Kenten	5 (7.1)
Nagaswidak	3 (4.3)
Sematang Borang	5 (7.1)
Kalidoni	2 (2.9)
Kertapati	5 (7.1)
Gandus	3 (4.3)
4 Ulu	4 (5.7)
Merdeka	3 (4.3)
Healthcare workers' TPT knowledge, n(%)	
Good (≥9/15 correct answer)	70 (100)
Poor (<9/15 correct answer)	0 (0.0)
Availability of TPT facilities and medications, n(%)	
Facilities and drugs available	70 (100)
Only drugs available	0
Only facilities available	0
Neither facilities nor drugs available	0
Qualification of healthcare worker in charge of TB treatment program, n(%)	
Physician	23 (32.9)
Allied health staff (nurse, midwife, pharmacist)	29 (41.4)
Public health professional	1 (1.4)
Laboratory analyst or radiographer	17 (24.3)

≤35 years of age were more likely to receive TPT (OR 11.7; 95%CI 1.5 to 92.1; P=0.003). The role of the caregiver was further analyzed by grouping caregivers into "father/mother" and "other than father/mother." Although there was a trend towards a difference in the pattern of TPT administration, this difference was not statistically significant. Family economic factors, as well as caregiver knowledge and education level, and distance from residence to community health center were not significantly associated with the rate of TPT administration (Table 4).

Although no significant association was found between caregiver knowledge and TPT administration, we further explored specific items related to TPT. The question regarding the definition of TPT was answered incorrectly by 180/364 (49.5%) caregivers. However, the question on the benefits of TPT was answered correctly by 284/364 (78%) of respondents. These results indicate that despite a good level of knowledge about TB, gaps in understanding the necessity of TPT still persist.

Caregiver perception the child's nutritional status did not differ significantly between children receiving TPT and those who did not. The majority of children receiving TPT were >5 years old (79.9%), perceived by caregivers as having obese/normal nutritional status (74.2%), and already attending school (83.3%) (Table 5).

Table 4. Family factors associated with TPT administration (N=364)

Parameter	TPT (n=12)	Without TPT (n=352)	OR (95%CI)	P value
Parents'/caregiver's age, n (%)			11.7 (1.5 to 92.1)	0.003*
≤35 years	11	170 (48.3)		
>35 years	1	182 (51.7)		
Caregiver's relationship to child, n (%)			0.4 (0.1 to 1.4)	0.214**
Father/mother	6	240 (68.2)		
Other	6	112 (31.8)		
Family income, n (%)			0.2 (0.03 to 2.0)	0.308**
Below minimum wage	1	90 (25.6)		
Minimum wage or above	11	262 (74.4)		
Caregiver knowledge level, n (%)			2.7 (0.5 to 12.7)	0.229*
Good	10	229 (65.1)		
Poor	2	123 (34.9)		
Caregiver education level, n (%)			0.8 (0.2 to 2.8)	1.000*
Completed secondary school	7	215 (61.1)		
Did not complete secondary school	5	137 (38.9)		
Distance between residence and healthcare center, n (%)			0.4 (0.1 to 1.4)	0.230*
<1.5 km	5	216 (61.1)		
>1.5km	7	136 (38.9)		

*Chi-square; **Fisher exact test

As described in Table 3, all healthcare workers who completed the questionnaire demonstrated good knowledge of TPT, and all community health centers had adequate facilities and drug availability. Therefore, bivariate analyses were not conducted on these variables. There was no significant difference in the decision to administer TPT between physicians and non-physicians (Table 6).

Multivariate analysis was conducted on variables with a P value of <0.25 on bivariate analysis, which included caregiver age, caregiver role, caregiver knowledge level, and distance from residence to community health center. The results are presented in Table 7.

Multivariate analysis revealed that children with caregivers aged >35 years were 12 times more likely not to receive TPT (aOR=12,093; 95%CI 1,544 to 94,713; P=0.018). Role of caregiver, caregiver knowledge level, and distance from residence to community health center were not found to be significant determinants.

Discussion

Healthcare facility factors showed that staff knowledge of TB was good, and facilities and drug availability were good. However, this does not reflect the implementation of adequate TPT coverage results.

Family economic factors, as well as caregiver knowledge and education level, were not significantly associated with the rate of TPT administration. These three factors, although often associated with access to healthcare, did not influence proportion of TPT uptake in this study.

