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CHILDHOOD TUBERCULOSIS: A CROSS-SECTIONAL STUDY OF PREVENTIVE PRACTICES AMONG MOTHERS OF TODDLERS IN INDONESIA

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ABSTRACT

Background: Tuberculosis (TB) control and prevention in children is a global health priority. Despite various preventive efforts undertaken by the South Purwokerto Community Health Center, the incidence of childhood TB continues to rise. **Purpose:** This study aimed to determine the behaviors of toddlers' mothers in preventing TB in children in Teluk Subdistrict, South Purwokerto. **Methods:** This study employed an analytical observational design with a cross-sectional approach. The population comprised 522 mothers of toddlers in Teluk Subdistrict, with a sample of 81 respondents selected through a multi-stage sampling procedure involving cluster and purposive sampling from integrated healthcare centers in several community units. Primary data were collected using a questionnaire in November 2023. Data analysis involved chi-square tests and multiple logistic regression. **Results:** The findings revealed a significant association between mothers' attitudes (p-value = 0.02) and healthcare workers' support (p-value = 0.003) and their behaviors in preventing childhood TB. Conversely, variables such as education level (p-value = 0.78), occupation (p-value = 0.51), knowledge (p-value = 0.90), and information access (p-value = 0.10) showed no significant relationship. Logistic regression analysis indicated that healthcare workers' support was the most influential factor in determining mothers' behaviors in preventing childhood TB (p-value = 0.02) (OR = 3.53). **Conclusion:** Healthcare workers' support emerged as the primary determinant of mothers' behaviors in preventing childhood TB in Teluk Subdistrict, South Purwokerto.

Keywords: tuberculosis, children, preventive behavior, health workers support, mother

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INTRODUCTION

Tuberculosis (TB), caused by the bacterium Mycobacterium tuberculosis, is one of the top ten deadliest infectious diseases globally. It primarily affects the lungs but can also attack other organs like skin and bones (Shaban, 2023). According to the WHO Global TB Report 2022, an estimated 10.6 million people worldwide suffer from TB, leading to 1.4 million deaths annually. Indonesia bears a particularly high burden, ranking second globally with roughly 969,000 cases (or 354 per 100,000 population) reported in 2022 (WHO, 2022). The management of childhood tuberculosis (TB) remains a critical public health challenge on a global scale. Annually, an estimated 500,000 children contract TB, with infants, young children, and HIV-positive children exhibiting a heightened susceptibility to severe illness and mortality compared to the adult population (Hirsch-Moverman *et al*., 2020). While progress has been made in TB prevention and treatment, significant gaps persist in understanding and addressing the specific needs of children, especially in low-resource settings.

Central Java Province exemplifies this challenge. As reported in the 2022 Central Java Health Profile, 11.2% of TB cases identified in 2021 involved children aged 0-14 years. Fortunately, healthcare authorities successfully identified and treated 4,559 children infected through contact with adult TB cases (Dinas Kesehatan Provinsi Jawa Tengah, 2022). Within Central Java, Banyumas Regency presents a particularly concerning case. It boasts the fifth-highest Case Notification Rate (CNR) for TB at 198.9 per 100,000 population. Notably, the regency reported 3,815 adult TB cases and 745 cases in children aged 0-14 years (Dinas Kesehatan Kabupaten Banyumas, 2023). Further attention is warranted in the South Purwokerto District, which recorded the highest number of TB cases within Banyumas Regency, with 197 cases in adults and 48 cases in children. Data from the South Purwokerto Community Health Center between January and August 2023 reveals a concerning trend: 110 adults and 51 children contracted TB during this period. Notably, childhood TB cases represent nearly half (46.4%) of all reported cases. Teluk Subdistrict emerges as the most affected area, recording 24 adult TB cases and 12 pediatric cases (0-14 years old). Alarmingly, eight of these pediatric cases fall within the toddler age group. Furthermore, the data suggests a link between childhood TB and household exposure, with most infected children residing with family members who have had TB. Living near family members with TB significantly increases a child's risk of contracting the disease. Early detection of childhood TB is crucial to prevent further transmission and its potential complications. Therefore, raising awareness among parents and families is needed. This includes understanding the early signs and symptoms of TB in children, along with the associated risk factors and transmission pathways (WHO, 2011).