In this study, the mean age of caregivers was 36 years (range 16-72 years). A significant difference was observed between groups, with children with caregivers aged <35 years being more likely to receive TPT compared to those with older caregivers. This result was consistent with findings of a study in Tanzania, which found that most caregivers of children who sought treatment for TB were aged 25-34 years (43%), a group considered more cooperative and willing to seek care for their children despite limitations in available health facilities.¹⁴ Similar findings were also reported in Malaysia, where

Table 5. Child factors associated with TPT administration (N=364)

Parameter	TPT (n=12)	Without TPT (n=352)	OR	P value
Gender			1.4 (0.4 to 4.8)	0.494*
Male	7	170 (48.3)		
Female	5	182 (51.7)		
Age, years			0.4 (0.1 to 3.4)	0.699**
<5 years	1	61 (17.3)		
≥5 years	11	291 (82.7)		
Caregivers' perception of child nutritional status			1.5 (0.3 to 7.0)	0.741*
Obese/normal	10	270 (76.7)		
Thin	2	82 (23.3)		
Child's education			0.5 (0.1 to 2.7)	0.738**
Not yet or not in school	2	89 (25.3)		
School	10	263 (74.7)		

*Chi-square; **Fisher exact test

Table 6. Healthcare facility factors associated with TPT administration (N=70)

Qualification	TPT given (n=12)	No TPT given (n=58)	OR (95%CI)	P value*
Profession, n (%)			1.5 (0.4 to 5.8)	0.511
Doctor	5	18 (31.0)		
Non-doctor	7	40 (69.0)		

*Fisher exact test

Table 7. Multivariate analysis of potential determining of TPT administration

Parameter	Number of children not given TPT (n=352)	Adjusted odds ratio (95% CI)	P value**
Caregiver age, n (%)			
≤35 years	170 (48.3)	12,093 (1,544 to 94,713)	0.018
>35 years	182 (51.7)		
Role of caregiver, n (%)			
Father/mother	240 (68.2)	1,793 (0,539 to 5,968)	0.341
Other	112 (31.8)		
Caregiver knowledge level, n (%)			
Good	229 (65.0)	0,381 (0,081 to 1,801)	0.2253
Poor	123 (35.0)		
Distance from residence to community health center, n (%)			
≤1.5 km	216 (61.4)	2,296 (0,703 to 7,506)	0.169
>1.5 km	136 (38.6)		

most parents of children (40%) with TB were aged 30-39 years.¹⁵ This may be related to the fact that the study subjects were children aged <18 years, with parents generally having children during the age range of 20-35 years.¹⁵

We found that most caregivers were the children's biological parents, who constituted the household contact for 246 children (67.6%). A diagnosis of TB in the family often elicits emotional reactions, including fear of transmission and social stigma. A previous study showed that mothers are generally responsible for caring for sick children, in line with cultural values in Indonesia that emphasize the role of the wife as the primary caregiver in the family. Parents are considered to have the most intense interaction with children, both in the home environment and in daily activities. This makes them a major factor in the transmission of TB to children, as studies have shown that childhood TB infection most often occurs through household contact with infected parents.¹⁶

The majority of the caregivers had an income below the regional minimum wage. In line with this finding, a prior study showed that the majority of caregivers of children with TB had low socioeconomic status (40.8%).¹⁷ Economic factors should not be a barrier to the provision of TPT. The TPT program is facilitated by the government, as stipulated in the *Indonesian Minister of Health Regulation no. 67/2016 on Tuberculosis Control*.¹⁸

Most caregivers had at completed least secondary education (61.0%), had one to two children (64.9%), and had good knowledge of TB and TB-preventive therapy (65.7%). A study in Semarang, Central Java,

Indonesia also showed that 66.6% of parents had good knowledge of TB treatment. such knowledge plays an important role in the success of therapy, as it influences the behavior, planning, and decisions made by parents/caregivers in supporting their child's treatment.¹⁹

There were no significant differences in sex distribution between the TPT and non-TPT groups. The mean age of the subject was 10 years 4 months. A previous study showed that patients receiving TPT were predominantly female (53.7%), although most children were younger than 3 years (46.6%).²⁰ Another study in London analyzing a total of 1,370 childhood TB cases recorded from 1999 to 2006 revealed a higher incidence among girls below 15 years of age.²¹ These similarities and differences may be influenced by the demographics of the region.