Data from Teluk Village health workers indicates a concerning pattern: delays in seeking medical attention for children suspected of TB. This hesitancy is observed even in cases with known exposure to infected adults, frequently family members. Investigations by village health cadres reveal a confluence of factors contributing to this delay. Limited parental knowledge and the prevalence of misconceptions regarding TB appear to be significant barriers. Furthermore, the educational attainment of many parents, with a majority having achieved middle school education or less, may pose challenges in comprehending the complexities of childhood TB prevention and treatment strategies. These knowledge gaps can have serious ramifications, potentially leading to delayed diagnoses and compromised health outcomes in children. The South Purwokerto Community Health Center implements various preventive measures to combat childhood TB. These efforts include TB screening programs, BCG vaccinations (Bacillus Calmette-Guérin vaccine), and monthly posyandu (integrated health services) programs in villages that assess children's nutritional status (Dinas Kesehatan Kabupaten Banyumas, 2023). However, according to the TB program coordinator at the health center, there appears to be a gap in public education regarding TB prevention. While healthcare professionals offer TB-related health promotions, these initiatives may not be reaching the broader community effectively. The paucity of information on preventive measures could potentially limit public knowledge and awareness about the significance of adopting healthy lifestyle practices to mitigate TB risk.

The alarming prevalence of childhood TB necessitates a multifaceted approach to curb the spread of this infectious disease and mitigate its detrimental impact on child health. Early intervention and preventive measures are paramount in reducing morbidity and mortality rates among this vulnerable population. One readily implementable and effective strategy is to promote healthy lifestyle practices, particularly within the household environment. Parents, especially mothers, play a pivotal role in shaping their children's health behaviors, particularly during the critical early childhood years. Therefore, understanding the factors influencing maternal behaviors in TB prevention among toddlers is of foremost importance. This study focuses on the understudied area of maternal behaviors in preventing childhood TB, aiming to identify key determinants and develop targeted interventions. By addressing this knowledge gap, we seek to contribute to the development of more effective TB prevention strategies for young children.

METHOD

Study Design

This study employed an observational analytic approach with a cross-sectional design.

Population and Sample

The population of this study comprised 522 mothers of toddlers residing in Teluk Village. A sample of 81 respondents was determined using the Lemeshow formula. The sampling technique employed in this research was a multistage sampling approach, indicating that sample selection was conducted in multiple stages to obtain the desired sample with equal probability. In the first stage, cluster sampling was utilized, involving the selection of a number of sample representatives from each group or area. Teluk Village consists of 17 RW (neighborhood units), from which 4 RW were randomly selected, resulting in RW 3, RW 4, RW 13, and RW 16. Within these 4 RW, 7 posyandu (integrated health services) were identified. To determine the sample size, a proportional allocation formula was applied to each posyandu. Purposive sampling was undertaken to select participants based on predetermined inclusion and exclusion criteria. Participants were eligible for inclusion if they were mothers of children aged 12-59 months who were tuberculosis-free, registered in the posyandu registry, and had provided informed consent. Participants were selected from those attending posyandu sessions during the data collection period. Participants were excluded if they did not complete the questionnaire or withdrew from the study.

Data Collection

Primary data was collected using questionnaires in November 2023. All participants were provided with detailed information about the study, and their written informed consent was obtained prior to data collection. The data collected on mothers' knowledge, attitudes, access to information, healthcare provider support, and preventive behaviors regarding infant health were categorized based on the normality of the data distribution. Normality tests indicated that all variables were not normally distributed. Therefore, the median was used as the cut-off point to determine categories. The category "good" was assigned to respondents with scores at or above the median, while the category "poor" was assigned to respondents with scores below the median. The validity and reliability of the questionnaires were established through a pilot study involving 30 mothers of toddlers. Content validity was assessed by experts in the field of public health and maternal and child health. Construct validity was examined using factor analysis. Internal consistency was measured using Cronbach's alpha, with values of $\alpha \geq 0.70$ indicating good reliability. The questionnaires were administered in face-to-face interviews by trained research assistants. Data was entered into a database and analyzed using SPSS software.

Data Analysis

The data was analyzed using univariate, bivariate, and multivariate analyses. Univariate analysis was conducted to describe the characteristics of the study participants, including demographic variables, knowledge of TB prevention, and maternal behavior in child TB prevention. Bivariate analysis was performed to examine the association between independent variables (demographic characteristics, knowledge of TB prevention) and the dependent variable (maternal behavior in child TB prevention) using chi-square tests. To identify the key factors influencing mothers' preventive behaviors against childhood

tuberculosis, a multivariate logistic regression analysis was conducted on six variables: education level, occupation, knowledge, attitude, access to information, and healthcare provider support. A backward stepwise selection method was used to determine the final model. This method starts with a full model containing all predictor variables and iteratively removes the least significant variable until only significant variables remain. Significance levels of $\alpha = 0.05$ were used for all analyses.

Ethical Clearance

The study received ethical approval from the Health Research Ethics Commission of the Faculty of Public Health, Universitas Jenderal Soedirman, with the approval number 1274/EC/KEPK/XI/2023.

RESULT

The study participants comprised 81 mothers of toddlers residing in Teluk Village. Most of mothers (69.1%) were between the ages of 20-35 years, with the remainder falling under the age groups of <20 years and >35 years. Most toddlers (58%) were between 12-36 months old, while 42% were between 37-59 months old. A majority of toddlers were female (63%), while 37% were male. Most mothers (59.3%) had a high level of education, while 40.7% had a low level of education. Most of mothers (87.7%) were not employed, while 12.3% were employed. These demographic characteristics provide a profile of the study population and may influence the analysis of maternal behavior in child TB prevention. The study revealed that a significant proportion of respondents demonstrated favorable knowledge (51.9%), positive attitudes (58%), adequate access to information (56.8%), and strong support from healthcare providers (59.3%). These findings suggest a potential association between mothers' health literacy and their ability to prevent TB transmission to their children. A significant majority of respondents (51.9%) reported implementing preventive measures against child TB transmission, including consistent child weighing (86.4%), regular window ventilation (88.9%), and timely BCG vaccination (76.5%). Conversely, nearly half of the respondents (48.1%) did not engage in these protective behaviors, such as avoiding morning sunlight exposure, promoting physical activity, and maintaining smoke-free environments for children (Table 1).

Table 1. Sociodemographic Characteristics of Respondents

Variable	Frequency (n)	Percentage (%)
Mother Age		
<20 and >35 years old	25	30,9
20 35 years old	56	69,1
Education Level		
Low	33	40,7
High	48	59,3
Employment Status		
Yes	10	12,3
No	71	87,7
Child age		
12 36 months	47	58
37 9 months	34	42
Child sex		
Boy	30	37
Girl	51	63
Knowledge		
Poor	39	48,1
Good	42	51,9
Attitude		
Poor	34	42
Good	47	58
Access to Information		
Poor	35	43,2
Good	46	56,8
Health Workers Support		
Low	33	40,7
High	48	59,3

Table 2. Bivariate and Multivariate Analysis Results of Factors Associated with Child Tuberculosis Prevention Behaviors

Variable	Child Tuberculosis Prevention Behaviors				POR (95% CI)	Sig. p-value
	Poor		Good			
	N= 39	%	N= 42	%		
Maternal Age						
<20 and >35 years old	13	52,0	12	48,0	1,25 (0,49 – 3,21)	0,82
20-35 years old	26	46,4	30	53.6	Ref	
Education Level						
Low	17	51,5	16	48,5	1,26 (0,52 – 3,05)	0,78
High	22	48,5	26	54,2	Ref	
Employment Status						
Yes	6	60,0	4	40,0	1,73 (0,45 –6,65)	0,51
No	33	46,5	38	53,5	Ref	
Knowledge						
Poor	18	46,2	21	53,8	0,86 (0,36 – 2,05)	0,90
Good	21	50	21	50	Ref	
Attitude						
Poor	22	64,7	12	35,3	2,06 (0,75 –5,68)	0,16*
Good	17	36,2	30	63,8	Ref	
Access to Information						
Poor	21	60,0	14	40,0	2,33 (0,95– 5,73)	0,10
Good	18	39,1	28	60,9	Ref	
Health Workers Support						
Low	23	69,3	10	30,3	3,53 (1,27– 9,78)	0,01*
High	16	33,3	32	66,7	Ref	