Healthcare facility staff knowledge of TB was good. Knowledge is a key factor in the successful implementation of pediatric TB management.²² Suboptimal knowledge of health workers, especially in TB diagnosis and opinions of health services, would have a negative impact on patients.^{22,23} A contributing factor to poor implementation of TPT could be the complicated procedural pathway, as prior to the 2025 update, children aged >5 years who were exposed but asymptomatic were required to undergo TST/IGRA testing before receiving TPT.^{3,8,24}

The caregiver's age was significantly associated with TPT provision, with caregivers aged ≤35 years more likely to accept TPT for their children. Consistently, a study found that respondents who refused TPT were more likely to come from families

with parents aged >50 years (52.2%) compared to those who were younger.^{9,25} Older people tend to have lower mobility and prefer to stay at home; thus, they may not prioritize TPT if their children appear healthy.⁹ However, this finding was inconsistent with a study which found no significant association between the age of caregivers/parents and TPT administration ($P=0.261$).²⁶ Another study in Peru also showed similar results, where the age of the caregiver had no significant association with TPT administration. REF This variation in results could be attributed to different geographical locations, along with social and cultural patterns in each region.^{26,27}

Family economic factors, caregiver knowledge and education levels were not significantly associated with TPT administration.^{13,17,28} Conversely, Otero et al. found that contact kinship with index TB was associated with TPT initiation in children aged <5 years and 5-19 years.²⁶ These differences could be attributed to population differences and community stigma regarding TB. Meanwhile, the low coverage of TPT in this study suggests that caregivers' knowledge and education do not fully influence health behavior. Even after further analysis of the questions that specifically addressed TPT, understanding of TPT was not as good as knowledge of TB in general. In terms of family economics, although the TPT programme is facilitated by the government, low economic status may result in difficulties accessing to healthcare facilities or longer working hours. A study in Jayapura, Papua, Indonesia showed result that differed from ours. The greater the distance from the health facility, the worse the implementation of TB management in the family.¹³ These differences could be attributed to geographical location and condition, the availability of healthcare facilities, and the presence of safety threats or local conflicts.^{13,17}

We found no association between children's education level and TPT provision. According to a study in Sukoharjo, Central Java, Indonesia, individuals with higher levels of education tend to have greater awareness of the importance of health, so they are more likely to utilize health care facilities for themselves and their families.²⁹ The higher a person's level of education, the easier it is to receive and understand health information, including that related to disease prevention and treatment. Education also plays a role in increasing access to valid sources of

information, which in turn can influence a person's decision to seek treatment or follow recommended health programs. This difference could be attributed to the different age ranges of the subjects. In this study, the children's education level was not directly associated with TPT provision, since the decisions were made by caregivers.

Knowledge gaps about TB among caregivers have been reported as an important challenge to the implementation of TPT.³⁰ Limited understanding of who can contract TB may contribute to a high proportion of TPT refusals among children who are eligible for therapy.³⁰ In the Southeast Asian region, lack of knowledge and misconception among health care recipients have also been identified as major factors slowing the expansion of TPT coverage.^{31,32}

Several factors to be aware of as obstacles to TPT implementation need to be considered, including the ease and waiting time in applying for drug regimens. Other factors that may contribute to low TPT uptake include attitudes and paradigms towards the effectiveness and importance of therapy, lack of prioritization, possibly ineffective contact tracing, and limited resources.¹¹ A study involving 112 health workers and 22 patients showed that the lack of standardized reporting mechanisms and inadequate patient education were also major obstacles.²² Similar problems were found in Cambodia, where despite an established TPT program, inconsistency in drug supply remained a barrier to implementation.³⁰

Conversely, a study in Yogyakarta, Indonesia reported that medical staff with higher TB knowledge tended to be reluctant to administer preventive therapy.³² Another study in Australia also reported that although health workers had a positive attitude towards preventive therapy, their understanding of TB infection and TPT was still relatively low.²³ This suggests that obstacles to implementing TPT are not only caused by system factors, but also by the perceptions and knowledge of health workers themselves, which can vary between regions.

The main limitation of this study was the small sample size, particularly the limited number of subjects who received TPT, which could have affected the interpretation of findings and introduce potential selection of information bias. In addition, some factors that may influence TPT administration were not included in the analysis, which could affect the

interpretation of the findings and introduce bias, such as the effectiveness of contact tracing, inconsistencies in TPT supplies in various health facilities, and the attitudes and paradigms of the community and health workers. These factors may impact the identification of TB contacts, the availability of drugs, and the willingness to start therapy. These obstacles may explain the low TPT coverage observed in this study and warrant further investigation to provide a more comprehensive understanding.

In conclusion, the proportion of TPT provision in Palembang remains substantially below the national target. Among the variables examined, only caregiver age of ≤ 35 years showed a significant positive association with TPT provision. Other factor including caregiver role, family's economic status, caregiver knowledge and education levels, and house-to-health facility distance, as well as child and health facility characteristics, were not significantly associated. These findings highlight the need for targeted interventions addressing younger caregivers to improve TPT uptake and for broader strategies to overcome systemic barriers in order to achieve national coverage goals. Further multicenter studies with larger sample sizes and the inclusion of additional contextual factors are needed to provide a more comprehensive understanding of determinants of TPT implementation.

Conflict of interest

None declared.

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