Notes: All statistical analyses were conducted using SPSS version 20.0. p-values < 0.05 were considered statistically significant. POR = Prevalence Odds Ratio; CI = Confidence Interval

In this study, there are six variables suspected to be associated with mothers' behaviors in preventing TB in children, namely education level, employment, knowledge, attitude, access to information, and health worker support. If the p-value is <0.25, it is considered substantively meaningful and can be included as a candidate for multivariate analysis. However, if the p-value is >0.25 but the variable is substantively important, it may still be included in the multivariate analysis. The technique used for selecting candidates in this study's analysis involves including all variables from the bivariate selection results into the analysis based on the significance criterion of p-value <0.25.

The results of the bivariate analysis showed that three variables were eligible for multivariate testing: attitude, access to information, and health worker support. The next step was to identify the most influential factor on the behavior of mothers of young children in preventing tuberculosis in children. In this model, all candidate variables were tested together, followed by a multivariate analysis using multiple logistic regression, including all variables.

Based on the results of the analysis above, variables with a p-value > 0.05 are the attitude and information access variables. Therefore, the information access variable, which has the highest p-value, is excluded first from the multivariate analysis. After conducting the second-round multivariate modeling analysis by removing the information access variable, there was no change in the Prevalence Odds Ratio (POR) > 10%, so the information access variable was excluded from the model. The table above represents the results of the multivariate analysis using multiple logistic regression, as the health worker support variable meets the p-value requirement of 0.01 < 0.05, meaning Ho is rejected. This suggests that the health worker support variable is the most influential factor on maternal behavior in TB prevention in children. Mothers with good health worker support are 3.53 times more likely to engage in good TB prevention behaviors for their children compared to mothers with poor health worker support. Among the population of mothers with young children, the researchers are 95% confident that health worker support is one of the factors that can influence maternal behavior in preventing

TB in children, with a confidence interval range of 1.27-9.78. These findings underscore the crucial role of healthcare workers in promoting preventive measures. Strengthening their support through education, counseling, and follow-up can significantly improve mothers' practices and, consequently, reduce the incidence of childhood tuberculosis.

DISCUSSION

Support from health workers is the most influential factor in encouraging mothers of toddlers to prevent TB in their children. This study shows that mothers of toddlers who received good support from health workers were 3,53 times more likely to take preventive actions against TB compared to mothers who received less support. These findings are in line with previous research which showed that adequate support from health workers can improve TB prevention behaviors in the community. This is possible because health workers who have received sufficient education about TB can provide accurate and comprehensive information to the community through various forms of health education (Amallia *et al*., 2021; Sa'diyah & Indarjo, 2021).

This study revealed that parents perceived health workers as providing adequate support in educating them about tuberculosis (TB) prevention strategies for children. The provision of counseling, accessible consultation services, new information, and consistent reminders about healthy lifestyles by health workers significantly influenced maternal behaviors in preventing child TB transmission. A positive correlation was observed between the level of support offered by health workers and the effectiveness of maternal preventive actions against child TB.

The current study found no significant association between maternal education level and preventive behaviors against child tuberculosis transmission. These findings align with previous research which reported a similar correlation between education and TB prevention practices (Devi *et al*., 2019). However, the results contrast with other research which identified a significant relationship between education level and preventive behaviors for pulmonary TB (Marhamah, 2019).

Health workers play a crucial role in educating parents about child health, including tuberculosis (TB) prevention (He *et al*., 2017). The observed lack of correlation between maternal education and TB prevention behaviors may be attributed to several factors. Firstly, mothers with limited healthcare experience, particularly regarding childhood TB, may struggle to apply educational knowledge to preventive practices. Secondly, the majority of mothers in this study possessed non-health-related educational backgrounds, potentially limiting their exposure to health-related information. Thirdly, even with higher education, individual factors such as prior TB exposure and personal beliefs can influence the adoption of preventive behaviors. Conversely, mothers with lower educational levels may also face challenges in effectively implementing TB prevention strategies due to incomplete information or limited healthcare access. These findings underscore the complex interplay of factors influencing maternal behavior in preventing child TB transmission, extending beyond educational attainment.

Maternal employment status was not found to influence preventive behaviors against child tuberculosis transmission. Both employed and unemployed mothers exhibited similar practices in this regard. These findings align with previous studies which reported no association between employment and TB prevention efforts (Amallia *et al*., 2021; Lambanaung *et al*., 2019). However, these results diverge from the findings which identified a relationship between employment and pulmonary tuberculosis (Widiati & Majdi, 2021). Maternal employment status appears to have a complex relationship with child TB prevention behaviors. While non-working mothers may be physically present at home, their heavy domestic responsibilities, such as cooking, cleaning, and laundry, could limit their ability to engage in preventive measures like outdoor activities and exercise for their children. Conversely, employed mothers might have less time for direct child supervision, potentially increasing the risk of TB exposure. Both scenarios highlight the challenges faced by mothers in balancing childcare and preventive health practices. These findings align with prior study suggested that employment-related factors can impact overall

health behaviors, including TB prevention (Marhamah, 2019).

The high prevalence odds ratio (POR) of 3.525 for the association between health worker support and good prevention behaviors highlights the substantial impact of this factor. This suggests that interventions aimed at strengthening healthcare worker support, such as training programs, mentorship, and improved communication channels, could significantly enhance mothers' adherence to recommended prevention strategies (An *et al*., 2022). Key strategies include expanding preventive therapy to high-risk groups, developing accurate biomarkers for disease risk prediction, and making shorter treatment regimens more accessible. Previous study suggested alternative strategies for prevention are needed, such as earlier initiation of preventive therapy through rapid diagnosis of adult cases or community-wide screening approaches (Harries *et al*., 2020; Martinez *et al*., 2020).

The present study has several limitations. The cross-sectional design and sample size may restrict the generalizability of the findings. Moreover, the specific focus on maternal preventive behavior and the potential lack of measurement of latent variables may limit the comprehensiveness of the explanation of the factors influencing TB prevention behaviors among mothers of toddlers. The study strongly suggests that providing support from healthcare providers is a crucial factor in encouraging mothers to engage in effective TB prevention practices. Interventions should focus on equipping healthcare providers with the necessary skills and resources to offer comprehensive support, including education, counseling, and guidance on TB prevention strategies.

CONCLUSION

This study highlights the importance of healthcare provider support in promoting effective tuberculosis (TB) prevention behaviors among mothers of young children. While other factors like education level, employment status, knowledge, attitude and access to information were not found to be significant predictors, providing support from healthcare providers emerged as a key determinant in encouraging mothers to engage in preventive practices.

SUGGESTION

Health workers at the South Purwokerto Community Health Center should intensify their efforts in providing comprehensive education, accessible consultation services, and consistent reminders about healthy lifestyles to prevent child tuberculosis. Mothers should proactively seek out information about TB prevention through various channels, actively participate in educational programs, and prioritize their children's health and nutrition. These collective actions are essential in safeguarding children from TB infection.

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CONFLICT OF INTEREST

The authors declare that there are no conflict of interest.

DECLARATION OF ARTIFICIAL INTELLIGENCE (AI)

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AUTHOR CONTRIBUTION

Author Zalfa’ul Rifdah was responsible for data collection and analysis. Author Lu’lu Nafisah was responsible for manuscript preparation and editing. Author Bambang Hariyadi was responsible for problem formulation and research methodology.

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